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cultivator will be willing to receive and put to the best possible use the advice and help which the agricultural and other departments are in a position to place at his disposal. Our enquiry, therefore, extends to the activities of all departments which are closely concerned with rural welfare. We endeavour to show the contribution which each of them Agricultural, Veterinary, Forest, Irrigation, Co-operative, Public Health, Education and Industries can make to the creation of an environment favourable to progress in all directions. Our object is, in short, to suggest ways and means of assisting the advance of the rural community towards a fuller life. These must be designed at once to awaken the desire in that community for better things and to arm each individual member of it against the temptations that beset him without impairing either his self-respect or his spirit of manly independence.

II. THE ORGANISATION OF AGRICULTURAL RESEARCH

CHAPTER III OF THE MAIN REPORT.

As a result of the constitutional changes of 1919, the Government of India divested themselves, except to a very limited extent, of all powers of superintendence, direction and control over the administration of "transferred" subjects of which, from the point of view of our enquiries, agricultural and veterinary subjects are the most important. The administration of central agencies and institutions for research and for professional and technical training was retained as a "central" subject, but no specific provision was made for co-ordinating the work of these with that of similar institutions in the provinces. Thus, the provincial departments have, in the all-important matter of research, been left without the stimulus of a central organisation which could guide and co-ordinate their policy. Although no specific provision has been made in the Constitution of 19 for co-ordinating research work, either as between the central and provincial spheres or as between province and province, there is nothing inherent in that Constitution which prevents appropriate machinery being devised for that purpose.

The basis of all agricultural progress is experiment. However efficient the organisation which is built up for demonstration and propaganda, unless that organisation is based on the solid foundations provided by research, it is merely a house built on sand. In spite of the marked progress which has been made in many directions during the last quarter of a century, it is hardly an exaggeration to say that agricultural research in this country is still in its infancy. The claims of research have received a half-hearted recognition and the importance of its efficient organisation and conduct is still little understood. The history of the scientific organisation of agriculture in other countries of wide extent and strong local administrations such as the United States of America, Canada and Australia should not make this comparative lack of appreciation of the need for organisation a matter of surprise. We have carefully studied the organisations which they have adopted and have had an opportunity of examining their representatives. We believe that the time will come in India as it has already come in those countries, when the indispensable part, which a central organisation has to play in the fields of agricultural research, and of rural development generally, will be fully recognised.

We think, indeed, that, with the undoubted demand for an increase in the pace of agricultural progress, the time has even now come when there will be a general measure of support throughout the country for proposals designed to promote co-ordination of a more effective character than would be provided by the continued existence of the appointment of Agricultural Adviser to the Government of India and by conferences of Ministers and Directors of Agriculture and meetings of the Board of Agriculture.

A reference has already been made to the Agricultural Research Institute at Pusa which is maintained by the Government of India. We feel strongly that it is essential to the advancement of agricultural research in India that Pusa should be brought into closer touch with the provincial

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cost of existing institutions and for normal expansion will be met from central or provincial revenues as the case may be. The Council of Agricultural Research and the Agricultural Research Fund should be constituted by an Act of the Imperial Legislature. The position of the Council of Agricultural Research in relation to the administration of the research fund would be analogous to that of the Indian Central Cotton Committee in relation to the funds raised under the provisions of the Indian Cotton Cess Act of 1923. Subject to such conditions as might be prescribed, the capital and income of the fund and any other funds received by the Council would be utilised in meeting its expenses and the cost of such measures as it might decide to undertake for promoting agricultural and technological research in the interests of agriculture in India. The powers of the Council would be regulated by rules issued by

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... with the Central Research Council, we would recommend that a Provincial Research Committee should be established in each of the major provinces which will work in close co-operation with the Council.

We propose that the Council should consist of 39 members. Three of these would be whole-time members—the Chairman, who should be an experienced administrator with a knowledge, if possible, of Indian conditions, and two eminent scientists qualified to represent respectively the interests of agriculture and animal husbandry. Of the remaining thirty-six members, eight would be nominated by the Government of India, eighteen would represent the provincial, agricultural and veterinary departments, three would represent the Indian universities, two would represent the Indian Central Cotton Committee and the planting community respectively and five would be non-official members

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in our view, rule any proposal of this kind out of consideration
conditions. If conditions alter, the Council of Agricultural R
which we propose could be expanded to include all activities that
any bearing on rural progress.

On the formation of the Council of Agricultural Research, the necessity for an Agricultural Adviser to the Government of India will disappear. This officer is at present the Director of the Pusa Institute. A whole-time Director will be required for Pusa who in addition to the administrative control of that Institute will also exercise administrative control over sub-stations now under the Agricultural Adviser but not over the Imperial Institute of Veterinary Research at Muktesar for which other arrangements are proposed in Section VII (Chapter IX of the main Report). On the constitution of the new superior provincial

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… is our view that the Board of Agriculture which, *inter alia,* provides the only means by which, in present conditions, Indian States can be brought in touch with the agricultural problems of British India and the methods employed in solving them will still have many useful functions to perform after the Council of Research has been set up. We, therefore, are strongly of opinion that the Board should continue to meet under the chairmanship of the Chairman of the Council of Research and that the Council should advise the Government of India as to any changes in its constitution which may seem calculated to promote its usefulness.

III. AGRICULTURAL IMPROVEMENT AND THE SUB-DIVISION AND FRAGMENTATION OF HOLDINGS

CHAPTER IV OF THE MAIN REPORT.

The principal concern of this Commission is to suggest the lines on which agriculture in India can be improved. The field is a vast one and the diversity of soils, local conditions and agricultural practices is very great. As an indication of the immensity of areas under the various crops, it may be noted that there are over 80 million acres under rice, some 24 million acres under wheat, 33 millions under the greater millets, *juar* and *bajra*, 18 millions under cotton, 14 millions under the principal oil-seeds and 14 millions under gram.

The soils of India may be broadly divided into four groups (*a*) the "red" soils of the crystalline tract, (*b*) the black cotton or *regur* soils, (*c*) the alluvial soils and (*d*) the laterite soils. These vary remarkably in agricultural properties and the desirability of soil surveys has been frequently pressed upon us. While admitting its importance, we do not think it is a practicable proposition to undertake at the present time a soil survey for the whole of India on the lines of that now in progress in the United States of America. In view of the prohibitive cost of a complete and scientific soil survey, we recommend that agricultural departments should undertake intensive surveys only when there is some specific problem to be solved or when laboratory examination of soils is called for to interpret more fully valuable information already on record.

The question has been much argued whether the soils of India are to-day undergoing a progressive decline in fertility. Such experimental data as are at our disposal suggest the view that, in an overwhelming proportion of lands in India, a balance has been established and no further deterioration is likely to take place under existing conditions of cultivation. The chemists of the agricultural departments have devoted much attention to the study of local soil types and local soil conditions. Such a study is indeed an essential preliminary to the initiation of research into local problems. The discovery of deficiencies in plant food materials which results from these examinations of soil attracts attention to manurial problems, and these investigations have formed the basis for manurial experiments. The conclusion to be drawn from the results which have been already obtained is that the foundation has been well prepared, but that much more research is necessary and that rapid and uninterrupted progress cannot be expected unless the staff of research workers is largely increased. The time has come when the assistance of specialist officers can be usefully called in, more especially in the direction of bacteriological, physical and biological research.

Our attention has been drawn to marked cases of soil deterioration as a result of erosion of the surface soil by flood water. In the United Provinces, this has been arrested to a large extent by the afforestation of the ravine tracts; in Bombay, by the terracing of land and the construction of earth and stone embankments. Other tracts in which

the evil exists are western Bengal, the submontane districts of northern India generally and Chota Nagpur. The applicability to these tracts of the methods which seem to have proved successful in the United Provinces and in Bombay should be investigated.

It must be admitted that although a great deal of careful work has been done, little progress has been made in introducing improved manurial treatment into general agricultural practice. The agricultural departments are not yet in a position to give definite advice in regard to the economic use of fertilisers. There is justification for the view that improved varieties of crops require for their fullest development more liberal manurial treatment than those ordinarily grown, but the subject is one which requires the most careful study by the agricultural departments. A large amount of information—the result of experiment—has been collected. This, we consider, should be carefully studied and the results obtained correlated. A definite programme of experiment should be laid down to ascertain, with all possible accuracy, the extent to which fertilisers can be used with profit. This is a matter of such great importance that we consider the Council of Research might suitably undertake the direction of investigations. This Council should be in a position to advise as to the manner in which experiments can best be conducted so as to secure uniformity of method and to render results obtained in one province of value to other provinces.

The most readily available supply of plant food is, of course, farmyard manure. But, unfortunately, a very large amount of this is lost to agriculture through the custom of using cowdung cakes for domestic fuel. No satisfactory alternative has been suggested where coal and wood are dear. If the practice of using the refuse of crops such as cotton stalks, megass, etc., as fuel could be extended, there would probably be less wastage of farmyard manure. Much more might, however, be done to conserve at any rate that portion of the manure which is not used for fuel purposes. This is a matter to which the agricultural departments should devote their attention. The manufacture of composts and of synthetic farmyard manure, and, where night soil is available, of poudrette by municipalities are directions in which investigation is called for. The activated sludge process provides a means of overcoming the objections of the cultivator to the use of night soil. Other matters which require close study, especially from the point of view of the small cultivator, are the place and value of leguminous crops in the cultivator's rotations and the economics of growing green manure crops.

Oil-seeds are an important crop in India and, if applied as manure in the form of cake, would give a very large supply of combined nitrogen. They are not much used for this purpose at present. The only method by which their advantages can be secured is by the development of the oil-crushing industry coupled with great changes in cattle management and the abandonment of the custom of using cattle manure as fuel. An extension of the oil-crushing industry would undoubtedly tend to promote the welfare of the Indian agriculturist,

and we would commend the investigation of its possibilities to all local governments.

Another source of nitrogen is found in sulphate of ammonia which is available as a by-product from coal, but the price factor limits its application to the most valuable crops such as sugarcane and garden crops and it is, therefore, unlikely to affect the small cultivator.

Other forms of manure which supply both nitrogen and phosphates are bones and bonemeal and fish manures. The crushing of bones is an industry which could be taken up on a larger scale in India but a far more thorough investigation of the economics of the bone-crushing industry than has yet been carried out is, we consider, required before the establishment of such mills by private enterprise can be encouraged. The first essential is to obtain definite data in regard to the price at which, and crops for which, the use of bonemeal is advantageous to the cultivator and we suggest that the agricultural departments should take early steps to collect this data. We do not consider that there is any justification for the restriction of the exports of oil-seeds and oilcakes, bones and bonemeal or fish manures by the imposition of an export duty or for the prohibition of such exports.

It may be said that the main success of the agricultural departments has been in the direction of the introduction of improved varieties of crops and in this branch of its work it has been eagerly assisted by the cultivator It is estimated that nearly nine million acres are now under improved varieties of different crops. It is true that this only represents a small fraction of the total area under these crops, but, even so, it can be claimed that a substantial beginning has been made. The crops in which the greatest advance has been made are cotton, wheat, rice, groundnut and jute, but there is still very great scope for further work especially in regard to the millets, pulses and oil-seeds

There are three methods of obtaining varieties superior to those ordinarily grown either in respect of yield, quality or suitability to the special conditions of environment. These are selection, hybridisation and acclimatisation. Of the three, selection seems to be the most hopeful line and that which offers the greatest immediate possibilities of effecting improvement in Indian conditions. Hybridising is highly specialised work and requires officers with a very special training and a wide knowledge of Indian conditions. Acclimatisation means the adaptation of exotic varieties to Indian conditions. The most notable achievement in this respect in recent years has been Cambodia cotton. This line of experiment, important though it is, should not take precedence of work on crops already grown in India. Whatever improved varieties may be evolved by selection or hybridisation, no new variety should be put out unless it has been thoroughly established that it possesses marked advantages over those already grown. It is important also that new varieties should be thoroughly tested on holdings typical of those in the tracts for which they are deemed suitable and also that the value of the new variety in its place in the

normal rotation of the cultivator should be proved. Such experiments should be carried on over a series of years.

We now pass to the question of distribution of the improved seed which has been evolved. The conditions of India in this respect are somewhat peculiar. Except for flower or vegetable seeds, there are no seed merchants in the sense in which the term is understood in European countries. For many years to come it seems probable that the work of seed distribution will have to remain in the hands of the agricultural departments. But if seed merchants of proved enterprise should be forthcoming, they should be given every encouragement. In present conditions, the co-operative agency seems to offer the best prospects of assistance to the agricultural departments in seed distribution though private seed agents, as distinct from seed merchants, might also be employed. They should be persons on whom the agricultural departments can rely and should deal only with seeds supplied by the departments in sealed bags or packets.

Until reliable seed merchants come into the business, the selection and distribution of pure seed should be controlled by the agricultural departments. It is not possible to lay down any rigid lines of policy. Departments must be guided by local conditions and must use such agencies as are available locally for the production and distribution of pure seed. But a considerable increase in the number of seed farms, both departmental and private, is very desirable. These can either be run departmentally or by cultivators who agree to grow seed for the departments under their supervision and control. Here again the co-operative movement can be of great assistance.

The problem of seed distribution is of such importance that, even with all the assistance which co-operative and other organisations can give, we consider that a separate organisation is necessary within the Agricultural Department, to deal with seed distribution and seed testing. The officer in charge of this work should be of the rank of a deputy director of agriculture and should take over all immediate administrative responsibility for seed testing and seed distribution. It would be his business to organise distribution through co-operative societies and other associations, through seed merchants wherever they are available, and through seed agents, as well as through the departmental staff and any other agencies which he may consider suitable. Whilst the agricultural departments ought not to look to seed distribution as a source of profit, the work has reached a stage at which it may legitimately be expected to pay its way.

Agricultural engineering is an important section of the activities of the agricultural departments and it is one to which, in our opinion, sufficient attention has not in the past been devoted. We consider that this section should be completely reorganised and that it should in all respects form an integral part of the department. Officers for the engineering branch should not only be recruited on the same terms as members of the new superior provincial agricultural services, but should be included in the cadre of those services. In provinces where

pumping and boring operations are of importance, it would probably be advantageous if this work could be entrusted to one branch of the engineering section and if a separate branch were to deal with agricultural machinery and implements. Where wells are numerous, it might be desirable to entrust the work on water-lifts to a third branch. All the activities of the agricultural engineering section should, however, be under the technical control of a senior engineer under the Director of Agriculture. This senior engineer could be selected either from the officers in the engineering section or from outside as necessitated by circumstances. Great care should be taken in the selection of the officer in charge of the work on implements and machinery. He should be a man who is not only an engineer but is also familiar with the use of agricultural machinery and implements. Amongst the most important problems to be dealt with by the engineering section is an enquiry into the capacity of the draught cattle of India with relation to the implements they are required to draw. Further, before discarding indigenous implements in favour of foreign designs, exhaustive trials are necessary to test the comparative merits of the two types under the conditions in which the cultivator works. In general, it may be laid down that the aim of the agricultural departments should be the evolution of a small number of types of implements and machinery suitable for a wide range of conditions and suitable also for mass production. In our view, the improvement of existing agricultural implements and machinery offers a more promising field than the introduction of new types.

It is desirable that, when new types have been evolved, their manufacture should be taken up by manufacturers in India. In order to overcome the difficulties of transporting such manufactures over the vast distances which one finds in India, we would suggest for the favourable consideration of the railway authorities a re-examination of railway freight rates on agricultural implements and machinery and the grant wherever possible of concessions. In this connection, it has also been represented to us that, whilst agricultural implements and machinery with a few exceptions are admitted into India free of duty, the high protective duties levied on imported iron and steel greatly increase the cost to the Indian manufacturer of his raw material whether imported or produced in India. We consider that this is a matter which might be investigated by the Indian Tariff Board.

Cultivators in dry and precarious tracts are those whose struggle for a livelihood is commonly the hardest. The problems of cultivation in such tracts in which crops are entirely dependent upon rainfall are, in our opinion, deserving of far closer attention than they have received from the agricultural departments.

The crops of the Indian cultivator like those of cultivators elsewhere are liable to suffer from insect pests and plant diseases. He is protected against the introduction of these from outside by the Destructive Insects and Pests Act (II of 1914). The rules framed under the Act are adequate but it is important that the co-operation of the maritime Indian States

should be secured, while Burma should consider the desirability of legislation to prevent the importation of pests and diseases from India. The Government of India as well as provincial governments should, as far as possible, strengthen their entomological and mycological staffs. It may also be advisable to frame provincial legislation to deal with internal pests and diseases, as has been done in Madras where an Agricultural Pests and Diseases Act was passed in 1919. Other dangers to crops are wild animals and vermin. The former can probably be dealt with by the grant of gun licenses on a more liberal scale, or by fencing if a cheap and effective method can be found. This is a matter for investigation by the agricultural departments. Where serious damage to crops is caused by vermin, a special staff might be organised for its destruction as in the Punjab and Sind.

CHAPTER V OF THE MAIN REPORT.

A serious obstacle to agricultural improvement is, in some provinces, caused by the subdivision and fragmentation of holdings. Subdivision is chiefly due to the laws of inheritance customary amongst Hindus and Muhammadans which enjoins a succession to immovable property amongst all the heirs usually in equal shares. Fragmentation is, in the main, due not to the laws of inheritance but to the method by which the law as to division of property amongst the heirs is carried into effect. The problem is being attacked by the Co-operative Department in the Punjab where some striking results have been achieved, and by legislation in the Central Provinces. The latter method is also proposed in Bombay. In paragraph 126 of the main Report, we state the general principles which, we think, should be adopted in any legislation designed to promote the consolidation of holdings.

IV. DEMONSTRATION AND PROPAGANDA

CHAPTER VI OF THE MAIN REPORT.

In order that agricultural research may be of use to the cultivator, its results must be given to him in a form in which they may become a part of his ordinary practice. In a country in which illiteracy is so widespread as it is in India, ocular demonstration is the best method of convincing the cultivating classes of the advantages of agricultural improvement. But, before an improvement can be recommended for general adoption, it must be thoroughly tested on a government farm. It must be within the means of the cultivator to whom it is recommended and it must give a substantial financial advantage either in increased outturn or in the reduction of his cultivation expenses.

There are two methods of demonstration—the demonstration farm and the demonstration plot. Opinion is almost unanimous that the best and quickest method of influencing the practice of the cultivator is to demonstrate an improvement in crop or method on a small plot cultivated under departmental control or direction. This has the advantage of bringing the demonstration right into the heart of a village. The demonstration farm is open to the objection that it creates a suspicion in the mind of the cultivator that the methods by which it is cultivated are not applicable to his means and conditions. The farm buildings, which are often of a somewhat elaborate character, the superior cattle, the up-to-date implements and careful layout are apt to create an impression that the methods adopted are entirely beyond his means. Again, the influence of a demonstration farm is very limited and can only reach the cultivators in its immediate neighbourhood. If, however, a demonstration is carried out on the cultivator's own land, it is open to none of these objections. We admit, however, that demonstration farms may be necessary for special purposes, for example, to demonstrate the advantages of using a particular method of curing tobacco or of a small plant for making white sugar or high quality *gur*. In other words, we realise the necessity for special farms for demonstrations which involve industrial as well as agricultural operations. But, for demonstration of actual agricultural processes, we are of opinion that the demonstration plot is the most suitable.

As a rule, demonstration work should not be carried out on experimental farms. The conditions imposed by the experimental character of the work carried out on such farms are often of such a nature as to render the practices followed on them inapplicable to ordinary cultivators. There is, however, no objection to spare land on an experimental farm being set apart for demonstrations. We see positive advantages in seed farms being used as demonstration farms, provided the primary purpose of the farm is not detrimentally affected thereby. The seed farm affords special opportunities to the cultivator of seeing the extent to which the adoption of improved methods of cultivation or the use of manures can increase the outturn of the seed issued to him.

A question which is often discussed is whether departmental farms should pay their way. Farms which have been established solely

for experimental work cannot be expected to do so. Receipts are an entirely secondary consideration in their case. Seed farms should ordinarily be expected to be at least self-supporting as far as their seed work is concerned. Demonstration farms established to demonstrate the possibility of commercial farming would obviously fail in their purpose if they did not yield a substantial profit. Where district and tehsil farms are opened to further the general propagandist work of the department, they should not necessarily be expected to pay.

We consider that short courses in particular subjects for cultivators given on demonstration and seed farms form an excellent means of establishing closer touch between the agricultural departments and the cultivator. These courses should be carefully thought out and a particular member of the staff should be detailed to give them. The question of providing stipends or free accommodation to attract cultivators is a matter for local settlement.

Two systems of demonstration on the cultivator's own fields are in vogue. In the first, a plot is hired for the demonstration and the cultivation is carried on throughout by the departmental staff. In the other, the cultivation is carried on by the cultivator himself from start to finish under the close supervision of the agricultural demonstrator. The first method has the advantage that more reliance can be placed on the data which are collected in the course of the demonstration; the second that, as all the work is done by the cultivator himself, he is placed in a better position to realise the true value of the improvement which is being demonstrated. Both methods have much to recommend them and we consider that they might well be tried in all provinces and the results compared.

The question arises whether the cultivator whose land is used for the purpose of demonstration should be guaranteed against any loss which may result. We consider the policy of giving guarantees to be one of doubtful expediency. It may be necessary if, without it, demonstration plots are not procurable. Even if no guarantee is given, some compensation should, of course, be made if, for any reason, failure in the methods adopted has involved the cultivator in loss.

There is no respect in which the short courses, the establishment of which we have referred to, should prove of more value than in promoting the use of improved implements, more especially if they include instruction not only in the use of the implements but also in their repair. We also consider that much could be done to popularise improved implements by peripatetic demonstrations. The demonstrators, wherever possible, should take with them a supply of spare parts and should be accompanied by an instructor who would teach the village smiths how to fit new parts and make adjustments and repairs. The use of the more expensive implements and machinery might extend more rapidly if suitable arrangements for hiring them out could be made either by the agricultural departments or by the manufacturers in consultation with the departments. We also desire to emphasise the importance of agricultural shows. These should include

demonstration of such machinery and implements as are suitable for the tract in which the show is held and exhibits of livestock and produce. If these shows are to exercise their full effect in educating opinion among local cultivators, it is essential that they should be held year after year, if not in one centre, at least in the same part of the country. A permanent agricultural stall should also be a prominent feature of the regulated markets, the establishment of which we recommend in Chapter XI of the main Report (*see* page 44 below). The agricultural departments might also have suitable exhibits at the big fairs and festivals which are so common in India.

The publications of the various agricultural departments include vernacular leaflets, bulletins, journals and calendars while the departments in most of the provinces supply regular material to the English and vernacular press. The success of these publications depends primarily on the amount of literacy in the various provinces and we have no desire to lay down any general directions in this matter. We would, however, point out that vernacular leaflets are of little value unless they are issued in connection with a definite demonstration of their subject matter. We approve of publicity in any form where it is felt that it will be appreciated by the public. Our remarks with regard to vernacular leaflets apply also to lectures, with or without lantern slides, and to cinema demonstrations. Propaganda through these means will be of little value unless it is used in conjunction with an actual demonstration of results. With regard to cinema exhibits, an agricultural film is apt to fail in its purpose unless it has been carefully prepared by a producer with considerable knowledge of village life and of the mentality of the average villager. For this reason, the agricultural departments should consider the advisability of preparing their own films.

In this connection, we would mention an interesting experiment which has recently been made in Bengal and the Punjab. A demonstration train was fitted up as a travelling exhibition by the Railway, Public Health, Agricultural, Industries, Co-operative and Veterinary departments and carried out an extensive tour throughout these provinces. In addition to the exhibits of various departments displayed to the public, open air lectures illustrated by films and lantern slides were given at each stop. The possibility of such a demonstration train should, when the results of the Bengal and Punjab experiment are known, be considered by other provinces.

Of other methods of propaganda, agricultural associations, as originally constituted, have, for the most part, hitherto proved a failure. The area from which the members were drawn was usually too large to permit of a concentration of activity sufficient to produce any positive results. The lack of a definite task often meant that nothing at all was done. Members were frequently drawn from people whose direct interest in the land was small or the associations depended too much upon the enthusiasm of a single member, while the staff of the agricultural departments was too limited to enable them to give the associations the necessary close attention. In recent years, however, in Bombay and the Central Provinces many of them have been reorganised in the light of experience

and converted into active bodies. The tendency in the Central Provinces now is to develop the smaller unit, starting with the tehsils and working up to the circle and the district. An interesting development is in progress in Bombay, where taluka development associations and divisional boards of agriculture have been formed. This represents the most systematic attempt which has yet been made to co-ordinate the propaganda work of the agricultural and co-operative departments in respect of agricultural improvement. The idea is that, as soon as possible after the constitution of an association, a survey of the taluka is to be carried out by the agricultural and co-operative departments. Where such associations exist, they have taken over the work formerly done in the taluka by agricultural associations, co-operative development committees and similar bodies. The associations are mainly deliberative bodies and approve the programme of work in the taluka. Their main object is the demonstration of improved implements, improved seed and manures, but they do not undertake the demonstration of any improvements unless they have already been successfully demonstrated on the cultivators' own fields by the staff of the Agricultural Department. If an association asks for them, the services of a fieldman are placed entirely at its disposal by the Agricultural Department, the cost being met from the funds of the association. The funds required for the work of the association are provided by a capital fund raised by donations, by annual subscriptions from co-operative societies, individuals, and villages as a whole and by an annual grant from Government which at present is equal to the income from other sources up to a limit of one thousand rupees. The taluka development associations work under the supervision of divisional boards, consisting of two official and four non-official members, two representing the co-operative movement and two agriculture. The board is expected to meet at least once a quarter and to submit a report of its proceedings to the Director of Agriculture and the Registrar of Co-operative Societies. The board distributes the government grants allotted to the taluka associations, and controls the distribution of the portion of the government grant for loans to co-operative societies which was formerly in charge of the Registrar of Co-operative Societies. It undertakes the distribution of the discretionary grant for propaganda purposes which was formerly administered by the Director of Agriculture. It is also expected to advise local officers as to the way in which the policy laid down by Government or by the Director and the Registrar is to be carried out in their division. It discusses questions of general importance and brings to the notice of the department concerned such measures as it thinks should be taken for the economic advancement of the division. The Government of Bombay have laid down that the propaganda work of the Agricultural Department should be carried on as far as possible through co-operative unions where they exist and, where they do not, through isolated co-operative societies. A report on the work of all the propaganda staff is submitted to the divisional board by the departments concerned every quarter and is forwarded to the Director of Agriculture and the Registrar of Co-operative Societies with the board's remarks. Any recommendations made by the

board are considered and orders on them are issued by the Director and the Registrar jointly. We consider that this system provides a model which is worthy of study by other provincial governments. We are convinced that it is only by the adoption of this, or of some similar system, that the agricultural departments can effectively utilise the help of co-operative and other associations.

We have described the work of the taluka development associations in some detail because we consider that agricultural departments have, on the whole, failed to exploit the possibility of propaganda work through the co-operative departments. While this has been largely due to the fact that the co-operative movement in several provinces in India has not yet reached a stage at which it can undertake on an extensive scale any activities other than credit, there can be no doubt that lack of sufficiently close touch between the agricultural and the co-operative departments has been a contributory cause. The agricultural departments should make far greater use of the co-operative credit society in their propaganda work than they are now doing.

We desire to emphasise the importance of concentration in all demonstration and propaganda work. For this reason small units should be selected. Once an improvement has thoroughly established itself in the agricultural practice of a small area, the knowledge of it spreads naturally over contiguous areas where conditions are similar. In particular, concentration is necessary in regard to the distribution of the seed of improved varieties. An improved variety can thus more easily be produced in bulk and a premium for the quality more readily obtained from the trade. Similarly the subjects selected for demonstration should be strictly limited. The energies of the agricultural departments should not be dissipated.

Questions of demonstration and propaganda are of such importance that we consider that an officer of the standing of a deputy director of agriculture might well be attached to the office of the Director of Agriculture whose sole duty would be to organise and systematise propaganda work throughout the province. His task would be to watch the various schemes of propaganda in operation, to record their results and to suggest methods of making them more effective. He would be expected to familiarise himself as far as possible with experiments in demonstration and propaganda in other provinces and in other countries, and generally to keep the research staff in touch with what was going on in the districts.

We consider that the propaganda work of departments concerned with rural welfare, other than the agricultural and veterinary departments, is best carried on through associations of a more general character than taluka development associations and agricultural associations.

We consider that a valuable stimulus to agricultural development in India would be given if the Government of India were to award an annual prize for the most striking agricultural improvement of the year. The conditions governing the award of the prize should be made as definite as possible and we would instance the invention of new or improved implements or the introduction of new or improved varieties of crops as examples of the class of work which would constitute a claim to it.

V. ANIMAL HUSBANDRY

The latest statistics give the following figures for the different groups of livestock in British India.

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	Millions
Cattle and buffaloes	151·0
Sheep and goats	62·5
Horses, mules and donkeys	3·2
Camels	0·5

In the 66 Indian States for which statistics are available, there were, in 1924-25, over 36 million cattle and buffaloes, 25 million sheep and goats, one million horses, donkeys and mules, and 262,000 camels. In no country of the world are cattle of more importance than they are in India. Milk, though important, is a secondary consideration. The primary function of the cattle is as draught animals for the plough or the cart. Without the ox, no cultivation would be possible: without the ox no produce could be transported.

In spite of the wide differences between province and province, in physical features and in the numbers of the cattle, there seems to be a general similarity in India in the methods of management by cattle owners. A detailed study of a few closely settled districts suggests that the total number of ordinary cattle is primarily determined by the number of animals needed for work on the land. A comparison of the number of cattle kept in India with those kept in other countries indicates the possibility of reducing the number of working bullocks without necessarily reducing the existing standard of cultivation. There would, in fact, appear to be an excess in the numbers of the cattle necessary for cultivation if these cattle were efficient. The figures suggest the existence of a vicious circle. The number of cattle within a district depends upon and is regulated by the demand for bullocks. The worse the conditions for rearing efficient cattle, the greater the numbers kept tend to be. Cows become less fertile and their calves become undersized and do not satisfy cultivators who, in the attempt to secure useful bullocks, breed more and more cattle. As numbers increase, or as the increase of tillage encroaches on the better grazing land, the pressure on the available supply of food leads to still further poorness in the cows. As cattle grow smaller in size and greater in number, the rate at which conditions become worse for the breeding of good livestock is accelerated. For it must not be supposed that the food required by a hundred small cattle is the same as that needed by fifty of double the size. As cattle become smaller, the amount of food needed in proportion to their size increases. Thus large numbers of diminutive cattle are a serious drain on a country in which the fodder supply is so scarce at certain seasons of the year as it is in India The process having gone so far, India having acquired so large a cattle population and the size of the animals in many tracts having fallen so low, the task of reversing the process of deterioration and of improving

the livestock of this country is now a gigantic one ; but on improvement in its cattle depends to a degree that is little understood the prosperity of its agriculture and the task must be faced.

Unless substantial changes in the existing management of cattle are introduced, a progressive deterioration in the quality of the cattle is to be feared. Four cardinal points in a policy of improvement must be (*a*) a reduction in the number of plough cattle ; (*b*) an increase in the efficiency of plough cattle ; (*c*) attention to all matters that would tend to decrease the number of bullocks required for cultivation; and (*d*) an effort to secure better treatment for dry cows and cows in-calf.

The most important matter in connection with the maintenance of stock is the manner in which it is fed. In India, where stall feeding is little practised, the facilities for grazing are the principal consideration. It may be said that, in nearly every part of India the common grazing lands and all grass lands close to villages are generally hopelessly overstocked. The custom that an animal, if not working, should find its own food in the jungle when there is no fodder available on his holding results in the cultivator being unwilling to make any unusual sacrifice for the well-being of his cattle. The general position as regards cattle management may be summed up as follows. The ordinary cultivator does what he can for his plough cattle and his cow buffaloes ; quite often he does well for them, but bad seasons create difficulties for even the best cultivators, and the best of their cattle. The cow is less fortunate ; she gets little stall feeding and has to seek the greater part of her food where she can ; young cattle and the male offspring of her rival, the she-buffalo, share her fate and pick up their livelihood on common grazing grounds or by raiding crops.

It is only fair, however, to note that there are exceptions and that, where their treatment is good, many fine cattle belonging to a number of well recognised breeds are to be found. Amongst them the best known are perhaps the Hariana and Sahiwal of the Punjab, the Thar Parkar and Sindhi of Sind, the Kankrej of Gujarat, the Gir of Kathiawar, and the Ongole of Madras.

The two important factors in cattle improvement are feeding and breeding. We place feeding first because no outstanding improvement in the way of breeding is possible till cattle can be better fed. The crux of the situation is the period of scarcity which in most, though not in all parts of the country, is the two or three months preceding the break of the south-west monsoon. Since it is the curtailment of uncultivated land as population has increased during the past century that is the most obvious cause of the present overstocking of village grounds, it is not surprising that many witnesses have advocated the extension of grazing land. After an exhaustive survey of the possibilities, we are of opinion that no large additions to existing grazing areas are possible and efforts should therefore be concentrated on increasing the productivity of the land already growing grass. The scope for such efforts is very great. The productivity of the existing grazing grounds could be increased in the following ways :

(*a*) grazing on the common land could be regulated and rotational grazing established with the consent of the majority of those possessing grazing rights and by means of authority conferred on a group of villagers, for instance on a *panchayat* or co-operative society ;

(*b*) in some instances, a definite area of the common land could be separated off for a village co-operative cattle improvement society ;

(*c*) in hilly districts, where the grazing facilities are better than they are elsewhere, an attempt should be made to demarcate areas to be assigned at nominal rates to groups of occupiers of village lands on the following conditions :—

(*i*) the area shall be grazed in rotation ;
(*ii*) cattle not owned by the group shall be excluded ;
(*iii*) part of the area shall be reserved for cutting grass for use in the hot season.

Where use cannot be made of natural grazing grounds owing to lack of water, the possibility of obtaining a supply should be investigated. In some parts of India, there may be considerable tracts of grass land which are not being fully utilised owing to lack of water.

As a supplement to, or a substitute for, natural grazing, the cutting and storage of dry grass is important. The possibilities of silage are also great, though the practice is attended by difficulties and has not been adopted by cultivators. Much propaganda is necessary. In many other directions, the fodder position can be improved. The use of the chaffcutter, the addition of cheap meal and condiments to make straw more palatable, harvesting at the right time so as to get full value from the straw, the encouragement of the growth of fodder crops are some of the lines for further trial and investigation. The cultivation of Egyptian clover (*berseem*) seems to hold out great possibilities if the seed can be cheaply grown in quantity in India. Every encouragement should be given to the cultivation of leguminous crops by the remission of charges for water from government sources of irrigation or by the grant of concession rates.

With regard to the improvement of cattle by careful breeding, the aim should be to establish pure and improved types of the best cattle now available and this should not be endangered by an attempt to produce a "dual purpose" animal suitable both for draught and for milking and *ghi* production. As a general rule to be followed in the breeding of draught cattle, we are of opinion that milking qualities should be encouraged only in so far as these are entirely consistent with the maintenance of the essential qualities which good draught cattle must possess.

Although government departments have now made a serious beginning with cattle improvement, very little progress has yet been made by government cattle farms towards meeting the total requirements for young bulls. As a general principle regulating such distribution, we commend for adoption elsewhere the policy pursued in the United Provinces of limiting the issue of breeding bulls to selected districts with a regular inspection both of the cows and their progeny and of the bulls placed out. We, therefore,

endorse the recommendation of the Bombay Cattle Committee of 1923 that intensive breeding operations should be conducted in selected areas. We consider the selection of areas and inspection of stock to be absolutely essential to securing any marked improvement from the issue of selected bulls from government farms.

The production of milk for urban consumers presents problems of great complexity. The cultivator, of course, uses milk and its products but for these he relies to a great extent on the buffalo. He is principally concerned with the cow as the mother of his bullock and attaches only secondary importance to its milking capacity. The essentials for a successful scheme of urban milk supply are a tract of country in which fodder is plentiful or can be easily grown, adequate arrangements for transport and a suitable type of cow. A cow for dairy purposes should average 5000 lbs. of milk during a lactation period and the aim should be to get an animal with an average of 8000 lbs. Improvement of indigenous breeds by selection is a safer policy for agricultural departments to pursue than cross-breeding and this process should also be applied to buffaloes. The supply of milk to urban consumers is at present most unsatisfactory. Municipal corporations of the larger cities, in addition to organising co-operative societies for the supply of milk should promote the establishment of large dairy farms and devise means by which capital and business ability may be attracted to large scale milk production.

As a rule, the control of livestock improvement should be entrusted to the agricultural departments but we do not recommend any change in the present arrangements in the Punjab where the Hissar farm has been in charge of successive veterinary officers with exceptional qualifications as stock breeders. When veterinary officers show a special aptitude for work on livestock improvement, they should be posted to livestock farms. Each major province should have a whole-time livestock expert.

At present, there is an Imperial Institute of Animal Husbandry and Dairying at Bangalore. This is divided into two sections, an animal nutrition section under a physiological chemist and a dairying and cattle breeding section under the Imperial Dairy Expert. The latter section, in addition to the farm at Bangalore, has attached to it farms at Wellington and Karnal, and a creamery at Anand in Gujarat. We consider that the staff of the animal nutrition section should be enlarged and that a scheme for a research institute for the investigation of animal nutrition problems should be prepared. There should be close touch between the staff of this institute and workers on the problems of human nutrition. In view of the fact that agriculture is now a provincial subject, we do not recommend the permanent retention of the dairying section of the institute nor of its cattle breeding stations with the exception of the station at Karnal which is well suited to become a centre for any cattle breeding experiments which may be required in connection with central research. Each province now has or will shortly have its own livestock expert. Cattle breeding problems are in the main local and it seems natural and proper that the

ordinary work of cattle breeding should be undertaken by the provinces themselves. Further we consider it the duty of the provincial colleges to provide instruction in dairying for their own students. Such research work of an all-India character as is necessary in connection with dairying could be conducted more advantageously at Pusa or some other scientific centre where chemical assistance is readily available, than at the Anand creamery. We do not recommend that these proposals should take effect till the present Imperial Dairy Expert retires. The three farms and the Anand Creamery should be retained until the enlarged nutrition institute has been established and the suggested changes at Pusa have been carried into effect.

As has already been noted, one of the members of the Council of Agricultural Research will represent the interests of animal husbandry. He should be an authority either in livestock breeding, animal nutrition or veterinary medicine. As he cannot be expected to be equally competent in all these three branches, arrangements should be made for *ad hoc* committees of experts under his chairmanship to deal with special questions.

VI. FORESTS

CHAPTER VIII OF THE MAIN REPORT.

Forests are often described as the hand maiden of agriculture, and it is as such in their relation to the agriculturists' needs that we deal with them. They provide the cultivator with fodder for his livestock and with fuel and timber for his domestic consumption. The part which forests play in the protection of soils liable to erosion has also an agricultural bearing.

Grazing in forests is permitted under the Forest Code on payment of certain fees or free of all charges. We consider that the replacement of grazing by grass cutting would, in many instances, be an improvement. But the present custom of grazing in forests will, for a very long time to come, be an important feature of forest economy. It, therefore, seems to us desirable that the intensity of grazing consistent with the proper development of forests and the preservation of desirable grasses should be determined as soon as possible.

The question of cut fodder is one which, at present, only comes into prominence at times of scarcity or famine. But with the improvement of the livestock of the country and the probable consequent development of stall feeding, cut fodder will assume an increasing importance. The possibilities of fodder supplies from forest areas should, therefore, be carefully examined both by the forest and the agricultural departments. Schemes should be devised for the improvement of grasses grown in forest and for the encouragement of grass cutting in preference to grazing. In this connection, the railway rates for fodder which can be transported are an important consideration and the railway administrations should offer the lowest rates for the transport of fodder compatible with their position as profit-earning concerns.

The next most important matter from the point of view of a cultivator is the provision of fuel and timber for domestic purposes. As is well known, the practice of burning cowdung cakes is very general in many parts of India and, in defence of this custom, it may be remarked that cowdung is at present the only certain supply of fuel which the great majority of cultivators can obtain. Before, therefore, this practice can be condemned or stopped, the possibility of supplying an alternative fuel must be carefully investigated. Fire-wood, charcoal and coal are the substitutes for cowdung cakes, but the cultivator must be convinced that it is cheaper for him to use one of these substitutes than to burn his manure. An investigation into the cost and efficiency of wood, charcoal or coal in terms of the loss to agricultural production by burning cowdung is urgently required. Into this question, again, enters the incidence of railway freights. We also realise that traditional custom will be a strong barrier to change of method. The breaking down of prejudice and the provision of an equally cheap and effective substitute are the essentials. The possibilities of afforestation for the increase of fuel supplies should also be thoroughly investigated.

We regard the development of forest industries as a matter of great importance to agriculturists, especially to those who live in the neighbourhood of forests, and we consider that a forest utilisation officer should be appointed in every province in order that their development may be made a definite responsibility of one officer.

At present, considerable damage is done to forests on hills in some parts of the country by the habit of shifting cultivation. The methods by which shifting cultivation in the Central Provinces has been gradually stopped appear to be worth studying by officers faced with this problem in other provinces. Where serious deterioration has taken place, the essential remedy in regions of heavy rainfall, that is, where the rainfall is over 60 inches, is protection against damage by cultivators and their goats and cattle in order to allow of natural regeneration. In tracts of light rainfall, there is no generally satisfactory remedy, but, in carefully selected areas, artificial regeneration might be possible though at heavy cost.

We consider that forest areas should be reclassified into areas most suitable for the growth of timber or for fuel plantations, or the preservation of which is desirable on climatic or physical grounds, those most suitable for development as fodder reserves or grazing grounds, and areas which should be handed over to ordinary cultivation.

The most promising method of establishing village forests is to hand over to village management certain more or less wooded areas now under the control of the Forest Department. Management by the people for the people of the forests close to their villages possesses so many desirable features that every effort should be made to ensure its success. We, therefore, recommend that, in each province, Government should aim at establishing two divisions within the forest departments, the officers in one division to be responsible for the charge of forests, the preservation of which is desirable on climatic or physical grounds and of commercial forests, that is of those forests managed with a view to direct profits from the sale of timber and other forest products; the other division to be in charge of minor forests, fuel plantations, village woodlands and waste land, now chiefly used for grazing and often included under unclassed forests. Officers of this second division, in addition to the conservation of the natural resources of such areas, should be definitely charged with the responsibility of developing them and should be encouraged to make experiments in sylviculture and in the improvement of grazing areas. Whether the minor forests division should continue under the Forest Department or be placed under the Revenue Department is a question for decision in the light of the local conditions. If the second alternative is adopted, the Revenue Department should have the advice and assistance of officers who possess a knowledge of forestry, more especially of sylviculture.

To foster closer touch between the forest and agricultural departments, it would, as in the case of irrigation officers, be an advantage if short courses were instituted at the agricultural colleges for all newly

recruited forest officers. Further, a forest officer, before being posted to the new minor forests division, should, we consider, be attached for a period of not less than three months to the headquarters of the provincial agricultural departments with the object of making himself thoroughly acquainted with the view of the department as to the needs of the cultivators in the vicinity of the forests which he is to administer and in the province generally.

VII. DISEASES OF LIVESTOCK AND THEIR CONTROL

CHAPTER IX OF THE MAIN REPORT.

The working capital of the cultivator is mainly represented by his livestock and losses of his cattle from disease press hardly on him. The recorded figures, imperfect though they admittedly are, indicate that the annual number of deaths is very considerable and that rinderpest takes the largest toll. Apart from losses by death, extensive indirect losses occur from the large number of cattle temporarily incapacitated by disease. The more serious diseases of cattle in India are rinderpest, hæmorrhagic septicæmia and foot-and-mouth disease. The general prevalence of these diseases is probably one of the most serious obstacles to the improvement of cattle.

The outstanding problem which faces the civil veterinary departments, is thus the control of contagious diseases. The proposals we make in regard to the organisation of the departments, the training of their staff and the research they should undertake hinge on this. They will thus be more readily understood if we discuss the measures necessary to combat disease. We discuss rinderpest in detail because it is the most formidable disease of cattle in India and because the measures necessary to control it are typical of other contagious diseases.

Rinderpest was formerly the most dreaded of all livestock scourges in western countries. It is now non-existent. The inadequacy of the veterinary staff, the prohibitive cost of compensation combined with prejudices against the destroying of healthy animals which have been in contact with infected ones render the adoption of western methods impracticable in India. Nor is it possible to isolate and safeguard parts of India by interposing belts of protected country between permanently infected areas and areas from which the adoption of intensive measures has succeeded in eradicating the disease. In these circumstances and for the present, rinderpest and other contagious diseases must be combated by measures designed to protect the individual animal rather than by those which aim at stamping out the source of infection.

The method in general use at present for dealing with rinderpest is inoculation by what is known as the "serum-alone" method. The blood serum of an animal which has recovered from the disease is injected into cattle which it is desired to protect in doses proportionate to their body weight and their breed. Protection lasts only for a brief period. With the dose commonly used an animal is safe for a period of nine to fifteen days. Animals after protection by serum are allowed to mix freely with infected stock in the hope that they may contract a mild form of rinderpest and thus remain permanently immune, for, after recovery, an animal is immune from further attack. This "serum-alone" method is now very largely and effectively used in India in checking outbreaks of rinderpest.

The serum-alone method is, however, subject to the very serious limitation that it confers complete immunity for less than a fortnight whilst infection may persist in a village for a much longer period.

Animals are, therefore, liable to contract disease unless they are re-inoculated and, when they do so, the process is discredited in the eyes of their owners. Re-inoculation, on the other hand, is not only expensive but when an outbreak is widespread, is often impossible.

The principle on which protected animals are exposed to infection is sound but it would appear in practice that the chances that the disease will be contracted at the right moment are not good. To ensure infection, therefore, another process known as the serum-simultaneous, or active, method of conferring immunity has been devised. In this process a small quantity (from ½ to 1 c.c.) of virulent blood taken from a diseased animal is injected into the animal at the same time that serum is used. A mild attack of rinderpest follows, the tissues of the animal prepare their own "antibodies" and an immunity which, in some instances, has been found to be permanent and, in others, to last for about three years is set up. The efficacy of the method has been proved in countries as far apart as Russia, South Africa and the Philippines while its success in Egypt is of particular interest to India. In India, only one experiment on an intensive scale has so far been made—in the Mysore State. Experience obtained there shows that the serum-simultaneous method is safe, effective and readily accepted by cultivators. Our examination of the evidence available as to the results obtained in India and in other countries from the use of the serum-simultaneous method of inoculation has led us to the conclusion that the introduction of this method is strongly to be recommended and that, indeed, it offers the only hopeful means of combating the ravages of rinderpest. Provided the materials used for inoculation are properly controlled, and the work of inoculation is carried out under the supervision of an experienced veterinary surgeon, careful to guard against such accidents as may occur, the risk involved is so slight that, in view of the great benefits incurred, it should be accepted without hesitation.

We are aware that there are practical difficulties which indicate the probability of some opposition from cultivators to the adoption of this method. In these circumstances, we consider that resort to compulsory inoculation would, at present, be undesirable. Cultivators should be given an opportunity of seeing what inoculation can do to protect their cattle before they are required to accept compulsory measures. To this, we would make one exception. We consider that compulsory inoculation by the simultaneous method should be enforced for all animals kept by milk sellers in large cities.

Outbreaks of rinderpest will supply favourable opportunities for popularising the use of simultaneous inoculation among cultivators and it may be hoped that co-operative breeding societies and cow-keeping societies will also show an example to the cultivator in this matter.

Experience has shown that when charges, however small, are made for inoculation, the extended use of preventive inoculation is greatly checked. We, therefore, recommend that all charges for inoculation, not only against rinderpest but also against other contagious diseases, should be abolished.

Rinderpest, although the most important, is only one of the serious infectious diseases to which India's livestock are liable. In discussing the measures which should be undertaken to deal with it, sufficient has been said to show that the suppression of epidemics must make large demands on the professional skill, the energy and the judgment of the officers in charge of the operations and that the type of education which such officers should possess is of a different order from that necessary for officers competent to deal with the diseases and injuries that are met with in ordinary veterinary dispensary practice. It will also be evident that to cope successfully with epidemic diseases, the number of officers employed by provincial governments must be largely increased. But as no staff, however large and skilled, can be fully effective, unless Government have the power to control the spread of infection, we recommend that a Contagious Diseases of Animals Act should be passed with a view to ensuring a uniform procedure in dealing with contagious diseases. The Act should empower local governments to apply by administrative order to any tract such of its provisions as may be applicable in the circumstances of the case.

The provision of veterinary aid in India is at present totally inadequate. Apart from a few practitioners in the large towns, there are no veterinary surgeons in private practice in India. There are in civil employ about 32 veterinary surgeons in the Indian Veterinary Service and 52 in the provincial services whilst the number of veterinary inspectors and veterinary assistant surgeons in 1927 was about 1,400. Several of the superior staff are employed in teaching and other duties. Thus some 33 only are available for the control and treatment of disease and of this small corps of officers, less than one-half are licensed to practise veterinary medicine and surgery through possessing the diploma of the Royal College of Veterinary Surgeons.

These figures sufficiently show the inadequacy of the existing arrangements for controlling contagious diseases and attending to animals suffering from ordinary ailments and from injuries.

Veterinary aid is supplied by permanent dispensaries, by itinerating veterinary assistants or by both methods. We recommend the establishment in each district of a central veterinary hospital having accommodation for in-patients with a number of dispensaries serving subdivisions of the district. To meet the obvious shortcomings of the single dispensary serving a large tract of country, we recommend that the staff attached to dispensaries should be increased and men sent out to tour in the surrounding districts. The value of most veterinary dispensaries would, in this way, be more than doubled.

Our view is that the control of contagious disease must rest with the provincial Government whose staff, so far as is practicable, should consist of qualified veterinarians. The duty of providing a local veterinary service for treating diseases not scheduled as contagious and dealing with operations and wounds should, when the necessary arrangements can be made, rest with local bodies. It is in the light of this

distinction that we proceed to frame our proposals for the future organisation of the veterinary departments.

The first necessity is a very substantial increase of veterinary officers of all grades. The aim should be to provide at least one veterinary assistant surgeon for every 25,000 cattle and one qualified veterinary surgeon for each district, who would have on an average about 600,000 cattle, in addition to other livestock, in the area under his charge. There are 272 districts in British India, so that, on this basis, the number of Provincial Service officers required would be in the neighbourhood of 300, allowing provision for leave reserves. The number of veterinary assistant surgeons would roughly be increased fourfold, that is, to about 6,000 officers. The co-operation and assistance of Indian States would also be necessary. If their staff were on the same scale, the total number of qualified veterinary surgeons in the employment of Government and that of Indian States, including the staff of the veterinary colleges, and officers employed in supervising duties, would be over 400 and the total number of veterinary assistant surgeons about 7,500.

The organisation which we would therefore propose is as follows. In each province there would be a Chief Veterinary Officer who might be styled Director of Veterinary Services. He would be in administrative control of the veterinary work in the province. The principal of the veterinary college should stand in the same relation to the Director of Veterinary Services in the province as the principal of an agricultural college to the Director of Agriculture. The posts of Director and Principal should be scheduled as selection posts outside the cadre of the provincial veterinary services. It is most important that the holders of these posts should be officers of ability and strong personality and, if need be, the provincial Government should be prepared to recruit an officer from outside the country. The rate of pay attaching to both posts should be reconsidered.

Under the Director of Veterinary Services in each province there would be deputy directors in charge of circles. These officers would be members of the present Indian Veterinary Service or of the new superior provincial veterinary services. Ordinarily vacancies in the latter service will be filled by promotion from members of the existing provincial veterinary services. The duties to be performed by the deputy directors will be responsible and vacancies should be filled by direct recruitment whenever an officer with the requisite abilities is not available from the existing Provincial Service. We suggest that an appropriate scale of pay for the new superior provincial veterinary services would be the existing scale of the Indian Veterinary Service. Underneath these administrative officers would be qualified veterinary surgeons, members of the provincial veterinary services and the aim should be to provide a qualified vete inary surgeon for each district. The primary duty of these services would be the control of epidemic disease but it would also be entrusted with the supervision of dispensaries and of touring veterinary assistants. The present scale of pay of the provincial veterinary services, Rs. 250 to Rs. 750 per mensem seems adequate. Beneath

this grade would be the subordinate veterinary services consisting of veterinary assistant surgeons in charge of the veterinary dispensaries and the veterinary work in the area commanded. The grade of veterinary inspectors, where it exists, should be abolished when the duties of inspection can be taken over by duly qualified veterinary surgeons. We do not recommend the complete provincialisation of the Veterinary Department. The subordinate veterinary services will continue, as at present, to be lent by Government to local boards. Progress in the direction of transferring greater responsibility to local bodies in veterinary matters, though desirable, will have to be made more gradually. When the complete control of the veterinary work, apart from that connected with the control and prevention of epidemic diseases, is entrusted to them, the assistance given by local goverrments to their branch of veterinary aid should take the form of a conditional grant-in-aid which might be given on a *pro rata* basis. It should be made a condition of the grant-in-aid that local bodies should look to the provincial veterinary services for advice and inspection and should consult the Director of Veterinary Services in regard to all appointments. In the mean time, local bodies should be consulted in regard to appointments, transfers, promotions, punishments, and dismissals of veterinary assistants employed in their dispensaries.

When the complete control of the veterinary assistant surgeons employed by them passes to the local boards, it will be necessary to create a veterinary reserve corps of selected veterinary assistants to deal with contagious diseases. Experienced veterinary assistants would be selected for membership of this corps by arrangement with the local bodies under which they are working. This, it is hoped, will render it possible to deal effectively with contagious diseases without interfering with the work of the dispensaries.

For the training of veterinary surgeons, that is the provincial veterinary services and the assistant veterinary surgeons, two entirely distinct courses of study are required with different entrance requirements and different classes at all stages. The framing of a suitable curriculum for the training of the latter class in the existing veterinary colleges should be referred to a body of experts. Special prominence should be given in the course to the anatomy and the diseases of cattle. For the provincial veterinary services, that is, for the district veterinary surgeons, the course which should be settled by conference between the university and veterinary authorities concerned, should extend over a period of five years from matriculation and should end in a degree. We do not recommend the establishment of an all-India veterinary college nor the expansion of the Muktesar Institute as an educational centre. We consider that the most satisfactory method is to train candidates for the provincial veterinary services in all provinces at one of the existing veterinary colleges. The additional expenditure involved in adapting the selected college to undertake higher veterinary education should be met by the Government of India. A short period at Muktesar should be included in or supplement the course at the selected college. We

recommend that the course of training for the provincial service should at present be limited to candidates nominated by the Government of India, provincial governments or Indian States, and that they should receive suitable stipends from the authority nominating them during their period of training. Officers on the teaching staff of the veterinary colleges should be expected and encouraged to undertake research work. In order to carry out successfully the training of the greatly increased number both of veterinary surgeons and assistant surgeons which our proposals require, it is most important that the principals and the staff of the colleges should be picked men. The staff should form part of the new superior provincial veterinary services. As a rule, special recruitment will be necessary but officers in the ordinary line of the Indian Veterinary Service and the new superior provincial veterinary services should be eligible for appointment. In order to secure officers with the requisite qualifications, it may be necessary to give special pay personal to the individual officer and based on his qualifications and experience.

At present, veterinary research is mainly concentrated at the Imperial Institute of Veterinary Research at Muktesar. We consider that this Institute is all that is required to deal with general problems of veterinary research and that any extension of central research in the immediate future should be provided by such additions to the staff and equipment of Muktesar as the nature of the work contemplated may call for. The Director of the Institute should be selected for his scientific qualifications and should be a man of outstanding position in the profession. As the number of superior posts at Muktesar is so small, we do not consider that any advantage would be gained in present conditions by the formation of a Central Veterinary Service. When an appointment, including that of Director, falls vacant, the officer recruited to fill it should be given a scale of pay in accordance with his special qualifications and experience. In view, however, of the very heavy administrative work which the manufacture of the various sera and vaccines involves, we consider that the Director should have attached to him, an officer with administrative experience to relieve him as far as possible of administrative detail. It is also important that an Institute such as Muktesar should have a thoroughly competent staff for secretarial work and estate management. The expenditure on research in Muktesar should be separated as far as possible from that on manufacturing operations and we consider that the provinces and States should share in any profits from the manufacture of sera and vaccines in proportion to their purchases. We recommend that the administrative control of the Muktesar Institute, at present vested in the Agricultural Adviser to the Government of India, should pass to the Director of the Institute, whose position, *vis-a-vis* the Muktesar Institute on the one hand and on the other the Council of Agricultural Research, would be precisely that of the Director of Pusa to his own Institution and to the Council.

The Council of Agricultural Research should have a small Standing Committee to deal with veterinary matters with powers

to co-opt members and constitute special committees for particular subjects. In these circumstances, we do not consider that the revival of the Inspector General of the Civil Veterinary Department or the creation of a post of a Veterinary Adviser to the Government of India is necessary.

VIII. IRRIGATION

CHAPTER X OF THE MAIN REPORT.

The Report of the Irrigation Commission of 1903 was so comprehensive and its recommendations so exhaustive that no further enquiry of a similar character has been considered necessary. Irrigation policy and development have followed, in the main, the lines laid down by the Commission. Our concern with irrigation is purely from the agricultural point of view.

The part which irrigation plays in the rural economy of the different provinces varies greatly from province to province, but it is of chief importance in Sind, the Punjab, the North-West Frontier Province, Madras, the United Provinces and Bihar and Orissa. On an average, for the five years from 1921-22 to 1925-26, nearly 50 million acres were irrigated by government and private irrigation works, the percentage of irrigated area to area sown being 19·4. Practically half the total area irrigated is irrigated by canals, the remainder being irrigated by tanks, wells and other sources.

We do not describe in detail the existing canal systems of India but indicate some of the principal projects in hand or contemplated. The very brief description which follows must not be regarded as in any way indicating a preference on our part for a particular scheme.

In the Punjab, where the area under irrigation from government works has steadily increased from 2·3 million acres in 1887-88 to an average of 10·4 million acres from 1921-22 to 1925-26, the possibilities of further expansion are far from exhausted. The Sutlej Valley project, which is the only large project at present under construction in the Punjab, will, when completed in 1933-34, provide perennial irrigation for two million acres. But other great schemes are under consideration. The Thal project, even in its revised form, would command an area of nearly a million-and-a-half acres. The Haveli project would bring perennial irrigation to an area of about 700,000 acres. The Sutlej Dam project would add two million acres of *rabi* cultivation between the Sutlej and the Jumna rivers.

At present, the existing canals in Sind are almost entirely of the inundation type. They only obtain water for some five months when the Indus is in flood and this only in fluctuating quantities. The construction of the Sukkur Barrage across the Indus just below Sukkur which, when completed, will be the greatest work of its kind in the world, will entirely change this. It is anticipated that it will irrigate over five million acres of which two million acres are at present very unsatisfactorily irrigated from the existing inundation canals.

In the United Provinces, the Sarda Canal is the only project of importance under construction. This will, it is estimated, irrigate annually an area of about 1·7 million acres. On its completion, all the principal available resources for perennial irrigation in the United Provinces will have been tapped.

In Madras, the great irrigation systems, the Godavari, the Kistna and the Cauvery differ completely in character from those already described. The problem has been to regulate the supply rather than to extend it to new areas. The works consist of weirs by which a sufficient head of water is obtained to irrigate the lands of the deltas and of sluices and regulators by means of which the water is conducted over these lands. The new works under construction or consideration are storage reservoirs to impound the water of the great rivers of the province, their tributaries and other streams, with a view to supplement the existing supplies. The Cauvery-Mettur project, at present under construction, will, it is estimated, improve the supply of an area of a million acres already irrigated and bring under irrigation a new area of 221,000 acres of first crop and 90,000 acres of second crop, while it will also supplement supplies in an existing wet area of 80,000 acres now inadequately irrigated. Two projects which have long been under consideration are the Kistna and the Tungabhadra projects. Attention is now being concentrated on a revised scheme for impounding the waters of the Tungabhadra by the construction of a reservoir at Timmalapuram in the Bellary district. This would provide water for a wide extension of irrigation in tracts very liable to scarcity. We are not in a position to express any opinion as to the feasibility of either of these projects from the financial or the technical point of view.

In Bombay proper, as distinguished from Sind, irrigation by canals is confined to the Deccan and (on a very small scale) to Gujarat. The most important works are of the reservoir type: the Khadak Wasla Dam across the Mutha river, ten miles above Poona, which was completed in 1879, being the first work of its kind in India. The object of irrigation in Bombay proper is mainly protection against famine and only about 450,000 acres are irrigated from government works. With a very few exceptions, there is a heavy annual loss in their working. This is the more unfortunate as the rainfall of the Western Ghats which they utilise is unfailing. The most important new work of this kind is the Lloyd Dam at Bhatgar intended to protect a part of Sholapur district which is specially liable to famine and also to improve existing irrigation.

Next to canals, wells are the most important source of irrigation and, during the five years ending 1925-26, they have on the average irrigated annually over eleven million acres. These wells are of all kinds varying from mere holes in the ground to elaborate masonry structures of great width and considerable depth or tubes of small bore, from which by power pumping, large and continuous supplies of water can be obtained. Well irrigation is most highly developed in the United Provinces where over 4½ million acres are irrigated from them. Tanks are the third great source of irrigation. These range from storage reservoirs, the distributary channels from which irrigate several thousand acres, to small works irrigating only a few acres. They are of special importance in Madras.

Since the introduction of the Reforms, local governments are in a position to raise the funds required for protective irrigation schemes by

loans if they are unable to finance protective schemes of irrigation from current revenues or from the Famine Insurance Fund which they are bound to maintain. We trust that, so far as the financial situation may allow, this may encourage the construction of further protective works.

The problem of preventing the waste of irrigation water, of securing greater certainty to the cultivator as to the supply he will receive and of relieving him from any harassment and interference from the staff which records his irrigation has long engaged the attention of irrigation experts in India. The Indian Irrigation Commission took the view that it would be of great advantage both to Government and the cultivators if the latter could be induced to take over their supplies at the outlets, to arrange all details of internal distribution between themselves and to relieve the canal administration of all further responsibility and of the great expense of recording the details of the irrigation and of making the final measurements and assessments. They concluded, however, that the system of charging by volume could not be safely introduced in India until a system of distribution by modules of the type which it might be proposed to use had been in force for a time sufficiently long to enable the people to understand what was proposed. They held that, even then, the change in the system of assessment should not be forced but should be introduced gradually, as the people learned to appreciate its advantages. They added that it was an end to be aimed at and that irrigation officers should be encouraged to design and experiment on modules which would be suited to the conditions to be met with in practice, until the work of distribution could be carried out with all the regularity and certainty which were essential to the success of any scheme of charging by volume. These recommendations of the Irrigation Commission marked the starting point of investigations into the possibility of more scientific and equitable distribution of water. Much progress has been effected in recent years in the improvement of the system of distribution. Every distributary in the Punjab has been, or is being, fitted with a meter so that the exact amount of water passed into it is known. By this means, considerable economy of supply has been effected, enabling irrigation to be extended to areas for which water was not previously available, and the opportunities of harassment and interference by the subordinate staff have been greatly reduced. But irrigation engineers display some scepticism as to the possibility of the sale of water by volume. Many arguments against this system were brought before us but we consider that further investigation and experiment are eminently desirable before a final decision against the sale of water by volume is reached.

Even under the area system of distribution, some cultivators make their water go much further than others. No reduction in the supply of water should be made solely because water has been economically used.

It was suggested to us by several witnesses that the distribution of water should be transferred from the Irrigation to the Agricultural Department. We see no advantage in this proposal. We are of opinion that there is at present no practical alternative to the system

of government control over distribution down to the field distributaries. There can, however, be little doubt that the general introduction of the sale of water by volume would greatly facilitate the substitution of private for official management of the minor distributaries. Irrigation *panchayats* for management of field distributaries seem to be a suitable organisation for obtaining collective action and fair dealing amongst cultivators. At present, the fundamental obstacle to entrusting distribution of water to private agency is the attitude of the cultivator himself. Water is so vital a thing to him that he is not yet prepared to leave his interest in this matter to the decision of his fellows. The group spirit which the *panchayat* would create might remove these difficulties and develop the mutual confidence necessary for the successful management of the larger distributaries.

Apart from the great irrigation schemes, smaller storage works and minor sources of irrigation are in certain tracts of great importance to cultivators. In Bombay, particular attention has recently been paid to this subject and, in 1925, a superintending engineer was placed on special duty to investigate natural resources for the protection of lands from famine. We are of opinion that much could be done to promote the development of minor works if the example of the Bombay Government were followed in other provinces and we would also suggest that the operations in Bombay should be extended to districts outside the insecure tracts. What is wanted in our view is an agency to which the cultivator who wishes to improve his land by utilising the natural sources of water supply can turn for technical advice and assistance. This agency should not wait for the cultivator to consult it, but should go to him and urge him to adopt the scheme best calculated to utilise his available water supply to the fullest advantage. The personnel should regard its function as educative rather than purely advisory. We, therefore, recommend that the construction and maintenance of minor irrigation works should be entrusted to a special agency.

Irrigation from tube wells is a comparatively recent development in India. They are almost entirely in private ownership and are privately financed, except in the United Provinces where substantial grants are given for their construction. Loans under the Land Improvement Loans Act are, of course, available for the purposes of sinking tube wells. Technical advice and assistance are freely given by the government department concerned and the well is, in fact, usually installed by that department subject to the payment of moderate fees for services rendered. In the United Provinces, an elaborate system of subsidy exists, the effect of which is that nearly one-half the cost is borne by Government. In addition to the assistance thus given, zamindars who undertake to multiply seed for Government or to lease land to Government for demonstration purposes may receive, in special cases, grants-in-aid up to a maximum of Rs. 3,000. We understand that, in practice, such grants are invariably applied for and are given at the maximum rate. We see no justification for the system of subsidies which has been adopted in the United Provinces and recommend that it should be terminated.

We consider that the department entrusted with the charge of pumping and boring operations should make detailed investigations into the economics of tube well irrigation and should also carry out a systematic survey of the subsoil water supplies. Government responsibility for the development of such irrigation should be limited to the supply of economic data, expert advice, and finance, where required, on the *taccavi* system. Government assistance may also include placing at the disposal of the landholder the boring equipment and skilled labour necessary on payment of a reasonable fee in tracts in which the scope for tube wells is limited or in which they are still a novelty ; but, in general, private enterprise in such matters should not be discouraged by government competition. We are of opinion that pumping and boring operations should be entrusted to the agricultural departments.

The area irrigated by ordinary wells in British India is practically stationary. Construction of such wells is essentially a matter for private enterprise, but there are many ways in which the agricultural and irrigation departments can help the landholder. The agency for minor irrigation works which we have recommended and the engineering section of the agricultural departments should be able to give much technical assistance. In tracts where holdings are very small and where the construction of a well is beyond the capacity of the individual, every effort should be made to encourage co-operative sinking and working of wells. In some parts of India, the number of abandoned wells is large and we would suggest that, where this is the case, a special enquiry should be made by the Revenue Department into the reasons why the wells have fallen into disuse.

In addition to irrigation by canals, wells and tanks, numerous temporary *bunds* for the storage of rainfall are constructed each season and water is obtained by lift from rivers and streams. In the aggregate these various subsidiary sources of irrigation are important as they supply over ten per cent of the total irrigation. We consider that there is a wide field of opportunity here for the branch of the agricultural engineering department responsible for pumping operations to devise cheap and efficient pumps and to induce private enterprise to undertake their multiplication and to provide a repairing service for them.

It is clear that the relations between the agricultural and irrigation departments should be of the closest as they are so intimately concerned with the problems of land improvement. We are of opinion that the views of the Director of Agriculture should be obtained at an early stage on the agricultural aspect of all new irrigation schemes, that there should be frequent consultations between the heads of the agricultural and irrigation departments and that their views should be formally on record. Further, in order that the officers of one department may have some acquaintance with the problems of the other, we recommend that short courses on agriculture for irrigation officers and on irrigation for agricultural officers should be instituted.

In order that the cultivators, for the furtherance of whose interests the Irrigation Department exists, should have a more direct avenue of

approach to the responsible officers of the department and to Government, we would suggest the creation, in those provinces in which irrigation is of importance, of an organisation on the analogy of the local railway advisory committees composed of representatives of the irrigation, revenue and agricultural departments with a majority of non-official members who should, if possible, be cultivators. The main duty of this advisory committee would be to deal with complaints from cultivators or associations of cultivators in regard to irrigation matters.

The Government of India have recently constituted a Central Irrigation Board of which the Consulting Engineer to the Government of India and all the chief engineers for irrigation in the provinces are members. The Board will work through sub-committees consisting of those engineers with recent experience of works akin to those to be discussed. These sub-committees will be convened by the Government of India at the instance of the local Government concerned when a new project is about to be sanctioned or when a province finds itself in difficulties in any technical matter. In addition to this Central Irrigation Board, we propose the establishment of a Central Bureau of Information for Irrigation which might suitably be placed in charge of the Consulting Engineer to the Government of India with its headquarters at Delhi. The main functions of the Bureau would be to establish and maintain a comprehensive library of irrigation publications and to act as a clearing house of information needed by provincial officers. It should endeavour to keep agricultural officers and the public generally in touch with irrigation developments in India and abroad. We also recommend annual or biennial meetings of irrigation engineers to be held in rotation in different provinces and in localities which possess features of special interest to the irrigation engineer. We also consider that provision for research on irrigation problems should be made in all provinces in which irrigation is of importance. The matters for investigation would include the distribution and application of water required for crops, the question of waterlogging, drainage and lining of canals. The scientific staff of the Indian universities might assist in the solution of irrigation problems for which geological, chemical or mechanical knowledge is required. We do not consider that a case has been made out for the establishment of a central station for irrigation research. The work of provincial stations engaged in such research should, however, be reviewed from time to time by a committee appointed by the local Government in consultation with the Central Board of Irrigation and the Council of Agricultural Research.

Many of the troubles which have arisen in the irrigated tracts of India in regard to waterlogging and the formation of alkali lands have been due to failure properly to correlate a new irrigation system with the natural drainage of the tract. We, therefore, consider that drainage maps should be drawn up by competent engineers who possess the necessary agricultural insight. Once these maps have been made it will be easy to control all such undertakings as the construction of roads, railways, canals and embankments and to see that nothing interferes with crop production.

Questions arising out of the great extension of irrigation in Sind as the result of the construction of the Sukkur Barrage are dealt with in detail in the main Report, as also are questions specially affecting the North-West Frontier Province and Baluchistan. As these questions, though important, are of local interest, they need not be referred to here. For the same reason we do not mention the problems peculiar to Bengal which are also dealt with in the main Report. These are so complex in their character and their solution is of such importance to Bengal that we consider that a committee of experts should be appointed to investigate them.

In regard to hydro-electric development, it is to be noted that the natural reserves of water power available in certain parts of India are considerable. In existing conditions, we consider that the immediate openings for electric power for agricultural purposes are confined to pumping schemes. Information required in connection with hydro-electric development should be supplied by the Central Bureau of Information for Irrigation. In view of the highly technical nature of the subject, expert advice in regard to any particular scheme of development should be obtained from a firm of consulting engineers.

IX. COMMUNICATIONS AND MARKETING

CHAPTER XI OF THE MAIN REPORT.

Good communications are of great importance to the cultivator for on them largely depends his opportunity for the favourable marketing of his produce. It is the improvement in communications since the middle of the last century that, more than any other factor, has brought about the change from subsistence farming to the growing of money crops such as cotton, jute and groundnuts. But good communications also react upon every aspect of the cultivator's life for the closer connection which they create between the villages and the towns must stimulate the more backward rural community to demand a higher standard of education as part of a higher general standard of living. They also induce interchange of ideas and so broaden the cultivators' outlook on life. The milage of railways and roads in India is rapidly expanding. All roads, except those of military importance, are a transferred subject in the major provinces. In Bengal, practically all the roads are under the district boards, who meet the entire cost of construction and repair from the roads and public works cesses. In Madras also, roads with few exceptions, are in charge of the local authorities but they receive substantial financial assistance from provincial revenues. In other provinces, except in the Punjab, roads fall into two classes, those of provincial importance which are maintained by the Public Works Department and local roads which are maintained by local bodies. Roads in the Punjab have been classified very systematically. Class I roads form the arteries of the road system and are maintained by the Public Works Department. Class II roads are those which pass through more than one district or connecting important places. These are in charge of the district boards but the expenditure on them is shared by government and local funds. Other roads fall in class III. In all provinces, village roads, that is, roads connecting villages which are not on any through line of communications with the road system of the district are almost entirely a matter for the villagers themselves. Such roads are often mere tracks that can only be used during dry weather.

The evidence we received shows that the condition of the roads in India has deteriorated in recent years, and that the rapid expansion of motor traffic has brought into existence an entirely new range of problems of road construction and maintenance. This new factor has led to the recent appointment by the Government of India of a Road Development Committee, consisting of fourteen members of the Central Legislatures, which is investigating the whole question of road development in India. The concern of this Committee is primarily with the development of the main roads, but we would emphasise the importance of subsidiary comunications which are of even greater concern to the cultivator. His village must be linked up with the main arterial roads if he is to get the advantage of good communications.

Road boards have been established in some provinces. Their functions are in the main advisory and it is only in the Punjab and Burma that they have wider functions and have embarked upon an ordered

programme of road development. We recommend that road boards with powers similar to those which have been given to the boards in the Punjab and Burma should be constituted in all provinces.

In the administration of their road policy, local boards are very much handicapped by lack of funds and we consider that local governments might give liberal financial assistance where a well-devised scheme has been thought out. The matter is of such importance that we would recommend flotation of loans for this purpose rather than that expenditure should be met from current revenues. There is, unfortunately, always a danger that main roads will receive a disproportionate amount of attention. Liberal grants-in-aid should be given from provincial revenues for the construction and improvement of village roads, although improvement of such roads must in the main depend upon the efforts of the villagers themselves. To this end, co-operative action on their part should be encouraged. All district boards should have the services of a qualified engineer.

It is desirable that, in the development of communications generally, railways and roads should be regarded as complementary to each other. Roads should be designed to serve rather as feeders to the railways than as competitors for traffic. Railway freight rates are frequently criticised from the point of view of the agriculturist. We do not accept the view that rates are generally too high, but we suggest a periodical revision of rates with a view to the adjustment of their incidence as between various sorts of produce We consider it desirable that closer co-operation between the railway and agricultural departments should be secured by the appointment of the Director of Agriculture or the Marketing Officer in each province as a member of the local advisory committee on railways.

With regard to water ways, the only point brought prominently to our notice was the extent to which their use is hampered by the spread of water hyacinth in Assam, Bengal and Burma. Various attempts have been made to deal with this pest but with indifferent success. Further research is urgently needed and, as the problem affects a number of provinces, we consider that a programme of work should be formulated by the Council of Agricultural Research so that concerted action can be taken simultaneously in all the provinces affected.

MARKETING

The agricultural departments in India have done much to improve the quality and to increase the quantity of the cultivator's outturn but it cannot be said that they have been able to give him substantial help in securing the best possible financial return for his improved quality and his increased outturn. This is the only inducement that can be held out to the cultivator to adopt improved seed and he is not likely to take much trouble if he finds that he cannot get a better price for his improved produce. For this comparative indifference to quality, the middleman may in part be responsible as he is inclined to buy rather in quantity than in quality, and it is only when an improved variety

has been grown over a large concentrated area that a reputation for quality can be obtained and a premium price commanded. There is great absence of information with regard to marketing conditions in India. In all provinces markets vary greatly in character and importance. Some are privately owned; some are directly under the control of the district board or municipality. It is only in Berar that the constitution of markets is regulated by special legislation and that the management is in the hands of elected committees. An act for regulation of cotton markets in the Bombay Presidency has recently been passed but has not yet come into operation.

In all provinces we received complaints of the disabilities under which the cultivator labours in selling his produce in markets as at present organised. It would be unfair to ascribe these entirely to the middleman. It must be recognised that the middleman fulfils essential functions and that it is not possible to dispense with him. That abuses exist and that some of these can be remedied or removed is, however, beyond dispute.

The most hopeful solution of the cultivator's marketing difficulties seems to lie in the improvement of communications and the establishment of regulated markets, and we recommend for the consideration of other provinces the establishment of regulated markets on the Berar system as modified by the Bombay legislation. The establishment of regulated markets must form an essential part of any ordered plan of agricultural development in this country. The Bombay Act is, however, definitely limited to cotton markets and the bulk of the transactions in Berar markets is also in that crop. We consider that the system can conveniently be extended to other crops and, with a view to avoiding difficulties, would suggest that regulated markets should only be established under provincial legislation. Local governments should also take the initiative and such markets should immediately be established in a few principal centres. Only in this way will public opinion be educated to realise the advantages of markets of this character and a demand for them be created. The relationship of a regulated market to the council of any municipality or to the local board in the area in which the market is being established will require careful consideration in drafting legislation.

We consider that the management of these markets should be vested in a market committee. This committee should contain adequate representation of the actual cultivators in the areas served by the market and, if their interests are not adequately safeguarded, an official of the agricultural department might well be nominated to the committee to protect them. It is undesirable that any licensed broker should be eligible for election to the committee as a representative of the cultivator. Provision should be made for the representation on the committee of co-operative societies in the area served by the market. The addition to the committee of nominated members should not be allowed to reduce the actual trade representatives below a certain limit. The committee should elect its own chairman. Details of the

working of this committee must be left to local decision, but we would suggest that in order to prevent fraudulent weighment, they should instal a weighbridge in the market with suitable arrangements for its use, and that machinery should be provided for settlement of disputes which arise. For this purpose a board of arbitration consisting of three members, one nominated by the buyer, one by the seller and a third who would be chairman, selected by both the parties from the market committee, would seem to be the most satisfactory arrangement. Market committees should charge themselves with the duty of posting prices, ruling in the market centres of the tract and at the ports, for the products dealt with in the market. They would frame rules for the control of brokers, especially for preventing them from acting for both buyer and seller, and might provide limited storage accommodation in the markets.

A question which has for long engaged attention is the standardisation of weights and measures. These vary most extraordinarily throughout the country and, in some provinces, almost from village to village. Although a committee to investigate this subject was appointed by the Government of India in 1913, no action has yet been taken on its recommendations. We consider the matter of such importance that we would recommend that the Government of India should again undertake an investigation into the possibility of standardising weights and measures throughout India and should lay down general principles to which provincial governments should adhere so far as this is possible without undue interference with local trade custom. A Bill to provide standards of weights and measures for use in Burma has been introduced in the local Legislative Council. A feature of the Bill is the power which is taken to recover from the villagers the cost of equipping village committees with standard weights and measures by the imposition of a tax or a cess on lands assessed to land revenue. It is explained that the reason for this provision is that the total expenditure involved in a free supply at the cost of Government would be considerable; and that the share of each village, if the cost is distributed over all villages, will be very small and its collection will do more than anything else to advertise the fact that standard weights and measures have been provided.

Much of the Indian produce exported to foreign markets would appear to be marketed in an unsatisfactory condition though matters have considerably improved within recent years. In England, we were informed that cotton is badly mixed, that jute is badly retted and graded and suffers from excessive moisture, that Indian hemp is very irregular in quality, badly mixed and contains an excessive proportion of dust and dirt. On the other hand the report on Indian oil-seeds, with the exception of groundnuts which frequently suffer from excessive moisture, was satisfactory. Opinion on the quality of Indian wheat was divided; in view of the possible expansion of the crop in Sind and in the Punjab as a consequence of the Sukkur Barrage and the Sutlej Valley project, we think that the possibilities of developing an export trade in high class strong wheats should be borne in mind. The buyer is the ultimate judge of the quality to which he gives a value by an increased or decreased

price. Organisation amongst the ultimate buyers can, in some instances, be an effective weapon in securing improved quality but it is difficult except in such a case as that of wheat in which the greater part of the exports from India go to one country. Effective measures to secure improved quality must, therefore, in the main be applied by the agricultural and co-operative departments who must keep in close touch with trade requirements so that the cultivator may get the benefit of his better cultivation and better methods of preparation. Organised trade associations such as the East India Cotton Association who are in a position to lay down grades and standards can give great assistance. Co-operative sale societies should be encouraged as these furnish the best means of enabling the cultivator to secure an adequate premium for produce of superior quality. The agricultural departments can substantially assist the co-operative sales societies by grading their produce. Auction sales by agricultural departments provide a useful means of securing to the cultivator in the early stages an adequate premium for the superior quality of a new variety grown under their supervision. Such auctions should, however, be only continued until they can be taken over by co-operative societies or suitable private agencies.

We do not consider that further investigation is called for into the possibilities of grain elevators. An elevator system would have to be financed by Government and the advantages to the cultivator appear altogether too problematical to justify this.

The marketing of his produce is such an important matter from a cultivator's point of view that we consider that an expert marketing officer should be appointed to the staff of the agricultural departments in all the major provinces. One of his first duties will be to organise market surveys. There is a great lack of exact information on the subject and this must be obtained and studied before Government can work out a scheme to assist the cultivator in his marketing operations.

One of the specific duties of the marketing officer will be to examine the working of the regulated markets, and to make recommendations for their improvement where necessary. He would advise the market committees on any points that may be referred to him.

In view of the growing importance of Indian agricultural products in Europe, we consider that the Indian Trade Commissioner in London should be given the assistance of an officer with experience of agriculture and co-operation in India. The main duties of this officer would be to keep in touch with all aspects of the trade in Indian agricultural products at the European end and with all developments of co-operation in Europe. An officer of similar standing and experience should be attached to the staff of the Director General of Commercial Intelligence in Calcutta, who would pass on to the departments concerned information which he receives from his colleague in Europe, in a manner which would enable them to utilise it to the best advantage. Ultimately, as Indian trade grows, it may be necessary to appoint separate Trade Commissioners in other countries.

X. THE FINANCE OF AGRICULTURE

CHAPTER XII OF THE MAIN REPORT.

As in every other country, the cultivator in India needs, from time to time, some source of capital either for carrying out permanent improvements, for the purchase of more expensive implements or for current requirements. The greater proportion of the funds required for these purposes is provided by local moneylenders, who, however, make no distinction between capital required to finance an industry and the money needed for ordinary household expenditure. Government also give loans for agricultural purposes under the Land Improvement Loans Act, 1883, and the Agriculturists' Loans Act of 1884. It has, however, never been the policy of the State to impose restrictions on the financing of agricultural operations by private individuals. Such restrictions as have been imposed have all been devised to deal with agricultural indebtedness and to check the activities of the usurious moneylender.

Mortgage of agricultural land is the most common method of arranging long-term credit and the total sum advanced upon this form of security must now be very large. Mortgage credit is rarely used to finance improvements in agricultural land. It is resorted to when the unsecured debt becomes larger than the lender considers safe and, in times of distress, for ordinary agricultural needs. In some provinces, legislation has laid emphasis on automatic extinction in certain cases within a limited period. The evidence given before us inclines to the view, in which we agree, that no usufructuary mortgage of agricultural land should be permitted by law unless provision is made for automatic redemption within a fixed period of years of which twenty should be the maximum. The risk of collusive evasion must be recognised but education and the development of character are the only specifics against both the wiles of the lender and the recklessness of the borrower. Another point in connection with mortgages is the reluctance of the mortgagees to accept redemption. The Usurious Loans Act was amended in 1926 to enable a mortgagor to take advantage of its provisions when suing for redemption. The Punjab Alienation of Land Act of 1900 and the Punjab Redemption of Mortgages Act of 1913 give certain powers to deal with the question. The operation of the latter Act is restricted to mortgages, the principal sum secured under which does not exceed Rs. 1,000, or to mortgages of land not exceeding thirty acres. These restrictions might perhaps be removed. We commend to local governments the consideration of legislation on the lines of the Punjab Acts in regard to the redemption of mortgages.

Various enactments have from time to time been passed by different local governments to deal with transfer by sale or mortgage of agricultural land to non-agriculturists. The best known of these are the Punjab Land Alienation Act and the Bundelkhand Land Alienation Act. The Bombay Land Revenue Code lays down rules with a similar object. The desirability of extending the principle

of statutory restriction on the alienation of land to districts or provinces other than those in which it is now operative is one which, in our view, can only be measured in the light of local conditions including the state of mortgage debt amongst cultivators, the extent to which land is actually passing from agricultural to non-agricultural classes, and the feasibility of defining with reasonable precision those agricultural tribes or classes whose interests it is sought to protect.

The business of joint stock banks, so far as it relates to the advancing of loans on the security of agricultural land, is usually confined to the larger landholders, the planting community and others who possess tangible marketable security. Outside these narrow limits, its effect on agricultural operations is not appreciable. Schemes for wholesale redemption of debt by private banks with the help of government funds have been put forward from time to time. The history of the Agricultural Bank of Egypt is, however, an instructive warning to those who hold that problems of rural debt are to be solved by the provision of cheap and abundant credit. In fact, cheap credit is a blessing to a rural population only where the average cultivator is possessed of the knowledge and strength of character required to induce him, on the one hand, to limit his borrowing within the range of his capacity to repay, and, on the other, to apply the greater part of the borrowed money to sound productive purposes.

As a general rule, it may be said that the larger landlords do not take that interest in the development of their estates which might be expected. In some cases, tenure or tenancy laws are an obstacle. We would suggest that, where existing systems of tenure or tenancy laws operate in such a way as to deter landlords who are willing to do so from investing capital in the improvement of their land, the subject should receive careful consideration with a view to the enactment of such amendments as may be calculated to remove the difficulties. The establishment of " home farms " run on model lines is to be commended and, where tenure difficulties arise, action to permit of the establishment of such farms appears especially necessary.

The Land Improvement Loans Act has on the whole worked well, but it is doubtful if its provisions are as widely known as they should be. Complaints of delay in dealing with applications are numerous, but reflection will show that in most cases some delay is inevitable if the enquiries preliminary to the grant of a loan are to be carefully carried out. Greater elasticity in the rules would increase the temptation to unwise borrowing, while careful scrutiny of the security offered, supervision to ensure that the loan is actually expended on the improvement for which it is granted, and insistence on regular recoveries are all necessary in the interest of the borrower himself. When land mortgage banks are firmly established, part of the allotments under this Act might be placed at their disposal provided that steps are taken to ensure utilisation on objects which fall within the scope of the Act.

With the limitations referred to in the case of the Land Improvement Loans Act, the Agriculturists Loans Act has also on the whole worked well. The grant of loans is restricted to the owners and occupiers of arable land and the purposes of the loans to the relief of distress, the purchase of seed or cattle and any other purpose not specified in the Land Improvement Loans Act but connected with agricultural objects. Since the Act came into force, it has proved of immense value in times of distress, whether arising from drought, floods, epidemics or earthquakes and is a potent weapon in the hands of any local government called upon to deal with a sudden emergency which requires the immediate issue of capital for current needs. The rules have repeatedly come under revision and are now as elastic as the interests of both borrower and lender permit. We are of opinion that this Act must remain on the Statute Book until the spread of thrift or of co-operative credit or of both renders it obsolete.

Knowledge of rural indebtedness and its causes has steadily increased as the subject has again and again come under review. The general expansion of the credit of the land holder, his illiteracy, and the temptation he has to relieve present necessities by mortgaging his future income and even his capital, have, on the one hand, led to increase in indebtedness, while, on the other the position of the moneylender has been strengthened by the rapid development of commerce and trade, the introduction of established law and permanent civil courts, and the enactment of such measures as the Contract Act. The annual reports on co-operation have contributed much information of value on the subject of indebtedness and village surveys in different provinces have thrown light on the details, whilst Mr. Darling's book on "The Punjab Peasant in Prosperity and Debt" is a valuable study of the subject. The conclusions drawn in this book apply to an area far beyond the confines of a single province.

Legislative measures designed to deal with the problem of indebtedness have proved a comparative failure. Evidence was received in one province that the provisions of the Civil Procedure Code exempting the cattle, implements and produce of agriculturists from sale may be ignored. The Kamiauti Agreements Act in Bihar and Orissa has been found ineffective. The provisions of the Deccan Agriculturists Relief Act are being evaded and the Usurious Loans Act is practically a dead letter in every province in India. We consider that an enquiry into the causes of the failure to utilise the last-named Act should be made in all provinces. If its provisions were fully utilised, this would go far to remove the worst evils of uncontrolled usury. Other Acts worthy of the consideration of local governments are the Punjab Moneylenders Bill and the British Moneylenders Act of 1927 while the case for a simple Rural Insolvency Act should also be examined.

We have no hesitation in recording our belief that the greatest hope for the salvation of the rural masses from their crushing burden

of debt rests in the growth and spread of a healthy and well-organised co-operative movement based upon the careful education and systematic training of the villagers themselves. Apart altogether from the question of debt, co-operative credit provides the only satisfactory means of financing agriculture on sound lines. Thrift must be encouraged by every legitimate means, for the savings resulting from the thrift of the cultivating classes form the best basis of the capital they require. If the rural community is to be contented, happy and prosperous, local governments must regard the co-operative movement as deserving all the encouragement which it lies within their powers to give.

XI. CO-OPERATION

No subject allied to agriculture is more frequently referred to in the course of our Report than co-operation. Like irrigation, it has been dealt with by a special Committee, that presided over by Sir Edward Maclagan, which reported in 1915. The report of that Committee contains an authoritative series of recommendations which have formed a guide for provincial policy in the direction of the movement. It dealt chiefly with credit societies which still form the main line of activity of the movement.

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Historically, the co-operative movement may be said to have originated with the recommendations of the Indian Famine Commission of 1901. Prior to that date, an exhaustive study of the system had been made by Sir Frederick Nicholson on behalf of the Madras Government and his reports were published in 1895-97. A few societies, which at that time could only be registered under the ordinary company law, had been started in the United Provinces and the Punjab, but the movement only really began to function with the passing of the first Co-operative Societies Act of 1904. The operation of this Act was strictly limited to credit. It was passed, not as the outcome of a popular demand, but was essentially the act of a Government anxious to ameliorate the condition of the people, and, to give it effect, a government department had to be established. In 1912, a second Act was passed and is still in force throughout India (except in Bombay and Burma which have their own Acts). This permitted the extension of the movement to non-credit activities. But credit societies still hold the field as is natural where rural indebtedness is so general, and they have this further important advantage that a good credit society has an excellent educative value and is the best foundation for more ambitious schemes. The rural credit society is, in point of fact, the chief corner-stone of the whole movement.

The progress of the movement is indicated by the fact that, in 1926-27, there were in British India some 67,000 agricultural primary societies with over two and a quarter million members and with a total working capital of nearly 25 crores of rupees. The main results achieved may be said to be the provision of a large amount of capital at reasonable rate of interest, and the organisation of a system of rural credit which, carefully fostered, may relieve the cultivator from the burden of usury.

Success in co-operation cannot, however, be gauged by figures and our enquiries have shown that progress has not been uniform in all provinces, and that increase in numbers has not always been accompanied by improvement in quality. The reasons for this would appear to be that, while societies have been registered freely, there has been a lack of patient and persistent education of the members in the principles and meaning of co-operation by teachers competent to perform their task efficiently under adequate supervision. Further there is evidence

that supervision and guidance have been withdrawn too soon. Members of co-operative bodies have not been adequately trained to assume the responsibilities thrown upon them ; a natural restiveness under control has found expression in resentment against what has appeared to be undue official interference and transactions have been embarked upon which have led to disaster.

Within recent years, a large number of honorary workers have interested themselves in co-operation, and their contribution to the success of the movement has been great. But it stands to reason that these honorary workers, most of whom have other professional or private interests, cannot devote the amount of time necessary for detailed instruction or supervision of societies. To the failure to recognise the limitations inherent in the system of utilising honorary workers must be largely attributed the very serious defects in the movement which have been brought to our notice. We consider that there is full scope for both the honorary workers and the official staff, and the time has not yet come when the official staff can be eliminated or even reduced. We, therefore, strongly recommend that every effort should be made to build up a highly efficient and well trained official staff in all provinces. Their duty will be to educate the members up to the point at which they will be competent themselves to undertake the duties of the official staff and so to dispense with their services. It will be for them to strengthen the hands of the honorary workers by furnishing skilled advice and guidance in the more difficult problems and to supervise the work of unions and federations engaged in the management and control of the movement. They should also devise new schemes to facilitate the work of other departments, to prepare the ground for their special propaganda and to organise the people to receive and adopt expert advice.

As the official head of the movement, the personality of the Registrar is a matter of the greatest importance. The post requires such special qualifications that we would recommend that local governments should select the very best man available. Administrative experience and knowledge of the people and their economic conditions and ability to enlist the co-operation of honorary workers are essential qualifications. It is most important that the Registrar should not be constantly changed. We consider that the minimum period of tenure of this appointment should be not less than five years and the maximum not more than ten years. The promotion in the regular line of an officer appointed to the post of Registrar should not be affected and we consider that he should retain his appointment as Registrar with the emoluments of the position of a higher grade in the service if he has reached the stage of promotion. It is most important also that a Registrar should always have one or more officers under training to act for him when on leave and ultimately to succeed him. Every opportunity should be given to registrars and the officers of the department to study the co-operative movement in Europe or elsewhere.

With regard to the training of members of the government staff, the Punjab entrusts this duty to three educational inspectors .who give

a course of intensive training in rural economics to approved candidates for the post of inspector in the Co-operative Department and hold classes for training sub-inspectors. In Bombay, auditors have to pass an examination in co-operative accountancy conducted by the Government Accountancy Diploma Board. We consider that the question of training the staff should be taken up seriously by all provinces and would recommend for consideration the procedure followed in the Punjab and in Bombay.

As regards the supervising agency, in some provinces supervision is largely undertaken by provincial unions which maintain a paid staff for whose education, training and efficiency they are responsible. The federation of primary societies into special unions who organise the work of supervision has been tried in some provinces with varying success. Provincial unions or institutes also undertake the work of propaganda and organisation and in other ways strengthen and stimulate the movement. Efforts in the direction of organising and developing such unions or institutes deserve every encouragement. Such unions or institutes may reasonably look to Government to supplement their resources with grants-in-aid. As a general principle, we do not think that central banks should undertake the work of supervision although there is no objection to deputing inspectors from provincial or central banks to examine the working of societies provided the duties of the inspectors are clearly defined and they are strictly confined to them.

In the early stages of the movement, Government advanced considerable sums of money as capital. This practice has now almost entirely ceased. We consider, however, that assistance from Government might be given in the following ways :

(*a*) by contributing towards the out-of-pocket expenses of honorary workers both whilst under training and whilst they are working in the field ;

(*b*) in assisting institutions whose object is to spread education and the application of co-operative principles to various objects and assisting unions in supervision ;

(*c*) in promoting organisations on a co-operative basis to facilitate specialised forms of co-operative activity, such as the consolidation of holdings, adult education, irrigation and the like ;

(*d*) in the propagation of the movement in backward tracts.

As a rule, we consider that Government should spend money rather on education than audit. The audit of healthy societies is not a proper charge on the public funds.

Various concessions are given by provincial governments to co-operative societies such as exemption from income tax, from stamp duty and from registration fees and the provision of facilities for the transfer of funds at par by means of remittance transfer receipts. These are detailed in the main Report and we recommend that, where possible, all the concessions indicated should be granted by provincial

governments to societies within their area. In particular, co-operative societies should be allowed to take full advantage of the facilities afforded by the district treasuries and subtreasuries for the movement of money to finance agriculture. They should be given a refund of three-fourths of the commission on postal money orders, when these are employed for remittances between societies, and should have a "first charge" on the property of their members where this has been purchased by a loan from a society or consists of a crop grown from seed obtained by such a loan.

The question of land mortgage banks has come into prominence within recent years. It has become apparent that village credit societies are not suitable agencies for the grant of long-term loans and that this class of business should not be mixed up with the short-term credit which it is the function of the village society to provide. The Conference of Registrars held at Bombay in January, 1926, considered the question and decided that land mortgage banks could, and should, be established under the provisions of the existing Co-operative Acts. We endorse the resolution passed on the subject at the Conference. The Acts already provide for land mortgage credit and we consider that, for the present, they should be utilised for the formation of land mortgage banks, and that no special legislation is required to establish such banks. With regard to assistance by Government to land mortgage banks, we do not recommend that Government should subscribe to debentures but we consider that a guarantee of interest on the debentures would be a suitable form of assistance. We consider also that the issue of debentures of land mortgage banks should be controlled by a central organisation, otherwise the position will arise of a number of small institutions flooding the market with competing issues. Land mortgage banks would be a suitable agency for distribution of loans under the Land Improvement Loans Act, and their debentures should be added to the list of trustee securities. We would emphasise the importance of a most careful preliminary enquiry before a land mortgage bank is floated and would insist on efficient management as essential. The simpler the constitution of such banks, the better they are likely to function.

So far little progress has been made with non-credit societies as compared with credit societies. This is natural as advance in other directions is difficult until the burden of rural debt has been definitely lifted from the shoulders of the cultivator. Purchase and sale societies, seed societies, cattle insurance societies and other forms of non-credit activity have been attempted with varying success, but it cannot be claimed that any substantial advance has generally been made in any of these directions. If such societies are to be successful, business management is required and it is not easy to find the capacity for this amongst their members. As a matter of principle, the single purpose society seems the best line of development. "One thing at a time" should be the policy.

Throughout our Report, we refer to the importance of co operative societies in connection with other activities and, in particular, in their relation to agricultural improvement, to education, to irrigation and in fact to anything which affects the cultivator. The function of the Co-operative Department, apart from the provision of credit, is to prepare the ground for the advice of the various experts employed by Government in its several departments. Naturally these departments can work best through co-operatively organised bodies of cultivators rather than through isolated individuals. The co-operative society should be the unit through which the various departments of Government concerned with rural welfare carry on their activities. As examples of the successful organisation of non-credit societies may be mentioned the Better Farming societies in the Punjab, the sale societies in Bombay and the Punjab, and the irrigation societies in Bengal. The desirability of appointing a special officer of the grade of deputy director of agriculture to work under the Registrar deserves to be examined in all provinces. As regards the appointment of specialist officers from other technical departments, much will depend on the stage of development and the particular form of co-operative activity which it is desired to foster.

XII. THE VILLAGE

CHAPTER XIV OF THE MAIN REPORT.

Economic changes are occurring rapidly in India. The development of communications and the consequent quickening and cheapening of travelling facilities are bringing the villages into closer touch with urban centres. This tends to break down the isolation and self-sufficing economy of the village. Contact with the towns introduces new ideas and a desire for better conditions of living.

The close relations between agriculture and public health are obvious and they react upon each other to a remarkable degree. There is no direction in which the rural community needs help more than in the provision of medical facilities and public health amenities. Economic wastage due to disease cannot be over-exaggerated. Malaria slays its thousands and lowers the economic efficiency of hundreds of thousands; plague and cholera sweep the country from time to time; hookworm disease, kala-azar and diseases arising from diet deficiency insidiously reduce the labour power of the cultivating classes. Any enquiry, therefore, into the general condition of agriculture and the position of the cultivator must take account of the public health aspect of his life; of the suitability of his diet; of the sanitary conditions under which he lives and of his general rural environment. In order that, as a result of the "better farming" to which we hope our proposals will lead, the cultivator may have that "better living" which should follow from it, it is necessary to take stock of existing conditions and consider what steps are necessary to improve them. These conditions in the rural areas are certainly bad. Sanitation, in any accepted sense of the word, is practically non-existent. The public latrine is too often the river bank or the margin of a tank. This predisposes to hookworm infestation and to the spread of all diseases incidental to a polluted water supply. The use of the open field, though not in all cases so objectionable, requires that the catchment areas of tanks and streams should be protected from pollution. Unprotected wells and tanks; unswept village streets; close pent windows excluding all ventilation—in such conditions does the average villager live—and yet observes a remarkably high standard of personal cleanliness and tidiness. The tragedy is that such a state of affairs should exist when, with corporate action on the part of the villagers, the evils would be so easily remediable. A common determination to protect wells, to keep villages clean and to avoid as far as possible the pollution of rivers would undoubtedly lead to an enormous improvement of the public health.

To deal successfully with this state of affairs imposes duties both on Government and on the people. It is the duty of Government to investigate basic medical problems and to enunciate and direct sound principles of public health administration. It is the duty of the people to co-operate in giving effect to such recommendations, and generally to assist in improving rural conditions. Much is being done by government and private agency and the general economic trend of events is conducive to, and suggests the possibility of, a rapid improvement in rural

conditions at no distant date. The matter largely rests with the people themselves.

Government discharges its duties through its public health and medical departments. The concern of the provincial public health departments is the establishment throughout each province of such precautionary conditions as render the incidence or spread of disease less likely. In recent years, there has been a great forward movement in this direction and questions of improved water supply and sanitary and conservancy arrangements have received an increasing amount of attention. The most highly developed provincial department is that of Madras which has a district health scheme with 26 health officers and 261 health inspectors.

On the medical side, the greater part of the research undertaken by the central Government is carried out by officers working under the Indian Research Fund Association. The objects of this Association are the promotion and assistance of research, the propagation of knowledge and experimental measures generally in connection with the causation, mode of spread and prevention of diseases, primarily of a communicable nature. Much research work has been done under the auspices of this Association in connection with such diseases as cholera, plague, malaria, kala-azar and in the investigation of problems of diet deficiency.

In the Bombay presidency, a village medical aid scheme has been devised under which rural schoolmasters are trained to deal with minor ailments and to administer first aid. In some provinces, schemes have been adopted under which private practitioners are given subsidies to induce them to settle in rural areas. Various schemes have also been evolved for the training of village midwives and nurses. Schemes of this nature have great potentialities and should be given all possible encouragement. Some local governments are already making annual grants to local authorities for the improvement of the potable water supplies. We consider such improvement a matter of paramount importance and in view of the heavy cost of water borne epidemics, we suggest that all governments may well regard expenditure on this object as constituting a sound policy of insurance.

In the course of our tour, we have been much impressed by the great awakening of non-official interest in the health and welfare of the country-side. It is from this manifestation of public interest that we derive our greatest encouragement and hope. This awakening is general and not confined to any particular province. As typical examples of such efforts, we would mention the Poona Seva Sadan Society, the Co-operative Anti-Malaria Society in Bengal, and the rural reconstruction work of the Y. M. C. A. in southern India.

Of all the diseases of India, malaria is the most widespread and its effects on the efficiency of the rural community are disastrous. The principal prophylactic in the treatment of this disease is quinine and cinchona febrifuges and not the least of Government's responsibilities in the control of malaria is connected with its policy in regard to the manufacture of this

drug. At present, all the cinchona plantations with one exception and the factories for the manufacture of quinine are owned by the provincial governments of Bengal and Madras. If the question of malaria is to be seriously tackled, we are strongly of opinion that the development of cinchona cultivation in all provinces which contain areas suitable for its growth, the manufacture of quinine and the control of its distribution, so far as price within India is concerned, should be taken over by the Government of India. In view of the all-India importance of the question it is not one which should be left to local governments, however efficiently they may in the past have carried out their obligations in the matter. In view of the great importance of extending cinchona cultivation and cheapening quinine, we consider that much more scientific investigation is called for than has been undertaken in the past.

In concluding our remarks on public health we desire to emphasise the urgency of the need for developing the rural medical and public health services to the utmost possible extent and with the utmost speed.

The problems of human nutrition, which have only recently come into prominence are being investigated by Colonel McCarrison who is working under the Research Fund Association at Coonoor. He lays emphasis on malnutrition as a problem facing those engaged in agricultural research. In his enquiries, Colonel McCarrison invokes the aid of the agricultural departments. The problems of human and animal nutrition are likely to assume such importance that we consider it desirable that work on human nutrition and on the nutrition of farm animals should be carried out in the closest co-operation, or, in other words, that there should be team work by workers with a knowledge of different branches of the science of nutrition. Continuity is also essential. The various workers on nutrition problems should be formed into a Committee on Nutrition which would meet at regular intervals to discuss common questions. This would assure the requisite close touch between workers in different branches of the subject. In view of the importance of the subject, we recommend that a Central Institute of Human Nutrition should be established. Although it is not necessary that both branches of nutrition work—human and animal—should be carried out in the same building, it is desirable, in order to secure the closest possible connection between the research workers in both these branches, that the respective institutes should, if possible, be at no great distance from each other.

In connection with diet, we are much impressed by the possibilities of a development of the fish industry in India and would commend this matter to the attention of local governments.

So far we have dealt mainly with what may be called the health aspects of the cultivator's life. We now propose to consider what help can be given to the villagers to enable them both to adjust themselves to changing conditions and to reap the fullest advantages from the various technical services with which they are now coming increasingly into contact.

Throughout our investigation, we have constantly been impressed with the thought that mere material improvement alone will not bring

lasting benefit to the agricultural population. Increase in yield by better seed and better cultivation; security of the harvests gained by the expansion of irrigation; immunity from losses due to pests or pestilence: higher prices from improved communications and conditions of marketing: everything, in short, which we have advocated for the material advancement of the people will merely postpone the effects of the growing pressure of the population on the soil. No lasting improvement in the standard of living of the great mass of the population can possibly be attained if every enhancement in the purchasing power of the cultivator is to be followed by a proportionate increase in the population.

In this Report, we have in their proper places stressed the importance of primary education, adult education and that more special form, the education in the economics of daily life, provided in some provinces through the agency of the co-operative staffs. We must now turn to other means calculated to stimulate the desire for better living. We are strongly of opinion that guidance here is far more called for than anything in the nature of what, for want of a better term, we shall call charitable assistance. What is required is to increase in desirable directions the number of the villager's wants and to show him how to satisfy them by his own efforts. We trust that the whole weight of those to whom the villager looks for guidance will be thrown into suggestions how to improve, during his spare time, the amenities of the village. Fortunately there is a tradition of corporate action for mutual benefit to which to appeal. In the olden days, tanks were dug or cleaned out, wells sunk and roads made or repaired in this way. Although this good custom has largely fallen into disrepute, we think that, if its advantages were brought home to the villager, a voluntary revival of it for these and other purposes such as the provision of a good supply of drinking water, drainage and street improvement should be possible. If revival is not possible, hope of radically improving the amenities of the village must be abandoned. The cultivator himself is not well enough off to pay for hired labour and it is certain that neither the local bodies nor the provincial governments can provide either the men or the finance for carrying out such undertakings.

It cannot, however, be reasonably expected of the cultivator that he should, unaided, revive this ancient custom of corporate action and utilise it for the improvement of the village and its surroundings. He lacks leadership, and the difficulty is to suggest the leader. The educated man is not willing to live his life in a village except in a few cases where ideals of social service overcome the absence of amenities. The system of village guides devised by Mr. Brayne, I.C.S., in the Gurgaon district of the Punjab seems worthy of consideration. Young men are given a special course of training which, in addition to imbuing them with a sense of the dignity of corporate labour for the mutual benefit, is designed to familiarise them with the principles of sanitation, elementary medical aid, co-operation, and agricultural improvement, and to give them some knowledge of the simpler home industries in order that each man may, when his training is completed, act as

" guide, philosopher and friend " to the group of villages to which he is posted. In technical matters, his knowledge is meant to enable him to direct the villagers where to go for advice rather than to give that advice himself. This system of village guides is part of an organisation in the Gurgaon district which has as its aim the general uplift of the rural community. The scheme embraces the work of every department of Government engaged in rural areas ; it seeks to assist in securing the adoption of the advice of the expert by a well-planned propaganda campaign ; it depends for its success on the enlistment in the cause of every one willing and able to assist, official or non-official, and more especially of the people themselves whose welfare is in the balance. Lecture, song, drama, magic lantern, cinema, and even the loud speaker are made to contribute what they can to arouse the people to a realisation that they themselves are largely responsible for their own undesirable condition. The attention of the villagers is thus attracted. Side by side with the propaganda campaign, there are provided facilities for those who wish to try the advice so tendered. Good seed, selected bulls, ploughs, well-gear, quinine, inoculation, and so on, are readily available. Co-operative societies, adult schools, domestic economy classes and every other means calculated to assist the spirit of service and self-help are at hand. Everything useful is brought within easy reach of those who need it. The chief value of this scheme, in our eyes, is its illustration of the great benefit which accrues from an all round effort at village improvement by everyone interested.

Next to making some one individual resident in the village itself responsible for advising the villagers, where to go for advice and how best to utilise their own skill and resources in improving the amenities of the village in their spare time, we attach most importance to linking the villages with the social life of the town. We consider that this can best be effected by social workers organised in societies like the Seva Sadan Society of Poona. Such organisation facilitates continuity of policy and steady pressure over a long period, both of which are required if permanent results are to be obtained. The universities also have an obligation and a great opportunity to assist in the work of rural development both on the economic and educational side. In particular, they might institute and organise economic surveys. In the Punjab, there is a Board of Economic Enquiry which is a non-official body consisting of officials and non-officials interested in economic studies. The establishment of such a Board in other provinces would give university students of economics ample opportunities for socio-economic enquiries under capable direction.

We would also refer to the Punjab Central Rural Community Board. The personnel of this Board is largely official but it is linked with a rural community council, set up in each district of the province and predominantly non-official. Each council is assisted in its work by the attendance of representatives of the various departments concerned with rural development, namely, educational, agricultural, veterinary and co-operative officers. The intention is that each district

community council should co-ordinate the propaganda work of all these development departments.

Sufficient experience has not been gained to pass an opinion on the practical efficiency of these councils. We are not, therefore, in a position to say to what extent this organisation may be suited to the needs of other provinces. The scheme certainly combines the advantages of both the official and the private type of organisation. This experiment deserves, therefore, the close attention and consideration of workers in other provinces. In our opinion, the movement will gain in power for good if it develops a women's side to its activities. The establishment of a women's institute in a village would supply a centre for educational and co-operative activities as well as for mother and infant welfare work and might remove the present obstacles to the employment of women teachers in village schools.

Local public opinion in favour of particular measures can also be organised by the formation of co-operative Better Living societies. The possibility of facilitating the settlement of village disputes by local arbitration organised on a co-operative basis also calls for careful consisideration. There is a general awakening of public interest in the depressed classes. The most efficient means of effecting any improvement in their condition lies, in our opinion, in education and the consequent inculcation of self-respect and self-help. In no field of rural work have private organisations a greater opportunity for usefulness.

XIII. EDUCATION

No enquiry into the rural economy of India with a view to the promotion of the welfare and prosperity of the rural classes would be complete without a careful survey of the existing systems of education, their suitability to village conditions and their influence.

CHAPTER XV OF THE MAIN REPORT.

Education is a transferred subject. For administrative purposes, educational institutions are divided into two classes, those recognised by the departments of education and those which are not so recognised and are, therefore, not inspected by government agency. Over British India as a whole, institutions that are recognised are six times as numerous as those unrecognised. Sixty-five per cent of these recognised institutions are privately managed, though subject to government inspection, and, of the remainder, thirty-three per cent are managed by district boards and municipal councils and two per cent are under direct government management. The importance of those under government management is out of all proportion to their number. It is unnecessary here to describe the legislation which governs the educational functions of local bodies in the different provinces. It will suffice to say that the most important additions to this legislation in recent years have been Primary Education Acts, one of the main objects of which has been to empower local bodies to introduce compulsory primary education in selected areas.

So far as the general mass of the agricultural population is concerned, primary education and the attainment of literacy are the main considerations. In this connection, the following statistics are of interest. In 1921-22,* the percentage of scholars in the primary stage, in both recognised and unrecognised institutions, to the total population of school-going age (*viz.*, 15 per cent of the total population) for the whole of British India was 32·2 males and 7·6 females. The percentage distribution of scholars, in 1925-26, in recognised institutions (no figures are available for non-recognised schools) was for males 87·1 in the primary stage, 8·8 in the secondary, 3·2 in special schools† and 0·9 per cent in the universities. For females, the corresponding figures were 95·2, 3·6, 1·1 and 0·1 per cent. At the census of 1921, the percentages of literacy for persons 20 years of age and over were 18·3 for males and 1·9 for females. The percentages for males ranged from 62 per cent in Burma to 8·9 in the United Provinces and for females from 11·8 per cent in Burma to 0·7 per cent in the United Provinces and Bihar and Orissa.

While the proportion of children of school-going age attending primary schools is still disappointingly small, it is increasing with some rapidity. A large proportion of those who attend these schools do not, however, remain at them long enough to ensure their reaching the

* Statistics are not available which could enable this information to be given for a later year.

† Special schools consist of technical and industrial schools, normal and training schools, commercial, medical and reformatory schools, schools for adults, schools for defectives, etc.

minimum standard of literacy and no definite information is available as to the extent to which those who reach this standard relapse into illiteracy. For this failure to achieve more rapid progress in primary education various reasons are given and we suggest directions in which improvements are possible.

Our enquiries have left us firmly convinced of the great importance to rural development in India of the spread of literacy amongst women. There are indications of an awakening interest in this direction. But progress is slow and we would suggest the desirability of demonstrating in striking fashion the value to the community of the education of its women, particularly in its effect upon the spread of lasting literacy amongst the young. Steps to this end might be taken fully by recording the educational history and subsequent development of children of typical cultivating families in which the mother is literate, while like particulars of illiterate homes in the same neighbourhood and conditions of life should be tabulated for the purpose of comparison with their more fortunate neighbours. It is essential, however, that the families chosen should be of entirely rural condition and not urban. Where no literate homes of the cultivating classes are available, we think a definite effort should be made to impart literacy to a certain number of young mothers selected where conditions are most suitable and where no similar experiment has been tried before. We have little doubt that the result of this comparison will show a markedly stronger tendency on the part of the literate parent both to send the children to school and to keep them there till literacy, which the mother has come to value has been fairly achieved.

We think that the trouble and expense involved in the collection of the necessary facts will be amply repaid if, as we anticipate, the result is to prov de convincing propaganda which can be used to demonstrate in ways that all will understand the true relation between female literacy and the spread of general literacy.

We consider that, if teaching is to be efficient, the training of the teacher must be improved and there must be an increase in the number of trained teachers. If possible, female teachers should be provided for small children for it is the experience of all countries that they are best qualified for such work. Although we realise that financial consideration may militate against the provision of a second teacher for the small primary school, we consider that a minimum staff of two teachers should be the ideal to be aimed at. Teachers in primary schools should be drawn wherever possible from amongst those who are familiar with rural life and the text-books should deal with every day objects familiar to the pupil and have a rural tone. The faculty of observation should also be developed by occasional school walks through neighbouring cultivation. If the teacher happens to be a keen and well-informed gardener or has qualifications for teaching nature study on sound lines, he should be encouraged to impart his knowledge to such of his pupils as are willing to learn. A stimulus in this direction might be given to the teacher by a supplement to his pay. But a pretence of teaching agricultural methods to [illegible] five to ten years old, whether theoretically

in the guise of nature study or practically in school gardens, should be avoided.

We are convinced that the progressive adoption of the compulsory system is the only means by which may be overcome the unwillingness of parents to send their children to school and to keep them there till literacy is attained. The provision of a sufficiency of trained teachers and of suitably equipped buildings must, of course, precede the enforcement of compulsory school attendance. Finance also imposes a limitation. Uniform progress cannot therefore be expected. But in all provinces (except Bengal where a Primary Education Bill is under consideration) legislative sanction exists for the introduction, at the discretion of local authorities, of compulsory education in rural areas. In all the provincial legislation on the subject, the onus of proposing the establishment of a compulsory area is placed on the local body concerned with primary education. The first essential for the spread of primary education is, therefore, to bring public opinion to realise that efficiency can only be secured by the introduction of the compulsory system. In the Punjab, the only province in which any measure of success in introducing the compulsory system can be said to have been achieved, the co-operative movement has been brought to bear on this problem. One hundred and fifty-eight societies with a membership of 7,000 parents pledge themselves under penalties to keep their children at school for four years continuously or until the completion of the fourth standard.

Within recent years, the question of adult education has assumed some prominence, notably in the Punjab and Bengal and to a lesser extent in Bombay. In the Punjab, the movement has in the main received its stimulus from the Co-operative Department. It is to co-operative societies and associations of public spirited individuals, interested in rural development, rather than to direct government agency that we must look for any marked advance in this direction. We consider, however, that there may be a case for Government assisting co-operative societies by a *pro rata* contribution from provincial revenues to the funds which a society has been able to raise privately.

Immediately above the primary school comes the secondary school—vernacular middle and Anglo-vernacular schools. The boys attending these schools are ordinarily from ten to fourteen years of age. The next stage is the high school—the stepping stone to the intermediate colleges and universities. Boys attending these are from thirteen to seventeen years of age. In 1925-26, there were 9,867 middle and high schools with 1,583,000 pupils. According to the last estimate made (1922), some half-a-million boys who are attending primary classes attached to secondary schools have, however, to be deducted from this number in order to arrive at the correct number of boys undergoing secondary education. Our concern with secondary education is the extent to which, and the manner in which, agricultural education can best be given in secondary schools. This subject has been much discussed. The divergencies of opinion in regard to it have led to the evolution of two

entirely different types of school; the vocational school and the ordinary rural secondary school, in the curriculum of which elementary agriculture is included. The former type finds favour in Bombay. In the adoption of the other, the Punjab has led the way.

At the Marathi Agricultural School at Loni near Poona, which is of the vocational type, admission is limited to fifty boys and the qualifications laid down for it are that the applicant must belong either to a cultivating or a landholding class, that he must have completed his education up to the fourth Marathi standard, that he must be between fourteen and seventeen years of age and that his object in coming to the school must be to train himself for work on his own land and not for service in a government department. The course lasts for two years and the instruction which is given in the vernacular is both theoretical and practical. Three hours daily are devoted to practical work on the farm of twenty-two acres which is attached to the school and the whole area of which is worked by the boys. In his second year, each boy is made responsible for the cultivation and cropping of an area of about one quarter of an acre; he is also required to keep a diary of his daily work and a cultivation sheet of expenses and realisations. Two crops are raised during the year, one dry and one irrigated. The care of the milking herd and of the farm bullocks is entrusted to the boys. The school has a workshop in which they learn smithy and carpentry work and also an oil engine and power driven farm machinery which they manage. Weekly visits are paid to neighbouring cultivation and, during their second year, the boys are taken on an extensive tour throughout the presidency. It is important to note that, if the student remains at the school for the whole of the course, this education is provided free of all cost except the small amount which has to be deposited to meet current expenses. There are now six schools of this type in the Bombay Presidency but it has so far made little headway in other provinces.

In the Punjab type, elementary agriculture is an optional subject in the curriculum of the ordinary vernacular middle schools. In the words of a Circular which was issued in 1923: "the aim is to enrich the middle school course in rural areas by the inclusion of agricultural training and thus to bring it more in keeping with the environment of the pupils; and the object is to use agriculture as a means of mental discipline and training and as an important accessory to the general subjects taught in these schools.

Under this system, the instruction given in the class room is both illustrated and supplemented by practical work in all agricultural processes on the land. For this purpose, farms of about three acres in extent were attached to the schools in which the new course was first introduced but, owing to financial stringency, the alternative of school gardens, half an acre to an acre in extent, was adopted in 1923. Six periods per week are devoted to the course by each of the four classes which make up the vernacular middle school in the Punjab. All the work on the farms and gardens, except that of looking after the bullocks on the farms, is done by the boys themselves and it is interesting to note that many of the farms

and gardens are not only self-supporting but have an annual balance to their credit. The teaching is in the hands of trained and carefully selected teachers who have first taken the ordinary senior vernacular training course and have then completed a separate course in agriculture at the Lyallpur Agricultural College. An additional link between the agricultural and educational departments is provided by the fact that the general supervision of these activities is entrusted to an adviser in agricultural training who is an officer of the Education Department. His headquarters are at the Lyallpur Agricultural College. When we visited the Punjab, there were 66 schools of this type, 26 of which had farms attached to them and 40 gardens. It was hoped to increase the number during 1927-28 to 121, of which 64 would have farms and the others gardens. The Punjab model has been very closely followed in the United Provinces, where there are, or shortly will be, some twenty of these schools. In Bombay, there are forty-three schools known as 'agricultural bias' schools of a very similar type.

After the most careful consideration, we have come to the conclusion that in no scheme of rural education the cost of which is defrayed by Government ought schools of the Bombay type to find a place. There is no evidence that there is a popular demand for them. They appear to us to be an artificial addition to the educational system and in no way a natural development of it. They are very costly and lead nowhere. The boys who attend them receive no instruction in the subjects required by high school and college. It is only in exceptional circumstances that a parent is prepared to decide upon the future career of a promising boy at the early age of thirteen or fourteen. The establishment of schools of the Bombay type merely means that an agency far more expensive than the normal is employed to train boys destined for work on the land.

We consider, on the other hand, that the Punjab type of school has much to recommend it. It is true that this method of imparting instruction in elementary agriculture in rural middle schools has not been in use sufficiently long to enable conclusions as to its merits to be reached. It may be, as we were told in Bombay, that most of the boys who pass through the course will prefer to become teachers or village accountants to farming their own land. But even if this should prove to be so, the value of the training in agriculture they have received will not be lost to the country-side and there would still remain a large residuum who would take up agriculture as their occupation. In the meantime, there is no doubt that the classes have so far proved a great success and that they have attained a popularity which has been denied to schools of the vocational type. Although no approximation to a final solution has been attained, it is, in our view, in this direction that the true solution of the problem of relating the instruction given in middle schools in rural areas to their environment is to be found. Similarly with regard to agricultural teaching in high schools. Where these schools contain a large proportion of boys from rural areas and have facilities for the provision of a farm or garden, the addition to the curriculum of a combined course

of practical and theoretical instruction in elementary agriculture somewhat on the lines of that now given in the middle schools of the Punjab type but of a rather more advanced character would, we believe, be productive of good results.

In our observations on rural industries, we emphasise the importance of introducing modern processes. This introduction will be greatly facilitated if the various technical institutes provide instruction in applied science of a high standard.

We are concerned with the universities only as regards the relation of agricultural colleges to them and with reference to their influence on rural development. We approve of the policy of affiliating an agricultural college to a university wherever this is possible. We contemplate closer relations between the universities and the agricultural colleges in the future and, though affiliation for the purpose of obtaining a degree is not essential to such relations, it undoubtedly tends to promote them.

From the point of view of agricultural development, we need not emphasise the importance of the part that the universities must play in educating those who will become the administrators, the technologists, and the research workers of the future. Here, however, we are concerned with the urgent need of instilling in rural communities the ideals of leadership and service, and we wish to make plain our conviction that the universities have it in their power to make a valuable contribution to this end. It is their highest mission to develop in the student that public spirit and zeal for the welfare of his fellows which, when he goes out into the world, will impel him to take a full and active part in the life of the community in which his lot is cast. But universities are commonly situated in large centres of population, and members who are attracted by the call of social service naturally tend to apply themselves first to the problems of the town. We wish strongly to press the claim of the rural areas upon the time and interest of the best of India's youth. It is upon the homes and fields of her cultivators that the strength of the country and the foundations of her prosperity must ultimately rest. We appeal to both past and present members of Indian universities to apply themselves to the social and economic problems of the countryside, and so to fit themselves to take the lead in the movement for the uplift of the rural classes. We trust that the authorities and teachers of universities will do all in their power to encourage the study of those most important subjects. The opportunities open in India to men able and willing to play a selfless and patriotic rôle in the field of local leadership and of service to the public are unbounded. Membership of village *panchayats*, local boards and the like and work in connection with the co-operative and adult education movements as well as that carried out by non-official bodies concerned with the well-being and advancement of the rural population offer scope for the exercise of a wide range of talent and inclination. Such service is of the utmost value to the State, for the welfare and happiness of the peasant must be largely dependent on the purity and efficiency with which local services are administered.

Among a people whose history goes back as far as does that of India, and in a society upon which the fetters of custom are so firmly bound, the inertia of centuries can only be overcome by the ready self-sacrifice, by the enthusiasm and by the sustained efforts of those who themselves enjoy the blessings of a liberal education.

Higher agricultural education is provided at agricultural colleges established at Poona, Coimbatore, Lyallpur, Nagpur, Cawnpore and Mandalay. The first four are affiliated to a university. Bengal, Bihar and Orissa and Assam have no college. We recommend that agricultural colleges on the model of the existing colleges should be established at Dacca for Bengal and also in Bihar and Orissa.

In general, the object of these colleges is to train students for employment in the agricultural and other departments or to qualify them to manage their own land or that of others. Up to the present the great majority of the qualified students have been absorbed in the agricultural departments.

We regard the agricultural colleges as the apex of the whole scheme of agricultural education. They should make their influence felt in all branches of rural education and every student who enters them should be encouraged to realise that, given the capacity and application, his foot is set on the road which leads to post-graduate training and thereafter to the highest distinctions in the fields of science and agriculture.

In order to obtain students better qualified to profit by training at the agricultural colleges, we recommend that the intermediate science examination of the provincial university should be prescribed as the qualification for admission. This will relieve the colleges of the necessity for arranging courses in elementary science with the principles of which students should be familiar before they enter them. If the intermediate examination in science is made the standard of admission, a three years' course at an agricultural college will be adequate.

The curricula of the agricultural colleges have been drawn up on much the same general lines and appear to us to be suitable. We consider, however, that more attention should be devoted to agricultural economics and that teachers of the subject should be selected with great care. More attention should also be paid to estate management, but to give instruction in this as part of the three years' course would involve the risk of overloading the curriculum and we, therefore, consider that directors of agriculture should make the best arrangements they can to provide passed students with opportunities of gaining experience in estate management. Such experience will be particularly useful for students who propose to farm their own land or that of others. Greater attention should also be given to agricultural economics and estate management in the two years' courses which are given in some of the colleges.

We also attach the greatest importance to miscellaneous short courses given at colleges. Colleges should initiate such courses and accept responsibility for creating a demand for them.

To remove the reproach that graduates of agricultural colleges are frequently weak on the practical side, something more than additional instruction in agricultural economics and estate management is required. Facilities should be provided to enable passed students to obtain further practical experience before commencing active work either in the public service or on their own lands.

As regards the college staff, we lay great importance on the personality of the principal. The head of an institution which combines research and teaching requires special qualifications, among which administrative capacity and breadth of outlook are as important as high scientific attainments. The best man available should be selected for this post and once appointed he should be retained in it and compensated, if need be, for foregoing appointment to the Directorship of Agriculture. All agricultural colleges should have a whole-time principal. The teaching staff of the colleges should also be carefully selected. Interchange between the administrative and the research and teaching branches of the agricultural services should ordinarily be restricted in the earlier years of service. The field of selection for the college staff might be widened to admit of the appointment of distinguished science graduates of Indian universities. We have carefully considered the question whether the research activities of the agricultural colleges should be entirely divorced from the teaching work and, as a result, we entirely approve the system under which the heads of sections give instruction in their special subjects. There can be no doubt, in our view, that such a combination of research with teaching is of mutual benefit to both.

For recruitment to the superior provincial services, post-graduate training, after taking a degree at an agricultural college, should be prescribed as an essential qualification. This can ordinarily be best given at Pusa. For the purpose of those graduates of an agricultural college who elect for other branches of government service, we recommend that a degree or diploma in agriculture should be placed on the same level as a degree in arts or science as a qualification for appointments in such departments as the revenue, irrigation and co-operative departments.

XIV. RURAL INDUSTRIES AND LABOUR

A problem of some importance is how the villager can best use his spare time for the improvement of his position. The amount of spare time which the cultivator has on his hands varies greatly according to the local agricultural conditions but it may be assumed, as a broad generalisation, that a large majority of cultivators have at least from two to four months absolute leisure during the year. At the census of 1921, only 10½ per cent of the total working population in British India was shown as employed in industry of one kind or another, including factories. Apart from the large industries concentrated in industrial centres, the smaller concerns such as rice mills, oil mills, cotton ginneries, etc., engaged only some 250,000 people which is equal to about 0·03 per cent of the total number employed in agriculture. It will thus be seen that industries located in rural areas are at present unimportant from the point of view of their demand for labour. On the other hand, their multiplication within economic limits suggests one solution of the problem of spare-time employment in rural areas.

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We have received various suggestions for the establishment of new industries which may offer increased employment to the rural population. An industry which seems to offer considerable promise is the extension of the local manufacture of agricultural implements. The engineering section of the agricultural departments can give valuable help in promoting such a development. Students who desire to be trained in implement manufacture should be encouraged by stipends to enable them to attend engineering schools, railway workshops or the workshops of the agricultural departments. Similar facilities should be provided for the training of the more progressive village artisans, such as blacksmiths and carpenters, who want to keep abreast of developments in agricultural machinery. Amongst other industries brought to our notice were paper manufacture from bamboo pulp, the oil-crushing industry and the handloom, pottery and rope-making industries, sericulture and lac. As regards sericulture, we would remark that there is a danger that the natural silk industry may be seriously affected by the increasing use of artificial silk, although at present high grade Indian silk meets the demand of the special luxury market. The lac industry appears to require organisation so as to bring together all the interests affected, while further research is needed to ensure a regular output of good quality lac. An enquiry should also be made into the economics of lac production.

There are opportunities for the development of a poultry industry and we are glad to note that increased attention is being devoted by the agricultural departments in most provinces to poultry rearing and the work done, notably in the United Provinces, suggests that this industry has possibilities of expansion.

With regard to rural industries in general, it may be said that the chief needs are the stimulus of new ideas and the provision of adequate

instruction and advice on the commercial side. The opportunities which they present for improving the condition of the rural population are extremely limited, and as a general principle it may be laid down that the chief solution of the problems of the cultivator lies in promoting the intensity and diversity of his agriculture.

The development of village industries on a co-operative basis is essential if they are to survive increasing competition. The question of organising them on such a basis should receive the attention of the departments of co-operation and industries in all provinces. One direction in which help could be given by Government would be by advances in special cases to artisan co-operative societies for the purchase of improved machinery. As small local factories dealing with the produce of limited areas multiply, the co-operative movement can play an important part in linking up the cultivator and the cultivator's produce with these localised factories. The main lines on which assistance can be given to the smaller industries to enable them to hold their own in the intensive competition of modern times are co-operative organisation and the provision of facilities for technical education. For a long time to come, Government will have to be prepared to make suggestions for the development of these industries and to assist them by advice. In some instances, they may have to make themselves responsible for running a pioneer enterprise.

Government can do much to assist the mutual adjustment between the larger industries and agriculture by their policy in respect to communications and the development of power, by technical education, and by the collection of marketing information.

Departments of industries have been constituted in Madras, Bombay, Bengal, Bihar and Orissa, the Punjab and the United Provinces and amongst their functions is that of the supervision of rural industries. Madras and Bihar and Orissa have passed State Aid to Industries Acts and the Punjab an Industrial Loans Act. Under these Acts, assistance, subject to certain conditions, can be given from provincial revenues to private enterprise for starting new industries. The intention of these Acts is to help the development of industries generally. Other things being equal we hope that particular attention will be paid to the development of agricultural industries. In some provinces, technical institutes exist for the training of artisans and it is on this education, general or particular, that we lay the greatest emphasis.

It is essential for the success of the departments of industries that the Director should be an experienced administrator.

The Famine Commission of 1880 observed that "the numbers who have no other employment than agriculture are greatly in excess of what is really required for the thorough cultivation of the land." The labour problem of to-day is the same from the agricultural point of view as it was when the Famine Commission wrote these words, namely, to lessen the pressure on the land. This pressure might be relieved by permanent migration within India, but, while seasonal migration prevails to a considerable extent, permanent migration does not take place on

the scale that might be expected. We think that the State should encourage the free movement of labour, and that where any restrictions exist, they should be reduced or abolished as soon as possible. In certain areas, migration is impeded by malaria or lack of water. Such conditions should be investigated and improved and definite schemes of colonisation introduced. In this connection we would quote the example of Burma where colonies for Burmans from the congested areas have been established on lands which have been disafforested, or on waste lands coming under irrigation for the first time. These colonies have been formed on a co-operative basis and are financed through their societies by the ordinary *taccavi* loans advanced by Government.

Finally, there is the question of relieving the pressure of population on the land by emigration abroad. Consideration of such possibilities is confined to the tropical and sub-tropical parts of the British Empire. Ceylon and British Malaya at present attract a large amount of Indian labour, but the limits of absorption in these parts have probably been reached. The British West Indies, Mauritius, British Guiana and the Fiji Islands also attract a certain number of Indian emigrants but British Guiana seems to be the only country which offers scope for migration on any considerable scale. A scheme of assisted migration to British Guiana, now under discussion, is worthy of further exhaustive investigation, as it would seem that that colony is capable of absorbing over two million people, or more than the total Indian population at present resident abroad.

XV. HORTICULTURE AND PLANTATIONS

CHAPTER XVII OF THE MAIN REPORT.

The cultivation of fruit and vegetables can be regarded from two points of view—the supply of the household and production for sale. In one form or another, vegetables appear almost daily in the Indian home and fruit is a popular addition whenever it can be obtained free or at small cost. In our Report, we deal in the main with the prospect of improving crops grown for the market. We assume that the relatively small number of market growers could be much more easily influenced by the advice and guidance of agricultural departments than could the growers for family consumption and that any improvements effected by the former would influence the cultivation of fruit and vegetables by the latter.

While there can be no question that there is much scope for the small cultivator who endeavours to supplement his income by growing cheap and hardy fruits for local sale, there are serious obstacles to be overcome by the grower who proposes to specialise in fruit-growing for the larger and more fastidious urban markets. The amount of capital required is, perhaps, the greatest single obstacle, especially as it appears from the information given to us that, in order to be successful, the small cultivator must rely on his orchard, once it has come into bearing, as his main source of income. In addition, the ordinary cultivator lacks the skill required in selecting varieties, planting, pruning and spraying which the successful production of high grade fruit for the market demands. Moreover, he does not, as a rule, live on his holding and the protection of small areas of fruit would be difficult even where the holding was in one compact block and quite impracticable if, as is so frequently the case, it consisted of a number of separate plots. The conditions, therefore, for the successful production of fruit for the market are that the grower, in addition to the possession of capital and acquired skill in the management of fruit trees, should have his holding in a compact block and be prepared to live on it in order to protect his crop during the ripening season. Further, supplies of water and manure must be readily available and a connection with a satisfactory market must be established.

The commercial fruit grower must in the main look to large urban centres for his market and he has to face the problems of transport and marketing. The difficulties of transport before the rail-head is reached are particularly great and can only be met by improvements in the packing of the fruit and the use of suitable containers. As regards marketing, sale takes place as a rule through an agent. The general absence of cold storage facilities and of an alternative market are obstacles to successful marketing. Regulated markets, when these are situated in areas in which fruit is grown to meet a local demand, might prove of much benefit to the wholesale vendor. The more immediate hope of expansion would seem to lie in the home markets, combined with the exploration of the demand in markets abroad for specially choice fruits, such as mangoes of good quality. These remarks apply with even greater force

to vegetables, because vegetables, to a much greater extent than fruit, may be regarded as having a potential market among the bulk of the population and, in these circumstances, the prospects of market gardening are more hopeful than those of fruit culture. Facilities for the disposal of fruit surplus to the demand for fresh produce become of great importance in the production of fruit on a commercial scale. It will be necessary to study the tastes of the mass of consumers in India as the home market is by far the most important, but an attempt might also be made to place one or two special products, such as mango pulp, on the foreign market.

There is much important research work to be done in connection with fruits and vegetables and the agricultural departments are devoting considerable attention to the subject. But, even more urgent than the need for research is the need to ascertain what the economic possibilities of increased fruit and vegetable production may be in order that the agricultural departments may know to what extent the development of their horticultural sections is justified in the interest of the small cultivator. Transport and marketing are basic difficulties and the provincial marketing officers should undertake the investigation of these problems.

While the economic possibilities of increased production are thus being worked out, we suggest that the agricultural departments should conduct experiments designed to ascertain the varieties of fruit and vegetables best suited to the various conditions of soil and climate. The information so obtained should be recorded in a form which will enable those intending to start fruit and vegetable production to profit by it. Should it become evident that there will be a large demand for young fruit trees and for seeds of improved varieties of vegetables, the agricultural departments should take steps to ensure that reliable stocks are obtainable by the public. The possibilities of introducing profitable exotics should also repay investigation. Nurserymen and seedsmen are making their appearance in India, but as a class they are not, as yet, fitted to make their own selections of fruit trees and vegetable seeds. The agricultural departments should use every means in their power to encourage and strengthen private enterprise in this direction.

The planting industries, which deal principally with tea, coffee and rubber, are well organised and both the Indian Tea Association and the United Planters' Association of Southern India maintain their own experimental stations and laboratories. They are in close touch with the Imperial and provincial departments of agriculture. We consider that the value of their scientific work should be recognised and co-operation between these associations and the agricultural departments secured by arrangements for their joint representation on the Council of Agricultural Research.

XVI. STATISTICS

CHAPTER XVIII OF THE MAIN REPORT.

The compilation of agricultural statistics of a uniform type for all India began in 1884. The Famine Commission of 1880 drew attention to the importance of improving statistics and the early efforts of the agricultural departments were largely concentrated on this work.

The statistics published by the Government of India which have an agricultural bearing deal with (*a*) cultivation and crops ; (*b*) livestock and implements ; (*c*) vital statistics ; and (*d*) economic data.

The Agricultural Statistics of India are published annually in two volumes, the first of which relates to British India and the second to certain Indian States. For each province or State figures are given of the total area, classified as cultivated, uncultivated and forests ; the area and crops irrigated ; the total area under crops and under each important crop ; livestock, ploughs and carts ; the incidence of the land revenue assessment ; the harvest prices of certain important crops ; and the average yield of the principal crops in each province. We have two recommendations to make regarding this publication. The date of issue might be expedited with advantage, and the figures might be given by districts as was formerly done.

A report is published quinquennially on the average yield per acre in each province of the principal crops in India, seventeen in number. There is also published in the *Indian Trade Journal*, a weekly publication, about one year after the year to which it relates, a provisional issue of Volume I of the *Agricultural Statistics of India* and full particulars relating to tea, coffee and rubber. A crop atlas has also been published.

Crop forecasts for all-India are issued each season for eleven of the principal crops and the *Estimates of Area and Yield of the Principal Crops in India*, including all crops for which forecasts are issued and also tea, coffee, rubber and certain other crops, are published annually. We suggest that, in this compilation, figures of areas and yield should be given separately for British India and the Indian States and that indigo should now be omitted.

Provincial forecasts, as well as those for the whole of India, are published in the *Indian Trade Journal*. We consider that the custom of publishing them in leaflet form should be revived. Arrangements should also be made for the issue of forecasts in the vernacular and for their supply to cultivators.

Except in Burma and the Central Provinces, forecasts are prepared by the agricultural departments. If these departments receive the statistical assistance we recommend later, we think it would be advantageous if forecasts in these two provinces were to be prepared by the agricultural departments. In Burma, however, the rice forecast should continue to be prepared as at present by the Commissioner of Settlements and Land Records.

A quinquennial census of livestock, ploughs and carts is held.

Much statistical information of value is contained in the provincial Season and Crop Reports and in various departmental reports. We suggest that the statistics in the reports of the irrigation, education and forest departments should be modified in certain directions to give fuller information.

The Statistical Abstract for British India summarises most of the information given in the reports referred to above.

Care should be taken to reconcile discrepancies between the figures given in the various departmental returns and those given in the *Agricultural Statistics of India.*

The figures for land classified as " not available for cultivation " and " culturable waste " are apt to give rise to misconception. The *Agricultural Statistics of India* suggest that nearly one quarter of the total area of British India is culturable but not cultivated. We consider that the classification requires careful re-examination.

It is generally admitted that the annual figures of the areas sown with the various crops attain a high standard of accuracy. In most provinces, there is a satisfactory agency for collecting the figures. The exceptions are Bengal and Bihar and Orissa. A fairly efficient machinery to which we refer below has been evolved to collect the statistics of jute production and we would suggest for consideration the possibility of extending it to other crops in the permanently settled parts of those two provinces and of Assam.

The three factors necessary for estimating the yield of a crop are area, normal yield and estimate of condition. The estimate of normal yield is based on crop-cutting experiments made over a number of years. At present, these experiments are generally conducted by the revenue departments. This practice should continue till the statistical side of the work of the agricultural departments is expanded. Changes in the figures of standard yield of crops should only be made on data based on accurate crop cuttings. The condition estimate is the most difficult to arrive at satisfactorily. We agree with the view expressed by the Board of Agriculture in 1919 that all attempts to teach the primary reporting agency to form an exact mental picture of a normal crop should be abandoned and that it is for the district officers and the provincial authorities through whom the village accountant's estimate passes, to correct it.

Jute is the only crop for the publication of the estimate of yield of which the Department of Commercial Intelligence and Statistics is not responsible. The Director of Agriculture, Bengal, issues the estimates not only for Bengal, but also for Bihar and Orissa and Assam. He now relies for his figures on presidents of *panchayats*. The figures are checked by the subdivisional officers and the district officers and forwarded to the Director of Agriculture. Agricultural officers assist the district officers, wherever possible. There appears to be no good reason why the trade interests should not collaborate with the Government of Bengal in the same way as the rice trade does in Rangoon. The fact that the cultivator

has an interest as important as that of the jute trade in the accuracy of these estimates should always be kept in mind.

The improvement in the statistics of cotton recently effected by the Indian Central Cotton Committee furnishes an example of the statistical benefits to be obtained from the thorough organisation of all interests connected with a particular crop.

The annual returns of rail and river-borne trade have been discontinued. We regard this as unfortunate as information regarding the movements of agricultural produce within India is now altogether lacking. We consider that they should be revived and that statistics should be collected of the trade on the main roads crossing the frontiers of India.

With regard to livestock statistics, we would recommend that the quinquennial census should be taken simultaneously in all provinces and that an effort should be made to ensure uniformity of classification. A suitable classification might be laid down by the Cattle Conference.

In the case of vital statistics, we suggest that separate figures should be given for urban and rural districts. We think also that the number and distribution of institutions for the treatment of disease and the strength and distribution of medical and health services, including trained midwives, should be shown separately for urban and rural districts as we consider it very important that the position of rural areas in regard to these essential services should be clearly stated.

There is also much useful work for private individuals and associations to do in correlating vital statistics and health data with those relating to agricultural and irrigation conditions. Similarly there is wide scope for scientific research into such socio-economic problems as indebtedness, mortgage debt and fragmentation of holdings. Such work can be taken up by university organisations and semi-official bodies of the type of the Punjab Board of Economic Enquiry.

If statistics are to be adequately dealt with, we consider that there must be a strengthening of staff all along the line. No statistical organisation at present exists in any province. In the first place, we consider that every Director of Agriculture should, without delay, be given a capable statistical assistant. His main concern would be with the compilation of crop forecasts, with statistics of agricultural production, with the technique and supervision of crop-cutting experiments and with the collection of statistics regarding prices. Such officers might suitably be attached to the central statistical organisation. Further, as the application of mathematics to agriculture has introduced an entirely new factor into scientific agriculture, we consider that a specialist with the highest qualifications in this branch of agricultural science should be attached to the Imperial Agricultural Research Institute.

Apart from agricultural problems, we would draw attention to the increasing importance which is being attached all over the world to statistical research as an aid to the formulation of social policies. We consider that the efforts of Government to promote rural welfare would

be greatly assisted by the appointment of a well qualified statistical officer to provincial headquarters to whom would be entrusted the duty of studying all aspects of the economic and social progress of the province. Such an officer should be the centre round which voluntary workers in the field of economic and social statistics would gather rather than the head of a purely official organisation. In short, he should be the director of a bureau of statistical information.

With regard to the central organisation, we consider that the Department of Statistics should be reconstituted as a separate department. The Director should be a man of recognised competence and should be relieved, as far as possible, of all avoidable routine matters in connection with ordinary statistics. It would, in our view, be useless to engage any but a first class statistician for the duties we have in mind. The officer selected must be of sufficient standing to make his advice acceptable not only to the provincial statistical officers but also to the business world and the informed public. One of his most important duties would be to establish close touch with these very important non-official sections of the community and we trust that provision will be made in the central statistical organisation for boards which would advise on the publication of statistics and their periodical revision and that representative leading economists, scientists and business men will find a place on these boards as well as officials of the departments interested. In this way, we trust that a school of statistical interpretation may develop in this country which would have little or no formal connection with Government but would, nevertheless, have access to, and be thoroughly familiar with official statistical material of all kinds. In fact, there would, we trust, gather round the Central Bureau of Statistical Information the beginnings of a Royal Statistical Society for India.

The whole basis of statistics in India urgently requires broadening. It should rest not on the work of a few government officials however able, but on the support of the informed public and through them on the recognition by the legislatures and by the general public that modern statistical methods are in a position to make an indispensable contribution to the successful development alike of scientific agriculture and of social administration.

We consider that every opportunity should be taken to utilise the statistical experience of the International Institute of Agriculture at Rome.

As a primary agency for the collection of agricultural statistics in temporarily settled areas, we see no practicable alternative to the continued employment of subordinate revenue officials, but more use should be made of non-official agencies.

XVII. THE AGRICULTURAL SERVICES

We consider here the recruitment, organisation, pay and conditions of service of the personnel of the agricultural departments with special reference to the increased responsibilities which will be imposed upon them if the recommendations made in the Report are accepted. Recruitment for the Indian Agricultural Service ceased in 1924 in consequence of the general decision taken, on the recommendation of the Royal Commission on the Superior Civil Services in India, not to recruit further for such of the all-India services as were administering subjects, of which agriculture was one, which had been transferrred under the Constitutional Reforms of 1919, to the control of the Governors of provinces acting with their Ministers. When recruitment for the Service ceased in 1924, its sanctioned strength was 157; 19 posts under the Government of India and 138 under local governments. The Service was, however, considerably under strength and only 109 posts were filled. This has since fallen to 93; 12 officers serving under the Government of India and 81 under provincial governments. To these 81 officers there should be added 16 officers holding permanent appointments not included in the cadre of the Indian Agricultural Service. Thus the duties of the higher branches of the service in the provinces are now being performed by 97 officers and this may be regarded as the minimum strength required for the existing work.

CHAPTER XIX OF THE MAIN REPORT.

Prior to 1920, Bombay and the Central Provinces were the only provinces which had a regular provincial service. As a result of the recommendations of the Public Services Commission, commonly known as the Islington Commission, such services were constituted in all provinces after 1920, partly by absorption of special posts, partly by the promotion of officers of the upper subordinate services and partly by direct recruitment. In the present depleted state of the Indian Agricultural Service some officers of the provincial services officiate more or less continuously in professorial or research appointments. In all provinces except Burma, the minimum pay of this service is Rs. 250 per mensem and the maximum Rs. 750 per mensem. In Burma, the minimum and maximum are Rs. 300 and Rs. 800 respectively. The present strength of the provincial services is 157.

Below the provincial services in all provinces come subordinate services, the designations of which are as various as their rates of pay. In most provinces, the qualification for the upper grade of the subordinate service is the possession of the degree or diploma of an agricultural college. Scales of pay differ greatly but, in no province, is the minimum starting pay of the upper grade less than Rs. 60 or the maximum more than Rs. 300 per mensem. The upper subordinate services provide managers and assistant managers of farms, demonstrators of agricultural improvements, and laboratory and teaching assistants at the colleges; it also renders general help in the work of the department under the orders of the deputy or assistant directors of agriculture. The lower grade of the subordinate services consists mainly of those who

hold a certificate that they have passed the two years' course of an agricultural college. It provides overseers for the smaller farms and for demonstration plots, and also sub-assistants on the research side of the colleges. The rates of pay vary greatly, but nowhere is the minimum less than Rs. 30 or the maximum more than Rs. 180 per mensem.

Below the two grades which have been described comes a large class of subordinates recruited for the most part from the sons of cultivators who are literate but have had no secondary education. They have, however, undergone a course of special training. Their rates of pay vary from a minimum of Rs. 15 per mensem to a maximum of Rs. 60.

For convenience of reference, we propose throughout the remainder of this chapter to designate appointments in the new superior provincial agricultural services, which will ultimately take over the duties of the Indian Agricultural Service entirely, as Class I appointments, and appointments in the existing provincial agricultural services as Class II appointments.

We consider the posts of Director of Agriculture and principal of an agricultural college of such importance that we would schedule them as selection posts outside the cadre of Class I officers. The officer selected for the directorship should combine administrative capacity with high scientific qualifications. The administrative responsibilities of the directors are certain to grow and much of the technical work at present in their hands must pass to the charge of officers subordinate to them. We cannot too strongly state our conviction that the directorship of agriculture is one of the key posts in rural development and that agricultural advance must in a very great degree depend upon the suitability of the officer appointed. It may happen that the administrative capacity we postulate as an essential qualification for a Director of Agriculture may not be forthcoming in the Agricultural Department of a particular province, when a vacancy in the appointment occurs. In such circumstances, we think that the local Government should, in the first instance, turn to the Agricultural Department of another province and, failing that, to the Indian Civil Service.

There is no appointment, except that of Director of Agriculture, the holder of which has greater opportunities for influencing the course of agricultural development in his province than the principal of an agricultural college. If this officer fails to take advantage of these opportunities, and if, in consequence, the efficiency of the college is lowered, agricultural progress in the province must suffer a set back from which it may take years fully to recover. In the event of a suitable officer not being available from the Agricultural Service, selection from the Educational Service should be considered.

In view of the greatly increased responsibilities which will be placed on directors of agriculture if the departmental organisation develops in the way we recommend that it should, we consider that their pay and status

should be improved. We therefore recommend that directors of agriculture should be placed on an equality with the heads of other important departments such as those of Public Instruction and Forests. The principals of agricultural colleges at present receive pay on the time scale of the Indian Agricultural Service with a special pay of Rs. 150 per mensem. The ordinary time scale of the Indian Agricultural Service is not, in our opinion, commensurate with the responsibility of the post and we would, therefore, suggest a scale of Rs. 1,500—50—2,000. The special pay of Rs. 150 per mensem would be abolished. In the case of both these appointments, overseas pay would, of course, continue to be given to those officers who are eligible for it and the posts would continue to be pensionable under the ordinary rules. The Director of Agriculture should be eligible for the higher rate of additional pension.

In some of the larger provinces, the additional responsibilities which fall on the Director of Agriculture as the result of the acceptance of our recommendations may render it desirable that the Director should be given the assistance of a joint director. If such an appointment is made, we consider that the joint director should be given, in addition to his pay in the ordinary line, suitable special pay in recognition of his increased responsibility.

Although recruitment for the Indian Agricultural Service ceased in 1924, no province has, as yet, constituted a new Superior Provincial Service to take its place. We offer the following suggestions as to the manner in which the agricultural services should be recruited and organised and the terms and conditions of service which should be offered. We recognise, however, that the financial circumstances of the provinces differ widely and that a scale of organisation which one province is in a position to adopt immediately may only be a distant ideal to another.

As regards the qualifications required of officers, we consider that the time has now come when the problems of agricultural research in this country demand a more specialised type of officer. In such branches of science as plant genetics and the investigation of plant disease, the conditions are now passing, if, indeed, they have not already passed, in which success comes rapidly because the field of research is virgin ground. Agricultural research in India now requires men who combine scientific knowledge and technique of the first order with the vision and creative power essential to the opening up of new and original lines of work. We are convinced that the field of recruitment for the Superior Provincial Service in any province ought not to be restricted to the province itself or to India. The best man should be selected, wherever he can be found. As regards qualifications, we consider that more importance should be attached to the record of the candidate in the field of research in which the appointment is being made than to his academic distinctions, but an honours degree in science at a university of repute, or its equivalent, should be regarded as an essential qualification.

As regards terms of engagement, we are not in favour of short-term agreements: The adoption of such a policy would mean, in many cases,

that valuable experience gained by an officer during his period of service would be lost to India at the end of it. At the same time, special arrangements will be necessary if research workers of the requisite calibre are to be recruited. The basic pay which might be sufficient to attract the right type of administrative or teaching officer is not, in our opinion, sufficient to secure the first class research worker. We consider that this can best be given in the form of special pay, personal to the individual officer. In view of the strong competition for first class men from private agencies and the new Colonial Scientific Service during the period of its formation, we consider that provincial governments would do well to institute a system of scholarships for their candidates. These scholarships would be awarded to graduates selected as possessing the kind of qualifications required and should be of sufficient value to maintain the scholar whilst he is obtaining the post-graduate qualifications necessary for research posts. As special machinery will be required to award the scholarships, to arrange for post-graduate courses of study at suitable centres for the holders of scholarships and to watch their progress, we consider it desirable that the scheme should be administered by a sub-committee of the Council of Agricultural Research.

In organising their research departments, provincial governments should realise that there are two quite distinct types of research workers—men capable of original research and men fitted only to carry on work along well established lines. Work of this character is an essential part of the work of a research station, but does not demand talents of a high order. It is most important that there should be no confusion between the two types when the creation or filling of an appointment on the research side is under consideration. Where what is required is routine work, this should be provided for by an appointment in Class II. It follows that promotions from Class II to Class I in the case of research posts should only be made where there are Class II officers available who are endowed with the qualifications of the true research worker.

If India is to achieve a greater measure of self-sufficiency in the matter of higher agricultural training, it is essential that the standard of teaching in the agricultural colleges should be a high one. For on the quality of the instruction in the fundamental agricultural sciences which students have received in the agricultural colleges will depend the use they are able to make of the post-graduate facilities which we have recommended should be provided at Pusa. We are, therefore, of opinion that the teaching side of the agricultural colleges should be strengthened and that the professorships in agriculture and agricultural economics and also, where the professorships in botany and chemistry are held by research officers, the senior lecturerships in these subjects, should invariably be filled by officers of the Indian Agricultural Service or by Class I officers of the new provincial services. We do not contemplate that the special pay we recommend for the holders of research posts should be attached to any posts in the colleges, the duties of which are solely or primarily teaching duties.

On the administrative side, we contemplate that a considerable number of vacancies in Class I appointments will be normally filled by the promotion of Class II officers. In the case of direct appointments, a university degree with honours in science or the diploma of a recognised agricultural college or other like distinction combined with practical experience of agriculture should be insisted on. Where the candidate has undergone his previous training in a provincial agricultural college or an Indian university, a post-graduate course should be made an essential qualification. All officers appointed to Class I posts, whether directly recruited or promoted, should be placed on probation for a period sufficient to determine their fitness. This period can hardly, we think, be less than two years. Confirmation should unhesitatingly be refused when a probationer has failed to justify his selection.

We consider that it will make for efficiency if, during the earlier years of service, interchange is freely allowed between the administrative, the research and the teaching branches of the service.

Subject to the reservation already made in regard to special pay for research posts and to the possibility that it may prove desirable to attach similar pay to administrative posts requiring exceptional qualifications, such as the deputy directorships for demonstration and propaganda work and for marketing investigations, we consider that the basic time-scale now in force for the Indian Agricultural Service (Rs. 350 to Rs. 1,250 per mensem) should be sufficient for Class I appointments. We regard it as of the greatest importance for obtaining men of outstanding merit who will ordinarily be in a position to choose the employment the conditions of which appeal to them most, that, before recruitment for Class I appointments commences, effect should be given to the recommendations of the Royal Commission on the Superior Civil Services in India that local governments and local legislatures should take immediate steps to pass Public Service Acts regulating both the new and the existing provincial services. That there must be some authority regulating service questions which is external to provincial governments if the evils of the intrusion of political influences are to be avoided seems to us self evident.

We consider that the relations between the various provincial services should be of the closest possible character and that arrangements should be made for the interchange of officers to deal with special problems. Similarly workers in India should keep in touch with other Empire workers. The creation of a chain of Empire research stations would furnish a unique opportunity for establishing personal relations, as it would greatly facilitate arrangements for interchange of visits between research workers in India and those in other parts of the Empire, the direct and, even more, the indirect results of which should be of the greatest value to both. Study leave should be freely given and, in the case of research workers, we trust that this will lead, to the development, in the course of time, of a system of exchange of officers between Empire and Indian research stations for definite periods.

Although we do not anticipate any substantial change in the nature of the duties which fall to the existing provincial agricultural services,

their duties will grow rapidly in importance as agricultural development proceeds. As advisers to the agricultural associations, taluka development associations, co-operative better farming societies and the other organisations through which, we trust, the desire for agricultural improvement will find increasing expression, they will continue to act as liaison officers between the expert officers in Class I and the individual landholder and cultivator. It will be important, therefore, that promotions to Class II posts shall be made strictly by selection on grounds of merit and that no weight should be attached to seniority. We see no reason to suggest any change in the system under which members of these services are recruited. Vacancies in administrative posts will ordinarily be filled by promotion from the upper grades of the subordinate services. Direct appointments will, as a rule, be for research and teaching duties. Until Public Service Commissions are set up in the provinces, we are of opinion that promotions and direct appointments to these services should be made on the recommendation of a strong selection committee.

We next come to the lower grades in the agricultural services. It is the men of these grades who carry out all the detailed work of the department, such as the management of the smaller farms, the selection, multiplication and distribution of seed, and the management of livestock. This work demands high qualities of skill and intelligence for its successful performance. The upper grades of these subordinate services are recruited from graduates and holders of diplomas of the agricultural colleges and, in order to remove any possible misapprehension as to the importance of the duties performed, we recommend that, in all provinces, the two higher grades of the subordinate services should be designated agricultural assistants, Class I and II. As a proportion of these assistants will be promoted in the normal course to Class II of the provincial agricultural services, we would emphasise the importance of careful selection on first appointment and the need for a period of probation with a strict review of the record of the probationer before he is confirmed.

We contemplate that the Research Institute at Pusa will set a standard for all research institutions in India, and we also hope that it will become a centre for post-graduate study for passed students of the provincial agricultural colleges. If Pusa is again to set the standard of agricultural research in India and become the recognised centre of post-graduate training, it will be necessary that its superior staff should consist of research workers and teachers of the highest calibre. In addition to the Agricultural Adviser to the Government of India, there are at present in residence at Pusa nine officers holding what are known as Class I appointments in the Imperial Department of Agriculture, of whom six are heads of the sections into which the work of the Institute is divided, namely, Bacteriology, Botany, Chemistry, Cultivation and Cattle breeding (in charge of the Imperial Agriculturist), Entomology, and Mycology. The Physiological Chemist and the Imperial Dairy Expert whose headquarters are at Bangalore are also heads of their respective sections. The number and character of the posts which will be required in future cannot be estimated with any certainty, but in considering the

strength of the staff at Pusa, it should be borne in mind that Pusa is not an ordinary research institute, as the term is used in other countries, but a group of institutes and that the sections into which it is divided have, up to the present, been staffed on a less generous scale than, for example, institutes in Great Britain. The Director and heads of sections will require to be most carefully selected. Whilst we have no desire to debar the appointment either as Director or Head of the Section, of any officer of exceptional merit already in the service, we consider it necessary under existing conditions, that these appointments should, in the main, be filled by direct recruitment from abroad. Other Class I officers should be recruited either directly or by selection from the Indian Agricultural Service or the superior provincial agricultural services. We prefer that the staff required both for Pusa itself and for its sub-stations should be recruited as members of a permanent service and not on short-term agreements; and we propose that this service should be called the Central Agricultural Research Service. For the Director it will be necessary to fix such a rate of pay as may be required to obtain the services of the best man available. Although we find it difficult to suggest an appropriate scale for the heads of sections, we consider a scale of Rs. 1,500—50—2,000 to be the minimum that is likely to attract men of the calibre that we regard as essential. Provident funds should be established for both the Director and heads of sections where these officers do not already possess pensionary rights.

Although we are unable, as we have stated, to estimate the number of posts required, we consider that, as a commencement, there should, in addition to the heads of sections, be at least one Class I officer attached to each section. The relationship between the heads of sections and these Class I officers will be very much the same as that between the incumbent of a Chair at a university and the lecturer on the subject for which the Chair is founded. We contemplate that these officers after a limited period of probation, which might suitably be fixed at three years, will either be confirmed in their appointments and ordinarily remain in the Central Agricultural Research Service for the remainder of their service, or be reverted to their provinces. For these officers we consider that the existing time-scale of pay of the Indian Agricultural Service with a suitable addition to the time-scale in substitution for the existing Pusa allowance is sufficient. In order to secure uniformity, provident funds should be established for officers directly recruited to these appointments. Officers of the Indian Agricultural Service or of Class I of the provincial services would continue to earn pension under the ordinary rules.

The superior staff at Pusa has at present the assistance of officers who are designated Class II officers in the Imperial Department of Agriculture. They are, as a rule, graduates or holders of diplomas of the agricultural colleges or graduates of universities who have distinguished themselves in science. We consider that this valuable class should be developed and its status raised. We think that it would be an advantage if appointments to this class were largely filled by promising junior

Class I officers in the provinces and partly by Class II officers in the provinces who have done work of outstanding merit. With a view to forging an additional link between the Pusa and the provincial services, we think that the tenure of these appointments should be limited to five years when held by Provincial Service officers. Graduates of Indian universities and passed students of agricultural colleges who have undergone a period of post-graduate training would continue to be eligible for direct appointments to this class. As regards pay, we suggest that provincial service officers should receive their provincial scale of pay with a Pusa allowance of Rs. 150 per mensem and those directly recruited should receive pay on the scale of Class II officers in the Provincial Service with a similar allowance. Appointments in this class should in every case be pensionable.

We hope that, as the result of the establishment of the Council of Agricultural Research, the Pusa staff will be brought into far closer relation with the provincial agricultural departments than now exists. Their visits to provinces cannot fail to enlarge the outlook of members of the Central Agricultural Service and to increase their experience. The cost of short visits should, we consider, be regarded as part of the normal expenditure of the Pusa Institute; and any obstacle to this course arising from existing rules governing the financial relations between the Imperial and provincial governments should be removed.

In conclusion, we record our considered opinion that restriction of recruitment for the new superior provincial agricultural services to a province or even to India would tell seriously on efficiency. From the point of view of wider outlook and variety of experience, officers recruited from abroad can make a valuable contribution to the development of Indian agriculture and we, therefore, strongly endorse the hope expressed by the Royal Commission on Superior Civil Services in India in regard to the continued co-operation of European officers.

XVIII. MISCELLANEOUS

Agricultural development in the minor provinces, which remains under the direct control of the Government of India, deserves, in our opinion, more attention than it has hitherto received. Much the most important of these provinces, though it is not the largest in area, is the North-West Frontier Province. The agricultural and other rural problems of this province have been examined with those of the nine major provinces of India in the previous chapters of this Report and it is, therefore, unnecessary to discuss them further here. The other five minor provinces under the control of the Government of India are Baluchistan, Ajmer-Merwara, the Andaman Islands, Coorg and Delhi. We consider that, with the exception of Delhi, they should have a definite agricultural organisation which, if they cannot finance it themselves, should be a charge on central revenues. For research, they should rely on Pusa and the research staff of the neighbouring major provinces. As regards district work, the staff of a deputy director's circle would form a suitable unit for Baluchistan, Ajmer-Merwara, Coorg and the Andamans. The deputy director should be obtained on deputation, preferably from the neighbouring major province, and should be given a special allowance in view of his increased responsibility. The directors of agriculture and the heads of the veterinary departments in the major provinces concerned should act as advisers to the heads of the minor provinces and should visit them periodically. Subordinate staff should be recruited on the advice of the deputy director. The Province of Delhi should continue to look for assistance to the Punjab Agricultural and Veterinary departments.

CHAPTER XX OF THE MAIN REPORT.

We trust that the Council of Agricultural Research will take a special interest in the agricultural development of these tracts. In order that agricultural progress in these provinces should be on sound lines it is essential that increased attention should be paid to the development of education and co-operation.

The foundations of an active policy of co-operation in agricultural and co-operative matters between the Government in British India and Indian States have already been laid through representation of some of the States on the Indian Central Cotton Committee and the Board of Agriculture. It is hoped that the manner in which co-operation can be rendered more effective, and more especially the manner in which Indian States can best be brought into the organisation for research in British India, will receive early and careful consideration from the Government of India and the rulers of Indian States.

From the point of view of rural welfare generally, we welcome the foundation in 1927 of a Local Self-Government Institute for the Bombay Presidency. The object of the Institute appears to us an admirable one. It is "to acquaint the people with the meaning and ideal of local self-government, its importance, its problems and the methods of dealing with these problems." The Institute will have local branches throughout the presidency and one of its main activities will be the

organisation of district, divisional and provincial conferences. The district conferences will be held once or twice a year and will provide an opportunity for representatives of local bodies in the district to meet and discuss local problems and difficulties. The scheme appears to us to hold out great promise of advantage to rural as well as to urban interests. It also provides a common meeting ground for both, and, by so doing, should do much to bring about an increasing sense of mutual interest and an increasing spirit of mutual help. We commend the principles of the Bombay scheme to the notice of other provincial governments and to the local self-governing bodies in their provinces.

The close relations of meteorology and agriculture are obvious. The study of the laws governing weather is the concern of the meteorologist: the effect of weather on crops is a matter for the agriculturist. The transfer of the headquarters of the Meteorological Department from Simla to Poona makes opportune an examination of the action which should be taken to promote the investigation of the problems of agricultural meteorology and to decide which departments shall be responsible for the different branches of the work. Investigations by scientists interested in agriculture can be undertaken in two directions; the first is statistical and the second biological. Much useful light would be thrown on agricultural questions if the weather data collected by the Meteorological Department were correlated with the statistics of area sown and yield of crops collected by the Revenue Department. Agricultural departments should make themselves responsible for meteorological studies relating to the influence of weather conditions on the growing crop. Such observations and study seem to be particularly necessary in Sind in view of the possibility that the completion of the Sukkur Barrage will produce a pronounced effect on the climate.

India should continue to adhere to the International Institute of Agriculture at Rome and to send representatives to the meetings of the General Assembly. As regards representation on the Permanent Committee of the Institute, the interests of India can, as at present, be adequately looked after by the British representative. The Institute has collected much information of the greatest value to India and its usefulness has recently been further enhanced by the establishment of a Bureau of Tropical and Colonial Agriculture. It is, therefore, very desirable that officers of the agricultural and allied departments should be encouraged to visit the Institute for the study of a specific subject when on leave or duty in Europe.

The principal functions of the Imperial Institute in London are to serve as a clearing house for information relating to the production and utilisation of the raw materials of the Empire and to carry out preliminary investigations of such materials in its laboratories. The Institute can render much useful help to agricultural workers and commercial interests in India and wide publicity should be given to the facilities it offers. The reorganisation of the Indian gallery at the Imperial Institute, on the lines followed by the Dominions and Crown Colonies and the renewal of the subscription for its maintenance, should be considered.

XIX. CONCLUSION

CHAPTER XXI OF THE MAIN REPORT.

We have been directed to examine and report on the present conditions of agriculture and rural economy in British India and to make recommendations for the improvement of agriculture and the promotion of the welfare and prosperity of the rural population.

The aim of the suggestions and recommendations we have made in the preceding chapters has been to bring about greater efficiency throughout the whole field of agricultural production and to render the business of farming more profitable to the cultivator. Throughout our Report, we have endeavoured to make plain our conviction that no substantial improvement in agriculture can be effected unless the cultivator has the will to achieve a better standard of living and the capacity, in terms of mental equipment and of physical health, to take advantage of the opportunities which science, wise laws and good administration may place at his disposal. Of all the factors making for prosperous agriculture, by far the most important is the outlook of the peasant himself.

This, in the main, is determined by his environment and it follows, therefore, that the success of all measures designed for the advancement of agriculture must depend upon the creation of conditions favourable to progress. If this conclusion be accepted, the improvement of village life in all directions assumes at once a new importance as the first and essential step in a comprehensive policy designed to promote the prosperity of the whole population and to enhance the national income at the source. The demand for a better life can, in our opinion, be stimulated only by a deliberate and concerted effort to improve the general conditions of the country-side, and we have no hesitation in affirming that the responsibility for initiating the steps required to effect this improvement rests with Government.

The realisation of this important truth has led, in recent years, to a large increase in expenditure on the departments concerned with rural welfare. None the less, we feel that its force is inadequately appreciated by the Government of India and by local governments and that the necessity that the rural problem should be attacked as a whole, and at all points simultaneously, is still insufficiently present to their minds. We cannot but think that the failure to grasp the full significance of the proposition we have laid down in some measure explains the absence of any co-ordinated attempts to effect that change in the surroundings and in the psychology of the peasant without which there can be no hope of substantially raising his standard of living.

If the inertia of centuries is to be overcome, it is essential that all the resources at the disposal of the State should be brought to bear on the problem of rural uplift. What is required is an organised and sustained effort by all those departments whose activities touch the lives and the surroundings of the rural population.

It is, no doubt, the recognition of the need for co-ordination that has given rise in many quarters to the view that lasting progress is unlikely

to be achieved unless, in all provinces, the activities of the various departments concerned are co-ordinated by development boards, advisory committees, or officers charged with the specific duty of securing combined action towards a given end. Development boards exist in some provinces, advisory committees in all. They are not without their value in bringing departments together and in interesting the leaders of public opinion in departmental activities. But there are definite limits to the extent to which governments may properly or usefully delegate the performance of their functions. The responsibility for framing policy, and for combining the activities of two or more departments in order to give effect to that policy, must remain that of Government and of Government alone.

It is no part of our duty to make recommendations regarding the internal organisation by which governments should seek to effect co-ordination. We would, however, point out that, in Indian conditions, a very special measure of responsibility in this direction falls upon the Viceroy and upon the Governors of provinces. Throughout our enquiry, we have been much impressed by the extent to which the Viceroy can, by the display of a personal interest in agricultural matters, forward the cause of India's premier industry. But the immediate responsibility of provincial Governors in this matter is the heavier, since the services most directly concerned with rural development are administered by provincial agency, and since it is they alone who provide a link between the reserved and the transferred departments. The responsibility of the Ministers in charge of the transferred departments, which include all those most directly concerned with rural welfare, is also a heavy one and they will need all the assistance that strong secretariats with senior and experienced administrators at their head can give them.

But though we hold it to be the duty of governments to initiate a combined movement for the betterment of the rural population, we recognise that success on a large scale can be rendered permanent only if the sympathy, interest, and active support of the general public can be enlisted. So vast is the population and so extensive are the areas concerned, that no resources which could conceivably be commanded by the State would be adequate to the task in hand.

Our recommendations extend to so wide a field that it has not been possible for us to frame any exact estimate of the cost of such of our proposals as involve expenditure or to classify them in order of urgency. We would express the earnest hope that, as the funds necessary to carry out the policy of rural development we have attempted to outline become available, the various legislatures will be willing to place them at the disposal of the appropriate departments. We are confident that the members of those legislatures will play their part in creating a public opinion favourable to the advancement of a great endeavour. Our enquiry has convinced us that, given the opportunity, the cultivators of India will be found willing and able to apply in progressive degree the services of science and of organisation to the business of agricultural production.

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ROYAL COMMISSION

ON

AGRICULTURE IN INDIA

REPORT

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THE ROYAL COMMISSION

GEORGE R. I.

GEORGE THE FIFTH, by the Grace of God, of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas King, Defender of the Faith, Emperor of India, to

Our Right Trusty and Entirely-beloved Cousin Victor Alexander John, Marquess of Linlithgow, Officer of Our Most Excellent Order of the British Empire;

Our Trusty and Well-beloved:—

Sir Henry Staveley Lawrence, Knight Commander of Our Most Exalted Order of the Star of India, Indian Civil Service;

Sir Thomas Middleton, Knight Commander of Our Most Excellent Order of the British Empire, Companion of Our Most Honourable Order of the Bath;

Rai Bahadur Sir Lala Ganga Ram, Knight, Companion of Our Most Eminent Order of the Indian Empire, Member of the Royal Victorian Order;

Sir James MacKenna, Knight, Companion of Our Most Eminent Order of the Indian Empire, Indian Civil Service;

Hubert Calvert, Esquire, Companion of Our Most Eminent Order of the Indian Empire, Indian Civil Service;

Raja Sri Krishna Chandra Gajapathi Narayana Deo Garu, Raja of Parlakimedi;

Nagendra Nath Gangulee, Esquire, Professor of Agriculture and Rural Economy, Calcutta University;

Lodhi Karim Hyder, Esquire, Doctor of Philosophy, Professor of Economics, Aligarh University, and

Balkrishna Sitaram Kamat, Esquire:

Greeting!

Whereas We have deemed it expedient that a Commission should forthwith issue generally to examine and report on the present conditions of agricultural and rural economy in British India, and to make recommendations for the improvement of agriculture and to promote the welfare and prosperity of the rural population; in particular, to investigate:—(*a*) the measures now being taken for the promotion of agricultural and veterinary research, experiment, demonstration and education; for the compilation of agricultural statistics; for introduction

of new or better crops and for improvement in agricultural practice, dairy farming and breeding of stock; (*b*) the existing methods of transport and marketing of agricultural produce and stock; (*c*) the methods by which agricultural operations are financed and credit afforded to agriculturists; (*d*) the main factors affecting the rural prosperity and welfare of the agricultural population; and to make recommendations subject to the limitations that it will not be within the scope of the Commission's duties to make recommendations regarding the existing systems of land ownership and tenancy or of assessment of land revenue and irrigation charges, or the existing division of functions between the Government of India and local Governments; but the Commission shall be at liberty to suggest means whereby the activities of the Governments in India may best be co-ordinated and to indicate directions in which the Government of India may usefully supplement the activities of the local Governments:

Now Know Ye, that We, reposing great trust and confidence in your knowledge and ability, have authorised and appointed, and do by these Presents authorise and appoint you, the said Victor Alexander John, Marquess of Linlithgow (Chairman); Sir Henry Staveley Lawrence; Sir Thomas Middleton; Sir Lala Ganga Ram: Sir James MacKenna: Hubert Calvert; Raja Sri Krishna Chandra Gajapathi Narayana Deo Garu; Nagendra Nath Gangulee; Lodhi Karim Hyder and Balkrishna Sitaram Kamat to be Our Commissioners for the purposes of the said inquiry:

And for the better effecting the purposes of this Our Commission, We do by these Presents give and grant unto you, or any three or more of you, full power, at any place in Our said United Kingdom of Great Britain and Ireland, or in India, to call before you such persons as you shall judge likely to afford you any information upon the subject of this Our Commission; and also, whether in Our said United Kingdom or in India, to call for information in writing, to call for, have access to and examine all such books, documents, registers and records as may afford you the fullest information on the subject, and to inquire of and concerning the premises by all other lawful ways and means whatsoever:

And We do by these Presents authorise and empower you, or any one or more of you, to visit and personally inspect such places as you may deem it expedient so to inspect for the more effectual carrying out of the purposes aforesaid:

And We do by these Presents will and ordain that this Our Commission shall continue in full force and virtue, and that you, Our said Commissioners, or any three or more of you, may from time to time proceed in the execution thereof, and of every matter and thing therein contained, although the same be not continued from time to time by adjournment:

And We do further ordain that you, or any three or more of you, have liberty to report your proceedings under this Our Commission from time to time, if you shall judge it expedient so to do:

And Our further will and pleasure is that you do, with as little delay as possible, report to Us under your hands and seals, or under the hands and seals of any three or more of you, your opinion upon the matters herein submitted for your consideration.

Given at Our Court at Windsor, the twenty-third day of April, 1926, in the sixteenth year of Our Reign.

By His Majesty's Command,

W. Joynson-Hicks.

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ROYAL COMMISSION ON AGRICULTURE IN INDIA

REPORT

To

THE KING'S MOST EXCELLENT MAJESTY.

May It Please Your Majesty,

We, the undersigned Commissioners appointed to examine and report on the present conditions of agriculture and rural economy in British India and to make recommendations for the improvement of agriculture and the promotion of the welfare and prosperity of the rural population; in particular to investigate:—

(*a*) the measures now being taken for the promotion of agricultural and veterinary research, experiment, demonstration and education; for the compilation of agricultural statistics; for the introduction of new and better crops and for improvement in agricultural practice, dairy farming and the breeding of stock;

(*b*) the existing methods of transport and marketing of agricultural produce and stock;

(*c*) the methods by which agricultural operations are financed and credit afforded to agriculturists;

(*d*) the main factors affecting the rural prosperity and welfare of the agricultural population;

and to make recommendations; humbly submit to Your Majesty the following Report.

We assembled in India, at Simla, on the 11th of October, 1926. Before that date, Dr. D. Clouston, C.I.E., D.Sc., Agricultural Adviser to the Government of India, who has acted as Liaison Officer between that Government and the Commission, had collected much valuable information for us. We wish here to record our appreciation of his services to us generally and to thank both him and other officers of the Government of India for the material with which they supplied us. This material and the provincial memoranda have proved most valuable and have been consulted by us at every stage of our enquiry. We owe a very special debt of thanks to the officers of the provincial governments who prepared these memoranda.

On first assembling in India, we devoted our attention to the revision and final approval of our questionnaire, a copy of which is printed as Appendix I to this Report. Copies of the questionnaire were sent to all persons who were to be examined as witnesses, as also to others likely to give useful information to the Commission. Local governments were supplied with a large number of copies for local distribution and a copy was sent to everyone who asked for it. The questionnaire was also widely published in the Press. In all we received 783 replies to the questionnaire.

Of those who replied to the questionnaire, 395 gave oral evidence before us, 178 being officials of the Government of India and of the provincial governments and the rest non-officials. A list of the witnesses examined is appended (Appendix II). We desire to thank both those who answered our questionnaire and those who gave oral evidence before us for the pains at which they have been to assist us.

After examining at Simla the heads of the various departments of the Government of India, connected directly or indirectly with agriculture, we visited successively Poona, Bombay, Bangalore, Coimbatore, Coonoor, Madras, Calcutta, Shillong, Jorhat, Dacca, Pusa, Raipur, Nagpur, Hoshangabad, Lucknow, Benares, Cawnpore, Agra, Delhi, Hissar, Lahore, Lyallpur, Sukkur and Peshawar. We examined witnesses at all these places except Coonoor and Sukkur. From Peshawar we returned to Bombay to hear further evidence.

The Commission broke up in India on the 1st April 1927, and reassembled in London on the 17th May 1927. As the Raja of Parlakimedi was unable to accompany us to England, Mr. F. Noyce, C.S.I., C.B.E., I.C.S., who had been attached to the Commission since February 1927, was appointed Assistant Commissioner during the stay of the Commission in England. The Commission examined, in London, representatives of trading and manufacturing interests, a number of experts in agricultural and veterinary matters and a few public men and retired officials from India, who had made a special study of questions germane to the enquiry. Witnesses were also examined at Cambridge and Rothamsted. The Commission visited the Agricultural Show at Bath, and the Royal Show at Newport.

Whilst in London the Commission suffered an irreparable loss by the death of one of its members, the late Sir Ganga Ram. His wide knowledge of the technique of agriculture and irrigation, as well as of the commercial aspect of farming, which he had tested and proved by original and successful ventures in the Punjab, invested his opinions with quite unusual authority. We regret profoundly that during the concluding stages of our work we have been without the support of his strong commonsense and practical wisdom.

The Commission broke up in England on the 9th of August, 1927, and reassembled at Karachi on the 24th of October, 1927. Some of us took advantage of this interval to visit places of agricultural interest in Holland, Germany, Italy and Egypt.

After hearing evidence regarding Sind at Karachi, we proceeded to Burma where we heard evidence at Rangoon and Mandalay. During our return to Rangoon, we visited Mahlaing, Myingyan, Magwe and Allanmyo. After our return from Burma, we visited Patna, where we again took evidence, and also the Imperial Forest Research Institute at Dehra Dun. We terminated our second tour on the 30th of November at Delhi. After examining a few witnesses there and completing the collection of our material, we left Delhi for Mahableshwar where we arrived on the 10th of December and proceeded to write our Report. In the course of our journeys, we visited all the major provinces in India, the North-West Frontier Province and the Province of Delhi and, in doing so, travelled 18,197 miles. A copy of our itinerary is printed as Appendix III to this Report.

In all the major provinces, we co-opted two members to assist us in raising points for discussion, eliciting evidence, and cross-examining witnesses. We would here acknowledge the assistance we received from them. In the course of our enquiry, we examined officers of the various departments connected with rural development, as also a number of non-officials, who could, from their own personal knowledge and experience, give information on the subjects referred to us for inquiry. We visited the agricultural and veterinary colleges, various experimental and demonstration farms, agricultural shows, and co-operative institutions and conferences. Visits were also paid to as many villages as time and opportunity permitted.

We took advantage of our visits to the various provincial headquarters to meet the respective governments, and to discuss informally with them the important questions arising from official memoranda and from the evidence submitted in their provinces.

We desire to take this opportunity to thank all those who have assisted us in our prolonged enquiry. They are far too numerous to make it possible to mention all by name. But it will be obvious that we could not have collected our information and accomplished our lengthy tours without most generous help from all those with whom we came into contact. This help it has been our privilege to receive throughout in the fullest measure.

To the provincial governments, to the directors of agriculture and to the many officials and private gentlemen who assisted us we desire to express our sincerest thanks for invaluable help most generously given. To the railway administration and its subordinate officers a very special measure of thanks is due for the safety, expedition and comfort with which we were conveyed over so many thousands of miles of track. Finally, we desire to record the obligations under which we rest to the Government of India as a whole and, more particularly, to the Honourable Member who was in charge of the Department of Education, Health and Lands during the whole of our enquiry and to his department.

In the course of our visits to the provinces, we acquired, partly from the memoranda with which each provincial government supplied us and partly as the result of personal observation, a considerable amount of information on matters of fact to which we attach importance but for which it has proved impracticable to find a place in the body of our Report. We have, therefore, decided to embody this information in a series of prefaces to the provincial volumes of evidence. We have decided also to publish these prefaces in a single volume as an appendix to this Report, for the convenience of those who desire to obtain a bird's eye view of the main features of provincial life.

CHAPTER I

INTRODUCTION

THE INDIAN VILLAGE.

1. Agriculture gives occupation, directly and indirectly, to the vast majority of the population of India. The census returns of 1921 showed that the proportion of the population directly engaged in, or dependent on, agricultural and pastoral pursuits in British India was 73·9 per cent. Almost everywhere in India it would appear that, from time immemorial, the people have lived in small villages, the mud houses of which are huddled together in a more or less compact area situated in the midst of the fields which provide the means of livelihood to their occupants. The farms and farmsteads which are so prominent a feature of the rural life of western countries are entirely absent. There is no obvious link between the home of the individual cultivator and the fields he tills. His house is in the village and the fields which make up his small holding are scattered over the area of land attached to it. In the south and east, the average holding is about five acres and elsewhere not more than half the holdings exceed this limit. Large towns are few, great cities rare; most of the 500,000 villages have not yet been touched by metalled road or railway; post offices are many miles apart, telegraph offices still more distant from each other. Except in the north-west, the whole country is dependent on the monsoon and all major agricultural operations are fixed and timed by this phenomenon. Except where perennial irrigation is available, climatic conditions thus restrict agricultural operations to a few months of the year. Under the prevailing system of tillage, the small holdings do not provide occupation for more than half the time of the cultivator. The urban population is relatively small, a little over eleven per cent of the whole, and the demand for agricultural produce for final consumption in the towns is thus small in comparison with the whole volume of production. Circumstances, therefore, have combined to maintain what is, in large measure, a self-sufficing type of agriculture. Since the Government of India passed, in 1858, from the hands of the East India Company to that of the Crown, there have been many developments, but the main characteristics of village life are still those of the centuries anterior to British rule. Each village tends to be self-contained; in each will usually be found some persons with permanent rights in the land, either as owners or tenants with hereditary occupancy rights; of these, some cultivate all they hold, others with larger areas at their disposal rent out to tenants, on a yearly agreement, a part or the whole of their lands; below these in the scale are agricultural labourers frequently of different castes from the actual cultivators; some of these have acquired small plots in proprietary right or permanent tenure, some have a field or two on rent; some work in the fields only at time of pressure and are mainly engaged in crafts such as leather work or in tasks regarded as menial. In all but the smallest villages, there are one or more skilled artisans, carpenters or ironsmiths, who provide and repair the simple

agricultural implements, bullock gear and water-lifts The household requirements are supplied by a shop or two, whose owners frequently provide the first market for the village produce and add to their earnings by engaging in moneylending. Almost invariably there is a religious building, a temple, shrine or mosque.

For the most part, the people belong to families that have lived within the same village for generations past; their holdings are inherited from their fathers before them and have been divided or aggregated as the descendants of a common ancestor have increased or decreased in numbers. By both Hindu and customary law, inheritance of immoveable property is by equal shares amongst sons or male agnates. Slight variations abound, but it is broadly true that inheritance is by blood in the male line and seldom by will. For the sake of simplicity, the rights of females are not here discussed. The result of repeated partitions amongst heirs is a persistent tendency to subdivision of holdings. This tendency is, however, in part counteracted by forces making for aggregation.

Where water is readily available, each village has its own supply and, in general, it may be said that, where means for irrigating the fields are within the power of the people, such irrigation is to be found. Firewood is usually obtained from the village waste or the fields; where fuel is scarce, dung cakes are of necessity employed for cooking. Indeed, for certain purposes dung cakes are preferred even when an alternative fuel is available. Seed is saved by the cultivator from the harvest or bought from the village shop; cattle are bred within the village or bought from some near neighbour or wandering grazier; the sire is frequently loosed as an act of piety or merit. From generations past, the occupations of the people have been pre-determined by something of the nature of an occupational caste or guild system. The more remote from road or town, the more self-sufficing is the village in all the requirements of its people from birth to death.

LACK OF COMMUNICATIONS AND OF ORGANISED TRADE AND COMMERCE.

2. Even when the population of India was much less dense than it is to-day and the area available for cultivation per head was much greater, it does not appear that there was any considerable section of the community which attempted to add to its wealth by producing more than it required for its own immediate needs. This state of affairs was not peculiar to India. The desire to accumulate money is not characteristic of rural society. Until communications have developed and organised trading and commercial communities have arisen, the cultivating classes have no incentive, beyond that which may be furnished by a local demand, to produce food grains and other agricultural products in excess of their own needs, and where everyone in the same neighbourhood is growing the same crops, the incentive provided by a local demand is small. In such conditions, they are apt to rest content with the production of sufficient to eat and drink and the wherewithal to clothe themselves. Increased labour brings no adequate reward if there is no use or enjoyment to which the increased outturn can be put. Without the means of disposing

of the surplus over family requirements provided by organised trade and good communications, there could be no agricultural progress and large scale farming was impossible. In the absence of markets and all that they connote, the cultivation of land by the joint effort of the members of the family was inevitable, and, where the area required for the support of a family with a simple standard of living is small, the cultivated holding must also be small.

LACK OF INTERNAL SECURITY.

3. Lack of communications and the absence of organised trading and commercial communities were not the only obstacles to agricultural progress in the past. When the cultivator cannot be certain that he will be left in possession of the harvest he has sown, the incentive to put more labour and capital into the land or to cultivate a larger area than is required for the maintenance of himself and his family is lacking. There were few periods in the recorded history of India anterior to the British administration when, over large tracts, the internal peace was not greatly disturbed and the demands of the State on the land were not heavy to an extent which made its possession a liability rather than an asset. These demands were based on the produce and not on the individual and, therefore, increased as his cultivation or outturn increased. They were frequently arbitrary and varied with the needs of the time, the embarrassment of the ruler and the temperament and rapacity of the local authorities. Though cultivators were essential if revenue was to be raised, the interests of revenue were apt to overshadow those of the cultivator.

FAMINES.

4. Although, throughout the history of India, famines due to drought have been frequent and often widespread, they have never been general over the whole country. It has been estimated that the turn of the individual to suffer occurs only once in half a century. It must, however, be remembered that drought, though the most usual, is not the only cause of famine. Storms and floods, swarms of locusts and rats and, in earlier days, invading armies, which laid waste everything in their path, and the immigration of hordes of refugees fleeing from starving homes have all on occasions brought about distress amounting to famine. With no large towns, no industrial population on the modern scale and little or no means of export overseas, the production of food grains and other agricultural produce was perforce confined to the demand for local consumption. When favourable seasons yielded a surplus, this was stored. Such stores were common, for the surplus could not be sold and storage was the obvious means of disposing of it. But it is doubtful if such stores were extensive; in most years, the harvests sufficed for the needs of the people and storage in excess of a season's requirements was not regarded as necessary. The contingency of famine was too remote to determine mass conduct and the failure by individuals to make any systematic provision against such a calamity need, therefore, occasion no surprise. For long, governments met it where and when it occurred. The modern view of the

responsibility of the State was not reached until long after India had passed under the Crown and it was not until the last decades of the nineteenth century that a definite famine policy was formulated. In earlier days, in the absence of accurate information, it was impossible to appreciate the effect of climatic variations on food crops, on the population and on the areas involved. Where governments failed, it was not to be expected that the individual would do better. Bumper harvests, therefore, merely caused a glut. They served to replenish stores but went little further towards strengthening the community to meet the strain of calamity. A severe drought, on the other hand, caused immense economic loss which good years did little to counterbalance. The trading community of the time was without the means of transportation and marketing required to meet the deficiency of the one or to absorb the surplus of the other. Its own development was the result of the normal requirements of the day and neither the surplus of a bounteous harvest nor the pressing demands of a year of famine were sufficient to bring into being the higher organisation of commerce and communications without which its special needs could not be met. For this, there was needed a steadily recurring movement of commodities, a normal surplus over local consumption in one area and a normal demand for this surplus in another. Famines occurred at too long intervals in any one area to stimulate such a development of trade and communications in that area as would have prevented the occurrence of a crisis or at least have mitigated its severity. For trade in food grains and other goods, a steady volume for sale is essential. The market requires steady feeding, not satiation in a season of plenty and starvation in a year of drought. The position was thus practically one of stable equilibrium. No organisation for trade and commerce could grow up without the production of a surplus over the local demand and no individual, village or province would continue to produce such a surplus in the absence of the machinery of trade and commerce essential to ensure for it a reward commensurate with the labour expended. Progress in agricultural production appeared to be waiting on the demand of a market which in India did not exist. From no quarter was the cultivator provided with any spur to increased effort, any scope for enterprise or any reward for labour in excess of that determined by the needs of himself and his family.

ESTABLISHMENT OF INTERNAL PEACE AND SECURITY.

5. Such were the conditions which prevailed over the greater part of India up to the early years of the nineteenth century. The first factor which changed them for the better was the establishment of peace within the country and of security on its borders. So complete has been the achievement that it has become increasingly difficult to realise what it has meant and how recently it has been accomplished. The establishment of internal peace preceded that of external security and it is hardly an exaggeration to say that the strain on the treasury which the latter entailed, to the detriment of internal development, continued up to the years of war, famine and pestilence which closed the nineteenth century.

EVOLUTION OF THE LAND REVENUE SYSTEM.

6. Following close upon the establishment of internal security came that exhaustive and elaborate enquiry into rights in land which forms the basis of rural prosperity. The benefits which the people have derived from it are almost incalculable. With the detailed record of rights in the land came the settlement of the government demand either permanently or for periods sufficiently long to relieve the revenue payer from the harassing anxiety of uncertainty. The system was largely adopted from the one already in existence but it was found possible to distribute the demand more evenly over the land and to reduce the burden in terms of produce. The effects of these changes were marked. They were easily traceable in the famine of 1837-38 and still more in that of 1866. Land had begun to acquire a value and the security for credit that it furnished appreciably mitigated the intensity of distress. The prolonged economic disorganisation which had followed previous calamities was thus avoided. The people were in secure possession of the land; their rights were on record and, although migration took place on a large scale, it was only of a temporary character. The whole outlook of the rural community was influenced by the fact that it owned rights which were rapidly becoming valuable and in the possession of which it was secured by settlements for comparatively long periods. In earlier times, land had been practically unsalable. It was of less value than the crop it yielded; in short, it was a burden involving liability for revenue and not an object of desire which could be pledged for credit. When famines came, it was not the land which was sold; the cattle and household goods were disposed of, ornaments were pledged and, when these resources were exhausted, the people deserted their villages and their fields and wandered in search of food. "Their land" as the Special Officer reported after the famine of 1837-38, "was totally valueless unless they could cultivate it; it had no market price for no man would buy it or make advances upon it as security so that their only resource was to become paupers or perish." With rights defined and the State demand fixed, with protection established against arbitrary ejectment and a clear understanding of his liabilities, the cultivator had some assurance that the fruits of his labours would be left to him.

It was this improvement in the cultivator's position which went far to strengthen his resisting power against the strain of prolonged drought. Although there has been a considerable rise in the price of grain, this has been much less than the rise in the value of land. The greatly increased value of land has been due to the establishment of internal peace, the preparation of a trustworthy record of rights, the reduction of the real land revenue demand and its fixation for a term of years as well as to higher prices of produce. Except in irrigated tracts, there is little evidence that it has been due to an increased outturn per acre. In the famine of 1837-38, the price of wheat never rose above 11½ *seers* to the rupee as compared with the normal price for that period of 36 *seers* to the rupee. At the present time, the normal price for wheat may be eight to ten *seers* to the

rupee and, in times of scarcity, it may rise to four *seers*. Very little calculation is required to show how great has been the rise in the price of land in terms of food grains or, to put the matter somewhat differently, to indicate the value of the enhanced credit based on the land when utilised to purchase food in periods of scarcity. It is this which provides the explanation for one outstanding feature of all recent famines, the absence of the small landholder from relief works. The landless labourer has not this new source of credit to fall back on and, when prolonged drought makes all agricultural operations impossible, his position rapidly declines to one of acute distress.

DEVELOPMENT AND IMPROVEMENT OF COMMUNICATIONS.

7. The rise in the value of land as a source of credit would be, in itself, of little use unless there were in existence the capital available in liquid form to meet demands for accommodation nor would it suffice in the long run unless the landholder were in a position to redeem, in times of plenty, the debt incurred to tide over distress. Both these conditions have been fulfilled first by the development and, later, by the improvement of communications which have facilitated trade, opened up new markets, stimulated the expansion of commerce and, by so doing, have resulted in a marked increase in wealth. The failure of the local food supply in times of drought offers to trade an opportunity for enhanced activity and legitimate enterprise but, in earlier days, there was neither the capital nor the organisation which enabled this opportunity to be seized. In the famine of 1866, private traders in Orissa proved unable to meet the demands upon them and were unable to overcome the difficulties in the way of importing food. Prices became merely nominal and money was spurned as worthless. A similar lack of strength amongst traders was revealed in the famine of 1868-69 in Ajmer, when men with money in their hands died for want of food. Measures designed to improve the lot of the cultivator alone could not achieve their object unless they were supplemented by others aimed at relieving obstacles to trade. The great lesson to be learnt from the Orissa famine of 1866 was the need for more extensive and, as funds permitted, better communications. In the generation which followed that famine, the internal communications of India underwent a revolution. The effect of improved communications in stimulating production and facilitating distribution has been great. Their influence in another direction is also becoming increasingly marked. The old self-sufficing type of agriculture is in some measure being replaced by a more commercialised system in which the cultivation of "money crops," that is, crops intended entirely for sale such as cotton, jute and oil-seeds is increasingly prominent. The cultivator has begun to look beyond the present needs of his family, and the demands of the market are more and more determining what he shall produce. Improved communications have stimulated that growing organisation of trade and commerce which has proved one of the most important features in increasing the resisting power of the people. They have brought with them that

practical certainty of finding a market which has encouraged production and they have made possible that increase in wealth which is reflected in the investment of funds in a multitude of improvements. They have been amongst the most potent factors in breaking the vicious circle of economic stagnation and in setting India on the road of economic progress. How great has been the change wrought by these and other factors in regard to famine is shown by the history of the famine of 1896-97, which affected an area of 225,000 square miles in British India with a population of 62 millions. Although the areas in which severe distress prevailed were greater than in any previous famine, private trade proved able to regulate the supply of food throughout India; the uniform level of prices all over the country testified to the effect of the extensive system of railways in facilitating distribution; and the unprecedented success of relief measures was a clear indication of the possession by the community as a whole of a reserve of strength which enabled it to meet the most widespread dearth on record.

No action of the State can prevent a failure of rain, and the distress consequent on the stoppage of agricultural operations; but it is important to emphasise that famine now consists in the lack of employment, and so of purchasing power, and not in the lack of available food. When, owing to the absence of rain, the small cultivator and the landless labourer are deprived of the means of earning their daily bread, the measures adopted by the State are effective in placing within their reach alternative means of livelihood.

IRRIGATION WORKS.

8. The possibility of remedying, by means of the provision of irrigation facilities, the obstacles to agricultural prosperity, consequent on the unequal distribution of the rainfall and its liability to failure or serious deficiency has naturally received special consideration. If ever interest on the subject appeared in danger of flagging, the vagaries of the monsoon speedily revived it. Wells, tanks and canals have been in use in India from early times and, although the aggregate achievement from both public and private sources is enormous, the work of planning and construction still goes forward. But as no scheme for the rapid enhancement of production over a large area can hope for financial success unless efficient means for the distribution of that production exist, railways are as essential to the large canals as the large canals have been to some of the railways. Neither canals nor railways can be built without capital, and capital might have waited upon the enhancement of production that only canals and railways could bring about, had it not been for the loans which the Government of India were able to raise through the sound credit which they had built up in the markets of the world.

DEVELOPMENT OF OVERSEAS COMMUNICATIONS.

9. Two other important factors, both external to India, have exercised a profound influence upon agricultural economy. The Suez Canal was opened in 1869; the steamer with its cheap freights and comparatively rapid transport followed soon after. What these have meant to Indian agriculture is clear from the figures of

overseas trade. When the Suez Canal was opened, exports were valued at Rs. 80 crores. For the three years ending 1926-27, the average value of the annual exports exceeded Rs. 350 crores. By far the greater part of the volume of exports is contributed by agricultural products, cotton, jute, oil-seeds and tea being the chief items.

THE ABSENCE OF LARGE SCALE FARMING IN INDIA.

10. Internal peace has been unbroken for several generations, railway comunications are now fairly satisfactory, roads have been improved and extended, there is free access to external markets and the principal agricultural products of India find a ready sale in them. But India is still pre-eminently the land of the small holder. Large scale farming, even in the altered conditions of to-day, though open to many is practised by few. The large landholder, and there are many such, leases his land on rent to a number of petty cultivators. The typical agriculturist is still the man who possesses a pair of bullocks and who cultivates a few acres with the assistance of his family and of occasional hired labour. For the absence of large scale farming in India there are many reasons. Among them are the obstacles to agricultural progress generally which have been discussed in preceding paragraphs and which have now been largely, if not entirely, removed. Others are the obstacles to development which continue to exist. Of the pressure of population on the soil, of poverty and its concomitant indebtedness, of illiteracy, of conditions unfavourable to health, we shall have much to say in the course of this Report. But there are two influences militating against the spread of large scale farming in India which deserve special mention here. To the influence of the laws and customs governing inheritance amongst the Hindu and Muhammadan community reference has already been made. These laws and customs vary among different communities but, broadly speaking, they favour the partition of immovable property among a number of heirs. The small holdings which have resulted from this have been rendered still smaller by the desire of each heir to gain possession of a plot of the best land even if this entails his accepting another of the worst. The second influence has been that of the tenancy legislation which is in force throughout the greater part of British India. The primary object of this legislation has been to give the tenants on an estate security of tenure, but its effect has been to render it difficult for the larger landholders to obtain unrestricted possession of compact blocks of land. But, even if greater opportunities for large scale farming operations had been open to the larger landholders, the lack, until recent years, of men with the requisite training to carry on such operations would have prevented full advantage being taken of them.

THE PRESENT ECONOMIC POSITION.

11. It is thus, in the main, with the needs of a vast population of small cultivators that we are concerned. Though our Commission is the first to be appointed specifically to examine and report on the conditions of agriculture and rural economy in India, it is by no means the first Commission which has made recommendations for the promotion of the

welfare and prosperity of the rural population of this country. The investigations into agricultural conditions carried out by the successive Famine Commissions of 1880, 1898 and 1901, by the Irrigation Commission of 1903 and by the Committee on Co-operation of 1915 have resulted in measures of great and lasting benefit to the people. We would here take the opportunity of acknowledging the assistance we have derived from their Reports. Those of the Famine Commissions were landmarks in the history of the agricultural development of India.

Each enquiry in its turn brought on record valuable material. The Commissions investigated their problems in the light of the knowledge of the day and their proposals embody the latest ideas current at the time. Most of their suggestions have led to measures designed to remedy defects in the economic system so that there has been an almost continuous series of legislative and administrative attempts to deal with the problem of poverty amongst the rural community. Whether, in fact, the economic position of the cultivating classes has improved and is improving is a matter on which there are still differences of opinion. Among a population so large as that of India, there must be examples of every stage of progress and decline but, if the position is viewed as a whole, there should be little room for honest doubt that there has been substantial progress.

Since the series of enquiries into famine came to a close in 1901, great economic changes have taken place in India. The development of irrigation on a vast scale in the Punjab, and, to a smaller extent, elsewhere has immensely increased the resources of the country: railways and roads have been extended and the effects of the improvements both of internal and external communications have made themselves increasingly felt. It took India nearly a generation to re-act to the great changes in these respects which have been mentioned but, since the commencement of the present century, the evidence of growing prosperity has been manifest to everyone whose acquaintance with India extends over the last twenty-five years. That there still remains much to be done and that great improvements have still to be carried into effect will be clear from the remainder of our Report. In a country so extensive as India, the effects of any single measure are apt to be so dispersed that they can be discerned with difficulty, but the cumulative effect of the measures of the last eighty years cannot be ignored.

THE PRESENT AGRICULTURAL POSITION.

12. In concluding this chapter, we would add a few remarks on the problems immediately before us. The large development of the export trade, on which we have commented, has been secured after providing for the increasing population, to which, according to the Census Report of 1921, some 62 millions were added in British India alone, between 1872 and 1921. That production has increased is beyond dispute: some part of this increase is due to the enhancement of yield resulting from the expansion of irrigation but a far larger part is due to the spread of cultivation. Only a small proportion of it can be attributed to the introduction of higher yielding varieties

of crops and it is doubtful if any appreciable increase in yield can be attributed to the adoption of better methods of cultivation or the increased use of manures. In a country with such a long history, little surprise need be felt that a system of tillage based on experience should have reached a stage beyond which further progress was bound to await scientific discovery. That in many places, the system of agriculture followed has attained a very high standard is matter of common knowledge; the cultivation of rice in the deltas, for example, has reached a marked degree of perfection and the wisdom of many agricultural proverbs stands unchallenged by research. The careful terracing of the hillsides, the various methods of irrigation from wells and tanks, the construction of accurately designed channels from the streams to the fields and similar achievements in improving land disclose skill, ingenuity and patient labour. Although they affect but a small proportion of the area under crops and though the works are simple and their benefit narrowly confined to their immediate neighbourhood, their importance is considerable and it should not be overlooked when contemplating the larger works of Government. In the conditions in which the ordinary cultivator works, agricultural experts have found it no easy matter to suggest improvements and the fact remains that the cultivator has, in the main, met new demands by breaking up new areas rather than by intensification of method, the employment of more efficient implements or the use of manures. In spite of the progress that has undoubtedly been made and of the great increase in gross wealth of the country, the ordinary cultivator on his tiny plot is still a man of small resources, with small means for meeting his small needs. He requires all the help which science can afford, and which organisation, education and training can bring within his reach.

In existing conditions, the activities of the agricultural departments have touched but a fractional part of the country. But though, throughout our Report, we have dealt at length with the problem of improving the efficiency of these departments and of extending their activities over the whole area of agricultural India, we have regarded this as merely one aspect of the far wider problem of creating an environment in which the cultivator will be willing to receive and to put to the best possible use the advice and help which the agricultural and other departments are in a position to place at his disposal. Our enquiry has, therefore, extended to the activities of all departments which are closely concerned with rural welfare. We shall endeavour to show the contribution which each of them, Agricultural, Veterinary, Forest, Irrigation, Co-operative, Public Health, Education, and Industries, can make to the creation of an environment favourable to progress in all directions. Our object, in short, has been to suggest ways and means of assisting the advance of the rural community towards a fuller life. These must be designed at once to awaken the desire in that community for better things and to arm the individual member of it against the temptations that beset him, without impairing either his self-respect or his spirit of manly independence.

CHAPTER II

HISTORICAL RETROSPECT

AGRICULTURAL POLICY PRIOR TO 1880.

13. The dependence of agriculture on empirical methods was general even in western countries until towards the middle of the nineteenth century, when the application of chemistry to soils in 1840 and the establishment of the Rothamsted Research Station in 1843 were rapidly followed by the opening of the first agricultural college in England at Cirencester in 1845. In India, the first proposal for a special Department of Agriculture originated with the Commission appointed after the great famine in Bengal and Orissa in 1866. The proposal was, however, considered premature and was dropped. It was revived in 1869 at the instance of the cotton trade, a trade which has frequently exercised considerable influence in shaping the agricultural policy of the Government of India. In that year, the Secretary of State for India forwarded correspondence with the Manchester Cotton Supply Association for the consideration of the Government of India. The Association urged that measures should be undertaken for the improvement of cotton, the crop in which it was primarily interested, and that a separate Department of Agriculture should be established in each province.

Although it was long before this ideal was to be realised, there is no doubt that the representation of the Association provided a stimulus to the serious consideration of the question of agricultural improvement. The suggestions put forward in it were very fully considered by Lord Mayo's Government but, although it was recognised in the discussions which followed that provincial departments of agriculture must form an essential part of any scheme for agricultural development, the weight of opinion was in favour of the establishment of a central secretariat for the superintendence of all measures connected with revenue, agriculture, forests, commerce and the industrial arts of India. The Government of India appear to have had some doubts as to the suitability of a secretariat as the controlling authority and recommended that the new department should be under the control of a director but the final decision of the Secretary of State was that it should begin as a branch of the secretariat of the Government of India. The Department of Revenue, Agriculture and Commerce of the Government of India commenced to function in June, 1871, and continued to do so until 1879 when financial stringency necessitated a re-shuffling of portfolios. The Secretary of State sanctioned the rearrangement with some reluctance and expressed the hope that it would not interfere with agricultural improvement. It cannot be said that the department, whilst it lasted, exercised any real influence on the problems of agricultural development. The attitude it adopted was too detached to admit of this but it has to its credit the evolution of systems for the collection of agricultural statistics and of other data

which proved of great value in dealing with famine problems and which formed a useful basis for schemes of agricultural improvement when the time became ripe for them. As for provincial expansion during this period, though, as will be seen subsequently, efforts to bring about agricultural improvement were made in most provinces, the only province in which a separate Department of Agriculture was established was the North-West (now the United) Provinces. This was, no doubt, due to the fact that the Lieutenant-Governor, Sir John Strachey, had been a Member of Lord Mayo's Government and had rightly formed the view, which indeed was that of Lord Mayo's Government, that substantial development could only come from provincial departments of agriculture and not from a government secretariat.

AGRICULTURAL POLICY, 1880-81.

14. Little real progress had thus been made when the Report of the Famine Commission of 1880 again revived interest in the subject of agricultural improvement. That Commission had been charged, amongst other matters, with the enquiry how far it was possible for government action to diminish the severity of famines or to place the people in a better position to meet it. It had further been directed to investigate the question of practical improvements in agriculture and of the best means of giving an impetus to the efforts of the State to encourage this branch of national industry. The Report of the Commission was a masterly review of the whole situation and, though many commissions and committees have, since then, investigated various branches of the subject, no general enquiry of such an extensive character was found necessary until the appointment of the present Royal Commission.

The Commission had much to say about the development of irrigation and the necessity for the extension of the railway system was strongly pressed. It hoped that the effects of famine in future would be mitigated in intensity partly by the extension of the means of communications and development of internal trade and partly by the greater preparedness of the people to meet them which grows from the increase of thrift and resourcefulness and the accumulation of capital due to a settled and civilised government. But, as the recurrence of famines in India appeared unavoidable, the Commission insisted strongly on the revival of the Department of Agriculture of the Government of India under the control of a Secretary and on the simultaneous formation in all provinces of a Department of Agriculture with a very large subordinate establishment working under an executive officer. To this department would be entrusted the duty of collecting experience of past famines and of undertaking definite and permanent charge of the administration of famine relief. The department would also hold charge of the records of past famines, collect comprehensive and exact records bearing on the agricultural, vital and economic conditions of the people, supply the Government with statistics when famine threatened and work on these. In ordinary times, it was contemplated that its duties would mainly consist in the collection of facts relating to the condition of the agricultural community and the agricultural produce of the country.

In order to carry out this scheme, the Commission recommended the improvement of the machinery for the collection of statistics, such machinery to include an officer in each district who would compile the agricultural returns and test their correctness. A Director of Agriculture would be appointed in each province as head of the new department. The working of this scheme in the provinces is described in greater detail in subsequent paragraphs. The general conclusion of the Commission was that "it is to the improvement of the internal communications and the removal of all obstructions to the free course of trade, accompanied by the extension of irrigation in suitable localities and an improved agriculture that we must look for obtaining security in future against disastrous failures in the food supply."

The Commission made many important recommendations bearing generally on the welfare of the rural community. Its advice that "it should be the policy of Government to advance money freely and on easy terms on the security of the land whenever it can be done without serious risk of ultimate loss" led to the enactment of laws—the Land Improvement Loans Act (XIX of 1883) and the Agriculturists' Loans Act (XII of 1884)—which regulated the grant of loans for agricultural improvements and the needs of agriculturists. Its suggestion that the distribution of such loans should be entrusted to the new Agricultural Department was not, however, accepted. On the subject of indebtedness, it wrote much which possesses a permanent value: in particular, it recommended that courts should go behind the bond. "Wherever the indebtedness of the landowners has assumed serious proportions, the appointment of special courts to examine into their debts, to reduce their amount to the sum equitably due, and to fix instalments which would pay the debt off in a given number of years, at a rate of interest proportionate to the diminished risk, would appear to be the only way in which Government can remedy the evil." A proposal had been placed before the Commission that agriculturists' relief banks should be established to meet the current needs of the landholders and land improvement banks and land improvement companies to grant them loans for longer terms. This was not supported, but, in its place, recommendations were made for the enactment of new legislation facilitating the grant of State loans.

AGRICULTURAL POLICY, 1881-1905.

15. The Government of India took no immediate action on the proposals which contemplated the creation of an extensive provincial agency and contented themselves with a request to the Secretary of State for permission to establish a new secretariat. The Secretary of State, whilst accepting their proposals in this respect, attached considerably more weight than they did to those for provincial development and made it clear that the first duty of the new secretariat was to be the consideration of the form in which provincial departments of agriculture could best be established. The history of the former secretariat had shown that, without provincial agency, no programme of development which emanated from headquarters could be productive of tangible results. It will thus be seen that the lessons of the past had not been lost and that it was at last

clearly recognised that the main responsibility for agricultural research and experiment must fall on the provincial governments.

The first Secretary of the new department was Mr. (afterwards Sir) Edward Buck. It was probably due to the fact that he was a keen agriculturist as well as a capable Secretary that the interests of agricultural improvement were pressed simultaneously with the elaboration of a statistical system. The subject was approached on the broadest lines and it was felt that the differences in the conditions in the provinces were such that all the Government of India could do was to give a general lead. In their Resolution of December 8th, 1881, they briefly defined the duties of a provincial agricultural department as being agricultural enquiry, agricultural improvement and famine relief. In subsequent paragraphs, we shall indicate the action which was taken on these lines in the various provinces.

The next ten years were spent mainly in conferences and in investigating the position in the provinces with a view to discovering the lines of development best suited to their needs. It was not long before the Imperial Department found that no advance could be made without technical advice and the first requirement laid down was " one first class expert who should make a general enquiry into the character of the soils and agricultural conditions of the country." In other words, the necessity for the appointment of an agricultural chemist had become evident. It was not, however, until the recommendation that a forward movement in agricultural policy should be initiated had been repeated by a succession of conferences that the Secretary of State was convinced of the reality of the desire for the development of agricultural research. In 1889, he sent out Dr. J. A. Voelcker, Consulting Chemist to the Royal Agricultural Society, to advise upon the best course to be adopted in order to apply the teachings of agricultural chemistry to Indian agriculture and to effect improvements in it. This was an important advance and may indeed be regarded as the first serious endeavour to frame a policy of agricultural research suited to the conditions of India. Dr. Voelcker arrived in India towards the end of 1889 and left the country early in 1891. His impressions and recommendations are contained in his book on the " Improvement of Indian Agriculture." Although thirty-five years have elapsed since this was written, the ability which Dr. Voelcker displayed in his comprehensive survey of the agricultural conditions of India, in his analysis of the problems they present and in his recommendations for their solution, still renders it a book of the utmost value to all students of agriculture in India. We are glad to have this opportunity of acknowledging the great assistance we ourselves have derived from it.

Advantage was taken of Dr. Voelcker's presence in India to hold another agricultural conference, the fourth of the series, which met at Simla in October 1890 and was attended by delegates from all provinces and from one Indian State, amongst whom was our colleague, Sir Thomas Middleton. Dr. Voelcker himself was present at this conference and a preliminary note which he had prepared was discussed by it.

The two main questions which were placed before the conference were whether the possibilities of improvement were sufficiently great to justify the gradual establishment of a sound system of scientific investigation as well as of education in connection with agriculture and what the general character of the system should be. The conference answered the first of these questions in the affirmative. Its reply to the second was that an expert was required for purposes of scientific investigation apart from the requirements of agricultural education. It was strongly of opinion that this expert should be able to deal with the practical side of agricultural questions and competent to direct general enquiries and, therefore, advised the appointment of a really first class man as agricultural chemist (for the conduct of general investigations) and an assistant (for purposes of instruction). The appointment of Dr. J. W. Leather and Mr. S. H. Collins to these posts was the beginning of the scientific staff of the Imperial Department of Agriculture. The senior officer was expected to occupy himself in research. His assistant was to concern himself principally with teaching at Poona, Dehra Dun and Saidapet and with chemical questions connected with forests and agriculture.

Dr. Leather, who arrived in India at the end of 1892, was engaged for five years. On the expiry of that period, the Government of India recommended that the post of agricultural chemist should be abolished and that an Inspector General of Agriculture should be appointed. It has already been mentioned that the earlier Imperial Department of Revenue, Agriculture and Commerce did little for agricultural research but that a mass of information was collected and machinery was devised for the organisation of land record systems and the collection of data in regard to prices and of other statistics bearing on rural economics. The collection of these data continued after the resuscitation of the department and, in asking the Secretary of State to sanction the appointment of an Inspector General of Agriculture, the Government of India were in a position to say that the local machinery for ascertaining and recording facts had attained a considerable degree of perfection in almost all parts of India and that they were, therefore, prepared to embark more actively than had hitherto been possible upon agricultural experiment and research.

The post of agricultural chemist was not, however, abolished but, in 1901, the late Dr. Mollison, at that time Deputy Director of Agriculture in Bombay, was appointed first Inspector General of Agriculture in India. It was laid down that his duties would comprise the systematic study of Indian agriculture, its conditions and remediable defects; the supervision and development of provincial agricultural departments; the establishment of improved agricultural methods and new staples and, generally, the direction of the agricultural policy of Government. In advertising the appointment, it was naively remarked that "the post gives scope for the highest administrative capacity." This it undoubtedly did. It was also laid down that the position of the Inspector General in respect both of the Government of India and of local governments would be purely advisory.

The need for development in directions other than purely chemical was soon felt. In 1901, Dr. E. J. Butler was appointed Imperial Mycologist or, as the appointment was then designated, Imperial Cryptogamic Botanist and, in 1903, the late Mr. Maxwell Lefroy was appointed Imperial Entomologist.

THE FAMINE COMMISSION OF 1901.

16. The recommendations of the Famine Commission of 1880, as stated in the report of the last of its successors, the Famine Commission of 1901, "powerfully influenced for good agrarian and administrative reform in India for the next twenty years." The next great advance was made as the result of the Report of the Commission of 1901 which recommended that the expert staff of the agricultural departments in all provinces should be strengthened and that mutual credit associations on the lines of the German co-operative credit societies should be introduced. The Commission found that "the steady application to agricultural problems of expert research is the crying necessity of the time" but reinforced this with the warning that "security of the harvest only postpones the pressure of the population on the soil; it is prudence and knowledge and the practice of thrift alone which will relieve it." In considering the problem of indebtedness, it recommended further legislation on the lines of the new Punjab Alienation of Land Act to restrict the transfer of land; otherwise "our moderate survey rates, intended to benefit the cultivator, will only benefit land speculators, who will, as occupants, pay the low rates to Government and grind down their sub-tenants under a hideous system of rack-renting."

THE POSITION IN 1905.

17. The recommendations of the Famine Commission of 1901 were speedily translated into action by Lord Curzon's Government. Effect was given to those relating to co-operative credit by the Co-operative Credit Societies Act of 1904. Those relating to agricultural problems led to the great expansion of the Imperial and provincial departments of agriculture which dates from 1905. The position on the eve of this expansion may be summed up as follows. Whilst there was evidence of keen desire on the part of the provincial agricultural departments to embark on schemes of agricultural research and improvement, developments in this direction were somewhat hampered by the limitations imposed by the policy of the Government of India in insisting upon statistical and economic investigations as an essential preliminary to any schemes of agricultural improvement. In their review of the Report of the Famine Commission of 1880, the Government of India had placed definitely in the forefront of the duties of an agricultural department, the collection and study of vital, economic and agricultural facts and conditions with a view to rendering the information thus obtained of practical use. They had also enjoined on agricultural departments the duty of organising famine relief. The gist of their orders was, in fact, that scientific enquiry and research in the laboratory and in the field on agricultural matters must be deferred until the statistical enquiries were complete

and until the facts so obtained had been analysed for the purpose of securing the greatest possible measure of protection against famine. In short, the Government of India insisted that the thorough adaptation of the existing revenue systems to agricultural facts and conditions should take precedence of agricultural experiments. The absence of reliable knowledge of existing conditions had been borne in upon the Government of India by the breakdown of their machinery when faced by recurrent periods of famine and scarcity and they had wisely decided to set their house in order in this respect before launching out in the new direction of agricultural research and experiment. The grim spectre of famine was before them and it was to combat this that all their plans and policies were directed.

Their instructions were loyally carried out by the provinces but this did not prevent spasmodic efforts towards agricultural improvement. The awakening of interest in agricultural science in England had reacted on India and there were indications of a keenness for agricultural research in this country before the facilities for giving practical effect to it became available. We make no apology for passing under rapid review the efforts at agricultural advance which were made in the different provinces before 1905. Such a review is of interest if only as showing how little of permanent value can be accomplished by enthusiasm which lacks the solid basis of a definite policy and an efficient organisation. The lesson is not without its moral to-day.

AGRICULTURE IN THE PROVINCES PRIOR TO 1905.

(*i*) BOMBAY.

18. To Bombay must be assigned the credit of priority in attempts at agricultural improvement. Cotton, as the most important crop of the presidency and one of special interest to the East India Company, first attracted attention and, as early as 1788, the Directors of the Company urged that encouragement should be given to its production and improvement, but the experiments to this end which were carried out during the next hundred years had little effect on the bulk of the crop. In 1839, the Court of Directors sent out twelve American planters to teach the local cultivators how to grow and clean cotton. Three of these were allotted to Bombay and it is only in the Dharwar district of that presidency that there has been any survival of their work in India. In Bombay, as elsewhere, the tendency of the earlier workers on agriculture was to aim at the improvement of particular crops by the introduction of exotic varieties rather than to attempt the improvement of the system of agriculture in general. Spasmodic and unsystematic efforts of this character led nowhere and it was not until the formation of an agricultural department in 1883 with the late Mr. E. C. Ozanne as Director that any real advance was made. In accordance with the policy of the Government of India which has been described in preceding paragraphs, his duties, for the first few years after his appointment, were mainly statistical and connected with land revenue assessments, but a superintendent of experimental farms was appointed in 1890 and thereafter progress was rapid. The first holder of the new appointment was the late Dr. Mollison, afterwards Inspector

General of Agriculture in India, and it was not long before he succeeded in training what, for that period, was a highly efficient subordinate staff.

In Bombay, as in some other provinces, considerable attention was devoted to agricultural education even before the formation of a separate department of agriculture. The necessity of improving Indian agriculture by the adoption of scientific methods came under the consideration of the Government after the famine of 1876-77 and it was decided that steps should be taken to train a number of Indians in scientific agriculture and an agricultural class for this purpose was opened at the College of Science at Poona in 1879. As no agricultural department then existed, the men from this class were drafted into the Revenue Department. The course was made a practical one in 1880, when a farm was attached to the class. The recommendation of the Famine Commission of 1880 that provincial agricultural departments should be created throughout India led to recognition of the necessity for men with higher agricultural training than the class provided and a committee appointed to consider the form this training should take recommended the institution of a degree in agriculture at the Bombay University. It was not, however, until 1890 that a diploma in agriculture was instituted by the university and agriculture first received university recognition in India. The diploma was granted to candidates who had successfully passed through a three years' course at the College of Science or the Baroda College. This course underwent many vicissitudes. The diploma conferred few privileges as regards admission to government service. For this reason, it became unpopular and, in 1895, there were no applicants for admission to the college of Science. In 1899, it was replaced by a course in which special stress was laid on practical agriculture and which led to the diploma of Licentiate in Agriculture. The Poona Agricultural College was opened in 1905, and in 1908 the degree of B.Ag. was instituted.

(*ii*) MADRAS.

19. A practical interest in agriculture in Madras was awakened as early as 1863 by the presentation to his Council of a note by the Governor, Sir William Denison, in which he drew attention to "the continuous cropping, the deficiency of manure and its consumption as fuel, the defective implements, the lack of trees, the poor cattle and the want of accurate knowledge and statistics." The Government of Madras not unwisely considered that irrigation, communications, education, cheap justice and careful assessments were the chief means of stimulating agriculture, but they allowed some virtue to implements. An order was, therefore, placed in England, for "a steam plough, steam harrows and cultivators, seed drills, horse hoes, threshing machines and winnowers, chaff cutters and water lifts." To find employment for this elaborate consignment, 350 acres of land at Saidapet, some five miles from Madras, which had lapsed to Government, were entrusted in 1864 to a committee of amateur enthusiasts which undertook to conduct a full trial and exhibition of the agricultural implements received from England, a full trial of

artificial manures and an exhibition to the people of the improved system of agriculture. The committee laboured heroically at its great task until 1871 by which time it may be assumed that its patience and the implements were worn out. Its failure to accomplish anything of value is easily explained. No preliminary investigation of local conditions had been made, no staff for experimental or propaganda work had been trained. The soil at Saidapet was not even typical of any large or important area of the presidency. It was merely assumed that what had proved successful in the West would be equally successful in the East. When the committee abandoned its self-imposed task, the farm passed under official control and the next decade was occupied in discussions of policy and in an attempt to work out a scheme of agricultural education. "A complete and high class public agricultural college" was established at Saidapet in 1876. In 1884, the control of the college was transferred entirely from the Board of Revenue to the Director of Public Instruction with whom it remained until the reorganisation of the Agricultural Department in 1905-06, and, in 1885, except for the small portion which remained attached to the college, the farm was abolished. Although, after 1885, the presidency nominally possessed an agricultural department of which a Member of the Board of Revenue, the Commissioner of Revenue Settlement, Land Records and Agriculture, was the head, its functions, as in Bombay, were for long restricted to statistical and economic enquiries. The history of Madras agriculture from 1863 until towards the end of the century falls into three periods. The first witnessed the ascendancy of the idea of a model farm worked on western methods, the second was dominated by a barren discussion on agricultural education and, in the third, agricultural effort was blighted by the insistence on the importance of statistics. None the less, in spite of the difficulties under which they laboured, the work done by Mr. W. R. Robertson during his long tenure of office, as Principal of the college and Superintendent of the experimental station at Saidapet, and subsequently by Mr. C. A. Benson, as Deputy Director of Agriculture, left its mark on the development of the department after the reorganisation of 1905. In that development, former students of the Saidapet College played no inconsiderable part.

Theory and academic discussion had, however, to yield to the forces of nature when the staple crops of Madras were attacked by disease. From 1895 to 1897, the area under sugarcane in the Godavari district steadily declined owing to the ravages of "red rot"; in 1898, complaints were received from the Madras Chamber of Commerce of the deterioration of groundnuts: in 1903 and 1904, the diseases of pepper attracted attention. Natural causes thus forced the hands of Government and compelled them to invoke the aid of science. Dr. Barber was engaged as Economic Botanist in 1898 and, in 1901, was allowed to lease land in Godavari for experiments directed to the discovery of disease resistant varieties of cane; foreign seeds of groundnut were imported and distributed through Collectors to selected cultivators; a farm was opened on the west coast for the investigation of diseases of pepper. In the light of the policy thus inaugurated, the claims of cotton and other fibres

could not be ignored and, in 1901, two farms were opened for the study of cotton, one at Bellary and the other in Tinnevelly, and another for agaves in the Anantapur district. In 1904, a farm for exotic irrigated cotton was opened at Hagari in the Bellary district. A foundation was thus laid on which it was easy to superimpose further development when the new era of agricultural advance commenced in 1905.

(*iii*) The United Provinces.

20. The first steps towards the formation of an agricultural department in what are now the United Provinces were taken in 1875 when Sir John Strachey, the Lieutenant Governor, obtained sanction to the creation of a temporary appointment of Director of Agriculture and Commerce for five years, an appointment which ultimately became permanent and the first holder of which was Mr. (afterwards Sir) Edward Buck. The instructions to the Director of Agriculture were ' to establish and prove to Indian agriculturists the advantages to be gained from small improvements such as they are able with the means at their disposal to carry out, and to make experiments as to staples and industries which it may be possible to introduce, if new, or to familiarise and improve if already existing in the country." Special attention was devoted to sericulture, the improvement of indigenous fibres and the manufacture of a finer grade of tobacco. There were already in existence three model farms which had been managed by district officers and these were taken over by the new department. A silk farm was opened in the Dehra Dun district, a tobacco farm at Ghazipur and a fruit farm in the Kumaon Hills. The farm at Cawnpore which was to be the nucleus of the department's development was started on rented land in 1881. One of the model farms mentioned above had been at Cawnpore and tradition ascribes its establishment to the interest displayed in indigo cultivation by one of the earliest Collectors of the district. Tobacco and sericulture proved a failure but the well established fruit and potato trade of the province owes its origin to the work on the Kumaon farm.

It is interesting to note that arboriculture was one of the branches of work entrusted to the department. Arrangements were made for providing nurseries for district arboriculture and for planting road-side trees. The work has been systematically carried on to the present day and the fine avenues of the province testify to the efficiency of the operations. In the early eighties, attention was directed to the improvement of existing wells and the construction of new ones, a branch of work in which the department has always been prominent. The first results were not satisfactory and little progress was made until it was realised that the main obstacle to the successful construction of wells by zamindars and others was the uncertainty of finding a sufficient supply of water without the information obtained from a preliminary boring. When this fact was appreciated, a small boring staff was appointed which has gradually expanded to its present dimensions.

Other problems with which the department concerned itself were cattle breeding, the reclamation of alkali (*usar*) and of ravine lands, experiments in breeding for staple in cotton and the improvement of sugarcane

crushing plant. Whilst the work on cattle breeding was not itself a success owing to the lack of a definite policy, the experiments in reclaiming *usar* land led directly to a development which had an important bearing on the cattle question. In these experiments, plots of land were taken up in different parts of the province and subjected to treatment. They were fenced and, in some cases, flooded and, when grass came up, it was grazed by cattle for the sake of manure. This led to enclosure, the keeping of small herds and the sale of milk which proved the beginning of a dairy industry. The farm at Cherat near Aligarh was placed in charge of Mr. Keventer who eventually took it over from the Agricultural Department and the well-known Aligarh dairy farm thus originated in the Cherat *usar* farm. Although, at the time, the reclamation of ravine lands and their conversion into fuel and fodder reserves went little further than demonstrating the feasibility of the scheme, it pointed to the possibilities of work which, in recent years, has been taken up on an extensive scale. The experiments in introducing long staple cotton failed, owing to the absence of trained officers and to lack of continuity, but the Cawnpore-American variety is probably a survival of the efforts in this direction. The departmental workshops at Cawnpore date back to the eighties of the last century. Iron cane-crushers rapidly became popular and private firms soon took over the work of distribution from the department.

Work in the nineties proceeded on similar lines. The outstanding event of the period was the opening of the school at Cawnpore which was to develop into the Cawnpore Agricultural College but the aim of which at the outset was to train teachers and to turn out subordinate revenue officials with some agricultural knowledge. In 1900, it was realised that the superior staff of the department which then consisted of a Director and an assistant director was insufficient for its growing needs and, in 1901, a deputy director of agriculture was added to it. In 1904, an economic botanist was appointed and new farms were opened.

It will be seen that, from the outset, the Department of Agriculture in the United Provinces possessed a breadth of vision which was unusual at the time. Whilst there were failures, due mainly to lack of expert guidance and of continuity of effort, much of its early work stood the test of time and proved an excellent foundation for the expansion which came with the systematic organisation of agricultural departments throughout India.

(*iv*) Bengal.

21. For purposes of historical retrospect, it will be convenient to disregard the administrative distributions of recent years and to include Bihar and Orissa in Bengal of which it formed part until 1912. As early as 1871, seven model farms were established in various parts of Bengal, but these disappeared in the famine troubles of 1874. One of them was at Shillong in Assam which was not constituted a separate province until 1874. A separate department of agriculture in Bengal was constituted in 1885 but its policy did not include research and the

only expert officers attached to it were two students who had returned from an agricultural training at Cirencester. Two experimental farms were started on estates under the Court of Wards at Dumraon and Burdwan. Another was opened at Sibpur in 1887-88 to which it was intended that an agricultural educational institution should ultimately be attached. Demonstration farms followed in 1889-90 when five of them were started in the Burdwan Raj in order to bring home to the cultivators the advantages of certain improvements which were considered to have been proved on the experimental farms. More experimental and demonstration farms were opened in the following years but it was not until 1904 that a deputy director of agriculture was appointed.

The question of agricultural education was taken up seriously in 1895-96 when agricultural classes were opened at the Sibpur Engineering College and encouragement was given to specialised agricultural education by the allotment of a certain number of appointments in public service to students who had received such education. This arrangement continued until the establishment of the Sabour Agricultural College in 1910. In general, it may be said that, prior to 1905, the staff of the Agricultural Department in Bengal was far too small to make any impression on the vast area of the province.

(*v*) ASSAM.

22. An agricultural department was nominally created in Assam in 1882, but its only concern with agriculture was the organisation of crop-cutting experiments on winter rice, mustard and sugarcane. In 1885-86, when the department became the Department of Land Records and Agriculture, a beginning was made in the direction of improving the local breeds of cattle. Experiments in growing various crops were also carried out through the agency of district officers and those with exotic potatoes led to the establishment of what is now the very flourishing potato industry of the Khasi Hills. The only government farm at this period was a fruit plantation which was started in 1885. It was not until 1897 that an expert agricultural officer was appointed to the department. In that year, Mr. B. C. Basu, a deputy collector from Bengal who had received agricultural training in England, became assistant director. An experimental farm was established in Upper Shillong, the cultivation of potatoes was extended and a small dairy with fourteen cows was started. This represents the sum of the work of the Assam Agricultural Department prior to 1905.

(*vi*) THE CENTRAL PROVINCES.

23. If an agri-horticultural society can be regarded as the beginning, the foundation of an agricultural department, in the Central Provinces may be considered to date from 1862 when such a society was opened in Nagpur. An agricultural survey of the cotton tracts by district agency began in 1861. A cotton commissioner was appointed for the Central Provinces and Berar in 1866-67. He experimented both with exotic varieties of cotton and with the indigenous varieties and endeavoured

to introduce the cultivation of cotton into tracts in which it was then unknown. The record of these attempts is, however, that of a series of failures, due to lack of knowledge of the climatic conditions suitable to the growing of cotton, lack of skill on the part of the cultivator and lack of efficient supervision by Government. Much greater success attended the efforts of the commissioner to improve the conditions in which cotton was brought to the market by inducing dealers to give better prices for cleaner cotton. Work of substantial value was done at this time in improving the management of cotton markets, in increasing their number, in encouraging European and Indian merchants to start gins and presses, in assisting dealers in cotton and exporters to Bombay in various ways and in improving the arrangements at the railway stations for the acceptance of bales. The model seed farm which was opened at Hinganghat was soon closed but another farm which was placed in charge of a gardener from Kew was opened at Nagpur on an area commanded by tank irrigation. The yearly reports of this farm up till 1882-83 are, however, a continuous record of failure, due to the lack of expert guidance of the gardeners from Kew who, whatever their merits as gardeners, were as ignorant of agricultural theory as they were deficient in practical experience of agriculture. A change came in 1883 when Mr. (now Sir) Bamfylde Fuller became Director of Agriculture. A new site was selected for the Nagpur farm and experiments of a more practical character were undertaken. The scheme of work was again overhauled in 1893 on the advice of the Agricultural Chemist to the Government of India and work on the lines then laid down continued until the reorganisation of 1905. In 1888-89, an agricultural class for the training of the land records and revenue staff was opened at Nagpur. In 1905, the situation in the Central Provinces was that the Nagpur farm had made its influence felt as a centre for the dissemination of agricultural knowledge amongst the cultivators and had also stimulated an interest in agricultural matters amongst officials. In addition, by a process of trial and error, much useful knowledge, some of it, it is true, of a negative character, had been acquired and existing agricultural practices were well understood. Some steps had been taken in the training of an agricultural staff and conditions were ripe for a great forward movement.

(*vii*) The Punjab.

24. As in other provinces, the recommendations of the Famine Commission of 1880 resulted in the creation of a department of land records and agriculture in the Punjab but, although a few disconnected experiments were made with exotic varieties of cotton, wheat and maize, nothing serious was attempted in the way of agricultural experiment until, in 1901, a small farm of 56 acres was opened at Lyallpur in the Chenab Colony which was staffed by agricultural assistants who had been trained at Cawnpore. In 1904, the first post of deputy director of agriculture in the province was sanctioned and an economic botanist for work in the United Provinces and the Punjab was engaged and stationed at Saharanpur. The Punjab had thus the advantage of starting the new era with a practically clean slate.

(*viii*) BURMA.

25. Whilst the serious study of scientific agriculture in Burma is a matter of the last twenty years only, efforts indirectly tending to the improvement of agriculture began at a much earlier date. On the annexation of what was known as the Province of Pegu after the second Burmese War of 1852, it was found that the population was sparse and cultivation in all respects very backward. It was not long, therefore, before attempts were made to attract population to the unoccupied tracts of the province by the construction of protective works such as the Myanaung, Sittang and Maubin embankments. The Government seem also to have considered that both the crops grown and the methods of cultivation were capable of improvement and, for some years after the annexation of the province, efforts were made to introduce improved varieties of paddy such as Carolina, and western types of agricultural implements. No success was obtained as regards implements but there is some reason to believe that the Carolina or another imported variety of paddy was the ancestor of the present Moulmein (*kaukkyi*) paddy, which is the best variety of paddy grown in Burma. Largely as the result of the protective embankments, the delta was brought rapidly under paddy cultivation.

The annexation of Upper Burma in 1887 confronted the Government with an entirely new set of agricultural problems. The light rainfall over the greater part of the newly acquired territory made the maintenance and improvement of the existing irrigation canals and the construction of others necessary. The Government at that period rightly attached more importance to the establishment of conditions which would make agricultural improvement possible than to efforts to obtain that improvement.

For the eighteen years after the annexation of Upper Burma, although there was a department of land records and agriculture, little was done beyond maintaining a few experimental gardens in remote parts of the province. Very moderate success attended most of the experiments carried out in these gardens but they undoubtedly gave the Burmans a taste for English vegetables and fruit and to them must be attributed part of the credit for the introduction of groundnuts into the dry zone and of wheat and potatoes in the Shan States and the Chin Hills. The early efforts of the department cannot, therefore, be considered altogether fruitless in view of the fact that the increased agricultural wealth of the province which has resulted from the introduction of groundnuts has far exceeded the expenditure on the department up to date and that which is likely to be incurred for many years to come. As elsewhere, the chief lessons derived from the experiments were the necessity for the expert supervision of experimental cultivation and the desirability of a close study of indigenous crops and of the existing method of cultivation before efforts were made to introduce extraneous varieties. No attempt to impart instruction in agriculture either in agricultural colleges or in ordinary schools was made during these years and, in general, it may be said that, prior to 1905, the Agricultural Department had made little or no impression upon the indigenous agricultural methods of the province.

26. Such, in brief outline, is the history of what had been accomplished by the provincial departments of agriculture prior to 1905. It would be idle to pretend that the sum total of their achievements was a large one but, in view of the difficulties they encountered, it is surprising that so much was done. Their work had, at least, the merit that it attracted attention to the importance of applying scientific investigation to questions of agricultural improvement. The magnitude of the problems which confronted them was so great that it was difficult for them to get down to essentials and they had neither the trained staff nor the organisation to carry into effect such recommendations as they were in a position to make. They did not, however, labour altogether in vain. From the failures which followed many immature efforts, there were lessons of value to be learnt. It was found, for example, that the improvement of indigenous varieties of crops by selection offered much greater possibilities than the introduction of exotic varieties. The influence of environment upon the latter was also established. A few outstanding successes were achieved in introducing new crops such as groundnut in Burma and Madras, potatoes in Assam and in the Kumaon Hills, fruit in the Kumaon Hills and American cotton in Bombay and the United Provinces. A vast amount of data, both positive and negative in character, was accumulated which proved of the utmost use to a scientific staff when it was appointed and organised. That staff became available as the result of the complete change of policy in matters of agricultural research and improvement which was brought about by the Government of Lord Curzon to whose far-sighted vision much of the progress of Indian agriculture since this date must be attributed.

THE POSITION IN THE PROVINCES IN 1905.

27. On the 4th June 1903, the Government of India addressed to the Secretary of State a despatch with which was submitted a scheme for the establishment of an agricultural research institute, an experimental farm and an agricultural college at Pusa in the Darbhanga district of Bihar, where a large government estate had been placed at their disposal by the Government of Bengal for the purpose. This despatch marks the beginning of organised agricultural research in India. To the establishment of the research station, Lord Curzon devoted the greater portion of a generous donation of £30,000 which had been given him by an American gentleman, Mr. Henry Phipps, of Chicago, to be applied, at his discretion, to some object of public utility, preferably connected with scientific research. Mr. Phipps's name is thus honourably connected for all time with the research laboratories at Pusa. In pursuance of the scheme outlined in the despatch, a research station with fully equipped laboratories, an experimental farm, an agricultural college for the training of students and a cattle farm for the improvement of the local breeds of cattle were established on the Pusa estate. The scattered scientists of the Imperial Agricultural Department, the Agricultural Chemist, the Mycologist and the Entomologist were brought together at Pusa as speedily as possible

THE REORGANISATION OF 1905—
(1) IMPERIAL.
THE PUSA RESEARCH INSTITUTE.

and to them in 1904 were added a Director of the institute and, in 1905, an agri-horticulturist (subsequently designated Imperial Agriculturist), a biological botanist (subsequently designated Imperial Economic Botanist), an agricultural bacteriologist and a supernumerary agriculturist.

In view of subsequent developments, it may be of interest to set out briefly the main functions which it was intended that Pusa should fulfil in regard to research and experiment on the one hand and to agricultural education on the other. It was anticipated that the farm would serve as a model for similar institutions under provincial governments. On this farm would be initiated lines of enquiry, the soundness of which would be examined before they were recommended for trial under local conditions on the provincial experimental farms. Varieties of crops would be tested and improved and the seed of improved varieties would be grown and distributed. The results reported from provincial farms would be tested under different conditions and more highly skilled supervision and, in particular, continuity would be secured for promising experiments begun, but, for some reason, discontinued in a province. Finally, the farm would be utilised for the practical training of students at the Imperial Agricultural College and would provide experimental field areas for the scientific experts.

On the educational side, the view which was taken at the outset was that an agricultural college was required at Pusa not only to provide for the needs of Bengal which had no college of its own but also to serve as a model for, and to raise the standard of, agricultural colleges in other provinces and to provide for a more complete and efficient agricultural education than was then possible in any of the existing institutions. The aim was thus twofold. In the first place, it was intended to train students who were not in a position to be admitted to any of the provincial colleges and schools. In the second place, it was intended to provide a higher course of training for those who had studied at provincial institutions and who desired to qualify for professorships, research work or posts requiring special scientific attainments.

THE PRESENT POSITION OF PUSA.

28. In no respect has the anticipation that Pusa would prove a focus of agricultural activity for all India been entirely fulfilled. Into the reasons for this on the research side, we shall enter into more detail later. In regard to the experimental work, it will suffice to say that the limitations imposed by conditions of soil and climate on the capacity of the farm to fulfil all the objects for which it was intended appear to have been overlooked. The soil of the Pusa farm, though well suited to growing most of the important Indian crops, is not typical of any large area of the province in which it is situated. Even if this serious drawback had not existed, the rapid development of the research work done by the provincial departments would, in any case, have rendered it less and less necessary for them to look to it for assistance in work which could be carried out far more satisfactorily in their own local conditions. As regards its educational activities, owing to the establishment of fully equipped agricultural colleges in the provinces,

Pusa was never called upon to provide for the first of the groups of students mentioned above for which it was originally intended. In respect of higher agricultural education, the weight attached in recruiting for the Indian Agricultural Service to the possession of degrees in honours in science of British universities or of diplomas from recognised schools of agriculture in Great Britain and the superior facilities for post-graduate work which were regarded as available at those universities and schools meant that Pusa had nothing to offer which the advanced student did not, as a rule, prefer to obtain elsewhere. Until the end of 1923, its teaching activities were confined to short courses in special subjects. In November of that year, with a view to enabling candidates for the higher ranks of the agricultural services to qualify for them in India, post-graduate courses of two years' duration were instituted at Pusa. These courses are at present being undertaken by nine students.

Throughout its existence, therefore, Pusa has been regarded almost entirely as a research institute in which fundamental problems of importance to the whole of India are investigated and special lines of experiment can be undertaken for the provincial departments. The extent to which it has been successful in fulfilling this function will be discussed subsequently. So far as equipment is concerned, it is admirably adapted for the purpose. Its laboratories, museums, libraries and lecture rooms challenge comparison with those of any similar institution in eastern or western countries. Since the abolition of the post of Inspector General of Agriculture in 1911, the directorship of the institute has been combined with the duties of Agricultural Adviser to the Government of India, who is assisted in the internal management of the institute by a joint director who is a senior member of the staff. The institute has the following sections:—agricultural (including cattle breeding), bacteriological, botanical, chemical, entomological and mycological. A physiological chemist has been appointed for work on animal nutrition, an agronomist has been added to the agricultural and a dipterist to the entomological sections. The appointment of a whole-time Director of the institute, of an assistant to the Agricultural Adviser, of a biological chemist for work on crops and of an agricultural engineer has been sanctioned but the posts have not yet filled. The headquarters of the Sugar Bureau which was formed in 1919 for the purpose of collecting and co-ordinating information regarding the sugar industry and furnishing advice to cane growers and sugar manufacturers are at Pusa. The bureau, of which an officer of the Indian Agricultural Service is secretary, is still on a temporary basis.

OTHER ACTIVITIES OF THE IMPERIAL DEPARTMENT OF AGRICULTURE.

29. Pusa, though by far the most important, is not the only research station directly under the control of the Government of India. The Institute of Animal Husbandry and Dairying at Bangalore, to which centre the animal nutrition work formerly carried on at Pusa, has been transferred, the cattle breeding and dairy farms at Karnal, Bangalore and Wellington, the creamery at

Anand and the Sugarcane Breeding Station at Coimbatore are also in the administrative charge of the Agricultural Adviser. For reasons of administrative convenience, the work of the Imperial Institute of Veterinary Research at Muktesar, though not strictly agricultural, has also been placed under his control. It should be added that the Agricultural Adviser has no direct authority over the provincial departments of agriculture but merely advises them when called upon to do so.

THE INDIAN CENTRAL COTTON COMMITTEE.

30. A recent development of considerable importance to Indian agriculture may here conveniently be mentioned. As the result of the Report of the Indian Cotton Committee of 1917-18, the Indian Central Cotton Committee was constituted in 1921 and was given definite legal status by the provisions of the Indian Cotton Cess Act of 1923. The Committee at present consists of 42 members in all. Three of these are appointed by the Government of India, of whom one is the Agricultural Adviser to the Government of India who is *ex-officio* president of the Committee. Nine members are representatives of the provincial agricultural departments, seven of cotton merchants and ginners, six of cotton spinners, eleven of cotton growers and six of Indian States. The secretary and assistant secretary are members of the Indian Agricultural Service. The work of the Committee falls under four main heads. It is concerned with the improvement of cotton marketing and the prevention of malpractices both by legislative measures and by constructive action. It is an advisory committee in regard to the policy—both agricultural and commercial—to be followed in promoting the development of cotton growing in the different provinces. It is a bureau of information for the agricultural departments, the trade and the general public. Agricultural and technological research on cotton is its special care. Technological research is under its direct control and it has its own technological laboratory in Bombay. Agricultural research is provided for by research grants to provincial agricultural departments for specific investigations and to the Institute of Plant Industry at Indore, which was established in 1924. This institute is practically a central research institution for cotton problems and, though subsidised by some of the Central Indian States, to which its Director acts as agricultural adviser, is mainly dependent on the grants it receives from the Central Cotton Committee. The finances of the Committee are provided by a cess of two annas a bale on all cotton used in mills in British India and exported from India. The cess is levied under the provisions of the Indian Cotton Cess Act of 1923. The present income of the Committee is about Rs. 6½ lakhs per annum.

The Indian Central Cotton Committee is, in short, a central body charged with the promotion of all measures which will tend to further the improvement of cotton growing in India. We have discussed its constitution and functions in some detail as the establishment for the improvement of a particular crop of an all-India organisation, on which all interests from the grower to the manufacturer are represented, marked a definite break with previous traditions. The Committee is so far the

only one of its kind in India and one of the questions which we shall later discuss is the possibility of constituting a similar organisation for the improvement of other crops.

THE REORGANISATION OF 1905—(ii) PROVINCIAL.

31. Lord Curzon's Government fully realised that a central institution under the direct control of the Government of India could only be the apex of their scheme and that such an institution would be valueless unless there were, at the same time, a real development of agriculture in the provinces. In 1905, therefore, the Government of India announced their intention of setting aside annually a sum of Rs. 20 lakhs, which was subsequently increased to Rs. 24 lakhs, for the development of agricultural research, experiment, demonstration and education in the provinces. The aim which the Government set before themselves was the establishment of agricultural colleges with a course of three years' duration in all the provinces and the provision of an expert staff for these institutions for purposes of research as well as for instruction. The superior staff of the colleges would consist of an expert agriculturist, an economic botanist, an agricultural chemist, an entomologist and a mycologist, one of whom would discharge the duties of principal of the college. The link between the colleges and the districts would be provided by an experimental farm which would be established in each large tract in which the agricultural conditions were approximately homogenous and by numerous small demonstration farms which would carry the work on the experimental farms a stage further. The expert officers in charge of the farms would be in close touch with the cultivators and would advise them in regard to the introduction of improved methods of agriculture. The scheme also provided for the appointment of a full-time Director of Agriculture in all the major provinces. The various expert appointments in the Imperial and provincial agricultural departments which it contemplated as well as those already in existence were constituted as an Imperial service known as the Indian Agricultural Service in 1906.

It is along the lines laid down in 1905 but, except for the interruptions caused by the war, with an ever increasing staff, that the provincial departments of agriculture have since developed. The expansion of staff at the outset was not so rapid as had been anticipated. Whilst the view taken by the Secretary of State was that education was the principal feature of the scheme, he limited the establishment sanctioned for each agricultural college to an all-round agriculturist as principal of the college, an agricultural botanist and an agricultural chemist. In pursuance of the scheme, colleges were started or reorganised at Poona, Cawnpore, Nagpur, Lyallpur, Coimbatore and Sabour. The college at Sabour was closed at the end of 1921. A college was opened at Mandalay in 1924.

It would cumber our Report with unnecessary detail if we were to give particulars of the various stages by which the provincial agricultural departments have reached their present development or of the strength of the staff of those departments as it stands to-day. A rough outline

of their organisation will suffice for our present purpose. With the exception of Bengal, which has only an agricultural school at Dacca, Bihar and Orissa and Assam, all the major provinces possess agricultural colleges which are fully equipped for the training of students to fill posts in the provincial and subordinate agricultural services and under private employers or to work on their own land. The colleges are also adequately equipped for research in the main branches of agricultural science, agriculture proper, agricultural chemistry and economic botany. We would here state that we were greatly impressed in our inspection of the colleges. all of which we visited in the course of our enquiry, by the excellence of the buildings and equipment for purposes both of research and instruction. In both respects, they compare most favourably with similar institutions with which we are acquainted in other countries. Whilst all colleges have an agriculturist, agricultural chemist and economic botanist, other experts such as entomologists, mycologists, bacteriologists, soil physicists, crop specialists and agricultural engineers have been added to the staff of one or more of them as the need has arisen and as funds for recurring expenditure have been made available. In the result, the total strength of the scientific staff varies greatly from college to college. The heads of the various sections have hitherto been drawn from the Indian Agricultural Service ; the assistants from the provincial agricultural services.

For district work, each province is divided into a number of circles. The officer in charge of a circle is known as a deputy director of agriculture and, hitherto, with few exceptions, has been a member of the Indian Agricultural Service. He is primarily responsible for the management of the experimental, seed and demonstration farms and demonstration plots in his circle as well as of seed and implement distribution and general agricultural propaganda. For this work he has a staff of agricultural assistants drawn from the Provincial Agricultural Service and of fieldmen who belong to the Subordinate Agricultural Service.

Although, from 1905 onwards, under the stimulus and direction furnished by the Government of India and with the assistance of substantial grants from Imperial revenues, all provinces seriously undertook the development of their agricultural departments, progress was not everywhere equally rapid. Some provincial governments took a greater interest in the subject than others, an interest which, in most instances, was a close reflection of the state of provincial revenues. In all provinces, however, it is true to say that substantial advance had been made when the outbreak of the war led to a temporary suspension of activity. Many members of the staff, both European and Indian, joined the forces ; expenditure was kept down to the barest minimum ; recruitment was in abeyance ; no new work, except such as had a direct connection with military necessities, could be undertaken and the few officers who were left to carry on had to strain every nerve to keep alive work already in progress. When hostilities ceased, much leeway had to be made up and the year 1920 may be said to mark a new starting point in the history of the agricultural departments in India both on that ground and on

account of the constitutional changes which followed the passing of the Government of India Act of 1919.

THE CONSTITUTIONAL CHANGES OF 1919.

32. The changes in the relation between the Government of India and the provincial governments which followed on the Montagu-Chelmsford Report of 1918 and the passing of the Government of India Act of 1919 are too well known to need explanation here. We are solely concerned with their bearing on rural development generally. With the exception of forests, elsewhere than in Bombay and Burma, and irrigation, the administration of all the departments which are closely connected with rural welfare, agriculture, veterinary, co-operation, local self-government, medical, public health and sanitation and education, has been transferred in all the major provinces, now known as "Governors' Provinces," to the Governor acting with a Minister. This transfer is subject to some small limitations as is explained below. The position of the Governor and the Minister in regard to the administration of "transferred" subjects is defined in the Instrument of Instructions to Governors where it is laid down that, in considering a Minister's advice and deciding whether or not there is sufficient cause in any case to dissent from his opinion, the Governor shall have due regard to his relations with the Legislative Council and to the wishes of the people of the province as expressed by their representatives therein. For the administration of the departments which are most closely connected with the subject matter of our enquiry, the Minister is thus, in fact, responsible to the local Legislative Council, to which he has to look to vote the funds required for it.

The transfer of the rural development departments is, as has been mentioned, not entirely complete. Under item No. 33 of Schedule I to Rule 3 of the Devolution Rules made under section 45 of the Government of India Act, "central agencies and institutions for research (including observatories) and for professional or technical training or promotion of special studies" remain a central subject. Accordingly, the institutions mentioned in paragraph 29 have continued, or been placed, under the administrative control of the Agricultural Adviser to the Government of India. It should also be mentioned that protection against destructive insects and pests and plant diseases and prevention of animal diseases have been "transferred." But, under items 10 and 11 of the Schedule just mentioned, this transfer is "subject to legislation by the Indian Legislature to such extent as may be declared by any Act of the Indian Legislature." Rule 49 of the Devolution Rules referred to above governs, with these exceptions, the general position of the Government of India *vis-á-vis* the provinces in all matters relating to agriculture, and it is, therefore, desirable to quote the rule in full. "The powers of superintendence, direction and control over the local Government of a Governor's province vested in the Governor General in Council under the Act shall in relation to transferred subjects be exercised only for the following purposes, namely :—

(1) to safeguard the administration of central subjects;

(2) to decide questions arising between two provinces, in cases where the provinces concerned fail to arrive at an agreement; and

(3) to safeguard the due exercise and performance of any powers and duties possessed by, or imposed in connection with, or for the purposes of the following provisions of the Act, namely, section 29-A, section 30 (*1-A*), Part VII-A, or of any rules made by, or with the sanction of, the Secretary of State in Council."

A word should be added as to the financial relations between the Imperial and provincial governments in regard to the administration of transferred subjects. The rule on this subject will be found in the Note on page 1 of the "Book of Financial Powers" which derives its authority from section 21 of the Government of India Act. It is as follows:—

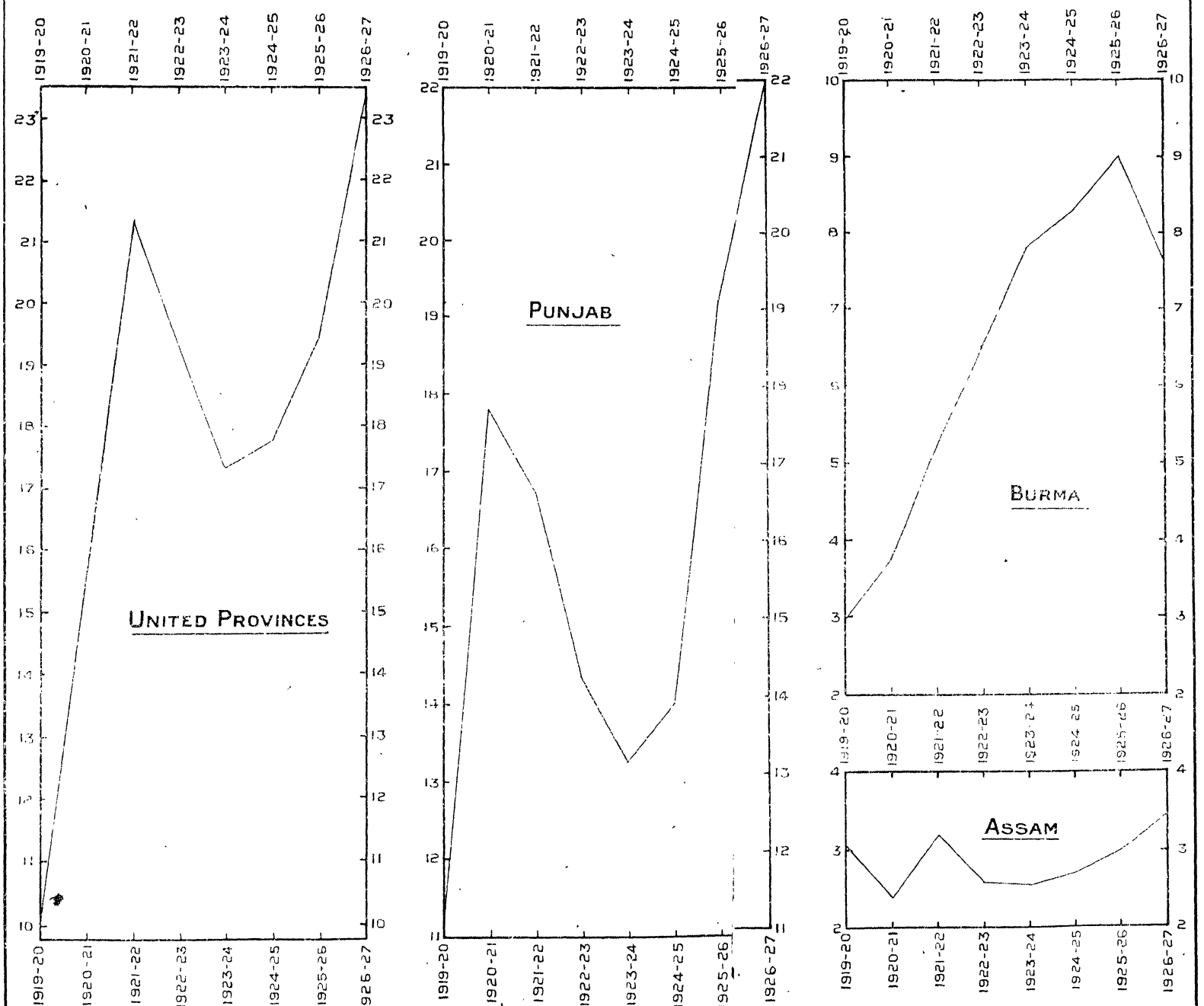
"Since the enactment to the Government of India Act, 1919, and of the Devolution Rules, it is not permissible to incur expenditure from central revenues on provincial subjects or to make assignments from central to provincial revenues for expenditure on a provincial subject except in so far as such expenditure represents payment for se vices rendered by the local Government."

We shall have occasion to comment on the working of this rule in subsequent chapters of our Report.

THE PRESENT POSITION OF THE INDIAN AGRICULTURAL SERVICE.

33. We have mentioned that the Indian Agricultural Service was constituted in 1906. As for other all-India services, recruitment for it was made by the Secretary of State for India. The position of the service under the new administration was not immediately defined and it was not until the Royal Commission on the Superior Civil Services in India had reported in 1924 that it was decided that, for the purposes of local governments, no further recruitment should be made to the all-India services as such, operating in transferred fields, and that the personnel required for these branches of administration should, in future, be recruited by local governments. Recruitment to the Indian Agricultural Service has accordingly ceased. The constitutional changes have, however, in no way affected the status of existing members of the Indian Agricultural Service who retain all the rights of officers of all-India services working in the reserved field of administration. Local governments are now empowered, by rules which were published in a Resolution of the Home Department of the Government of India dated April 1st, 1926, to build up a Provincial Service to take over their duties. The intention is that the Provincial Service should develop and increase gradually, as by efflux of time or for other reasons, members of the Indian Agricultural Service cease to become available. Meanwhile, the two services will continue to exist side by side as long as any members of the Indian Agricultural Service remain. Although it is two years since these rules were issued, the evidence we received showed that no definite decision has yet been reached in any province as to the manner in which the new superior provincial agricultural services, which are to be

EXPENDITURE OF THE PROVINCIAL DEPARTMENTS OF AGRICULTURE



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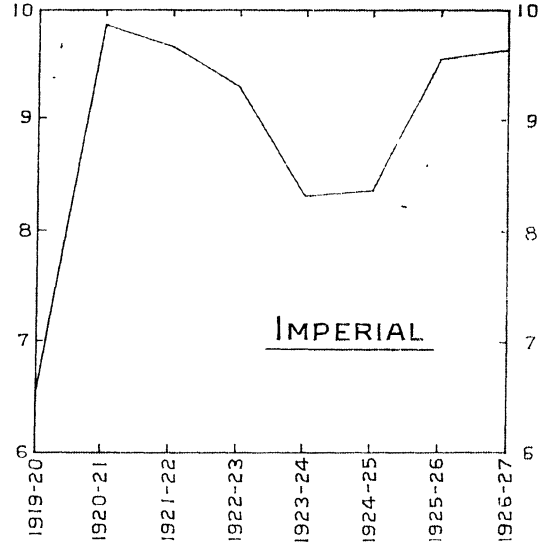

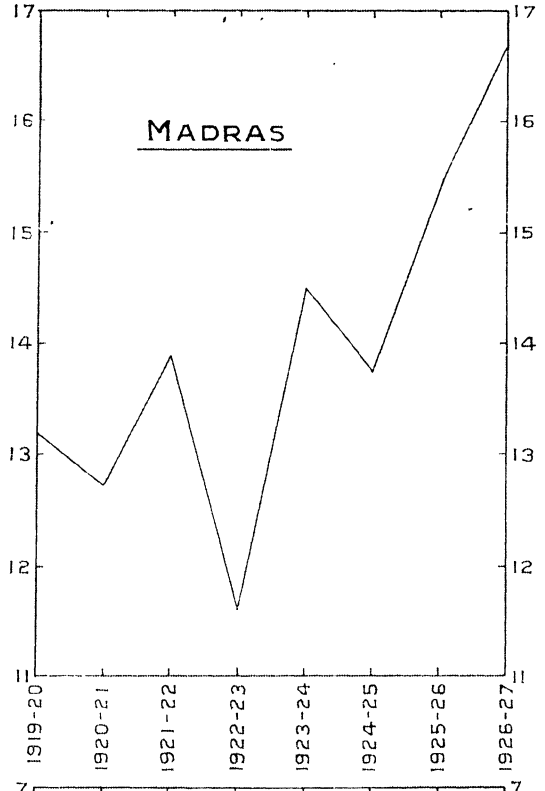

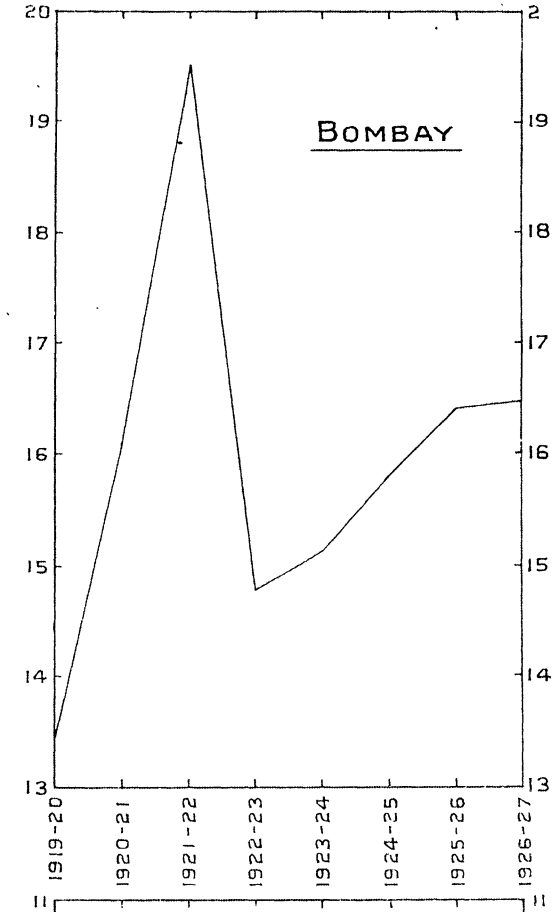

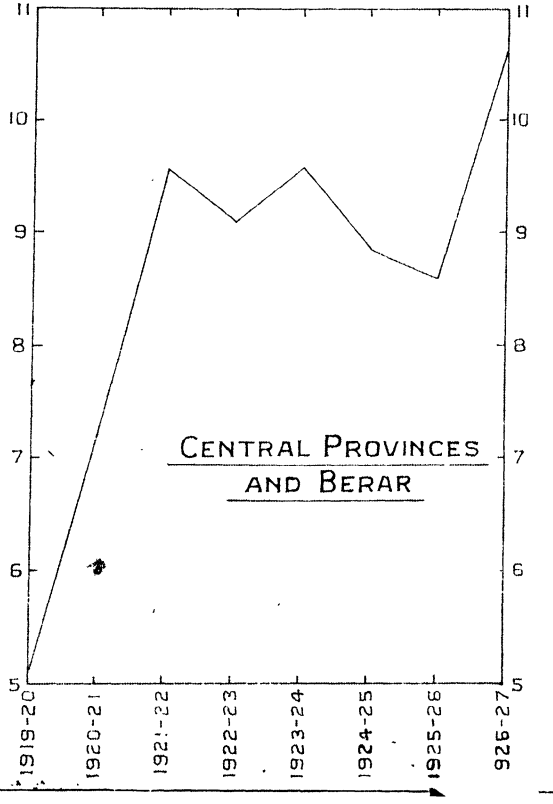

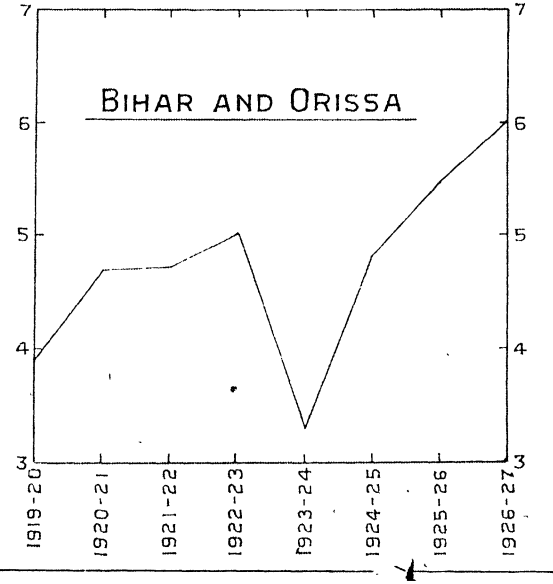

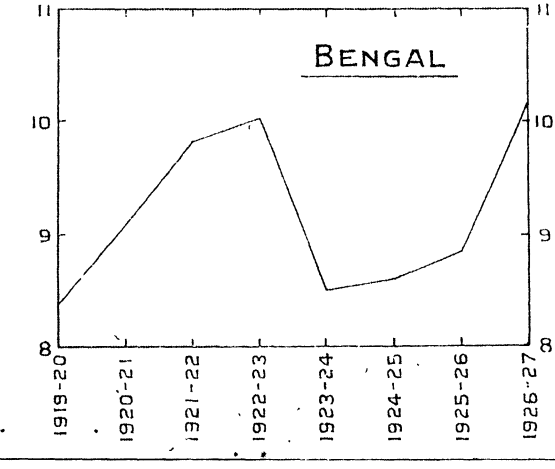

substituted for the Indian Agricultural Service should be recruited, the qualifications which should be required from candidates seeking to enter them or the salary and other conditions which should be attached to them. Similarly, the Government of India have yet to decide how posts in the Imperial Agricultural Department should be filled. Except in regard to the Medical Department, the position in respect of other all-India services working in transferred departments is similar. It should be added that local governments have also been empowered to make rules regulating the existing provincial services to which they have always possessed powers of appointment.

THE WORK OF THE AGRICULTURAL AND VETERINARY DEPARTMENTS.

34. Before we pass to consider in detail the agricultural and veterinary problems of India, we desire to record our appreciation of the work which the agricultural and veterinary services have done. The war sadly interrupted the development and work of both departments and, after its conclusion, the agricultural services in particular had to face the loss of able officers through premature retirement. But despite all hindrances, the achievements of the departments, both in the fields of research and in the application of the fruits of that research, are a source of legitimate satisfaction to the officers who have made those achievements possible and should inspire both them and the new superior provincial services to fresh endeavours.

CHAPTER III

THE ORGANISATION OF AGRICULTURAL RESEARCH

THE CONSTITUTIONAL POSITION.

35. In the preceding chapter, we have shown that, as the result of the constitutional changes of 1919, the Government of India divested themselves, except to a very limited extent, of all powers of superintendence, direction, and control over the administration of " transferred " subjects of which, from the point of view of our enquiries, agricultural and veterinary subjects are the most important. Although the administration of central agencies and institutions for research and for professional and technical training was retained as a " central " subject, no specific provision was made for co-ordinating the work of these with that of similar institutions in the provinces. Thus, since the Reforms, the provincial departments have, in the all-important matter of research, been left without the stimulus of a central organisation which could guide and co-ordinate their policy and the fact must be faced that the lack of co-ordination has prejudicially affected progress. Although no specific provision has been made in the Constitution of 1919 for co-ordinating research work, either as between the central and provincial spheres or as between province and province, there is nothing inherent in that Constitution which prevents appropriate machinery being devised for that purpose.

The basis of all agricultural progress is experiment. However efficient the organisation which is built up for demonstration and propaganda, unless that organisation is based on research, it is merely a house built on sand. In spite of the marked progress which has been made in many directions during the last quarter of a century, it is hardly an exaggeration to say that agricultural research in this country is still in its infancy. The claims of research have received a half-hearted recognition and the importance of its efficient organisation and conduct is still little understood. As will be seen from the paragraphs which immediately follow, the history of the scientific organisation of agriculture in other countries of wide extent and strong local administrations such as the United States of America, Canada and Australia should not make this comparative lack of appreciation of the need for organisation a matter of surprise. We believe that the time will come in India, as it has already come in those countries, when the indispensable part which a central organisation has to play in the fields of agricultural research, and of rural development generally, will be fully recognised.

We think, indeed, that, with the undoubted demand for an increase in the pace of agricultural progress, the time has even now come when there will be a general measure of support throughout the country for proposals designed to promote co-ordination of a more effective character

than would be provided by the continued existence of the appointment of Agricultural Adviser to the Government of India and by conferences of Ministers and Directors of Agriculture and meetings of the Board of Agriculture. The numerous passages in our Report in which we comment on the harmful results of the lack of co-ordination, which are now becoming only too apparent, and the evidence given before us on which those comments are based will, we hope, convince those who are still in doubt as to the justification for the recommendations we make to facilitate co-ordination.

Before we proceed to discuss possible means of rectifying the present situation, it will, we think, be of interest to describe briefly the manner in which the question has been dealt with in some other countries, the constitutions of which, though not exactly on the same lines as that of India, bear sufficient resemblance to it to make such a comparison of value. The countries we have selected for this purpose are Canada, the United States and Australia. Representatives from all three countries, who were in a position to speak with special authority, were good enough to appear before us in London.

ORGANISATION FOR AGRICULTURAL RESEARCH IN CANADA.

36. Canada is the only one of the three countries in the constitution of which agriculture receives special mention. Agriculture and immigration are the only subjects in regard to which the British North America Act of 1867 recognises concurrent powers of legislation in the Parliament of Canada and the provincial legislatures. Section 95 of that Act lays down that, in each province, the legislature may from time to time make laws relating to agriculture in the province and that the Parliament of Canada may, from time to time, make laws in relation to agriculture in all or any of the provinces. It also lays down that provincial laws only have effect so far as they are not repugnant to any Act of the Parliament of Canada.

In pursuance of these provisions, the Federal Government have their own Department of Agriculture which carries out a considerable amount of research work on the experimental farms which are under its jurisdiction and which are scattered throughout the Dominion. They also maintain laboratories in connection with plant pathology, entomology, animal pathology, seed testing and dairy research at a number of stations. The provincial governments also possess and exercise the right of carrying on research work which is mainly undertaken at the agricultural colleges connected with the provincial universities. This research work is frequently carried out in co-operation with the institutions under the control of the Federal Department of Agriculture but is, in some cases, carried on independently. Canada also possesses a Committee of the Privy Council for Scientific and Industrial Research which is designated the Research Council of Canada. The Council functions in a general advisory capacity in connection with all research work, not only in agriculture but in other fields. Its activities fall under three main heads, the training of

research workers through the provision of bursaries, studentships and fellowships, the investigation of a number of special problems by the aid of grants to investigators, known as " assisted researches " and the encouragement of development of research by the organisation of the research workers of Canada into standing associate committees of the Research Council and by the appointment of special committees to the same end. The Council has no institutions under its immediate control. Education in Canada is a matter which comes entirely under provincial jurisdiction. The Federal Government has no concern with it, as it is a subject which has been specifically reserved to the provinces by the British North America Act.

ORGANISATION FOR AGRICULTURAL RESEARCH IN THE UNITED STATES.

37. Neither in the Constitution of the United States of America of 1787 nor in the Commonwealth of Australia Constitution Act of 1900 is there any specific mention of agriculture or agricultural research. In Australia, the development and supervision of all lands within State boundaries is the concern of the State governments but, in both countries, it is now recognised in very practical ways that agricultural research is a matter with which the Federal Government are very closely concerned.

The United States, because of its resources and the long period over which efforts to promote agriculture by the action of the Federal Government have extended, provides more useful guidance than any other country for those attempting similar tasks. Some salient points in its experience may be noted. The first concern of the Federal Government was to provide for higher education in agriculture and certain other subjects, and, in 1862, the first Morrill Act endowed State colleges with grants of public land the revenues of which were to be applied to the promotion of agricultural education. The need for experimental work was soon felt and, in 1887, the Hatch Act provided grants-in-aid enabling States to create experimental stations, which were usually associated with the existing colleges. These experimental stations quickly commended themselves to the public, and, in 1906, the Adams Act added largely to their incomes. The additions to the knowledge of the methods required in improving agriculture accumulated by State experimental stations made it possible to initiate demonstration and propaganda work on a great scale and, in 1914, the Smith-Lever Act provided a large fund for extension work. Finally, a competent staff of specialists having been trained, the people having realised the benefit of scientific assistance and the war having enforced the importance of economic studies, the Purnell Act was passed in 1925. This substantially increased the endowments of the experiment stations and extended their scope. The funds provided were " for paying the necessary expenses of conducting investigations or making experiments bearing directly on the production, manufacture, preparation, use, distribution and marketing of agricultural products, and including such scientific researches as have for their purpose the establishment and maintenance of a permanent and efficient agricultural industry,

and such economic and sociological investigations as have for their purpose the development and improvement of the rural home, and rural life, and for printing and disseminating the results of the said researches." Thus, beginning with the training of qualified investigators, and taking up, in the first instance, the somewhat narrow technical problems commonly met with by agriculturists, the scope of agricultural research in the United States has been expanded in less than half a century until it covers all questions bearing on rural well-being.

This extension has been brought about by co-operation between the Federal Government and the States, and the expenditure by both is now large. The part of the Federal Government is to make grants-in-aid from central funds and to guide and supervise the expenditure of such grants; and their own headquarters organisation has been carefully created for this purpose. The extension work carried out with funds provided by the Smith-Lever Act is supervised by the States Relations Department, which, in the year ending 30th June 1927, distributed 5,880,000 dollars (Rs. 161 lakhs*). The research work aided by funds provided by the Hatch, Adams, and Purnell Acts is under the supervision of the Office of Experiment Stations which, in the same year, made grants-in-aid to the several States of 2,880,000 dollars (Rs. 79 lakhs*). The larger part of the cost of experimental and research work aided by the Federal Department through the Office of Experiment Stations is a charge upon the funds of the States; the total expenditure on these subjects during the year 1926-27 was about 12,500,000 dollars (Rs. 343 lakhs*). Apart from what in India would be called the provincial expenditure on research, the Federal Government maintain a number of special institutions or agencies for investigational purposes, at a cost, in the year ending 30th June 1927, of 10,600,000 dollars (Rs. 291 lakhs*).

The resources, though not the needs, of India are very different from those of the United States, and it is not because of the expenditure, but because of the methods of providing and using funds that the experience of the latter country is of value. When experimental work was initiated in the United States, it was realised that it was necessary to provide both for some degree of permanency and for popular control; the Hatch Act, therefore, provides money in the following terms, "the sum of fifteen thousand dollars per annum is hereby appropriated to each State to be specially provided for by Congress in the appropriations from year to year." After forty years' experience of the value of experimental work, Congress, in the Purnell Act, authorised not only an appropriation of a fixed amount, but an increasing appropriation in these terms; "in addition to the amounts now received by such experimental stations, the sum of $20,000 for the fiscal year ending June 30th, 1926, $30,000 for the fiscal year ending June 30th, 1927, $40,000 for the fiscal year ending June 30th, 1928, $50,000 for the fiscal year ending June 30th, 1929, $60,000 for the fiscal year ending June 30th, 1930, and $60,000 for each fiscal year thereafter, to be paid to each State and Territory; and the Secretary of Agriculture shall include the additional sums above authorised to be

* Rs. 100 = $ 36·50.

appropriated in the annual estimates of the Department of Agriculture, or in a separate estimate, as he may deem best."

In the case of the Smith-Lever Act, which aimed at promoting extension and demonstration work, the form of providing money was different. It was considered that a fund should be created, and the Act includes the words " there is permanently appropriated out of the money in the Treasury not otherwise appropriated the sum of ——." In this instance, State legislation was necessary in order to give effect to the schemes which the Federal Government were prepared to aid. Negotiations between representatives of the central and local governments were called for, and a non-lapsing fund of considerable amount was required for success. The permanent appropriation of 1914 provided $4,580,000 for expenditure in the year 1925-26, but owing to the growth of the work, a supplementary sum of $1,300,000 for that year was voted by Congress.

The administration of these large grants-in-aid necessarily calls for close supervision, but, by means of a carefully devised form of accounts, routine correspondence on financial questions is reduced, and the general relations between Federal and State institutions may be indicated by quoting two sentences from the annual report (for the year ending June 30, 1927) of the Chief of the Office of Experiment Stations. " While many questions in regard to the use of these Federal funds have arisen, in the main the supervision exercised has been in the nature of advice or suggestion, with the speedy correction of any doubtful procedure to which attention was called. There is, perhaps, no similar example of the administration of so large a public sum for research in any line, and the spirit in which it is met is a sign of the community of interest and the desire to secure for the funds (Hatch, Adams and Purnell) the highest practicable degree of productivity."

ORGANISATION FOR AGRICULTURAL RESEARCH IN AUSTRALIA.

38. In the matter of agricultural legislation, administration and research, each of the States which compose the Commonwealth of Australia is practically independent. Each State has its own Department of Agriculture which is controlled by a Minister. Under the departments of agriculture in New South Wales, Victoria and South Australia, there are a number of research and demonstration farms and also of agricultural training colleges. With a view to co-ordinating agricultural and other research in Australia, the Federal Government, in 1920, passed an Act* establishing a " Commonwealth Institute of Science and Industry. " We were informed that, so far as agriculture was concerned, one of the reasons for passing this Act was that it had been found that fundamental research had been forced into the background owing to the large amount of attention necessarily given to demonstrational, extension and administrative work by the officers of the State departments. Although the staff of the departments consisted in most cases of thoroughly competent men, it had proved impossible for them to include much necessary fundamental work in the programme of departmental activities. It was further

*The text of the Act will be found in Evidence Vol. X, page 639 *et seq.*

evident that overlapping had caused a considerable waste of effort and that the energies of investigators, considered nationally, had not always been used to the best advantage.

At the outset, grave difficulties were encountered in setting up the Commonwealth Council. One of the greatest was the suspicion entertained in some States that the Council was seeking to usurp State functions and that the efforts of the States to build up their own scientific research institutions would be discouraged. It was, therefore, decided to reorganise the Institute and two Acts, the Science and Industry Research Act and the Science and Industry Endowment Act,* were passed in 1926 to achieve this end. When reorganising the Institute of Science and Industry into a Commonwealth Council for Scientific and Industrial Research, the Commonwealth Government laid it down as axiomatic that, before the initiation of any new Commonwealth establishment for research purposes, no effort should be spared to utilise to the fullest extent existing State organisations and establishments and, since the Council was constituted, its activities have proceeded on these lines.

The Council thus created consists of three members nominated by the Commonwealth Government, the chairman of each of the State committees constituted under the Act and such other members as the Council, with the consent of the Federal Minister, co-opts by reason of their scientific knowledge. The State committees consist of a chairman who is nominated by the Commonwealth Government after consultation with the State authorities, three members appointed by the State governments from the staff of their scientific departments, three members representative of pure science, of whom at least two must be from the local university and all of whom are selected by the Commonwealth Council, and three other members co-opted by the chairman to represent primary and secondary industries within the State. Sub-committees on special subjects are appointed from time to time. The three nominees of the Commonwealth Government on the Council constitute an executive committee which may exercise all the powers and functions of the Council between its meetings.

As regards the provision of funds for the work of the Council, we were informed by Mr. G. A. Julius, the Chairman, whose visit to England fortunately synchronised with ours, that last year £250,000 was voted by the Commonwealth Parliament to form the nucleus of a non-lapsing fund, the only condition imposed being that estimates, not in detail, should be submitted through the Minister. It was anticipated that a further substantial grant would shortly be made. In addition, a trust fund of £100,000 was created under the provisions of the second of the two Acts mentioned above. This is vested in the three members of the Executive Committee and the interest on it is to be devoted entirely to the training of research workers and to making grants-in-aid to persons engaged in scientific research.

One of the first actions of the Commonwealth Council was to convene an agricultural conference of the permanent heads and other officers of

* The text of the Act will be found in Evidence Vol. X, page 639 *et seq.*

the State departments of agriculture in March, 1927. The professors of agriculture at the Australian universities were also present. Some of the resolutions passed by this conference are so relevant to our present problem that no apology for quoting them appears called for. It was resolved that Commonwealth participation in agricultural research was desirable ; that problems which are national in scope and fundamental in character, and which require concentration of effort and highly specialised research for their solution, are specially suited for investigation by the Commonwealth ; that the Commonwealth Council can render great service to the agricultural institutions throughout the Commonwealth by acting as a clearing house for information on research projects in State institutions and universities ; that the Council should adopt a scheme which will enable the universities to attract students to the faculties of agriculture and of veterinary science by notifying that appointments will be available for suitably trained men ; that the ways in which the Council can best serve Australia in its agricultural development are by co-operation and collaboration with State departments of agriculture, with the universities and with the institutions concerned with agricultural and livestock interests, it being understood that such co-operation would be compatible with the independence of individual research organisations undertaking research activities ; and finally that, to effect the desired co-operation and collaboration, the Council should bring into existence a Standing Committee on Agriculture, comprising the permanent heads of the State departments of agriculture and representatives of the Council, such Standing Committee to act as the advisory and consultative body on matters relative to agricultural and livestock research undertaken by the Commonwealth.

The position in Australia is specially illuminating. It will be seen that, although the States which compose the Commonwealth were, at the outset, as jealous of interference from the central Government as any provincial Government in India could be, their views in this respect have undergone a complete change and they are now convinced that the Federal Government can give them the most valuable assistance in regard to agricultural and industrial research.

THE PROBLEM IN INDIA.

39. The evidence we received convinced us of the lack of sufficiently close touch not only between Pusa and the provincial departments but also between the provincial departments themselves. One is to a very large extent the outcome of the other. Had the provinces been in closer touch with Pusa, they would have been in closer touch with each other. The problem before us is to devise some method of infusing a different spirit into the whole organisation of agricultural research in India and of bringing about the realisation on the part of research workers in this country that they are working to an end which cannot be reached unless they regard themselves as partners in the same enterprise. Of all the problems with which we have been confronted, there is none which we regard as more important than this and to none have we devoted more anxious thought.

We wish to make our position in this matter perfectly clear. It is not our business, nor have we any desire, to suggest any changes in the

Constitution which would reverse the present position and would restore to the Government of India powers of superintendence, direction and control over the administration of what are now transferred subjects. We conceive it our duty to accept that position with all its implications and to frame our recommendations in the light of it. But we are convinced that, even as matters now stand, there is a wide field open for the co-operation of the Government of India and of the provincial governments in regard to agricultural research and that it is the duty of the Government of India, in the discharge of their ultimate responsibilities for the welfare of the vast agricultural population of this country, to advance research in every way possible without in any way encroaching upon the functions of provincial governments in that sphere. It is in this spirit that we put forward the proposals which are explained below.

THE POSITION OF PUSA.

40. The first question which arises is whether there is any necessity for the continuance of a central research institute and whether agricultural research might not be left entirely to the provincial departments. Our review of the position in India and in other countries will, we think, have left no doubt as to our views on this point and it is, therefore, unnecessary to enlarge upon it at any length. All that need be said is that agricultural development is so vital to the prosperity of India that it is inconceivable that the Government of India should divest themselves of all responsibility for it. The promotion of research and the provision of information are now the only ways in which they can render substantial assistance to agricultural progress and, in those directions, they should, in our view, give all the help possible, especially as the evidence we have received has shown how wide a field for research still remains and how desirable it is that provincial activities should be co-ordinated and supplemented. Pusa has been in existence so long, is so well endowed with buildings and equipment and has accumulated such a fund of information and experience, that it is impossible to contemplate a cessation of its activities. It should be mentioned that, in putting forward this view, we have the practically unanimous support of a very large body of non-official opinion.

It may be held that the continued existence and expansion of Pusa are, in themselves, a sufficient discharge of the responsibilities of the Government of India in regard to agricultural research. We are unable to concur in this view. It would, in our opinion, have a solid basis in fact if there were any evidence of an increasing tendency on the part of the provincial agricultural departments to look to Pusa for help and guidance. The evidence we received showed that the reverse is unfortunately the case and that the thread of connection between Pusa and the provinces is becoming more and more attenuated. For this there are many reasons. The first and not the least important is one that has always existed. It is the comparative inaccessibility of the Pusa Institute. The choice of Pusa as a site for an all-India research institute was, as we have seen, mainly determined by the fact

that a large government estate happened to be available for the purpose. An ideal site for a central research institute for all India was doubtless impossible of attainment but we cannot but regard it as a matter for regret that the site actually selected was one six miles from a railway station, in an out-of-the-way district to which access from most parts of India can only be obtained by a river crossing, and from all parts by a somewhat tedious railway journey. In this connection, we should mention that we have given careful consideration to the question whether this handicap could not be removed by transferring the work now carried on at Pusa to some more eligible site. We are, however, of opinion that so much has been spent on buildings and equipment and on the development of the estate that it would be impossible to justify such a proposal. Moreover, the climate is good and the soil fertile and well suited to growing most of the important Indian crops. A district chosen by men with a good eye for country such as the early Dutch and English planters is not lightly to be abandoned. The second reason is the relative decline in the prestige of the Pusa staff. This, to a large extent, was inevitable. At the outset, the staff of the Pusa Institute included among its members the senior officers of the then newly constituted Indian Agricultural Service whose subsequent performance showed them to the men of high scientific capacity. The provincial departments, on the other hand, were staffed by junior men who had to prove their worth and were naturally very willing to be guided by the more senior officers at Pusa. The disparity in this respect has gradually disappeared and the provincial departments rely more and more on their own experts. Within limits, this spirit of provincial independence in regard to agricultural research is natural and praiseworthy. But its effect has undoubtedly been to bring about a lack of touch between Pusa and the provinces and between province and province and a certain narrowing of scientific outlook that have now reached a point at which they are beginning to tell seriously on efficiency. Whilst it is undoubtedly a phase of the general spirit of self-sufficiency which has grown up in the provinces since the Reforms, it must also be attributed in part to the fact that the spheres of central and provincial research have never been clearly defined and the provincial departments have remained in a state of uncertainty as to the extent to which they are entitled to invoke the assistance of Pusa. It is unfortunate, from the point of view from which we are considering this problem, that Pusa was not, from the outset, an educational as well as a research institute. A constant stream of men returning from Pusa to the provinces would have furnished an excellent means of maintaining contact between the Imperial and provincial departments and would have placed the latter in a better position to discover in what ways the work done at Pusa could be made of value to them.

CONSTITUTION OF CROP COMMITTEES.

41. There would appear to be three possible methods by which closer contact might be established between scientific investigators working in institutions under the central Government and investigators employed

under provincial governments. The first is by dividing research into compartments, in other words by the formation of crop committees on the lines of the Indian Central Cotton Committee. The second is by the transfer of the control of Pusa from the Government of India to a quasi-independent body on which the provinces would be represented, and the third is by constituting a new organisation to which both Pusa and the provincial research institutes would stand in exactly the same relation. We dismiss, at the outset, the possibility of subordinating provincial research institutes in any way to Pusa. The time for that, if it ever existed, has long passed. We shall proceed to discuss these three possibilities in some detail.

One of the most satisfactory features of our enquiry was the universal approbation elicited by the work of the Indian Central Cotton Committee, the organisation and functions of which we have described in paragraph 30, Chapter II. The marked success which has been achieved by that committee led to many suggestions that other crops should be dealt with in similar fashion and the possibilities of dividing up agricultural research by crops have, therefore, to be considered. These possibilities, however, appear to us to be very limited. Agricultural research cannot, in our view, be suitably divided into longitudinal sections in this way and any attempt to do so would involve more loss than gain. It must be remembered that the Indian Central Cotton Committee does not confine itself to research on cotton but is concerned with all questions arising out of cotton growing from the field to the factory. Nor does the research work which is carried out under its auspices embrace the whole field of research on cotton. It is supplementary to, rather than independent of, the work of the provincial departments on this crop.

Without in any way desiring to minimise the success which has attended the work of the Indian Central Cotton Committee, it must be remembered that cotton offered a specially promising field for the experiment involved in constituting such a committee. In the first place, the cotton problem is very definitely an all-India problem; in the second, the cotton industry provides, to a greater extent than any other industry in India, except the tea industry, which has its own organisation, and possibly the jute industry, the personnel required for a successful central committee; and, in the third, the question of financing the operations of a central committee for cotton presented fewer difficulties than would be encountered in financing those of any similar committees, again with the possible exceptions of tea and jute. It would be extremely difficult to provide a satisfactory personnel for central committees on such crops as wheat, the millets, oil-seeds or rice, and, even if such committees could be constituted, the field of research which would remain untouched would still be a very large one. Apart from these considerations, there appear to us insuperable difficulties in fitting into a research organisation based only on crops the work of Pusa and of the provincial research institutions, as this is based on an entirely different and more logical division of research into branches of agricultural science. We revert to the question of constituting crop committees in

paragraph 65 below but sufficient has been said here to show that no solution of our immediate problem is to be found in this direction.

CONSTITUTION OF A GOVERNING BODY FOR PUSA.

42. The second possibility which falls for discussion is that of transferring the control of Pusa from the Government of India to a quasi-independent governing body which would comprise representatives of the Government of India and of the provincial agricultural departments as well as of non-official interests. If such a body were constituted, the presence on it of provincial representatives would enable them to bring influence to bear to direct the research work at Pusa into channels which would prove fruitful of results to the provinces. The presence of non-official representatives would bring home to the public at large the fact that agricultural research is not a matter for experts only, but one of vital concern to the community as a whole. There appear to us, however, to be grave difficulties in advocating this course. Such an arrangement as that proposed involves no element of reciprocity. The provincial representatives on the governing body might have a deciding voice in determining the direction of research work at Pusa but the representatives of the Government of India would be without any corresponding influence on the work of the provincial research institutes. The link between Pusa and the provinces would be only the personal one provided by the presence on the governing body of a representative of the provincial department and there would be no guarantee in practice that this would be sufficient to provide the requisite degree of co-ordination between the research work at Pusa and that in the provinces. Again, we do not contemplate any contributions from the provinces to the cost of maintaining and expanding Pusa. We consider that such expenditure should continue to be regarded as the contribution of the Government of India to the development of the most important industry in India. In these circumstances, it may be doubted whether the central Government would be willing to surrender the control of the central research institute to a body on which representatives of that Government would be in a small minority.

CONSTITUTION AND FUNCTIONS OF AN IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

(i) PROMOTION, GUIDANCE AND CO-ORDINATION OF AGRICULTURAL RESEARCH.

43. We, therefore, prefer the third of the possible methods of proceeding which we have outlined above, that of constituting a new organisation to which Pusa and the provincial research institutions would stand in exactly the same relation. Our proposal is that an Imperial Council of Agricultural Research should be constituted. Before discussing the manner in which this Council should be composed, we would state our conception of the functions it should discharge. Its most important duty would be to promote, guide and co-ordinate agricultural research throughout India, and to link it with agricultural research in other parts of the British Empire and in foreign countries. It would not exercise any administrative control over the Imperial or provincial research institutions. Such control would

remain, as at present, with the Imperial or provincial departments of agriculture. But it would be a body to which those departments could look for guidance in all matters connected with research and to which such research programmes as they might choose would be submitted for criticism and approval. Research programmes were formerly submitted to the Board of Agriculture for criticism but the practice has been discontinued as the Board did not feel itself in a position to perform this function satisfactorily. It would further be a body to which the Imperial and provincial governments could, if necessary, turn for advice as to whether their research work is proceeding on sound lines and is of such a standard that it commands respect and justifies the expenditure incurred on it. Our object, in proposing that such a body should be constituted, is, in short, to provide provincial governments with an organisation in which they can feel that they have a real and lively interest, which, unfortunately, is not the case with Pusa as at present constituted. That interest will undoubtedly be greatly accentuated if the Council is entrusted with the administration of funds with which it can supplement provincial activities in the matter of agricultural research. We cannot emphasise too strongly our view that agricultural research knows no provincial boundaries and that there are few, if any, research problems which do not affect agricultural development throughout India. Research on rice in Madras, for example, may be of profound importance to Bengal, and work done on the millets in any part of India cannot but be of value wherever they are grown. If agricultural research in this country is to develop satisfactorily, it is essential that continuity of policy should be secured. Only if the Council is placed in a secure financial position, beyond the possibility of being affected by financial vicissitudes, will it be able to embark upon a programme of ordered advance. We, therefore, propose that an agricultural research fund should be constituted by a grant of Rs. 50 lakhs from central revenues to which additions should be made from time to time as financial conditions permit. This is, in our view, the minimum grant which can usefully be made, and we have only been able to propose so low a figure on the assumption that provision for the cost of existing institutions and for the normal expansion, both of these institutions and of any others which it may be decided to establish, will be met from central or provincial revenues as the case may be. The Council of Agricultural Research and the Agricultural Research Fund should be constituted by an Act of the Imperial Legislature. The position of the Council of Agricultural Research in relation to the administration of the research fund would be analogous to that of the Indian Central Cotton Committee in relation to the funds raised under the provisions of the Indian Cotton Cess Act of 1923. Subject to such conditions as might be prescribed, the capital and income of the fund and any other funds received by the Council would be utilised in meeting its expenses and the cost of such measures as it might decide to undertake for promoting agricultural and technological research in the interests of agriculture in India. The powers of the Council would be regulated by

rules issued by the Governor General in Council in the Department of Education, Health and Lands similar to those issued under section 15 of the Indian Cotton Cess Act. These rules would, *inter alia*, regulate the powers of the Council to enter into contracts, to appoint officers and servants, and to grant them leave, pay and allowances. They would further regulate the powers of the Council to incur expenditure and would provide for the submission of its budget to the Governor General in Council for sanction and for the audit and publication of its accounts. They should also provide that its accounts and also a report containing a summary of the work done and of the research and investigations made during the preceding year, should annually be placed before the Imperial Legislatures. We would here express the earnest hope that the agricultural research fund thus constituted will, in course of time, be considerably augmented by private benefactions. It cannot be regarded as a matter for satisfaction that the only names hitherto associated in this way with the advancement of agricultural research in India should be those of Mr. Henry Phipps of America and of the late Sir Sassoon David of Bombay.

44. We wish to make it clear that in agricultural research we include veterinary research. In our chapters on Animal Husbandry and Diseases of Livestock and their Control, we shall show that, from the cultivator's point of view, agricultural and veterinary research are merely two branches of one subject. We shall also show the immense importance to Indian agriculture of research on the diseases of livestock and their control. We are aware that the position in regard to veterinary research is not quite the same as that in regard to agricultural research. The veterinary colleges in India are teaching rather than research institutions and research at present forms an entirely subordinate part of their activities. The need for a link between them and the Imperial Institute of Veterinary Research at Muktesar is not, therefore, so clear as is that for a link between Pusa and the agricultural colleges. We look forward, however, to the veterinary colleges taking a larger part in research work than they have hitherto done and consider it desirable to make provision for closer touch between them and the Muktesar Institute. This object can, in our view, best be secured through the Council of Agricultural Research, both because of the very intimate connection between agricultural and veterinary research and because the constitution of a separate body to deal with veterinary research could hardly be justified in existing conditions.

(*ii*) PROMOTION, GUIDANCE AND CONTROL OF VETERINARY RESEARCH.

45. The Council would also have most important functions to fulfil in regard to the training of agricultural research workers. Part of its funds should, we consider, be utilised in the establishment of research scholarships tenable by students who have given evidence that they are capable of taking full advantage of an opportunity for intensive training in scientific research in agriculture.

(*iii*) TRAINING OF RESEARCH WORKERS.

The scholarships would ordinarily be held by men who have passed with distinction through an agricultural college but should not be confined to this class and should be open to graduates from the universities in branches of science other than those directly connected with agriculture. In this connection, it is of great interest to note that, whilst the scientific staff at Rothamsted is chosen from the best science schools in the United Kingdom, no agricultural knowledge is expected. Complete familiarity with the use of his tools is regarded as far more important to the agricultural investigator than some diffuse knowledge of the processes used by the farmer in tilling the soil. As will be seen from paragraph 60 below and from our chapter on Education, we contemplate that the post-graduate training required as a qualification for admission to the superior provincial agricultural services should ordinarily be given at Pusa and it will be for the Council of Agricultural Research to advise as to how best it can be given at that institution and the extent to which it will be necessary to supplement it by further training abroad. The Council will exercise similar functions in regard to the training of veterinary research workers.

(*iv*) CLEARING HOUSE OF INFORMATION.

46. A further function which should, in our view, be discharged by the Council of Agricultural Research is that of acting as a clearing house for information not only in regard to research but also in regard to agricultural and veterinary matters generally. The Government of India can render substantial assistance in this respect to provincial governments and there is nothing in the existing constitution which prevents them from doing so, as the existence of the Sugar Bureau bears witness. We consider that similar bureaus should be established for other crops as well as for animal husbandry and dairying and veterinary matters and that these, together with the Sugar Bureau, should be placed directly under the Council of Agricultural Research. We prefer to make no detailed suggestions under this head as we consider that the order in which these bureaus should be established and the scope of their functions can best be determined by the Council of Agricultural Research.

(*v*) PUBLICATION BUREAU.

47. In connection with its functions as a clearing house of information, the Council of Agricultural Research would take over the publication work at present carried out by the Agricultural Adviser to the Government of India either in that capacity or as Director of the Pusa Institute. It would thus be responsible for the Agricultural Journal of India and for the Annual Review of Agricultural Operations in India. At present, all scientific papers intended for publication either in the series of scientific memoirs or in that of bulletins issued by the Pusa Institute are submitted to the Pusa Council which consists of the heads of sections with the Director (who, as has been mentioned, is now also Agricultural Adviser to the Government of India) as president. After approval by the Council, the papers are forwarded to the Agricultural Adviser for his sanction to publish. In future, all scientific work of this character

would only be published after it had received the imprimatur of the Council of Research.*

(vi) MEETINGS OF EXPERTS.

48. Another duty which should, we think, be discharged by the Council of Agricultural Research is that of arranging for meetings of experts in particular branches of agricultural and veterinary science such as entomology, mycology and botany. Such meetings afford the workers in the same field a means of interchanging views on problems of common interest and of profiting from each other's experience which is of the greatest value and which neither correspondence nor interchange of literature can satisfactorily provide. They have occasionally been held in the past and the conferences of entomologists were, we understand, specially successful. Financial considerations and the lack of contact between Pusa and the provincial agricultural departments have brought about their cessation. We consider that they should be revived and should meet under the auspices of the Council of Agricultural Research, the Chairman of which, or his nominee, would preside over them.

POSITION OF THE COUNCIL IN REGARD TO RESEARCH.

49. We do not contemplate that the Council of Agricultural Research should have research stations directly under its control or should have its own staff of experts. Such a proposal would be incompatible with the main principle underlying our scheme which is that the Council should stand in exactly the same relation to Imperial and provincial research stations. It will be for the Council to decide whether any particular piece of research work is of all-India or merely of local importance and, if the former, whether it can best be carried out at an Imperial or provincial research institution or entirely outside such institutions, in a university, by private individuals, or even abroad. It would then make the necessary grant to enable the work to proceed. Any additional staff required for it would be recruited in the ordinary way by the Imperial or provincial departments concerned, but the qualifications required for such staff would be determined by the Council and the grant would only be given on condition that staff with the prescribed qualifications was obtained.

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* Professor Gangulee considers that it would be of very great assistance to the Government of India and to provincial governments if they were able to obtain, from time to time, an outside and independent opinion of the state of research in the country. At present, they have no means of discovering whether the research work done is of real value and whether the results obtained are commensurate with the expenditure involved. He considers that the establishment of the Council of Agricultural Research will not altogether remove this uncertainty and he would, therefore, suggest that there should be a quinquennial review of the progress of agricultural research in India which would be carried out in a manner to be determined by the Council of Agricultural Research. Should such a review be entrusted to a small committee of eminent scientists drawn from Great Britain and other countries, both central and provincial research institutions might receive valuable suggestions from that body. The publication of a quinquennial review of research will, he hopes, provide an effective means of stimulating agricultural research in India in all directions and of making it a far more vital factor in agricultural development than it is at present.

EXPENDITURE FROM CENTRAL REVENUES ON AGRICULTURAL RESEARCH.

50. A word should be said as to the financial position of the Council in relation to the present Constitution. We have pointed out that, under the existing Constitution, it is not permissible to incur expenditure from central revenues on provincial subjects and that the Devolution Rules, as they now stand, only permit expenditure on agricultural research and the training of research workers in central institutes. It will be seen that our scheme contemplates expenditure on research in provincial institutions. We have explained our reason for this, which is that there are few, if any, important problems of agricultural research which can be regarded as of purely provincial interest. The position in this respect appears to us to be analogous to that of the development of industries, which is not considered merely a provincial matter but has been declared a central subject "in cases where development by central authority is declared, by order of the Governor General in Council, made after consultation with the local government or local governments concerned, expedient in the public interest." All that is required, therefore, to bring our proposals within the four corners of the present constitution is an alteration in the Devolution Rules which would declare the development of agricultural research by a central authority expedient in the public interest.

PERSONNEL OF THE COUNCIL.

(i) THE CHAIRMAN.

51. The success of the Council of Agricultural Research will, to an extent which can hardly be exaggerated, be dependent on the personality of its Chairman. He should be an experienced administrator with a knowledge, if possible, of Indian conditions. The justification for this recommendation is to be found in the nature of the duties we have assigned to the Council of Research in paragraphs 43 to 48 above. He must possess the ability to make the new organisation a vital factor in Indian agricultural development, to overcome any jealousy or suspicion which may be entertained towards it by the Imperial or provincial departments of agriculture and to inspire enthusiasm for research not only amongst research workers themselves but amongst others whose aid can in any way be utilised to further its advancement. The success which has undoubtedly been already achieved by the Council for Scientific and Industrial Research in Australia furnishes an inspiring example of what can be done in this direction. In conditions in India, we consider it essential that the chairmanship of the Council should be a whole-time appointment. We prefer to make no recommendation as to the salary which should be attached to it beyond stating that it must be such as to attract an outstanding man.

(ii) THE WHOLE-TIME MEMBERS OF THE COUNCIL AND THE SECRETARIAT.

52. We consider that in addition to the Chairman there should be two whole-time members of the Council. One of these should be an eminent scientist who has specialised in some branch of crop production. It is also desirable that he should possess a knowledge of Indian conditions. The necessity for these qualifications will be

evident from many passages in our Report and especially from our chapters on Agricultural Improvement, Communications and Marketing, and Education. The second should specially represent the interests of animal husbandry including animal nutrition and veterinary matters. Our justification for this recommendation will be evident from our chapters on Animal Husbandry and Diseases of Livestock and their Control, and need not, therefore, be discussed in detail here. If the Council is satisfactorily to discharge its functions in regard to the training of research workers, as a clearing house of information on agricultural and veterinary matters generally and as a publication bureau, it will require a strong secretariat. As in the case of the Chairman, we prefer to make no recommendation as to the salary of the two whole-time members of the Council; it must be such as will attract men of outstanding ability.

(*iii*) THE MEMBERS OF THE COUNCIL.

53. It is, in our opinion, very desirable that the Council should not be an unwieldy body as otherwise there is a danger that its activities might be in inverse proportion to its numbers. At the same time, it is obviously essential that all the major provinces should be represented upon it. We do not wish to lay down any rigid rules for the composition of the Council as we realise that an entirely satisfactory constitution can only be evolved in the light of experience. We would suggest that, at the outset, the Council might consist of thirty-nine members, inclusive of the Chairman and the two whole-time members. Eight of these would be nominated by the Government of India, of whom one would be the Director of the Pusa Institute who, under the proposals we put forward in paragraph 58 below, would be a whole-time officer, one would be the Director of the Muktesar Institute, one would represent minor administrations under the Government of India, one would be a non-official elected member of the Council of State and two would be non-official elected members of the Legislative Assembly. The remaining two members would be representatives of the European and Indian business communities respectively. Agricultural research is so closely bound up with the trade and commerce of the country that we consider it desirable that these two important communities should be represented on the Council. There should also be three representatives of Indian universities nominated by the Inter-University Board. Touch between the Council of Research and the Indian Central Cotton Committee will be provided by the fact that the Chairman of the Council of Research will also be Chairman of the Indian Central Cotton Committee, but we recommend that this Committee should also be permitted to elect a representative to the Council of Agricultural Research. In view of the value to Indian agriculture generally of the scientific work of the Indian Tea Association and the United Planters Association of Southern India, we would suggest that these two bodies should also jointly nominate a member of the Council. The provincial agricultural representatives would consist of the nine directors of agriculture of the major provinces. We have carefully considered whether it is necessary that both the directors of agriculture and the principals

of the agricultural colleges should be members of the Council but are of opinion that this would unduly enlarge the membership of the Council and that, in view of the responsibility of the directors for the general policy of their departments, they are the most suitable provincial representatives. For a similar reason, we recommend that the provincial directors of veterinary services should represent their departments on the Council. Should a Director of Agriculture or of Veterinary Services be unable to be present at a meeting of the Council, we consider that his place should be taken for that occasion by a member of the scientific staff of his department, nominated by the provincial Government. The remaining five members would be non-official members nominated by the Government of India on the recommendation of the Council, by reason of their scientific knowledge or other special qualifications, for the approval of the Government of India.

A suitable period for the duration of appointment as a member of the Council of Agricultural Research will have to be fixed. We suggest that for the Chairman and the two whole-time members a period of five years, and for the members a period of three years, would be appropriate as a general rule. Provision should be made for extending these periods and we are inclined to think that, with a view to maintaining continuity of experience, arrangements should also be made for securing that only a certain proportion of the vacancies should occur at any one time.

COMMITTEES OF THE COUNCIL.

54. In ordinary circumstances, we do not consider that it will be necessary for the Council to meet more than twice yearly. In view of the great distances in India, more frequent meetings would involve an undesirable degree of interference with the ordinary duties of the great majority of its members. It would be necessary to make provision for the conduct of business between meetings and we are of opinion that this can best be done by a provision in the legislation constituting the Council permitting the Council, with the previous sanction of the Governor General in Council, to make rules, *inter alia*, for the appointment of a Standing Finance Committee* from amongst its members and the delegation to it of any powers exercisable by the Council. Subject to such restrictions as might at any time be imposed by the Council, this committee would exercise all the powers of the Council in regard to the control and disposal of its funds and also such other powers as might be delegated to it by the Council. The Chairman of the Council would be *ex-officio* chairman of this committee and the two whole-time members of the Council should be members of it. Beyond this, the only suggestion we would make is that, as a very important function of the committee will be to deal with applications for grants for research institutions, no member of the Council directly connected with any research institution should be a member of it.

* Mr. Kamat considers that, in a scheme for a fund of this nature, it is desirable that, in the legislation constituting the Council of Agricultural Research, provision should be made ensuring an adequate representation on the Standing Finance Committee of the non-official element which may include one of the nominees of the Government of India on behalf of the Indian Legislature.

The Council will undoubtedly find it advisable to do much of its work, other than that connected with financial matters, through sub-committees. These should have power to co-opt members from outside the Council to assist them in dealing with special questions.

THE HEADQUARTERS OF THE COUNCIL.

55. The question of a suitable headquarters for the Council presents some difficulty. The choice of Pusa would be open to the objection that it is difficult of access, and the excellence of its library would not compensate for this drawback. It is further undesirable that the headquarters of the Council should be at a station in which there is a research institute whether Imperial or provincial. In these circumstances, we consider that the most suitable headquarters for the Council would be those of the Government of India, *viz.*, Delhi and Simla.

FLEXIBILITY OF THE CONSTITUTION PROPOSED FOR THE COUNCIL.

56. The scheme we have put forward above has, we think, the advantage that it could, if necessary, be adapted to any changes in the Constitution in respect of agriculture and allied subjects which may follow on the recommendations of the Statutory Commission. The possibility of establishing a Development Commission for India on the lines of that established for Great Britain under the provisions of the Development and Road Improvement Funds Acts of 1909 and 1910 has naturally occurred to us. That Commission consists of eight members, appointed by Royal Warrant, of whom two are in receipt of salaries. A total sum of £4,540,000 has, up to date, been provided for purposes of development. Grants for this fund are made by the Treasury on the advice of the Development Commission which, in effect, controls the administration of the Fund as no grants can be made without its sanction. The Commission occupies a position distinct from government departments in the sense that it is free to report without reference to a Minister, that its recommendations are not subject to confirmation by parliament and that its status and procedure are laid down by statute. The purposes to which the Development Fund can be devoted are as follows :—"Aiding and developing agriculture and rural industries by promoting scientific research, instruction and experiments in the science, methods and practice of agriculture (including the provision of farm institutes), the organisation of co-operation, instruction in marketing produce and the extension of the provision of small holdings and by the adoption of any other means which appear calculated to develop agriculture and rural industries." It will be seen that the scope of the British Development Commission is much wider than that we have proposed for the Council of Research. The establishment of a similar Commission for India under the purview of which would come large schemes for development generally and not only those for an extension of agricultural research, would, we have no doubt, have a far reaching effect on agricultural progress in this country. The idea is an attractive one but the limitations imposed by the existing Constitution are such as, in our view, rule any proposal of this kind out of consideration in present conditions. If conditions alter, the frame work

of a Development Commission will be found in the Council of Agricultural Research we have proposed, which could be expanded without difficulty to include not only agriculture in all its aspects but also all activities which have any bearing on ruralprogress*.

PROVINCIAL COMMITTEES.

57. It is our hope that the Council of Agricultural Research will be brought into close touch with the provincial governments and departments of agriculture through its Chairman and whole-time members and that, in the altered conditions, their visits to the provinces will be welcomed. Even this and the provincial representation on the Council we have proposed above will not, in our view, provide sufficient contact between the Council and the provincial departments and we, therefore, suggest that a committee should be established in each major province which would work in close co-operation with the Council. Here again, we would suggest no rigid composition for such provincial committees and would prefer to leave their constitution to the discretion of provincial governments. We would, however, suggest that the Director of Agriculture and the Director of Veterinary Services should invariably be members, as should also the principals of the agricultural and veterinary colleges where these exist in a province, that there should be in addition at least one scientific expert from the staff of the agricultural and veterinary colleges or departments, one representative of pure science from the provincial university or universities and one or more non-official members. The selection and appointment of the chairman should rest with the provincial Government. The exact functions of the provincial committees can best be determined after the Council of Agricultural Research has been constituted but amongst its duties would be the preparation of programmes of research to be laid before the Council of Agricultural Research and a report on any application from any association or persons within the province for a grant from the Council. These functions, in the case of Pusa, would be discharged

* SIR THOMAS MIDDLETON and DR. HYDER are of opinion that the administrative duties arising out of the allocation of grants from the Research Fund should be separated from the other functions proposed for the Imperial Research Council. They recommend that two independent, but closely associated, bodies should be created :—

(1) A Council charged with the duty of promoting scientific enquiry and providing scientific guidance ;

(2) A Board charged with the examination of applications for grants from the Research Fund and with the detailed arrangements necessary to ensure the effective use of money granted to promote research.

The constitution of the Imperial Agricultural Research Council should follow generally the lines indicated in the Report ; but each major province should be entitled to send to the Council one officer engaged in scientific investigation, in addition to administrative officers ; and there should be five, in place of three university representatives, so that close touch may be established, and maintained, between scientific workers in universities and those in government research stations.

The Imperial Agricultural Research Board should consist of the three whole-time official members referred to in the Report, and of four members elected by, and representing, the Council. The choice of the Council in selecting representatives should be unfettered ; but it would be desirable that a majority of those elected should represent Indian unofficial opinion, and that there should be on the Board not less than two scientific men representing Indian universities.

The Chairman of the Board should be the Chairman of the Council. Both bodies should be authorised to set up such committees as they may require.

by the Pusa Council. We would suggest that, where a problem is of interest to more than one province, joint meetings of the provincial research committees of the provinces concerned might be arranged.

THE AGRICULTURAL ADVISER TO THE GOVERNMENT OF INDIA.

58. The scheme we have outlined above leaves no place for the Agricultural Adviser to the Government of India. The duties of that appointment at present fall under two main heads, advisory and administrative. The Agricultural Adviser, as his designation implies, advises the Government of India on all matters of agricultural policy and acts in a similar capacity to provincial governments when he is called upon to do so. He is, as we have seen, in administrative control of Pusa, the Institute of Animal Husbandry and Nutrition at Bangalore, the cattle breeding and dairy farms at Karnal, Bangalore, and Wellington, the creamery at Anand, the Sugarcane Breeding Station at Coimbatore, and the Imperial Institute of Veterinary Research at Muktesar and its branch at Izatnagar near Bareilly in the United Provinces. In the administrative charge of Pusa, he has the assistance of a senior member of the staff as Joint Director. He is also *ex-officio* Chairman of the Indian Central Cotton Committee. Under the scheme we have put forward, his advisory duties would be transferred to the Chairman and the two whole-time members of the Council of Research, whilst the small but by no means unimportant part of his work which is connected with agricultural publications would be taken over by the Council. His administrative duties except in regard to the Imperial Institute of Veterinary Research at Muktesar, for which in our chapter on Diseases of Livestock and their control we propose parallel arrangements, should, we consider, be transferred to a whole-time Director of Pusa. That the administrative work connected with Pusa is sufficient to justify a whole-time appointment has already been recognised by the creation of an appointment of Director which has, however, remained unfilled pending the provision of funds. We consider that the Director of the Pusa Institute should also be in charge of the sub-stations now under the control of the Agricultural Adviser as it is very desirable that the agricultural activities in which the Government of India are directly concerned should be linked in this way. The chairmanship of the Indian Central Cotton Committee and of any other crop committees which may hereafter be formed should, in our view, be taken over by the Chairman of the Council of Agricultural Research. With the establishment of that Council, therefore, the post of Agricultural Adviser to the Government of India would be abolished.

THE POSITION OF PUSA AND THE QUALIFICATIONS OF THE DIRECTOR.

59. We have already stated that, in our view, there can be no question, in present conditions, of the subordination in any way of the provincial research institutions to Pusa. But whilst Pusa, relative to other research institutes in India, will be no more than *primus inter pares*, we contemplate that it should, as the research institute which is engaged on fundamental problems of all-India importance, be the institution which sets the standard for all agricultural research work throughout India. We wish to restore to it that prestige in the world

of scientific research in agriculture which it once enjoyed but which the evidence we received shows that it has unfortunately lost. For the proper discharge of its functions in this respect, a staff of the highest calibre will be required. The personality of the Director of the institute is, therefore, a matter of very great importance. The qualifications required are administrative ability, scientific eminence and knowledge of Indian conditions but, here again, we consider it unlikely that these qualifications will be found in the same person and we are inclined to attach the greatest importance to (administrative ability) We deal with the question of the pay and other conditions attaching to the appointment in our chapter on The Agricultural Services, paragraph 564. In the same chapter, paragraphs 565 and 566, we make recommendations regarding the superior staff and class II appointments at Pusa.

PUSA AS AN EDUCATIONAL CENTRE.

60. It is essential that India should become self-contained in the matter of higher agricultural training at an early date. The interests of agricultural development in the country generally require that provision should be made for post-graduate study in all branches of agricultural science. There can be no question that, in existing conditions, the only institution in India ; in which facilities for such study can be provided is Pusa. In any event, financial considerations and the difficulty of recruiting the requisite staff makes it undesirable, in our view, that there should, at present, be more than one institute specialising in post-graduate training in agriculture in this country.

In our chapter on Education, we have stated our view that the completion with credit of an approved course of post-graduate study should be regarded as an essential qualification for admission to the new superior provincial agricultural services, whether for service in the districts or for research work in the agricultural colleges. We hope that candidates for these services will take this course at Pusa, but the organisation of Pusa as a centre of post-graduate study should in any case be proceeded with. The advice of the Council of Agricultural Research as to the lines on which the present facilities for post-graduate research at Pusa should be expanded should be taken as soon as possible after its constitution.

AFFILIATION OF PUSA TO A UNIVERSITY.

61. In this connection, we have considered the desirability of affiliating Pusa to a university. An alternative would be to constitute Pusa a separate university but it is most improbable that the number of students under training there will ever be sufficient to justify such a course. We do not think that affiliation to a university is called for. The question of the university to which affiliation should be made would present difficulties. Of the government agricultural colleges, Cawnpore and Mandalay are not at present affiliated to universities but, in both cases, affiliation appears likely to come about in the near future. The affiliation of the Agricultural Institute at Allahabad to the Allahabad University is under consideration, and the only other private college in India where agriculture is taught, the Khalsa College, Amritsar, is affiliated to the Lahore

University up to the Intermediate B.Sc. (Ag.) It follows, therefore, that the majority of the students at Pusa will be graduates of Indian universities. This being so, we consider that the most suitable link between Pusa and the universities would be an arrangement under which research work carried out at Pusa could be submitted as a thesis for the degree of M.Sc. or D.Sc. of the university of which the student was a graduate.

THE POSITION OF THE UNIVERSITIES IN REGARD TO AGRICULTURAL RESEARCH.

62. The position of the Indian universities in regard to agricultural research cannot be regarded as satisfactory. The Madras, Bombay, Nagpur and Lahore universities have faculties of agriculture. The Calcutta University has established a Chair of Agriculture and the University of Benares has now founded a similar Chair to which we make further reference in our chapter on Education, paragraph 463. But it does not appear that, at any Indian university, steps have been taken to bring agricultural research into close relationship with the other branches of science taught at the universities. Agricultural research is regarded as entirely a matter for the government agricultural colleges. It should not, in our view, be isolated in this way. In a country so large as India, in which the problems involving research in every direction which must be solved if the potentialities of agricultural production are to be realised are so numerous, it is plain that government institutions cannot cover the whole field. The importance of carrying out agricultural research in the closest touch with other branches of scientific research can hardly be exaggerated. The advantages of mutual intercourse between research workers in different fields have been demonstrated in many countries, and Indian universities and agricultural colleges can no longer afford to work in isolation. We look forward to a state of affairs in which the universities will not only initiate agricultural research but will also undertake schemes of research, the importance of which is brought to their notice by the agricultural departments. It will, we fear, be long before the universities are in a position to take over agricultural research to the extent to which it has been taken over by universities in western countries but this is the end which should be kept steadily in view and which both the universities and Government should endeavour to reach as speedily as possible. It is with a view to facilitating advance in this direction that we have provided for the representation of universities on the Council of Agricultural Research and on the provincial committees which will work in co-operation with it. We have also suggested that the Council of Agricultural Research should be in a position to make grants for research work in connection with agriculture carried out at the universities.

In the meantime, the universities can make a most valuable contribution to the advancement of agricultural research in India by raising the standard of their scientific teaching. It was clear from the evidence we received that the character of this teaching leaves much to be desired. In our chapter on Education, we have mentioned the large number of students attending even the residential universities and this and the

overcrowding of classes which inevitably results from it make the attainment of a high standard of individual instruction in any branch of science difficult. In such circumstances, the development of practical classes and the allotment of more time to laboratory work is much to be desired. While we do not suggest that a special agricultural bias should be given to such practical training, we would emphasise the value of the study of agricultural questions in the training of senior science students. We would, in this connection, again point to the example of Rothamsted, the eminence of which in the world of agricultural research is universally acknowledged but where previous agricultural knowledge is not regarded as an essential, or indeed as an important, qualification for appointment to the staff. It is for the Indian universities to turn out better botanists, better chemists and better biologists and the improvement most calculated to achieve this end is the provision of more adequate practical training in these branches of science. If this improvement is effected, those who benefit from it will have no difficulty in proceeding to specialisation in these subjects along agricultural lines.

THE PROVINCIAL RESEARCH INSTITUTES.

63. It has not been possible, in the discussion of the agricultural colleges in our chapter on Education, entirely to separate their educational functions from their activities in regard to research and the latter have, therefore, been indirectly touched upon in that chapter. Here we would explain that, in emphasising the position of Pusa as a centre for research work on problems affecting all India, we have had no desire to minimise the importance of the work to be done at the provincial research institutions. Our proposals for the constitution of a Council of Agricultural Research will have shown that this is very far from our intention. On the other hand, we wish to stress the desirability of securing the best men possible for such work and to express our earnest hope that the cessation of recruitment for the Indian Agricultural Service will not result in any lowering of the standard of research in the provincial institutions. We revert to this subject in our chapter on The Agricultural Services where the training, rates of pay and other conditions of service for research workers are discussed.

INTERNAL CO-ORDINATION AND CO-OPERATION IN RESEARCH INSTITUTES.

64. The co-ordination of the research work carried on in the various sections of a research institute is only a degree less important than that of co-ordinating the work of the institution as a whole with that of other research institutions. Work is apt to get into a groove. Barriers are apt to arise, especially when research institutions are located in remote places where the intellectual stimulus provided by intercourse with intelligent outside opinion, not necessarily of a scientific character, is absent. We hope that the Council of Agricultural Research will do much to further what may be described as internal co-ordination and co-operation, as well as external, but we think that more definite steps should be taken to secure this. Pusa already has a Council consisting of the heads of sections with the Agricultural Adviser to the Government of India in his capacity as Director of the Institute as chairman, but we are doubtful if the existence of this Council has in any way tended to bring the

branches of work carried on in the Institute closer together. The difficulty under discussion is certainly not special to Indian research institutions and we were much impressed by the arrangements which are made at Rothamsted with a view to overcoming it. Rothamsted, like Pusa, has a Staff Council consisting of the heads of sections with the Director as chairman but it also includes two members elected by the staff who are not heads of departments. The Staff Council meets once a month when it hears from the head of each department an account of his programme of work and discusses it with him. The whole of the staff together with any post-graduate and other workers at the Institute assembles twice a month, except in the holiday season, to hear from some one person an account of the work he has done and to discuss it. All the work of the station is thus brought under review before it is published. The laboratory assistants are also invited to attend when the subject interests them. The entire body of workers also meet daily; there are no formalities but every worker has the opportunity of meeting the others. All the junior members of the staff are expected to have a general acquaintance with the work of every department of the Institute, to be able to show scientific visitors round and to explain, in broad outlines, the investigations in progress. To facilitate acquisition of this knowledge, statements are drawn up periodically by the heads of the various departments and circulated among the staff; staff tours of the laboratories and fields are also arranged when suitable demonstrations are given. It is held that the result of these activities is that the work of the various departments tends to grow into one whole; much joint work is arranged and there is considerable discussion and interchange of views. We have described the system followed at Rothamsted in detail as it appears to us well calculated to secure the maximum of co-operation between the different sections of research institutions and we recommend the adoption of a somewhat similar system in all agricultural research institutions in this country.

CONSTITUTION OF CROP COMMITTEES.

65. In Chapter II, paragraph 30, we have described the constitution and functions of the Indian Central Cotton Committee and, in paragraph 41, we have stated our view that the constitution of a number of similar committees for other crops does not offer a solution of the problem of advancing agricultural research in India. This problem must, broadly speaking, be dealt with as a whole and not in sections. At the same time, if any particular trade feels that its interests are not sufficiently recognised by the proposals we have put forward in regard to research generally, we see no objection whatever to the constitution of an organisation on the lines of the Indian Central Cotton Committee to deal with its special problems provided that it is willing to tax itself for this purpose. As we have explained, the Indian Central Cotton Committee is financed by a cess of two annas per bale on all cotton used in mills in British India and exported from India. The only other products on which a similar cess is levied are tea and lac. A cess of six annas is levied on every hundred pounds of tea exported and the proceeds of this, which now amount to over Rs. 12 lakhs per annum, are made

over to the Indian Tea Cess Committee to be utilised in promoting the interests of the Indian tea industry. The money is spent mainly on advertisement and propaganda. A cess of four annas a *maund* on exports of lac and of two annas a *maund* on exports of lac refuse is also levied. The proceeds of this cess are administered by the Indian Lac Association for Research which was constituted in 1921. If any other trade is willing to submit to a similar cess for the purpose of promoting additional research on the product in which it is interested and, generally, of advancing the solution of all problems connected with the cultivation, marketing and manufacture of that product, it should be encouraged to do so, but such cesses should, in our view, be imposed only with the consent and at the instance of the trade.

To the general principle that the trade concerned should provide the funds required for any research on the product in which it is interested beyond that undertaken in the normal course by the agricultural departments, we would make one important exception. Jute is at present a monopoly of India but there is no guarantee that it will remain so. The danger that an artificial product may be discovered and placed on the market at a price which will enable it to replace jute has to be faced. The history of indigo is a striking illustration of the possibilities in this direction. The situation is one which demands constant watchfulness. For jute to retain its present position, it is necessary that every effort should be made to improve quality, outturn and methods of manufacture and to maintain the relative cheapness of jute as compared with other fibres. Unless this is done, there is an ever present risk that jute will cease to be cultivated and that a blow at the prosperity of Bengal will be struck from which it will take long to recover. In these circumstances, we consider it most desirable that a Jute Committee which would watch over the interests of all branches of the trade from the field to the factory should be formed. The constitution of such a committee should present no difficulty as it should be as easy to obtain as satisfactory a personnel for it, composed of representatives of the agricultural departments of the three provinces concerned, of growers, merchants and manufacturers as it has been for the Indian Central Cotton Committee. This is a matter in which the Government of India are very closely interested as they derive a large income from the export duties on raw and manufactured jute. These duties brought in a revenue of nearly four crores of rupees in 1926-27. In addition, there is a small cess of two annas a bale on raw jute and twelve annas per ton on manufactured jute, the proceeds of which go to the Calcutta Improvement Trust. In view of the fact that the export duty brings in so large a revenue to the Imperial Government which is, therefore, very directly interested in the prosperity of the jute industry, we consider that this is a case in which the expenditure on additional research and on the promotion of the interests of the trade generally should be met from central funds. Our recommendation thus is that a Central Jute Committee should be formed on the lines of the Indian Central Cotton Committee and that it should be financed by an annual grant of Rs. 5 lakhs. The necessary link between the research

work on jute and all-India research work would be provided by the appointment of the Chairman of the Council of Agricultural Research as Chairman of the Central Jute Committee.

ESTABLISHMENT OF OTHER CENTRAL RESEARCH INSTITUTIONS.

66. In paragraph 40 above, we have pointed out that Pusa is not an ideal site for a central research institution for all India. It is not surprising, therefore, that it has been urged before us that much of the work carried on there is of little or no value to the tropical regions of peninsular India or to the vast agricultural tracts of the north-west. It has been suggested that, in these circumstances, at least one other central research institution should be immediately established in peninsular India, preferably at Coimbatore, where work of all-India importance on such crops as rice, coconuts and groundnuts could be carried on. We are not in favour of such a course in present conditions. The first essential, in our view, is to bring the existing central institution in closer touch with provincial institutions and to infuse a new spirit into the whole organisation of agricultural research in India. When this has been done, it will be time enough to think of the establishment of additional central research institutions on any large scale. Financial considerations and the recruitment of the additional staff which would be required are questions the importance of which cannot be overlooked. It must be admitted that there are many fundamental problems, especially in relation to the crops grown in tropical India, for work on which Pusa is not a very suitable centre. It will be for the Council of Agricultural Research to determine how far the deficiencies of Pusa in this respect can be remedied by the establishment of small sub-stations and to what extent the funds which will be placed at its disposal for the advancement of agricultural research can suitably be utilised for this purpose.

THE BOARD OF AGRICULTURE.

67. The Board of Agriculture in India was constituted in 1904. It was intended that it should fulfil two functions. These were to advise Government on agricultural matters generally and to bring agricultural experts working in various parts of India into touch with each other. Until 1912, it met annually at Pusa, but, since then, the meetings have been held biennially, and alternately at Pusa and in a province. The membership of the Board has been enlarged from time to time. As at present constituted, it consists of 56 members. In addition to the Agricultural Adviser and the heads of sections at Pusa, it includes the directors of agriculture in the provinces, members of the expert staff of the provincial agricultural departments, the Director of the Imperial Institute of Veterinary Research and representatives of the provincial veterinary departments, the Secretary of the Indian Central Cotton Committee, the Director General of Commercial Intelligence, representatives of the Indian Tea Association and the United Planters Association of Southern India, and members of the agricultural departments of those Indian States which possess such departments. In addition, a limited number of non-officials are invited to attend as visitors. The functions of the Board as an advisory body to the Government of India and local

CHAPTER IV

AGRICULTURAL IMPROVEMENT

SCOPE OF THE CHAPTER.

69. Indian soils, local conditions and agricultural practices vary to an extraordinary degree. A brief description of the agricultural economy of the different provinces will be found in the introductions to the provincial volumes of evidence. It has not been possible in this Report to discuss in detail every variation in tillage and cropping as practised throughout India. We have, therefore, confined ourselves to those features of Indian agriculture which are more or less common to India as a whole or which are of substantial importance in particular tracts, and have framed recommendations accordingly. We propose in this chapter to deal with the various factors affecting crop production other than irrigation. Irrigation is of such importance that we discuss it in a separate chapter.

THE PRINCIPAL CROPS OF INDIA.

70. For the benefit of readers who may be unacquainted with Indian conditions, it may be explained that throughout northern India, the Central Provinces and the greater part of the Bombay Presidency, there are two well defined crop seasons, the rainy and the cold, yielding two distinct harvests, the autumn or *kharif* and the spring or *rabi*. In the south of the peninsula, the greater part of which gets the benefit of the north-east monsoon from October to January and in which extremes of temperature are absent, the distinction between the seasons tends to disappear and there are merely early and late sowings of the same crops. As a general statement, both in the north and south, the principal *kharif* crops are rice, *juar*, *bajra* and sesamum, to which should be added cotton for northern, jute for north-eastern, and groundnut and *ragi* for southern India. The principal *rabi* crops in northern India are wheat, gram, linseed, rape, mustard and barley; and in southern India, *juar*, rice, sesamum and gram. The season for cotton in the south of the peninsula varies with the type and the soil but it is throughout a much later crop than in other parts of India. Sugarcane is on the ground for at least ten months of the year. The total area sown with the principal crops in British India in 1925-26, the latest year for which statistics are available is shown below :—

	Acres (in 000's)		Acres (in 000's)
Rice ..	80,172	Linseed ..	2,524
Wheat ..	23,979	Sesamum ..	3,410
Barley ..	6,610	Rape and mustard ..	3,089
Juar ..	20,617	Groundnut ..	3,767
Bajra ..	12,269	Sugarcane ..	2,638
Gram ..	14,325	Cotton ..	18,186
Maize ..	5,504	Jute .	2,923
Ragi ..	3,881		

The area under fodder crops, *i.e.*, crops used exclusively for fodder in normal times, in 1925-26 was 8,932,000 acres.

Crops irrigated are, in the main, rice, wheat, barley, sugarcane and garden crops. One-fifth of the total area under crops was irrigated in 1925-26.

THE SOILS OF INDIA.

71. Nowhere in India does the traveller pass over the rapid succession of geological formations he may meet in the course of a journey across England. Several of the great geological series are but feebly represented; others are altogether absent. Again, the variations of rainfall from district to district in India are seldom sharply marked away from the northern mountains and the Western and Eastern Ghats. Over wide stretches of the country rocks and soils are subject to much the same amount of annual leaching by water.

The geological structure of the country and the character of the climate over wide areas thus combine to produce an appearance of uniformity in its soils. But this appearance is deceptive. Wherever, as in the presidencies of Madras and Bombay, a careful classification of soils from the agricultural point of view has been carried out, pronounced variations in quality have been detected not only in the uplands but in the plains.

In any particular area, these variations are usually associated with the depth of soil, and lateral changes are not rapid, but when subjected to the action of flowing water, the texture may vary widely even within the confines of the lands of one village. Where, as may often happen in the uplands, changes of composition occur in the gneisses, crystalline schists and traps forming the subsoil, these changes become evident in the chemical composition of the soil.

Reference to local soils will be found in the series of introductions which preface the evidence taken in the provinces. Here it will suffice if a very brief description is given of the predominant types of soil found associated with the main geological series of India. These are the red soils derived from the rocks of the archaean system, the black cotton or *regur* soils which are usually associated with the middle period traps of the Deccan but are also found in Madras where they overlie, and are derived from, certain types of rocks occurring in the archaean system, the recent alluvium which is specially developed in the plains of northern India but of frequent occurrence elsewhere, and the lateritic soils which form a belt around the peninsula and extend through east Bengal into Assam and Burma.

THE "RED" SOILS OF THE CRYSTALLINE TRACT.

72. The crystalline and gneissic rocks of the archaean system cover the whole of peninsular India outside the areas described in subsequent paragraphs. These formations thus characterise almost the whole of Madras, Mysore and the south-east of Bombay and extend through the east of Hyderabad and the Central Provinces to Orissa, Chota Nagpur and the south of Bengal. Rocks of the same series are exposed throughout the whole of Bundelkhund and in north-western India appear as isolated outcrops extending

north of Baroda in the Aravallis and Rajputana. Gneisses and crystalline rocks also occur along the whole length of the Himalayas and a fairly broad zone of rocks similar to the gneisses of the peninsula is found in Assam and extends through Burma from north to south. Many of these gneisses and schists contain a large proportion of biotite and hornblende and, as they are highly ferruginous, the soils derived from them are deep red, brown and even black in colour. Crystalline limestones and dolomites belonging to the series are found in the Central Provinces and other localities in the peninsula.

The wide variations in the characteristics of the rocks included in the archaean system give rise to corresponding differences in the soils derived from them. These soils also differ greatly in consistency, depth and fertility; in general, they vary by intermediate stages from the poor, thin, gravelly and light coloured soils of the uplands to the rich, deep, darker-coloured, fertile soils of the lower levels. Where the depth of soil is favourable, irrigation, either by wells or canals, can be applied advantageously. As a rule, soils of this class are deficient in nitrogen, phosphoric acid and humus but potash and lime are generally sufficient.

THE BLACK COTTON OR REGUR SOILS.

73. The type of soil known as black cotton soil or *regur* covers practically the whole of the Deccan trap and large areas in the Bellary, Kurnool, Cuddapah, Coimbatore and Tinnevelly districts of Madras. It constitutes the second great division of the soil types of India and is itself divisible into two groups.

The Deccan trap extends over about 200,000 square miles and covers the greater portion of the Bombay Presidency, the whole of Berar and the western parts of the Central Provinces and Hyderabad. The soils throughout this area vary to an extraordinary extent in character and productivity. There are the thin and poor soils of the slopes and uplands of the lower trap hills which are moderately productive only in years with a well distributed monsoon. In the broken country, between the hills and the plains, occur deeper and dark-coloured soils which are constantly improved by washings from the higher levels. Finally, in undulating or sloping situations below the general level of the foot hills, is to be found the black cotton soil which varies in depth according to position and, where very deep, has often been accumulated by alluvial deposit. The alluvial areas of black cotton soil in the Surat and Broach districts of the Bombay Presidency, though outside the trap area, have been produced by deposit from rivers flowing through it.

The second group of black cotton soils, those of Madras, do not comprise one continuous whole as do those overlying the trap but are divided up into a number of large but clearly defined areas. A mineralogical analysis of the soils of these different areas discloses the fact that they are derived from the rocks with which they are intimately associated and this renders it possible readily to distinguish between them and also clearly to differentiate them from the soils of the trap area. They would appear to have been derived from ferruginous schists and gneisses by weathering under semi-arid conditions. The soils of the Madras division never attain the

depth of the soil associated with the trap area. Under them, at varying depth, is generally found a well marked bed of *kankar* which in turn overlies the partially weathered rock.

Although both the Madras and the Deccan soils are derived from the rocks of the geological systems with which they are associated, and therefore are of diverse origin, they possess many agricultural characteristics in common. *Regur* is a highly argillaceous, very finely grained, dark or black soil containing a high proportion of calcium and magnesium carbonates. It is very tenacious of moisture and extremely sticky when wet. It permits, however, of cultivation being carried out within a short period after heavy rainfall. The damp soil contracts markedly on drying, producing wide and deep fissures in the fields. The dark colour, often ascribed in the past to the presence of a considerable proportion of humus, appears to be due in reality to the large proportion of iron contained in the finest soil particles.* In soils derived from the trap, it is accentuated by the presence of titaniferous magnetite but this ingredient is not found to any appreciable extent in the Madras soils.

The suitability of black cotton soil for irrigation is a matter of controversy and appears to differ according to the composition of different varieties of this soil. Attempts at extensive irrigation of rice and other crops on the Hagari experimental farm near Bellary were not successful but this has not been the experience in Bombay and probably the two types of black cotton soil behave differently in this respect. Phosphoric acid, nitrogen and organic matter are generally deficient but potash and lime are not.

THE ALLUVIAL SOILS.

74. The alluvial tracts of India are not only the most extensive but also agriculturally the most important. A strip of these soils, of varying width, extends along the coasts of the peninsula. Much of this is lateritic in origin and will be referred to in the succeeding paragraph, but extensive areas are found at the mouths and along the courses of the great rivers, the Godavari, the Kistna and the Cauvery. These deposits naturally partake of the characteristics of the soils found in the drainage areas of the rivers, but, in all cases, they consist of level tracts of heavy rich loams producing, under irrigation, excellent crops of rice, sugarcane, etc. They are deficient in phosphoric acid, nitrogen and humus, but potash and lime are usually present in sufficient quantity.

Large areas of alluvial soil are also to be found in Burma but the most extensive alluvial tract in India is that which forms the vast Indo-Gangetic plain and comprises the greater part of Sind, northern Rajputana, the greater part of the Punjab, the United Provinces, Bihar and Bengal and half of Assam. The area of this tract is 300,000 square miles and its width varies from 300 miles in the west to less than 90 miles in the east. The maximum thickness of the deposits has never been ascertained but the few borings which have been made show that the depth exceeds 1,600 feet below the ground surface. The soils of the tract are derived mainly from the Himalayas.

* *Memoirs of the Department of Agriculture in India*, Chemical Series, Vol. I, No IX, and Vol. II, No. V.

The plains of northern India present a monotonous uniformity to the eye but their soils differ according to their local origin and vary in consistency from drift sand, through loams and fine silts, to clays so stiff that drainage is entirely prevented and injurious salts of soda and magnesia accumulate, reducing the soil to the sterile condition so well known under the names of *usar*, *reh* and *kallar*. The subsoils are not uniform in texture but consist of well-defined layers varying from pure sand to heavy clay, and it would appear probable that the great variations in fertility which are encountered, especially in the east where the rainfall is heaviest, are not so much due to differences in the surface soil as to the effect of the immediate subsoil layers on drainage and the retention of moisture. The soils of this tract present a wide field for investigation by the physical chemist and the physicist.

Alluvial soils can, as a rule, be irrigated with great advantage and, with a moderate and well distributed rainfall, are capable of growing a wide variety of crops as the depth of the soil secures great fertility. (The amounts of nitrogen and organic matter in these soils vary but are usually low. Potash is adequate and phosphoric acid, though not plentiful, is generally less deficient than in other Indian soils. The lime content shows an extraordinary variation.) The soils of the Tirhut district of Bihar, for example, often contain over thirty per cent of carbonate of lime in sharp contrast to the soils in adjacent districts which are almost devoid of lime. Generally the amount present can be considered sufficient.

THE LATERITE SOILS.

75. A rock peculiar to India and a few other countries is that known as laterite. This is found as a cap on the summits of the basaltic hills and plateaus of Central India and along the Eastern and Western Ghats of the peninsula. It is also found in Assam and Burma. The mechanical weathering of this rock gives rise to extensive areas not only of sedentary but also of alluvial soils which, owing to their character and composition and the peculiar agricultural problems associated with them, must be placed in a category different from the other alluvial soils of India.

Laterite is a porous clayey rock composed essentially of a mixture of the hydrated oxides of iron and aluminium. Geologists attribute its formation to the action of sub-aerial weathering agencies on the underlying rock which are either basalts or gneisses. The tracts in which it occurs are characterised by warm humid conditions and heavy rainfall. In such conditions, the weathering process is carried to an extreme limit with the result that the rock contains an exceedingly small proportion of those minerals usually associated with the supply of plant food materials in soils. Laterite rocks and the soils derived from them are thus markedly poor in silicates of the alkalies and alkaline earths.

The laterite soils show wide divergences in character. Those found on the higher levels and, presumably, formed *in situ* are exceedingly thin and gravelly with little power to retain moisture. Their agricultural value is, therefore, small. The soils of the valleys and lower levels, on the other hand, are dark-coloured heavy loams and clays which readily retain moisture and are capable of producing quite good crops. As a general rule, the potash, phosphoric acid and lime content of laterite soils is

deficient but humus is present in quantities decidedly higher than in most other Indian soils. The ferruginous clays of the Nilgiris and the other planting districts of south India, Bengal and Assam are generally placed in this category. The almost total absence of lime and magnesium from laterite soils and the character of the soil matrix constitute their great peculiarity and give them their marked acid reaction. The main agricultural problem of these soils, apart from the ordinary manurial ones, centres around the correction or amelioration of this acidity. Considerable attention is being directed to it by the agricultural departments of Bengal, Assam and Burma and the scientific staffs of the planters' associations. It is unfortunate that the absence of lime deposits in the near vicinity of the laterite areas renders the application of the obvious methods of amelioration very difficult.

Soil surveys.

76. Sufficient has been said to show the extent to which the soils of India vary in agricultural quality, and, were the personnel and the funds available, a soil survey would be desirable with the view of classifying and mapping these soils by modern methods. A soil survey of the whole of India on the lines of the soil survey now in progress in the United States of America would, however, be a gigantic enterprise, and we do not recommend that it should be undertaken at the present time. At a later period, when scientific knowledge is more widely diffused and when competent workers can be trained in India, the position may be reconsidered.

Meanwhile, the agricultural departments should confine their efforts to intensive studies of the more important types of soil found within their areas. Material for such studies already exists. In some provinces, a careful examination of soils for the purpose of assessing the land revenue has been carried out, and even where there has not been a field-to-field examination, a general description of the quality of soils has been included in most settlement reports. Much information regarding the chemical and mechanical analysis of the chief types of soil has been collected in most provinces in the course of the ordinary routine work of the agricultural departments. If this information were collated and published and a full description of the methods employed in collecting it were given for purposes of comparison, it would, in combination with the agricultural information already on record, furnish a basis not only for developments in general research work but also for devising schemes for the improvement of land by the use of appropriate fertilisers, and for mitigating the damage so frequently caused by the uneconomic use of irrigation water. A field survey of limited scope, followed by laboratory examination of the soils collected, has already been carried out for typical areas in several provinces, but only in a few instances have the results been published in an accessible form. The experience obtained has shown that the cost of even such a partial survey is considerable and that the cost of a complete soil survey would be prohibitive. Whilst, therefore, we recognise the usefulness of all such work, we recommend that it should only be undertaken either when there is some specific problem to be solved, or when laboratory examination of soils is called for to interpret, more fully, valuable information already placed on record

by the Settlement Department. We would suggest that the Council of Agricultural Research, the establishment of which we have recommended in Chapter III, should undertake the collation and publication of all the information in regard to the composition and characteristics of Indian soils which is available.

DETERIORATION OF SOIL.

77. The question has been much argued whether the soils of India are to-day undergoing a progressive decline in fertility. In discussing this problem, we propose to disregard those cases in which, for one cause or another, limited areas of land have been rendered unfit for cultivation by the formation of injurious salts. Nor are we here concerned with such damage as is brought about by the action of running water in either eroding the surface soil or burying it beneath deposits of sterile material. We leave out of account lands that have recently been cleared of forest growth, and on which the deep layers of decayed vegetation provide a natural accretion of nitrogen. Such land, when first cleared, is far richer in combined nitrogen than is land entirely dependent for the process of nitrogen recuperation upon biological and chemical action in the soil under the influence of sun and weather, and, unless freely manured, it must inevitably, and for many years in succession, show an annual drop in fertility as each season's crops are produced and harvested. Again, it is evident that where increased pressure of population upon the land forces the cultivator to till inferior soils, there will occur a decrease in the average outturn. This fact is no doubt often responsible for the belief that soils are becoming less fertile. Density of population may also lead to a diminution in the number of periodical fallows and a resulting increase in weeds, and to an increase in the area cultivated in relation to available supplies of manure, and so may give rise to soil deterioration. And it must not be forgotten that improvements to land, such as terracing, *bunding*, and the extension of irrigation may invalidate, for the purpose in question, a comparison between any two statements of crop outturn.

The point to which we have addressed ourselves is whether long-cultivated agricultural land is to-day suffering a growing diminution in its capacity to yield crops, as a consequence of the removal, year by year in the form of produce, of more of those substances essential to the growth and development of crops than is replaced by nature and by the practice of the cultivator.

We were already in possession of a memorandum prepared for us by the Director of Agriculture in Bombay. We communicated with local governments in all provinces from which it seemed likely that definite evidence on the question of deterioration could be obtained. In answer to our enquiry, we have been informed that, in Bombay, Bengal, and Burma, there is no evidence of any decline in the yield of staple crops, while the local governments of Madras, the United Provinces, and the Punjab tell us that the tendency in those provinces is towards a slight increase in outturn. The Government of Bihar and Orissa take the view that the available statistics are not sufficiently accurate to justify any definite conclusions being drawn from them.

So far as we have been able to ascertain, no evidence of progressive soil deterioration can be deduced from settlement reports, or from these in comparison with such earlier records as exist. Mr. W. H. Moreland, who, in his "India at the Death of Akbar," has set forth much of the available information bearing on crop production during the reign of that ruler, sums up the position in these words ". . . it is highly probable that the land which was already under regular cultivation at that period has, under similar conditions, given an approximately constant return, and clear, positive evidence would be needed to establish the fact that a decline has occurred over the bulk of the old-established cultivation."

The Agricultural Adviser to the Government of India told us in evidence that "most of the area under cultivation in India has been under cultivation for hundreds of years, and had reached its state of maximum impoverishment many years ago." The same witness, however, held the view that, in certain areas, there may be taking place a continuous reduction in the available phosphates, but we have received no definite evidence supporting this view. In this connection, it must be remembered that deficiency of combined nitrogen is the limiting factor throughout the greater part of India.

Such experimental data as are at our disposal support the view that, when land is cropped year by year, and when the crop is removed and no manure is added, a stabilised condition is reached; natural gains balance the plant food materials removed by crops and other losses and no appreciable changes are to be expected in the outturn of crops except those due to changing seasons, provided that the same system of cultivation is adhered to. While the paucity of records of crop outturn throughout India over any long period of time makes the matter impossible of exact proof, we are of opinion that the strong presumption is that an overwhelming proportion of the agricultural lands of India long ago reached the condition to which experimental data point. A balance has been established, and no further deterioration is likely to take place under existing conditions of cultivation.

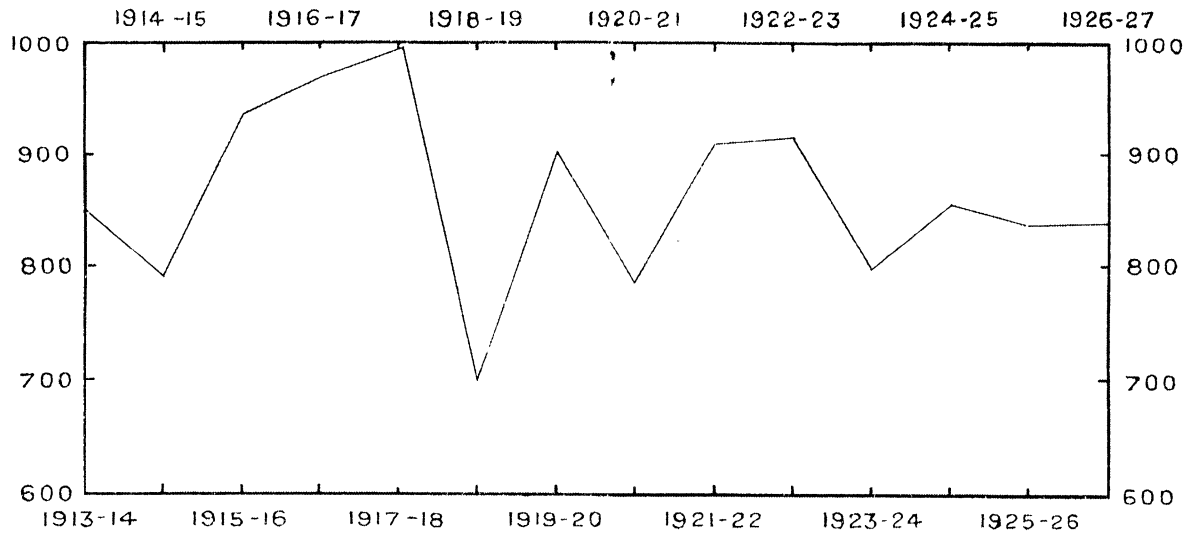
RESEARCH ON SOILS AND SOIL CONDITIONS.

78. The study of local soil types and local soil conditions, which was the first work undertaken by the agricultural chemists appointed to the agricultural departments when they were reorganised in 1905, was an essential preliminary to the initiation of research into local problems. Much of the research work arising out of these studies has proved of interest and importance to India as a whole. That it has not been greater in volume has been due to the fact that the time and energies of the scientific officers engaged in it have been largely occupied in the collection of data, in carrying out routine analytical work, in training assistants and in educational work. The desirability of appointing specialist officers for work on specific problems is becoming more and more realised and this development will no doubt lead to an increased output of research work of general importance.

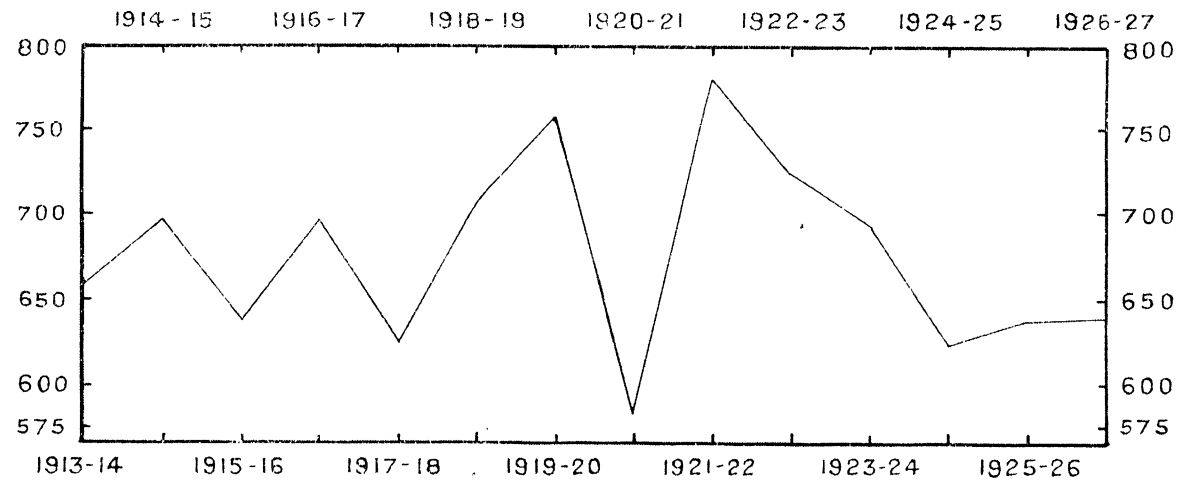
It was not long before the work of the agricultural chemists established that Indian soils, generally, are seriously deficient in plant food materials

AVERAGE YIELD IN POUNDS PER ACRE

RICE (CLEANED)



WHEAT



* Yield per acre for All India including Indian States

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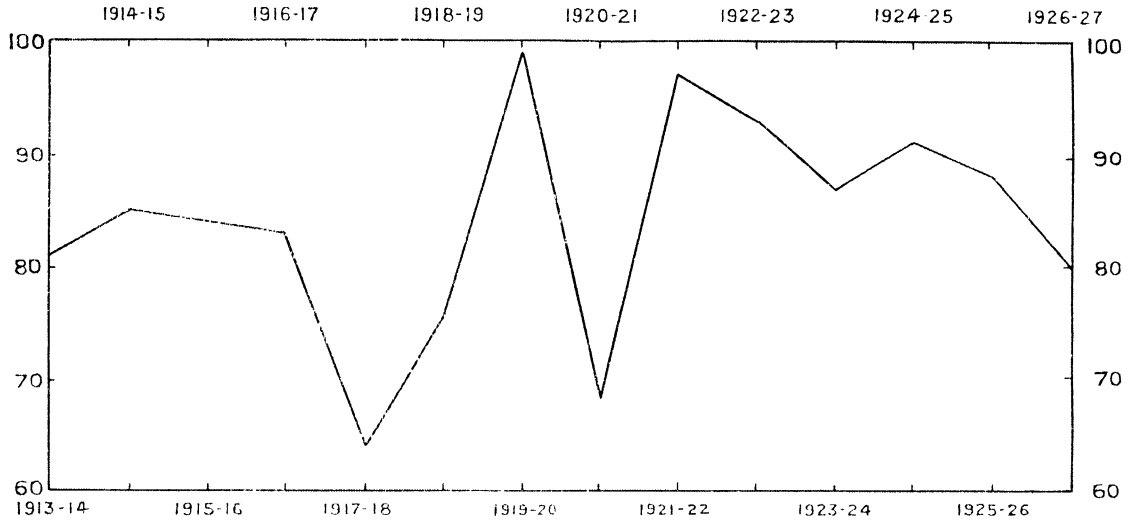
AVERAGE YIELD IN POUNDS PER ACRE *

COTTON (GINNED.)



JUTE

* Yield per acre for All India including Indian States.

To face page 76 (2)

and their attention was thus attracted to the manurial problems to which this deficiency gives rise. Many of these problems were of local interest but that of nitrogen deficiency was found to be common to all provinces. The work done at Pusa and Cawnpore demonstrated the very considerable loss of nitrates by drainage during periods of heavy rainfall, and the deductions drawn from the records of the drain gauges maintained there were amply confirmed by quantitative estimates made in the field under very varied conditions of cultivation, cropping, manuring and rainfall. For several well defined tracts, it is now possible to state the conditions which must be satisfied if the loss due to this and other causes is to be reduced to a minimum, but further research is necessary before generalisations applicable to India as a whole can be formulated. The work of recent investigators at Pusa and Nagpur points to the conclusion that the gains and losses of nitrates from Indian soils may be very much greater than those occurring in temperate climates. At Pusa, for example, losses of 60 to 150 lbs. of nitric nitrogen per acre per annum may occur on cultivated fallow land, the actual loss varying with the soil and character of the monsoon. At Nagpur, a loss of as much as 160 lbs. of nitric nitrogen per acre per annum has been recorded from unirrigated black cotton soil. In comparison with the quantities lost through drainage and denitrification, the amounts of nitrate removed from soils by most crops are very small.

(Although but little of the nitrogen removed is returned to the soil in the form of manure, there is no definite evidence that the cropping values of Indian soils are diminishing. That they are maintained at a low but stable level of fertility as a result of the large annual increments of nitrogen which accrue from natural recuperative processes in the soil has been established by work done in all provinces, and quantitative estimates of these increments have been made in Bombay, the Central Provinces and the Punjab. It has also been established that these increments vary widely owing to the operation of causes which have not as yet been clearly defined. Further research in this direction is urgently required to determine with greater precision the causes involved and to enable practical measures for accelerating the natural recuperative processes under varying conditions of soil and rainfall to be devised. Many phases of the problem are of a biological character but the lack of suitably trained research workers has prevented the biological aspect from receiving the attention it deserves. In particular, little work has hitherto been done on the recuperative processes in the extensive areas in which rice is grown under swamp conditions and in which the agricultural conditions and practices differ in a very marked degree from those obtaining in the rest of India.)

The low humus content of Indian soils is, to some extent, due to the fact that organic manures are so little used. Its primary cause is, however, the very rapid decomposition of the organic matter in the soil which takes place in tropical and sub-tropical conditions and which makes it difficult to maintain a sufficiently high proportion of humus. The experiments with various forms of organic manures which have been carried out by the agricultural departments have shown that the amount

of humus present in the soil can be materially increased, though not to the extent possible in temperate climates. Quantitative measurements have, however, seldom been made and, in general, the experimental procedure followed has not departed from stereotyped methods. There is thus considerable scope for investigation into the factors which govern the rate and the character of the decomposition of organic manures in Indian soils in order to determine the conditions in which they can be utilised to the greatest advantage. In paragraphs 83 and 84, we emphasise the importance of investigations into the economic production of bulky organic manures, including poudrette.

Most of the problems connected with the lateritic soils of India and Burma are of local and restricted interest but that which arises from their deficiency in lime and their consequent acid character is one of outstanding general importance. Much research has been directed towards the discovery of means for ameliorating soils of this character by such methods as the application of lime and wood ash in varying cultural conditions. Where the humus content is low, the nature of the acid substances in lateritic soils has not been ascertained, but there is some evidence that their toxicity may be related to the presence of soluble or colloidal aluminium compounds. In some instances, similar iron compounds have also come under suspicion. These are problems which require further study. They are often rendered still more complicated by the marked deficiency of potash which is found in certain lateritic soils. Where there is a deficiency of potash, a closer study is required, on the one hand, of the extent to which the methods of amelioration employed succeed in modifying the supply of potash available in the soil and, on the other, of the action of special potash manuring on the acidity and toxicity of the soil. (A connection between potash deficiency and the prevalence of crop diseases and pests has been observed in a few instances, and the possibility that a general relation between the two may exist requires to be kept in view.)

(As already mentioned, the soil conditions existing in the tracts in which rice is grown in swamp areas possess characteristics which mark them off from those of other Indian soils. Some work has been done on the aeration of the roots of the rice plant, on the utility and functions of green manures in relation to the rice crop and on certain aspects of soil biological factors. Little is, however, known not only about the recuperative processes in such soils but also about the effects of varying rates of drainage, the most suitable methods of manuring the crop with special reference to the supply of nitrogen, and the action of varying cultural conditions upon soil conditions both in the cropping season and when the crop is off the ground. In general, it may be said that the whole position is very obscure and that, if substantial advance is to be made in the cultivation of one of the most important food crops in India, far more research work on the soils and soil conditions in which rice is grown is required.)

We have indicated in general terms the lines on which we consider it eminently desirable that research work on soils and soil conditions should be carried out in the immediate future. The problems are so numerous and so complex that rapid and uninterrupted progress cannot be expected

unless the staff of research workers is largely increased. The work so far accomplished shows that the time has come when the assistance of specialist officers can be usefully called in, more especially in the direction of bacteriological, physical and biological research. The agricultural departments of the Central Provinces, Madras and the Punjab already have agricultural bacteriologists and we are glad to note that a soil physicist has been added to the cadre of the Bombay Agricultural Department and that it is proposed to create a similar appointment in the Punjab in the near future. Sanction has also been obtained for the appointment of a soil physicist in Madras. Physical chemists will find a wide field for the utilisation of their special knowledge in the study of the factors governing drainage, the movement of soil moisture, the control of the physical characteristics of the soil and the problems of acidity and base exchange. That the universities can assist in the study of such problems is illustrated by the work that is being done by the Department of Physical Chemistry in the University of Calcutta. The appointment of specialist officers in the agricultural departments would also advance the solution of the soil problems specifically arising out of irrigation. Bacteriologists and biological chemists are also required if full and accurate knowledge is to be gained of the factors which dominate soil recuperation, the conservation of manurial constituents and the determination of the optimum conditions of plant nutrition in tropical conditions. We do not consider it advisable to make detailed recommendations regarding the expansion of the staff required for work on the problems the nature of which we have indicated above. Such expansion must depend on the extent to which funds are available and trained workers are forthcoming. There is, in our view, no direction in which the Council of Agricultural Research, should be able to render greater service than in the promoting, guidance and co-ordination of research work on soils and soil conditions. It is to that body that provincial governments should turn for advice regarding the appointment of specialist officers to undertake it.

SOIL EROSION.

79. Before passing on to consider the extent to which soil deficiencies can be rectified by the application of natural or artificial fertilisers, mention should be made of the very definite instances of soil deterioration which arises from the erosion of the surface soil by flood water. This problem is of special importance in the submontane districts of northern India generally, and particularly in the United Provinces and in western Bengal, where extensive areas on the banks of the large rivers, such as the Jumna and the Chambal, have lost all agricultural value by the formation of a network of ravines. Fluvial action is not the only cause of soil erosion. The action of the monsoon rains on the sloping hillsides in upland tracts in peninsular India, more especially in the southern districts of the Bombay Presidency and in Chota Nagpur, produces the same result though not in such striking degree. In the United Provinces, the main remedy for soil erosion has been sought in the afforestation of the ravine tracts. Experiments in this direction are being carried out and some twenty square miles are being converted into forests which not only prevent

further erosion but also serve as fuel and fodder reserves for the adjacent villages. Although it has yet to be established that the afforestation work will prove directly profitable, the success which has so far been achieved is sufficient, in our view, to justify its rapid expansion. In Bombay, the measures adopted to prevent soil erosion are the terracing of land and the construction of earth and stone embankments (*tals*). In the past, these were left entirely to the individual cultivator who had to rely on his own resources to find the best site for the construction of the embankment or the correct way in which to align it. The result was that he frequently selected a site which involved him in the construction of unnecessary earthwork and also endangered the safety of the embankment in seasons of abnormal rainfall. Advice on these matters is now given in those tracts of the Bombay Presidency which are liable to scarcity by the staff of the superintending engineer on special duty to investigate natural resources for the protection of lands from famine and, outside those tracts, by two subordinate officers working under his orders. This represents a distinct advance but we are of opinion that the question is not one in regard to which it should be left to the cultivator to seek advice. It is desirable that the exact extent of the evil should be investigated and that, if the scale on which erosion is proceeding is found to justify such a course, schemes for preventing it should be prepared. The manner in which such schemes should be financed, whether by co-operative effort or by loans to individual cultivators under the Land Improvement Loans Act, would also require examination. In western Bengal, where no steps have yet been taken to deal with the problem presented by erosion, and in the submontane districts of the Punjab where the measures adopted have not achieved much success, we would suggest that the feasibility of combining the methods adopted in the United Provinces and Bombay should be investigated. The methods employed in Bombay would also appear specially applicable to Chota Nagpur.

FERTILISERS.

80. Of the principal plant-food materials in which the soils of India are deficient, by far the most important (except in parts of the crystalline tracts where the deficiency of phosphates may be more serious) is nitrogen, and the manurial problem in India is, in the main, one of nitrogen deficiency. India, as is well known, depends almost exclusively on the recuperative effects of natural processes in the soil to restore the combined nitrogen annually removed in the crops, for but little of this is returned to the soil in any other way. Much of the farmyard manure available is burnt as fuel whilst a large quantity of combined nitrogen is exported in the form of oil-seeds, food and other grains, and animal products such as hides and bones. This loss is in no way compensated by the importation of nitrogenous fertilisers, for 1925-26 was the first year in which the imports of sulphate of ammonia into this country, which amounted only to 4,724 tons, exceeded the exports and was also the first year in which the greater part of the production of this fertiliser by the Tata Iron and Steel Company at Jamshedpur and of the coal-fields of Bengal and Bihar and Orissa was consumed in India. In these

circumstances, it is fortunate that the recuperative processes in the soil are more pronounced in tropical and sub-tropical than in temperate regions. Although it has been stated in evidence before us that it has not been established that improved and higher yielding varieties of crops, more especially of wheat and sugarcane, take more from the soil than the varieties they replace, and that their cultivation on present lines will not, therefore, be followed by any loss of permanent fertility, we are of opinion that there is justification for the view that improved varieties of crops generally require, for their fullest development, more liberal manurial treatment than those ordinarily grown. The subject is one which requires careful study by the agricultural departments in India and should form an essential part of the investigations discussed in the following paragraph.

MANURIAL EXPERIMENTS.

81. An acceleration of the recuperative processes in the soil can be effected by improved agricultural methods, by adequate soil aeration, judicious rotations and the cultivation of green manure crops. The loss of combined nitrogen can also be partially made up by the application of natural and artificial manures. With certain definite exceptions, however, such as, for instance, sugarcane and the more valuable garden crops, it has yet to be determined for what conditions and for what crops artificial manures can be profitably used to stimulate crop production in India. In this connection, we have been impressed by the importance of research into the fundamental problems connected with losses in nitrogen and with nitrogen recuperation. We saw something of the work in this field which was being carried on at Pusa by Dr. Harrison and at Nagpur by Dr. Annett. Although, ever since the reorganisation of the agricultural departments in 1905, manurial experiments have engaged a large part of their time and energies and have been carried out on every agricultural station in India, it cannot be said that the agricultural experts are even yet in a position to give satisfactory advice to the cultivator in regard to the use of manures. A large amount of data has been collected but it has not been studied systematically or reduced to a form which would enable clear and definite conclusions to be drawn. The problem requires to be studied in three aspects, in relation, in the first instance, to the crops which are dependent solely on rainfall, in the second, to crops which are grown on irrigated land and, lastly, to the planters' crops and intensive cultivation such as that of sugarcane and garden crops. It is hardly necessary to point out that the use of nitrogenous or other artificial fertilisers is not profitable in all conditions. Where crop production is limited by a small rainfall, the annual additions of combined nitrogen to the soil as the result of natural processes may be sufficient to meet the needs of a crop the outturn of which is limited by the moisture available. It has, for example, been found in the Central Provinces that the application of fertilisers benefits dry crops, including unirrigated cotton, only in years when the rainfall is adequate and that, in particular, it does not benefit wheat which, in that province, is grown on rainfall only. The planting community, which has its own specialist officers, needs

no advice from the agricultural departments in regard to the economic use of manures. We would, however, take this opportunity of stressing the value of close touch between the community and the departments in regard to this and other agricultural matters. It is essential that the departments should be in a position to give the ordinary cultivator, both of irrigated and unirrigated crops, definite guidance on the point. The first step is the careful study of the existing material and the correlation of the results hitherto obtained. The second step is the formulation of a programme of experiment with the object of ascertaining, with all possible accuracy, the extent to which fertilisers can be used with profit. This programme should include the laying out of a short series of permanent manurial plots, on lines appropriate to conditions in India, on provincial experimental farms. Only by conducting manurial experiments over a number of years will it be possible to compile such records as would make a substantial contribution to the knowledge of the problems of manures and manuring under tropical and sub-tropical conditions about which little is yet known. The scientific value of continuous experiments depends on accurate methods of collection of all relevant data with a view to their subsequent correlation. All such schemes for manurial trials would ordinarily be drawn up by the Director of Agriculture in close consultation with the agricultural chemist and the deputy directors of agriculture under whose immediate supervision the experiments would be conducted. We wish especially to emphasise the importance of manurial experiments on unirrigated land as the cultivator of such land, who runs, with his very limited financial resources, the risk of losing his crop in an unfavourable season, stands most in need of guidance in this matter. The study of the available data and the formulation of an ordered programme to replace the present somewhat haphazard methods of dealing with the problem would, we think, provide sufficient work to justify an officer of the Agricultural Department being placed on special duty for a limited period, but we prefer to make no definite recommendations on this point and to leave it to the consideration of the local governments. Local conditions vary so greatly between province and province, especially in regard to unirrigated land, that it does not appear necessary to attach an officer to Pusa specially to assist the provinces in this investigation. The Council of Agricultural Research should be in a position to advise as to the manner in which the experiments can best be conducted so as to secure uniformity of method as far as possible and to render the results obtained in one province of some value to other provinces.

INTERNAL SOURCES OF SUPPLY AND THEIR DEVELOPMENT—
(*a*) FARMYARD MANURE.

82. The first question which arises, in considering the internal supplies of nitrogen available in India and the methods by which these can best be developed, is that of the use of farmyard manure as fuel. The view is generally held that it is the absence of a sufficient supply of firewood which, over large parts of India, compels the burning of cowdung as fuel. But it must be recognised that there is often a definite preference for this form of fuel, as its slow burning character is regarded as making

it specially suitable to the needs of the Indian house-wife. Thus we are informed that, in Burma, immigrant labourers from India persist in using cowdung as fuel, although an abundant supply of fire-wood is readily available. Our evidence does not suggest any alternative fuel for domestic purposes in districts where wood and coal are dear. In some tracts, cotton stalks, the dry stubble and stalks of *tur* (*Cajanus indicus*), the pith of jute and *sann* hemp and the megass of sugarcane, where the use of the McGlashan furnace leaves a surplus which is not required for boiling the juice, could be utilised for fuel to a far greater extent than they are at present. Fuel plantations, more especially irrigated plantations, the formation of which we discuss in Chapters VIII and X, can assist only in a very limited area. In our view, the agricultural departments have a difficult task to perform in attempting to promote the utilisation of farmyard manure for its proper purpose. Propaganda in this direction can only prove effective if an alternative fuel is suggested and if the cultivator can be sufficiently imbued with a sense of thrift to induce him to burn that which will probably seem, to him, a less satisfactory substance. There has been little advance in regard to the preservation of manure since Dr. Voelcker wrote his report on Indian agriculture in 1893. The practice of providing litter for cattle is rarely, if ever, adopted except on government farms. No efforts are made by the cultivator to preserve cattle urine. Manure pits are still seldom found in Indian villages. Where they do exist, no attempts are made to preserve the manurial value of the contents or to safeguard the public health by covering the material with earth.

(*b*) Composts.

83. While the task is difficult, there is no doubt that something can be done to promote the better preservation of such farmyard manure as is not diverted to consumption as fuel, by using it as a compost with village sweepings, leaves, and other decomposed vegetable matter. In this connection, we are impressed by the results achieved in the Gurgaon district of the Punjab, where many villages have, as a direct consequence of propaganda, adopted the practice of depositing in pits all village sweepings and refuse, along with a proportion of cowdung. The effects on crops to which such manure has been applied, and on the sanitation and general amenities of the villages, were most marked. There is no reason why efforts on similar lines should not be made in other parts of the country. The Indian cultivator has much to learn from the Chinese and the Japanese cultivator in regard to the manufacture of composts. Artificial fertilisers are used as little in China as they are in India; but there is no organic refuse of any kind in that country which does not find its way back to the fields as a fertiliser. Not only is all human waste carefully collected and utilised, but enormous quantities of compost are manufactured from the waste of cattle, horses, swine and poultry, combined with herbage, straw, and other similar waste. Garbage and sewage are both used as manure. The agricultural departments in India are fully alive to the necessity for instructing the cultivator in the better preservation of manure and the use of composts, but there is great scope for an extension of their activities

in this respect. For example, the possibilities of manufacturing synthetic farmyard manure from waste organic material on the lines worked out at Rothamsted deserve to be fully investigated. At Rothamsted, research was at first directed towards discovering artificial means whereby the decomposition of straw might be effected. Straw contains three essentials to plant growth, *viz.*, nitrogen, phosphate and potash. The work proved successful and a method was devised for treating large quantities of straw for the preparation of manure. Reagents were subsequently discovered, which were capable of bringing about the rapid rotting, not only of straw but also of other plant residues, and thus of producing a valuable organic manure at a moderate cost. Synthetic farmyard manure is being prepared by the departments of agriculture in Madras and the Central Provinces. The Agricultural Department in Bengal, following the valuable lead given by Rothamsted, has attempted the manufacture of artificial farmyard manure on a considerable scale. Cattle urine and washings from cattle sheds, mixed with bonemeal, have been used with immediate success. Weeds, various grasses, sugar-cane trash, refuse, straw, prickly-pear, etc., have all proved capable of breaking down into excellent material approximating more or less closely in appearance and in composition to that of cowdung. Experiments have also been made in Burma but have not so far proved successful. Valuable work on the preparation of composts from night soil and refuse and from cattle urine, weeds, etc., is being done by Dr. Fowler at Cawnpore. In Europe, work of this character has now emerged from the experimental stage and processes devised for dealing with various classes of materials are already on the market. In India, however, the departments concerned have still to devise and introduce a practical method which can be used with profit by the ordinary cultivator on his land.

The manurial value of earth obtained from the sites of abandoned villages is recognised in many parts of India. The quantities available are, however, negligible in relation to the manurial requirements of the country.

(c) Night soil.

84. Prejudice against the use of night soil has deterred the cultivator in India from utilising to the best advantage a valuable source of combined nitrogen. There is, however, evidence that this prejudice is weakening and that, where night soil is available in the form of poudrette, it is tending to disappear. From the point of view of public health, the use of poudrette is preferable to that of crude night soil and, given co-operation between agricultural departments and municipal authorities, there is hope that the manufacture of poudrette should prove profitable to municipalities and beneficial to the cultivators in their neighbourhood. The methods of converting night soil into poudrette adopted at Nasik and elsewhere in the Bombay Presidency have been highly successful and appear well worth study by other municipalities. The advantages of this system of dealing with night soil appear to us to justify a recommendation that the departments of local self-government in all provinces should bring them to the notice of all municipal authorities and should also take steps to

establish a centre at which members of the municipal sanitary staffs can receive a suitable training in this method of disposing of night soil. The agricultural departments should keep a watchful eye on all experiments in the conversion of night soil into manure and should themselves conduct such experiments. Where municipal authorities in any part of the country are in a position to supply it, the agricultural departments should assist them to find a market by arranging demonstrations of the value of night soil as manure on plots in the neighbourhood of the towns.

Another way in which night soil can be converted into a form in which its use is less obnoxious to the cultivator is by the adoption of the activated sludge process. This process reduces sewage, by the passage of air through it, to a product which can either be used as required in the form of effluent from the sewage tanks or dried and sent where there is a demand for it. The activated sludge process is suitable only for towns which have a sewage system. It is much more expensive than conversion into poudrette but has the advantage of conserving a larger percentage of nitrogen. Up to the present, this system has been adopted in India on any considerable scale only at Tatanagar. The possibility of selling the product at a price that would yield a fair return on the cost of manufacture must depend upon local circumstances. Each case must be decided upon its merits, after a careful survey of all the relevant factors, including the local market for the product. In estimating the cost of the necessary plant, due regard should be paid to the cost which would be involved in installing any alternative method of sewage disposal, and, if it should prove possible to place a valuable fertiliser at the disposal of the cultivators at a price they can afford to pay, without risk of imposing any additional net charge upon the local rate-payers, we think that it is in the public interest that such schemes should be adopted.

(*d*) LEGUMINOUS CROPS.

85. Another indigenous source of combined nitrogen to which increasing attention is now being paid by the agricultural departments in India, is leguminous crops and green manures. The value of leguminous crops in his rotation has always been recognised by the cultivator and the work before the agricultural departments in regard to these crops lies not so much in popularising the principle of their cultivation as in discovering the varieties of leguminous crops best suited to increase the soil fertility and in recommending such varieties to the cultivators. Recent research has drawn attention to the fact that such crops vary greatly in their power of fixing nitrogen in the soil and should not be regarded as of equal value. Moreover, it is only when the leguminous crop is grown for green manure that, in all cases, the soil gains in nitrogen. Mr. Howard instances gram as a crop which improves the soil and Java indigo as a crop which seriously depletes the supply of combined nitrogen.

(*e*) GREEN MANURES.

86. The agricultural departments in India have devoted much time and attention to work on green manure crops with a view to discovering the crops which can

best be used for green manure, the time at which they should be grown and the manner in which they should be applied. Their work has shown that *sann* hemp on the whole gives the best results and it would doubtless be more often grown for use as green manure were it not that it may exhaust so much of the moisture in the soil that, when it is ploughed in, there is not sufficient left both to decompose it and to enable a second crop to grow. Much experimental work is still, therefore, required to discover the green manure crops which can best be included in the cultivators' rotations. The economics of green manure crops from the point of view of the small cultivator also require to be worked out. The small cultivator is naturally hesitant about growing a crop which only indirectly brings him any financial advantage. With his slender resources, it is, indeed, not unreasonable for him to take the view that he cannot afford to sacrifice even a catch crop in this way and it is therefore not until the agricultural departments are in a position to demonstrate to him beyond a shadow of doubt the paying nature of green manure crops on small holdings that these departments will be justified in persuading the small cultivator to adopt them or that their advocacy of them will stand any chance of success. In the present state of knowledge, such crops would appear an expedient to be adopted by the larger landholder and, for the small cultivator, a leguminous crop in his rotation would seem to hold out better prospects of benefit.

The possibility of growing such crops as *dhaincha* and groundnut, the leaves of which can be used as green manure without interfering with the commercial value of the crop, is worth consideration. The use of groundnut in this way for green manure would furnish an additional reason for extending the area of this valuable crop. In the case of crops of a woody nature such as *sann* hemp, it must, however, be remembered that their utility as green manure for the succeeding *rabi* crops depends to a large extent on the presence of sufficient moisture in the soil to rot the dry stems and roots.

In Madras, the Punjab and the Central Provinces, the experiment has been made of encouraging the cultivation of green manure crops under irrigation by the remission of the charge for water from government sources of irrigation. The fact that the results have so far been disappointing may be due to a failure to accompany the remission with sufficient propaganda as to the advantages to be derived from the growing of these crops. We think that the continuance of the concession and its extension to other areas should be conditional on its being accompanied by an active campaign of propaganda, directed particularly to the larger landholder rather than the small cultivator. All areas where the concession is made should be kept under regular examination. If, after a period of five to ten years, it should appear that the concession given in regard to water charges has failed to achieve its main purpose, it should be rescinded.

87. The loss to India of a valuable source of combined nitrogen as the result of the export of so large a proportion of its production of oil-seeds was emphasised by many witnesses before us. The yield and exports of oil-seeds during the last fifteen years are shown in the following Table :—

(*f*) Oilcakes.

Totals by five year periods

—	Cotton seed	Ground-nut	Rape and Mustard	Lin-seed	Sesamum	Total of columns 2—6	Total of all oil-seeds
1	2	3	4	5	6	7	8
1910-11 to 1914-15							
Yield ('000 tons) ..	8,419	3,475	6,129	2,541	2,354	22,918	*
Exports ('000 tons) ..	1,125	1,035	1,149	1,983	494	5,786	6,832
Percentage of exports to yield ..	13	30	19	78	21	25	..
1915-16 to 1919-20							
Yield ('000 tons) ..	8,545	4,758	5,362	2,171	2,104	22,940	*
Exports ('000 tons) ..	387	567	495	1,283	166	2,898	3,408
Percentage of exports to yield ..	4½	12	9	59	8	12½	..
1920-21 to 1924-25							
Yield ('000 tons) ..	10,733	5,786	5,602	2,203	2,336	26,660	*
Exports ('000 tons) ..	686	1,240	1,181	1,376	119	4,602	5,116
Percentage of exports to yield ..	6½	21	21	62	5	17	..
Total of 15 years *1910-11 to 1924-25*							
Total yield ('000 tons)	27,697	14,019	17,093	6,915	6,794	72,518	*
Total exports ('000 tons) ..	2,198	2,842	2,825	4,642	779	15,286	15,356
Percentage of exports to yield ..	8	20	16½	67	11½	18	..

These figures indicate that, of the outturn of the seed of cotton, groundnut, rape and mustard, linseed and sesamum, the exports amount to an average of eighteen per cent and they suggest the loss which the soil of India suffers by the export of a valuable by-product on the assumption

* Complete data not available.

Note.—Approximately one-third of the yield of linseed, one-half of the yield of rape and mustard and one-sixth of the yield of sesamum is described as highly conjectural.

The figures for yield of cotton seed are not shown in the "Estimates of Area and Yield of Principal Crops in India". The figures shown above are based on the statistics of net exports and consumption of cleaned cotton (lint) on the assumption that the ratio of cotton seed to lint is 2 : 1.

that the whole of the nitrogen contained might be returned to the soil. Under existing practice, indeed, much of this material would probably be fed to cattle and subsequently dissipated as fuel. But it is not surprising that the view that an export tax on oil-seeds and oilcakes should be imposed in order to check exports and to bring oilcakes within the purchasing power of the cultivator has found much favour and even received the support of the Board of Agriculture in 1919 and of the majority of the Indian Taxation Enquiry Committee, but not that of the Indian Fiscal Commission. Some witnesses before us went further and urged the total prohibition of export. Whilst we fully recognise the advantages to Indian agriculture which would follow from a greatly extended use of certain oilcakes as a manure for the more valuable crops such as sugarcane, tobacco, cotton and tea, we cannot but feel that those who suggest the attainment of this object by the restriction or prohibition of exports have failed to realise the economic implications of their proposal. In the first place, it must be remembered that India has no monopoly of the world's supplies of oil-seeds and is not even the chief supplier of those seeds. The world's linseed market is controlled by the Argentine crop and the sesamum market by the Chinese crop. The competition of West Africa in the supply of edible oils is becoming increasingly serious. In these circumstances, it is an economic axiom that an export duty will be borne by the producer and that the cultivator will, therefore, receive a lower price for the oil-seeds exported. The acreage under oil-seeds in British India is still considerably below the pre-war figure and the tendency to replace oil-seeds by other crops which may be inferred from this would undoubtedly be greatly accentuated if any effective restrictions on export were imposed. The immediate fall in price, which would result from such restrictions, would tend to a reduction of area and consequently of outturn. Even if such a fall in prices were obtained by the method advocated, the gain to the cultivator *qua* consumer would be far more than counterbalanced by the disadvantage to the cultivator *qua* grower by the loss of the income he at present derives from his export market. In the second place, it may be argued that if the Indian oil-crushing industry were fully developed to deal with the present outturn of oil-seeds, then the area might remain at its present level and there would grow up a considerable export of oil, while the cake would remain to be used as a feeding stuff or manure. The market for oil in this country is, however, a very limited one and will remain so until India has reached a more advanced stage of industrial development. The oil-crushing industry would, therefore, have to depend mainly on the export market for the sale of its main product. The problem of cheap and efficient transport to the great industrial centres of the West presents almost insurmountable difficulties. Oil-crushers in India would find themselves in competition with a well established and highly efficient industry and there is little reason to believe that their costs of production or the quality of their product would enable them to compete successfully with that industry. In the third place, even if restriction on exports succeeded in reducing the

price of oilcakes, this would mean that a section of the agricultural community would be penalised for the benefit of another and much smaller section, for the growers of oil-seeds would probably not be those who would make the most use of the oilcakes.

A similar line of reasoning applies to oilcakes, the average exports of which from India for the five years ending 1925-26 were 165,600 tons against a negligible import. The oilcakes exported from India are a far less important factor in the world's supply than are the oil-seeds and, in these circumstances, the burden of the duty would be entirely borne by the producer, in this case the oil-crushing industry. There can, in our view, be little doubt that the effect of a duty on oilcakes, with or without a duty on oil-seeds, would be the curtailment of oil-crushing activities and a diminution in the available supply of oil-cakes, in other words, it would have effects entirely different from those desired by its advocates. It is not, therefore, by any restriction on trade that Indian agriculture is likely to reap greater advantages from the supply of combined nitrogen available in the large crops of oil-seeds she produces. The only methods by which these advantages can be secured are by the natural development of the oil-crushing industry coupled with great changes in cattle management and in the use of fuel. The question how far the development of the industry can be promoted by Government assistance in the matter of overcoming difficulties of transport and in the form of technological advice in regard to improved methods of manufacture and standardisation is one for the departments of industries rather than the departments of agriculture. An extension of the oil-crushing industry would undoubtedly tend to promote the welfare of Indian agriculture and we would commend the investigation of its possibilities to the earnest consideration of all local governments.

(g) Sulphate of ammonia.

88. The important potential sources of supply of combined nitrogen discussed in the preceding paragraphs are supplemented to a small though increasing extent by the sulphate of ammonia recovered as a by-product from coal at the Tata Iron and Steel Company's works at Jamshedpur and on the coal-fields of Bengal and Bihar and Orissa. There has been a very marked increase both in the consumption and production of this fertiliser in India in recent years. Of the 4,436 tons produced in 1919, all but 472 tons were exported and there were no imports. In 1925, of the estimated production of 14,771 tons, 6,395 tons were retained in India. With three exceptions, all the producers of sulphate of ammonia in India have joined the British Sulphate of Ammonia Federation which, through its Indian agents, is conducting active propaganda to promote the use of artificial fertilisers and has established a number of local agencies in agricultural areas in several provinces. The manner in which this source of supply is being developed is very satisfactory and it is still more satisfactory that a market for increasing quantities of the sulphate of ammonia produced in India is being found in the country. The importance of the price factor need hardly be stressed for though the present average price of Rs. 140 per ton free on

rail at Calcutta is much lower than that which prevailed immediately after the war, it is sufficiently high to preclude the application of sulphate of ammonia to any except the most valuable of the cultivators' crops such as sugarcane or garden crops.

(*h*) Artificial nitrogenous fertilisers.

89. A method of increasing the internal supplies of combined nitrogen in India, the adoption of which has received powerful support, is the establishment of synthetic processes for obtaining combined nitrogen from the air in forms suitable for use as fertilisers. The Indian Sugar Committee was of opinion that, from the point of view of the development of the sugar industry alone, the successful introduction of synthetic processes in India was a matter of the first importance. That committee recommended that the possibilities of utilising the hydro-electric schemes, which were at that time under investigation in the Punjab and the United Provinces, for the fixation of nitrogen should be thoroughly examined and that, if it were found that electric energy could be obtained at a rate approximating to Rs. 60 per kilowatt year, a unit plant of sufficient size to afford trustworthy information should be installed. Of the three processes in use for the fixation of atmospheric nitrogen, the arc process, the cyanamide process and the manufacture of ammonia by direct synthesis, the committee considered the cyanamide process as the one which offered the best prospects of success in India but drew attention to the possibilities of the Haber process for obtaining synthetic sulphate of ammonia.

The position has changed greatly since the report of the Sugar Committee was written. The full effects of the diversion of the capital, enterprise and, above all, the research devoted to the manufacture of munitions to the production of peace-time requirements had not been felt in 1920. Since then, it has resulted in a fall in the world's price of nitrogen by fifty per cent and there are prospects of still lower prices in the near future. We see no reason to question the view which was placed before us in the course of the evidence we took in London that, in present circumstances, only very large units with a minimum capacity of about 150,000 tons of pure nitrogen per annum can be expected to pay even under the most favourable conditions in Great Britain and on the Continent of Europe and that conditions in India make it much less likely that even a unit of that capacity would prove a paying proposition. The possibilities of manufacturing nitrogen from the air in India have already been exhaustively examined by a leading firm of chemical manufacturers in England which has decided against proceeding with the project. It is probable that no factory on a scale which could be contemplated by any local government, or even by the Imperial Government, would be in a position to produce synthetic nitrogenous fertilisers at a price less than that at which they can be imported. The whole object of establishing such a factory, that of producing fertilisers at a price which would place them within the reach of a far greater proportion of the agricultural community than is at present in a position to use them, would be defeated if a protective duty were imposed to enable its outturn

to compete against imported supplies. It is also to be hoped that should the demand for artificial fertilisers in India make it worth while, private enterprise will come forward to erect synthetic nitrogen works in this country. While the economics of the industry remain as they stand to-day, we are unable to recommend any further investigation into the subject under government auspices.

CENTRAL ORGANISATION FOR RESEARCH ON FERTILISERS.

90. The discussion of the question of nitrogenous fertilisers would not be complete without mention of the proposal placed before us by the British Sulphate of Ammonia Federation, Ltd., and Nitram, Ltd., for the establishment by the Government of India of a central fertiliser organisation on which the Imperial and provincial agricultural departments as well as the important fertiliser interests would be represented. The two companies, which are already spending £23,000 annually on research and propaganda in India, expressed their willingness to increase this amount to £50,000, the additional amount to be handed over to a central organisation constituted in the manner they suggest, provided that an equal sum is contributed by Government. The companies have made it clear that the research and propaganda they contemplate would be on the use of fertilisers generally and would not in any way be confined to that of the products they manufacture or sell. This offer, though not disinterested, is undoubtedly generous and we have given it our most careful consideration. We regret, however, that we are unable to see our way to recommend its acceptance. We cannot but feel that, whatever safeguards were imposed, the work of, and the advice given by, an organisation, at least half the cost of which was borne by firms closely interested in the subject-matter of the investigation, would be suspect and would thus be deprived of much of its usefulness, especially since, as we have pointed out, the agricultural departments in India are not yet in a position to pronounce authoritatively on the relative advantages of natural and artificial fertilisers. We, therefore, consider it preferable that the agricultural departments should remain entirely independent in this matter but we need hardly say that we would welcome the establishment by the two firms mentioned, or by any other fertiliser firms, of their own research stations in India working in the fullest co-operation with the agricultural departments, the Indian Tea Association, the Indian Central Cotton Committee and any other bodies interested in the fertiliser question. So much work remains to be done on the manurial problems of India that it is desirable that every possible agency should be employed on it. To the supply by the fertiliser interests of free samples for trial by the agricultural departments there can, of course, be no objection but we do not consider that any financial assistance beyond what is involved in this should be accepted. In coming to this conclusion, we have not overlooked the fact that the Rothamsted Experimental Station accepts grants from fertiliser interests to meet the cost of experiments with their products. Rothamsted is not, however, a government institution and, further, the experiments it carries out are only undertaken on the clear understanding that the information obtained is not to be

used for purposes of propaganda. The conditions at Rothamsted are thus entirely different from those under which it is proposed that the central fertiliser organisation in India should function.

BONES AND BONE MEAL.

91. Nitrogen deficiency can be remedied to some extent by the application of bones and bone meal. This form of fertiliser is, however, of greater value as a means of rectifying the deficiency of phosphates which, as we have pointed out, is more prominent in peninsular India and Lower Burma than that of nitrogen. As with other forms of combined nitrogen, an important quantity of this fertiliser is lost to India by a failure to apply it to the soil and by export. Except in the war period, the total export of bones from India has shown little variation in the last twenty years. The average exports for the five years ending 1914-15 were 90,452 tons valued at Rs. 64·20 lakhs. For the five years ending 1924-25, they were 87,881 tons valued at Rs. 95·94 lakhs. In 1925-26, they were 84,297 tons valued at Rs. 89·16 lakhs and in 1926-27 100,005 tons valued at Rs. 97·76 lakhs. The imports of bone manures are negligible. Practically the whole of the exports are in the form of the manufactured product, that is, in the form of crushed bones or of bone meal, the highest figure for the export of uncrushed bones in recent years being 545 tons in 1924-25. Only a very small proportion of the bone manure manufactured in India is consumed in the country. During the war period, when prices were low, freight space difficult to obtain and export demand weak, it was estimated that not more than ten per cent of the total production was consumed in India and this at a time when the prices of all Indian agricultural produce were exceptionally high. Enquiries we have made show that there is no reason to believe that the percentage retained for internal consumption has increased since the close of the war. Many witnesses before us advocated that the heavy drain of phosphates involved in the large export of bones from this country should be ended by the total prohibition of exports and this proposal received the support of the Board of Agriculture in 1919, whilst the majority of the Indian Taxation Enquiry Committee recommended the imposition of an export duty. For much the same reasons as those for which we have rejected the proposal for an export duty on oil-seeds and oilcakes, we are unable to support this recommendation. As was pointed out by the Board of Agriculture in 1922, local consumption, even in the most favourable conditions in recent years, has accounted for such a small fraction of the total production that the industry could not continue to exist on that fraction, and the imposition of an export duty would involve a serious danger of its extinction through the closing down of its markets. Further, any restrictions on export would deprive one of the poorest sections of the population of a source of income of which it stands badly in need.

For slow-growing crops such as fruit trees the rough crushing of bones is sufficient, but for other crops fine grinding is required. The crushing mills are at present located almost entirely at the ports and, in order to

get bone manures to the cultivator, the establishment of small bone-crushing factories at up-country centres where sufficient supplies of bones are available has been advocated. A far more thorough investigation of the economics of the bone-crushing industry than has yet been carried out is, we consider, required before the establishment of such mills can safely be undertaken by private enterprise. The first essential is to obtain definite data in regard to the price at which, and the crops for which, the use of bone meal is advantageous to the cultivator. We suggest that the agricultural departments should take early steps to collect these data. The department of Government responsible should also investigate the cost of processing bones with special reference to those districts in which the development of hydro-electric schemes gives promise of a supply of cheap power. It should then be a comparatively easy matter to determine whether the level of prices is such as to justify any attempts on the part of Government to interest private, or preferably co-operative, enterprise in the establishment of bone-crushing mills in suitable centres. In determining the level of prices, allowance should be made for the advantage which local mills will enjoy in competition for local custom with the large units at the ports through the saving to the local concerns of the two-way transportation charges borne by the product of the port mills.

FISH MANURES.

92. Little need be said about fish manures which are another source of supply of both phosphates and nitrogen. The export of these from India for the five years ending 1925-26 averaged 16,774 tons valued at Rs. 19·94 lakhs. In 1926-27, only 7,404 tons were exported valued at Rs. 9·21 lakhs. Except for a negligible export from Bombay and Sind, the exports of fish manures are confined to the west coast of Madras and parts of Burma.

The arguments against the prohibition of the export of bones or for the imposition of an export duty apply equally to fish manures. Any restriction of export would involve most serious hardship on the small and impoverished fishing communities of the two provinces, and cannot, therefore, be justified. The only measures which can be undertaken to lessen the export of fish manures, without damage to the fish-oil industry or the curtailment of the amount of fish caught, are measures to establish that such manures can be profitably used for Indian agriculture at the price obtained for them in the export market.

NATURAL PHOSPHATES.

93. Reference should be made here to the extensive deposits of natural phosphates which are to be found in the Trichinopoly district of Madras and in South Bihar. In neither tract do these phosphates exist in a form in which they can be utilised economically for the manufacture of superphosphate; and their employment in agriculture has been limited to applications of the crude material in pulverised form. This source of supply does not offer any important possibilities.

LEGISLATION AGAINST ADULTERATION OF FERTILISERS.

94. The question whether legislation against the adulteration of fertilisers on the lines of the British Fertilisers and Foodstuffs Act, 1926, is necessary requires consideration. The sale of artificial fertilisers in India is still confined in the main to a few firms of high reputation who sell under guarantee and usually deal direct with the actual consumer. The opportunities for adulteration are thus rare and we have received no evidence of its existence apart from certain complaints in Bengal regarding the adulteration of oilcakes. We recognise that the absence of complaints, except in this one instance, is no evidence that adulteration does not exist. That a certain amount of adulteration does exist in the case of fertilisers supplied through local bazaars to small cultivators is, in fact, probable. All that can be said is that the practice does not at present exist on any considerable scale. The witnesses who appeared before us were not agreed as to the desirability of legislation, and we ourselves are not satisfied that legislation at the present time is either desirable or practicable. Legislation of this kind, unless strictly enforced, is demoralising. Personnel with the necessary qualifications to make the inspection efficient throughout the country would be difficult to obtain and expenditure would have to be incurred on a scale which the present sale of fertilisers could scarcely justify. Our general conclusion is that it will be sufficient for the present if all the agricultural departments keep a close watch on the quality of the fertilisers in common use and subject samples of them to frequent analysis by their agricultural chemists. Should the trade in fertilisers develop sufficiently to attract the attention of the middleman or should analysis show that even, in existing conditions, adulteration is at all common, the question of legislation should be reconsidered.

RAILWAY RATES ON FERTILISERS.

95. It was suggested that it would assist in popularising the use of fertilisers if the railway rates on them were reduced. We are, therefore, glad to notice that material reductions in the rates for the carriage of oilcakes and manures generally are being made on the State railways. We trust that similar reductions will be made on company-managed railways. Any considerable increase in the crop yield as a result of the use of such manures—and for such use price is often the limiting factor—must eventually lead to an increase in traffic and thus benefit the railways concerned. The railway authorities should, therefore, constantly review the possibilities of giving still further concessions in regard to the transport of fertilisers.

INTRODUCTION OF IMPROVED VARIETIES OF CROPS.

(*i*) THE PRESENT POSITION.

96. In no respect has the readiness of the cultivator to accept an improvement the value of which has been demonstrated to him been clearer than in his adoption of improved varieties of crops. The figures for the areas under improved varieties introduced by the agricultural departments which are given below have been extracted from the Review of Agricultural Operations in

India for 1926-27. They do not, however, do full justice to the work on crop improvement which has been done by the departments as the selected varieties of certain crops such as wheat and cotton are now so generally grown in some provinces that the departmental statistics are no longer a true representation of the extent to which they have spread.

Crop	1925-26		1926-27	
	Area under improved varieties	Percentage to total area of crop	Area under improved varieties	Percentage to estimated total area of crop
	(Thousands of acres)		(Thousands of acres)	
Cotton	3,198	17·6	3,587	22·7
Wheat ..	2,342	9·8	2,894	11·9
Rice	654	0·8	882	1·1
Jute	336	11·5	505	14·1
Groundnut .	405	10·7	380	10·3
Sugarcane ..	172	6·5	208	7·2
Gram	100	0·7	120	0·8
Juar	75	0·4	100	0·5
Barley .. .	21	0·3	25	0·4
Other crops ..	109	..	114	..

Every cotton-growing province has its own improved varieties, the most widely spread of which are the strain of American cotton known as 4F in the Punjab, Company Cotton and Hagari 25 in Madras and 1027 A. L. F. in Bombay. The agricultural departments have been especially successful in the isolation of heavy yielding rust resistant wheats of good milling and baking qualities both for home consumption and for export. The Pusa No. 4 and Pusa No. 12 wheats are to be found in every wheat-growing tract in India, though Punjab 11 and Punjab 8A have proved more suitable for the greater part of the wheat-growing area of the Punjab.* Some 146,000 acres are under various strains of improved rice in Madras whilst the *indrasail*, *dudshar* and *kataktara* varieties cover some 139,000 acres in Bengal. Practically the whole of the area under improved varieties of jute is in the latter province, where it is estimated that over 500,000 acres, that is about fifteen per cent of the total area under jute, now grows the two heavy yielding types known as *Capsularis* D154 and *Olitorius* green Chinsura which were originally isolated on the Dacca farm. As was to be expected from the fact that nearly half the total area under sugarcane in India is in the United Provinces, the greater part of the acreage under improved varieties of cane is in that province, in which varieties either evolved at the Sugarcane Station at Coimbatore or

* Of the total area under wheat in the two provinces of the Punjab and the United Provinces, which are the chief wheat producing provinces, between 13 and 14 per cent was under improved varieties in 1926-27.

imported originally from Java or Mauritius are now grown on about 105,000 acres. The Coimbatore varieties are also making steady progress in the Punjab and in Bihar and Orissa. Of the "other crops" included in the Table given above, the most important is groundnut, early maturing varieties of which are grown on 291,000 acres in Bombay. The Bombay figures furnish a remarkable illustration of the readiness with which the cultivator takes to a crop of the financial possibilities of which he is satisfied. The total area under groundnut in Khandesh and northern Gujarat in 1912-13 was only 4,500 acres. In 1926-27, it was 316,000 acres. Improved varieties of gram now cover a considerable acreage in the United Provinces and Burma.

(ii) Future work.

97. Considerable as have been the achievements of the agricultural departments in India in introducing improved varieties of crops, the percentages given in the Table above are in themselves sufficient to show that there is still a vast field for further work in this direction. Much remains to be done even in respect of crops such as cotton, jute and wheat where the success of the departments has been most marked. We received evidence, for example, which showed that the 4F variety of American cotton, which is now grown on approximately one million acres in the Punjab, is undergoing deterioration, apart from the effect on the quality of the crop produced by the mixing in the ginneries of American cotton with the indigenous short-stapled varieties. There appeared to be some difference of opinion as to whether the deterioration is merely temporary and due to the passing effect of unfavourable seasons or whether it is permanent and has resulted from cross fertilisation in the field between plants which have diverged from the original type selected and from the continued renewal of the seed supply from contaminated sources. In this case, seasonal influences have no doubt been at work; but experience elsewhere renders the latter explanation a probable one. The falling off in the quality of the 4F variety is only one example of the well-known need for reselection that arises in most forms of crop improvement work. It shows how essential it is that the agricultural departments should be ready either to undertake the difficult and tedious process of eradicating deterioration once it has appeared in a crop or to replace the deteriorated strain by another.

The agricultural departments are still at the beginning of the work of improving some of the most important crops grown in India such as the millets, of which *juar*, the acreage under which is only exceeded by that under rice and wheat, is the most extensively grown. Oil-seeds are another class of crop on which some work has been done but no striking progress has to be recorded. The comparative neglect of the millets is especially to be regretted in view of the prominence of these grains in the diet of a large section of the population throughout peninsular India and of the fact that they are so largely grown in tracts which are liable to famine. It is the cultivators in such tracts who stand most in need of all the help that improved varieties can give them. This neglect has undoubtedly been due to the complicated nature of the problem

which arises from the natural pollination which takes place in the field and which makes it very difficult to keep a pure line uncontaminated.

The work of crop improvement cannot, even in the most favourable circumstances, give very rapid results. The shortest period required for a plant breeder to evolve a new strain by hybridisation up to the point at which it can safely be given out to the cultivator is usually placed at seven years, and success in so short a time is only to be anticipated when working with plants to which no breeder has hitherto given attention. When the further improvement of crops, which, through some process of selection, have reached a high standard of quality, is in question, twice the period of seven years may be required. When the agricultural departments were reorganised, it was natural that they should desire to establish their reputation as rapidly as possible and that, to this end, they should first take up work on crops which offered the best prospects of giving comparatively speedy results. By the time that they were in a position to give a greater measure of their attention to other crops, their work was interrupted by war conditions. We are, however, of opinion that the time has now come when the departments of agriculture should devote an increasing share of time and attention to the production of improved strains of millets, pulses and oil-seeds.

Sufficient has perhaps been said to indicate the extent of the work which still lies before the agricultural departments in India in regard to crop improvement. There are three methods of obtaining varieties which are superior to those ordinarily grown either in respect of yield, quality or suitability to special conditions of environment. These are selection, hybridisation and acclimatisation. The last of these is discussed in the following paragraph. The work of selection is based on a systematic examination of the forms met with in the various tracts and their classification into types. The next step consists in raising pure lines and making a comparative study of the selected types. The successive elimination of inferior types follows until only a small number of promising types remain, from which a final selection is made for trial in the conditions under which the crop is ordinarily grown by the cultivator. In the hybridisation process, pure lines of selected types are crossed in order to bring about new combinations of useful characters in the offspring. Of these two methods, selection and hybridisation, there can be no doubt that selection offers the readiest means of effecting improvement in Indian conditions, and it is by this method that the greatest successes of the agricultural departments, except in regard to wheat and sugarcane, have been obtained. Hybridisation is a much slower process than selection and requires greater scientific experience and a higher level of scientific aptitude. Sooner or later, of course, there comes a point when the plant breeder may be forced to resort to hybridisation if any progress is to be secured. We are, however, of opinion that the plant breeder in India will, in general, be well advised to adhere to the selection method until its possibilities for a number of the crops we have referred to have been much more nearly exhausted than is at present the case and that hybridisation

should only be undertaken by officers who, in addition to special training, have had the experience of Indian crops and conditions which is necessary for successful work. The work of crop selection in India is, on the whole, well done and the agricultural departments, in our view, have but little to learn in regard to the technique of this branch of its work, though in many cases an increase in the amount of systematic work is desirable.

(*iii*) APPOINTMENT OF CROP SPECIALISTS.

98. There has been a tendency in recent years on the part of most provincial departments, which has been accentuated by the influence of the Indian Central Cotton Committee, to appoint specialists for work on particular crops. A number of specialists are now engaged on work on cotton, Madras has a millets and a paddy specialist, the Punjab a specialist on cereals—to mention only a few examples. We recognise the importance of specialisation ; the improvement of one important crop such as cotton may indeed call for the combined efforts of a number of specialists. But we received evidence from scientists in England to which we attach great weight, which went to show that specialisation is not without disadvantages. It was urged that work on a particular crop would, in all probability, prove of greater value if it were combined with work on another entirely different crop of secondary importance. An expert working on cotton would, for example, gain in freshness and preserve a broader botanical and biological outlook if he were to combine his work on cotton with work on some other crop which enters into the rotation with it. We commend this view to the attention of those responsible for the administration of the agricultural departments in India.

INTRODUCTION OF NEW CROPS.

99. The agricultural departments in India have a fund of experience on which to draw in regard to the possibilities of the successful introduction of crops which are entirely new to India or new to particular parts of it. Until scientific agriculture had made some progress in India in the later decades of the nineteenth century, the introduction of exotic varieties was regarded as the shortest road to general agricultural improvement. To it the Directors of the East India Company pinned their faith, as the very illuminating history of the twelve American planters who were sent to India in 1839 to grow American cotton, to which reference has been made in Chapter II, bears witness. But as we have mentioned in that chapter, the spasmodic and unsystematic efforts of this kind produced little in the way of tangible results. Even after they were completely reorganised in 1905, the agricultural departments were unable to shake themselves entirely free from the ideas of previous seekers after agricultural improvement and, for some years, a disproportionate share of their time and energies and of the space available on their agricultural stations was devoted to experiments with exotics. That the introduction of new crops offers abundant possibilities has been amply demonstrated not only by experience in the United States of America and in Australia, in which country there is no paying crop which is indigenous to the soil, but also by experience in India itself. Dr. Voelcker gives a long list of crops now

commonly grown in India which must originally have been imported. This list includes various millets, maize, tobacco, tea (which, however, was subsequently found and cultivated in India), Dharwar-American cotton, potatoes and many other vegetables. An example of more recent date and of greater relevance in the present connection is furnished by Cambodia cotton, an American type, the seed of which was obtained direct from Cambodia in 1905, by Mr. C. Benson, then Deputy Director of Agriculture in Madras. This is now the most important variety of cotton grown in Madras, both in acreage and outturn and also in length of staple. The successful cultivation of dates in the Punjab also deserves mention. The spread of groundnut to parts of Bombay, to Bundelkhand, Orissa, Sind, the Central Provinces, and the dry zone of Burma is perhaps the best example in recent years of the extension to new parts of India of a crop already grown in other parts of the country, but other examples are to be found in the cultivation of potatoes in the Punjab and Assam and of oil-seeds in Sind. It is obviously not possible for us to indicate in any detail the direction in which further experiments with new varieties should be made but we would mention Australian *bajra*, white seeded maize, American tobacco, grasses and Egyptian clover (*berseem*), especially if it is found that seed can be produced cheaply and on a large scale in India, as crops the possibilities of which deserve further investigation. At the same time, we desire to emphasise that work on exotics should, in no circumstances, take precedence of work on crops already grown in India. No importation offers a reasonable prospect of success unless it is made after a careful study of the environmental conditions in the country of origin and a comparison of those conditions with the conditions under which the crop would be grown in India. The early experiments with exotics were a failure because the necessity for such a study and examination was not realised ; but, even when such experiments prove successful, it must be recognised that the element of chance enters largely into the problem. Whilst one lucky shot with an exotic may prove more than ample compensation for very many failures, work on the improvement of crops already grown, though more laborious, is in the nature of things far more likely on balance to yield results of substantial value and should, therefore, always take precedence in the estimation of the agricultural departments.

A small measure of encouragement to experiments with exotic crops would be given if seeds, seedling plants and cuttings were exempted from the fifteen per cent duty which is at present levied. Rubber seeds are the only seeds which are specifically exempt from this duty though grain and pulse, in so far as they are imported for seed purposes, are covered by the general exemption which applies to that class of produce. We recommend that the concession given to rubber stumps and seeds should be extended to all seeds, seedling plants and cuttings of exotic species and of exotic varieties of indigenous species imported for experimental sowing or planting. We understand that the loss of revenue involved in the grant of this concession would be very small.

100. Whilst there can be no finality in the work of crop improvement in India, and whilst it is important that agricultural departments should constantly have new varieties to put out to replace varieties which have degenerated, we consider it advisable to utter a word of warning against undue multiplication of the new varieties which are offered to the cultivator. We have given examples which show how readily the cultivator takes to an improved variety, of the extra financial return of which he has been convinced. The conservatism which has so commonly been attributed to him with some measure of justice has been overcome in this respect to a greater extent than in regard to any other branch of his agricultural practice. But it would be unsafe to assume that it no longer exists or that it will not again come into play if improved varieties are thrust upon him in too rapid succession. We consider it very desirable, therefore, that, except in the case of crops, such as sugarcane and potatoes, which are apt to degenerate rapidly unless frequent changes of seed are made, no new variety should be put out unless it has been thoroughly well established that it possesses a marked advantage over those already grown in respect either of yield, quality, or suitability to special environmental conditions. We do not feel called upon to indicate to which of these advantages most importance should be attached. The problem is one which can only be decided in the light of the local conditions and the solution will necessarily vary with the crop and with the trend of the market for it. It is impossible, therefore, to lay down any general principles. All that need be said is that, as the cultivator desires a higher financial return for his labour, he is more attracted by a crop which will give a higher yield without any counterbalancing increase in cost of cultivation than by a crop of better quality. This is especially the case in Indian conditions, in which the problem of securing to the grower the additional price to which the superior quality of his crop entitles him has always been one of great difficulty. We have dealt with this question in our chapter on Communications and Marketing and do not, therefore, propose to discuss it further here.

SPREAD OF IMPROVED VARIETIES.

Whilst due consideration must be paid to the preference on the part of the grower for a higher yielding variety over one of better quality, circumstances may arise in which it may be desirable that the agricultural departments should take a longer view of what is required in the best interests of the cultivator. Attention to quality may, in the long run, prove more profitable to him than attention to yield. We have in mind the case of the short staple cotton known as *roseum* in the Central Provinces and Berar. This cotton, the staple of which is only four-eighths to five-eighths of an inch, is still the most paying variety of cotton the cultivator in those provinces can grow on land free from wilt disease, and its introduction has, during the last fifteen years, brought many crores of increased income to the cultivator. But there are now indications that a cotton of better quality, which will yet yield the grower a profitable return, is required owing to the tendency of the

mills in India and Japan to spin yarn of finer counts. We would add that the Agricultural Department in the Central Provinces is fully alive to the signs of change in the position and that there is every reason to believe that, when the time comes to replace *roseum* by cotton of longer staple, suitable types of the latter will be available. The past and the probable future history of *roseum* shows how essential it is that the agricultural departments should keep in the closest touch with the trend of the world's markets and should frame their policy in regard to plant-breeding accordingly.

One point regarding the introduction of varieties suited to special local conditions, such as wilt-resistant cotton, rust-resistant wheat and drought-resistant *bajra*, may conveniently be mentioned here. It is not sufficient merely to direct the cultivator's attention to these varieties. It is necessary to demonstrate to him on his own fields that his losses from the special factors which have hitherto reduced his crop-yield can be considerably lessened, if not entirely eliminated, by the cultivation of a variety which has been found more suited to the peculiar conditions of the locality.

The agricultural departments in India are now so well aware of the disappointments which may ensue unless an improved variety is thoroughly tested in the conditions under which it would be grown by the cultivator, before it is given out on a field scale, that it is unnecessary to stress the importance of such tests. We are of opinion, however, that tests of new varieties, carried out on holdings typical of those in the tracts for which the varieties are deemed suitable, would be of much value. An attempt should be made to demonstrate the value of the new variety in its place in the normal rotation of the cultivator over a series of years. Where arrangements for cost-accounting are possible, the test holdings should be conducted on a purely commercial basis; they should be self-contained as regards both labour and draught cattle, and detailed costings of all operations should be recorded. In this way, there would be available, after a number of years, a body of data bearing upon every aspect of the budget of the small cultivator.

DISTRIBUTION OF SEED.

(i) THE PROBLEM.

101. The work of the plant breeder in evolving improved varieties of crops is obviously merely a means to an end and its value depends entirely on the efficiency of the link with the cultivator for whose benefit the improved variety is evolved. Not only must there be a very complete organisation for the supply of seed to the cultivator, which can be extended as the demand increases and which must be built up simultaneously with the progress of the work of the plant breeder in evolving the new varieties, but this organisation must also have, as one of its aims, the maintenance of the standard of improvement which the original introduction offered. If the standard is permitted to fall as the result of mixing in the field, deterioration due to cross fertilisation and similar causes, the improved variety will rapidly lose its distinctive

qualities and fall to the level of the variety it displaced. Deterioration in such cases can only be prevented by continuous renewal of seed of the highest quality from stock.

In no respect is the difference between agricultural conditions in India and in western countries more marked than in regard to seed distribution. In most European countries, in the British Dominions and in the United States, the distribution of new varieties of proved value is the work of private agency. After the preliminary stage of testing has been completed and a variety has established itself in commerce, the State takes no active part in it. Seedsmen as understood in Europe do not exist in India where, even if his means permitted him to do so, the cultivator has yet to be educated up to the payment of the premium for improved seed which makes the seedsman's business possible and profitable. In these circumstances, the only agencies for the distribution of improved seed in India are the agricultural departments or agencies such as co-operative societies working under their auspices. Should seed merchants of proved integrity and enterprise be forthcoming, they should be encouraged by the agricultural departments, but the too rapid multiplication of this agency might prove a hindrance rather than a help to the work of the departments. The seed merchant in western countries derives much of his income from the introduction of a constant succession of new varieties, but, as we have already pointed out, such a succession in India would only tend to confuse the cultivator and to arouse his suspicion. Again, in Indian conditions, it would be difficult to ensure that the seed sold by seed merchants as departmental seed was actually that obtained from the department. If seed of doubtful quality were sold to the cultivator, as "departmental seed," this would react most unfavourably on the work of the agricultural departments. For a very long time to come, therefore, seed distribution must continue to form one of the most important branches of their work, and we feel that the departments should face the prospect of a substantial expansion of their activities in this direction. While we regard co-operative agency as the one offering the best prospects of relieving the Agricultural Department, we consider that use might be made of private seed agents as distinct from seed merchants. Seed agents would be persons on whom the Agricultural Department could rely, and would deal only in seed supplied by the department in sealed bags or packets.

(*ii*) THE PRESENT ORGANISATION.

102. The efficiency of the organisation for the distribution of seed of improved varieties varies greatly in the different provinces. In all provinces, the nucleus of the organisation is the government seed farm. In most provinces, the seed from these farms is used to stock and re-stock a number of private seed farms, the operations of which are supervised more or less closely by the provincial agricultural department. In the Central Provinces, in which the organisation for seed distribution is perhaps more highly developed than it is elsewhere, there were, in 1926-27, 3,430 wheat seed farms, 1,368 paddy seed farms, 1,627 cotton seed farms, 501 *juar* seed farms

and 1,041 groundnut seed farms. In that province, the seed multiplied on the private farms is sold to the grower at market rates which are, in all cases, above those at which the seed of ordinary varieties is sold, the difference between the two rates being specially marked in the case of cotton. In Madras and the Punjab, the Agricultural Department purchases at harvest time seed of the purity of which it is satisfied at rates which are slightly above the ruling market rate. The seed is either stored in departmental godowns or with agents at convenient centres under the supervision of the department. In the United Provinces, whilst much of the seed issued from the departmental farms and seed depôts is sold on a cash basis, a large proportion of it is sold on a credit system which involves repayment in kind and provides material for wider distribution in the following year. In Bengal, the distribution of the seed of improved varieties of jute forms by far the most important part of this branch of the Agricultural Department's operations. The work of distribution of seed of these varieties has, for special reasons mainly connected with the paucity of staff, been entirely handed over to an agent who has undertaken full financial responsibility for the production and sale of the improved seed and who has been guaranteed against loss up to a maximum of Rs. 2½ lakhs by the Indian Jute Mills' Association. The Agricultural Department, however, still retains full control over the amount of seed which is to be produced and scrutinises the list of growers and the amount of seed which they undertake to produce. It takes delivery of all the seed produced and tests the germinating capacity of every bag before it is handed over to the agent for sale at a price which is fixed departmentally at such a level as should, in normal conditions, allow the distributor a sufficient margin to cover his expenses and yield a moderate profit. This system is specially suited to conditions in Bengal where the river steamers offer unrivalled facilities for the cheap and steady distribution of seed from a convenient centre.

The difficulties presented by the problem of seed distribution vary greatly with the nature of the crop. Wheat, rice and jute are crops for which self-fertilisation is the rule and crossing the exception and it is, therefore, comparatively easy to maintain the improved variety at the same level of excellence for long periods, especially if it possesses characteristics which enable it to be easily distinguished in the field. Cotton, tobacco and the millets, on the other hand, are crops in which cross fertilisation is very common and, if this occurs, it nullifies the work of the plant breeder. Cotton is a crop with problems of its own for, in addition to cross fertilisation, centralised ginning results in the mixing of seed of different types. Special measures have, therefore, to be devised to overcome this handicap. In the United Provinces, for example, private seed farms equipped with their own ginning machinery are being organised. Seed cotton (*kapas*) is also bought from selected cultivators and is ginned under careful departmental supervision. In Madras, cultivators are assisted to gin their seed cotton co-operatively, to sell their own lint and to benefit by the premium obtained for it. The Central Provinces formerly had a number of agricultural unions, about

half of which were registered as co-operative societies. These obtained their stocks of seed from the union's central farm where the crop was grown from seed supplied by the Agricultural Department. The crop grown from this seed was ginned in the union's own ginnery and was then placed on the general seed market. This organisation which had much to recommend it is not as common now as it was and, though single farms have increased, unions have tended to decline.

The direct operations of the agricultural departments in regard to seed distribution are supplemented—again, in varying degree—by other agencies. In the Punjab, there are a number of large land-holders in the canal colonies who co-operate with the Agricultural Department in the distribution of pure seed. Three of these have, in fact, been granted land on condition that a certain proportion of it is utilised for growing pure seed for the Agricultural Department. In the United Provinces, some assistance in seed distribution work is given by large zamindars, and in Bombay by the newly formed taluka development associations. Mention should also be made of the scheme which is in process of elaboration in the Central Provinces for financing tahsil and circle agricultural associations by a loan (*taccavi*) from Government to the extent of one lakh of rupees. The associations will get their seed from approved seed farmers to the amount of the loan which is taken up on joint security. They will lend the seed to the members on the condition that a quantity of seed equal to that lent *plus* twenty per cent in kind will be returned at harvest. After harvest, the associations will pay ten per cent of the loan *plus* one-tenth as interest in kind to Government. The seed returned by the members of the associations, less than that needed to pay the interest to Government, will be lent to them on the same terms for the following year.

Of all the agencies for seed distribution which are not strictly departmental, the most important are co-operative agencies, from the provincial bank down to the primary society. In all provinces, these render an appreciable amount of assistance to the Agricultural Department and, in some provinces, the assistance is considerable. In Bombay, for example, the whole of the task of multiplying and distributing the seed of improved varieties of cotton in the southern Maratha country is in the hands of the co-operative cotton sale societies at Hubli and Gadag. But it has regretfully to be admitted that the sum total of the efforts of co-operative agencies in this direction has so far been disappointing. It is not easy to come to definite conclusions as to the reason for this. It appears to be partly due to the weakness of the co-operative movement on the non-credit side, a point which we shall discuss in greater detail when we come to deal with co-operation. It is also partly due to the fact that in some, if not in all, provinces, the relations between the agricultural and co-operative departments are not as close as is desirable, a point upon which we shall also have further observations to offer. We were told that, in the Punjab, the agencies for seed distribution work were offered to co-operative societies where they were prepared to take them up but that, on the whole, they did not work as satisfactorily as private agents who were business men with self-interest at stake and knew that they

could be dealt with summarily in case of unsatisfactory work. In selling seed, co-operative societies are undoubtedly handicapped as compared with the agricultural departments as the latter are in a position to provide free storage and have other advantages. We consider that local governments should assist co-operative societies in making storage arrangements.

(*iii*) THE POLICY TO BE FOLLOWED.

103. We think it unwise to lay down any rigid lines of policy to be followed by the agricultural departments in regard to seed distribution. For those crops for which cross fertilisation is the rule, compactness of the area in which it is proposed to spread the improved variety is the essential requirement and it should be the aim of the departments to make this area as wide as possible in the shortest space of time. For such crops, we would again stress the necessity of keeping up the supply of pure seed and of maintaining an organisation which ensures that this supply is rapidly multiplied. Compactness of area is not so necessary for crops which are self-fertilised. The selection and distribution of pure seed of all crops should be controlled by the agricultural departments in the manner best suited to the local conditions of each tract. We would emphasise the necessity for strict control by the agricultural departments as this appears to have been overlooked to some extent in the Central Provinces. The system in vogue there is that the seed from the private seed farm goes direct to the grower and is not purchased and distributed by the department. This, as we have explained, may easily lead to deterioration of a crop such as cotton although permissible for crops such as wheat or rice. We need hardly stress the necessity for the greatest care in ensuring that the seed distributed should be pure seed of high germinating power. We are of opinion that a considerable increase in the number of seed farms, both departmental and private, is very desirable in all provinces. Such farms should be established as rapidly as funds and staff permit. We realise, however, that the establishment of farms for crops such as millets, pulses and oil-seeds can only proceed *pari passu* with the evolution of pure or improved strains.

There are indications that the work of seed distribution in some provinces has brought with it the penalties of success and that the burden on the agricultural departments which it involves is becoming an unduly heavy one. We have given reasons for thinking that it is impossible for the departments to look for relief to the establishment of seed merchants. An increasing interest in the distribution of pure seed on the part of large landholders may assist them in some provinces, but there can be no doubt that the agency which offers the best prospect of materially lightening the load borne by the agricultural departments in this respect is the co-operative movement, strengthened as we trust it will be if the recommendations we make under the appropriate head are accepted. Amongst these recommendations is one that the co-operative departments should be given expert assistance on the agricultural side generally and this would, of course, apply to the distribution of seed.

We would add that, where the work of seed distribution is handed over to co-operative agency, this course can only prove a success if the transfer is made with the entire goodwill of the agricultural departments. There should be no question of competition between the two departments. The price at which seed can be obtained from the agricultural departments should never be less where co-operative societies are working on a commercial basis than that at which it can be purchased from co-operative societies in the same tract. Other associations of cultivators, such as taluka development associations or agricultural associations, where these are well managed, could similarly be used for the work of seed distribution. But even where such co-operative societies and associations are utilised to the fullest extent, the burden on the agricultural departments will, as pointed out above, remain a heavy one. The departments will also have to face a considerable expansion of seed distribution work. For this reason, as also for the reason that the work of distribution requires to be carefully watched and that the frequent testing of seed for purity and germination has often to be made, we recommend that there should be a separate organisation for seed distribution and seed testing in charge of a deputy director working under the Director of Agriculture. This officer should be of sufficient standing to relieve the Director of all immediate administrative responsibility for this work. It would be his business to organise distribution through co-operative societies and other associations, through seed merchants wherever they are available, and through seed agents, as well as through the departmental staff and any other agencies which he may consider suitable.

We are of opinion that, whilst the agricultural departments ought not to look to seed distribution work as a source of profit, the work has reached a stage at which it may legitimately be expected to pay its way. The evidence we have received shows that it is either entirely self-supporting or very nearly so in all provinces. It also shows that the demand for the seed of improved varieties could be more readily met if, in all provinces, grants were placed at the disposal of directors of agriculture for financing the purchase of seed and these were not subject to the rule under which receipts and expenditure remain in watertight compartments. Whilst the transactions must, of course, be subjected to audit, we are of opinion that the financial rules which govern them should be so framed as to admit of the greatest possible turnover of seed in the year as it is only by the adoption of this course that a new variety can spread as rapidly as is desirable.

ROTATIONS AND TILLAGE.

104. The Indian Cotton and Sugar Committees made very detailed enquiries in regard to the methods of cultivation of cotton and sugarcane and of the crops which enter into the rotation with them and also in regard to the most suitable rotations for them. These enquiries not only resulted in a number of valuable recommendations but also served a most useful purpose in enabling the provincial agricultural departments to acquaint themselves with the agricultural practices in other provinces. Our

terms of reference are so much wider than those of the Cotton and Sugar Committees, and the ground we had to cover in a limited time was so great, that it was impossible for us to make similarly exhaustive enquiries in regard to crops which did not come within the purview of those two committees. The evidence we took on this subject was, however, sufficient to convince us that, whilst the customary rotations have been built up as the result of generations of experience of soil and climate, there is every reason to believe that research and experiment may show ways in which these can be improved. One direction which appears to hold out special promise is the introduction of leguminous fodder crops which might, in part at least, replace the millets in the rotations in which millets appear. The position in regard to methods of cultivation, apart from questions connected with improved implements with which we deal in subsequent paragraphs, is very similar to that in regard to rotations. Among definite improvements we may mention economical methods of transplanting paddy seedlings, drill-sowing of cotton and other crops and intercultivation with bullock power, and the reduction of the number of setts used for planting sugarcane, to give only a few examples, as improvements which have been thoroughly tested and the advantages of adopting which have been satisfactorily established. Whilst continued research and experiment on rotations and methods of tillage are necessary, the more important problem in regard to the latter is at present that of bringing home to the cultivator knowledge which is already available. It is hardly necessary to add that, in all research and experiment on rotations and methods of tillage, the specialists on each subject relating to the problem taken up for investigation should be freely consulted by the officer in charge of the investigation. Thus the botanist will often be in a position to make useful suggestions when a system of rotation is being studied and the agricultural engineer when it is a question of devising the most efficient and economical way of carrying out a new method of tillage.

AGRICULTURAL IMPLEMENTS.

105. Agricultural implements in India are, on the whole, well adapted to local conditions. They are within the capacity of the draught oxen, comparatively inexpensive, light and portable, easily made and, what is perhaps of even greater importance, easily repaired and they are constructed of materials which can be readily obtained. In spite of these advantages, there is undoubtedly very great scope for improvement in the light of modern knowledge of soil conditions. The agricultural departments have, however, so far done disappointingly little in this direction. The sales of improved implements through departmental agencies are infinitesimal compared with the total number of implements in use in India, as is shown by the fact that, in spite of the large number of types of improved ploughs which have been placed on the market, only about 17,000 were sold in 1925-26. The total number of ploughs in use in British India in 1925-26 is given in the "Agricultural Statistics of India" as nearly 25 millions. Even if full allowance is made for the extent to which departmental sales are supplemented by private

enterprise, we cannot but feel that the agricultural departments have hardly made the fullest use of the opportunities which have presented themselves in this field. For this there are, in our view, two main reasons. Hitherto, agricultural engineering has been regarded by those responsible for the administration of the agricultural departments merely as a secondary sphere of departmental activity. This has led to the recruitment of agricultural engineers on special terms which have been distinctly inferior to those on which the members of the Indian Agricultural Service have been engaged. It is not surprising, in these circumstances, that it has proved increasingly difficult to recruit or to retain engineers with the requisite qualifications for the charge of this section. Burma and the Central Provinces were without an agricultural engineer when we visited them, as were Bengal and Madras, in both of which provinces the appointment of an agricultural engineer has only recently been sanctioned and has not yet been filled. Again, work on implements has, in several provinces, been entirely overshadowed by that connected with pumping and boring operations and with waterlift generally. As our chapter on Irrigation will show, we are very far from desiring to minimise the importance of these operations but it is unfortunate that they should have thrust the improvement of implements so much into the background. We fully realise the special difficulties which have to be faced in pushing the use of improved implements and of improved agricultural machinery generally. There are difficulties of finance. Certain kinds of agricultural machinery such as tractors, power mills for crushing sugarcane, and threshing machines are obviously entirely out of the reach of the small cultivator unless some method of using them co-operatively can be devised. But while the financial difficulty may militate against the adoption of an improved type of even comparatively inexpensive implements such as ploughs and hoes, we think that an important obstacle is the natural dislike which the normal individual has to being regarded as eccentric because he has bought a novel implement. The remedy for this is simple and effective. Propaganda must always be intensive, that is, it must not rest content with trying to convert one or two individuals in a village here and one or two in a village there; it must reach all the cultivators of a village and induce as many of them as possible to accept the improvement. In so far as cost is a deterrent to the adoption of even comparatively inexpensive implements, the agricultural departments would do well to consider the possibilities of mass production of the wooden parts of such implements. At the departmental farm at Hmawbi close to Rangoon, we saw a striking example of the reduction in price which such mass production can effect. The indigenous plough, consisting of a wooden frame and iron share, costs Rs. 5 to Rs. 6. The share costs annas 8 to Rs. 1-8 according to size. A strong frame when made by hand costs Rs. 4-8, but can be turned out by machinery in lots of 200 at Rs. 1-12 each, thus enabling a much improved share costing Rs. 2-8 to be fitted and the whole plough to be sold at a price below that of the inferior indigenous plough. The result was that the implement recently introduced was selling rapidly. There are also difficulties arising out of

the lack of facilities for repairs and for obtaining spare parts. But, even after due weight is given to these, it is impossible to avoid the conclusion that the agricultural departments are far from being in as strong a position *vis-á-vis* the cultivator in regard to those implements which are within his means as they are in regard to improved seed.

ORGANISATION OF THE AGRICULTURAL ENGINEERING SECTION

106. Research into problems connected with agricultural machinery and implements will not take that place in the estimation of the agricultural departments which is justified by its intrinsic importance unless the agricultural engineering section of the departments is completely reorganised. The first essential, in our view, is that the section should be regarded as an integral part of the departments and that the officers in charge of it should not only be recruited on the same terms as members of the new superior provincial agricultural services but should be included in the cadre of those services. Their staff would similarly form part of the provincial or subordinate agricultural services. The second essential is that the pumping and boring operations should be completely separated from work on agricultural machinery and implements. Both branches of work are highly specialised and it is only in very exceptional circumstances that a man capable of handling both of them satisfactorily is likely to be found. In our chapter on Irrigation, we have discussed the question of the department which can most suitably carry out pumping and boring operations and have there recommended that these should be entrusted to the Agricultural Department. The importance of pumping and boring operations varies greatly in different provinces ; but we are of opinion that, in any province in which these are in progress on a considerable scale, the engineering section of the Agricultural Department should be divided into two branches, one of which would concentrate solely on work on agricultural machinery and implements and the other on pumping and boring. Work on water-lifts should be entrusted to that branch from which it is likely to receive the greatest attention ; but in provinces, such as Madras, the Punjab and the United Provinces, where wells are numerous, it might be desirable to entrust this responsibility to a third and separate branch. We consider that it would probably tend to administrative convenience and efficiency if the two branches or, if the sub-division suggested in the preceding sentence were effected, the three branches, were under the technical control of a senior engineer who would himself be under the general control of the Director of Agriculture and who would be selected from either branch of the section, or from outside, as necessitated by circumstances.

As regards the qualifications required for the officer in charge of the work on agricultural machinery and implements, we are of opinion that the head of this branch should be a research engineer who is primarily an engineer and secondarily a farmer, a man familiar not only with the manufacture of machinery and implements but also with their use on the land. In short, he should be thoroughly conversant with the various problems which confront the small cultivator. He

should know how to test implements in the field and to adapt them to the conditions he there finds. Such qualifications are by no means common as, except in the United States of America, graduates in engineering seldom come from the agricultural community and it is still more rare for graduates in agriculture to possess sufficient mechanical aptitude to enable them to benefit from an engineering training. For some time to come, it will probably be necessary to look to America or Europe for the type of agricultural engineer we have in view, that is, for a man who is a first class mechanical engineer with farming knowledge.

SCOPE OF RESEARCH WORK ON AGRICULTURAL IMPLEMENTS AND MACHINERY.

107. There is a very wide field of research awaiting the worker on agricultural implements. A fundamental problem which has still to be taken up is the relation of the capacity of the cultivator's bullocks to the implements they are required to draw. There is no feature of Indian agricultural practice which more forcibly strikes the agriculturist from other countries than the apparent inadequacy of the Indian plough to the work it is called upon to do. The construction of the ordinary country plough is such that it does not invert the soil and ploughing with it to any depth is difficult. Opinion is somewhat sharply divided as to why the cultivator has adhered so firmly to the use of this and similar primitive types of implement. It has been held by some authorities, notably by the Indian Sugar Committee, that his present implements, more especially the plough, are the best that he can use with the bullocks he possesses and that, everywhere in India outside the Punjab, Madras and Bombay, where a large type of plough bullock is employed, the first essential to the adoption of improved types of implements is the improvement of cattle. A second view is that the reluctance of the cultivator to adopt improved implements is due far more to his preference for implements he can carry to and from his fields than to any serious deficiency in draught power. We believe that the importance of conserving moisture has been the principal reason for the Indian cultivator's preference for the type of plough used by him; and, as he is too poor to afford a variety of implements, the ordinary Indian plough is the best type of general purpose implement for his needs. It does not work as a plough in the western sense, but as what in English practice is termed a "cultivator." Although Indian soils would undoubtedly benefit at times by the use of an inverting plough, it is held that they still more often require the process known as "cultivating" for the purpose of conserving moisture. If, therefore, for financial reasons, two implements cannot be purchased, the best single type is that which stirs but does not invert the soil. By repeated use the Indian plough can reduce the soil to the same physical condition as is secured by the inverting implement in a single operation. Support is given to this view by the fact that the fellaheen of Egypt, who are remarkably successful cultivators, adhere to an implement of the Indian type. The differing views have probably taken their colour from varying local conditions and it is clear

that the only method by which the correctness of any one of them can be definitely established is by a series of careful experiments carried out over a term of years. It is eminently desirable that further attention should be given to this subject on which evidence based on experiment is lacking. If the draught capacity of the bullock should prove the limiting factor in regard to the adoption of improved implements in any part of India, it is obviously useless for the Agricultural Department to push the use of such implements in that tract until such time as a bullock has been produced which will prove equal to the work required of it or until the condition of the present cattle has been improved to make them equal to drawing implements of greater draught. We would remark, in passing, that, even if lightness and portability of implements should prove the principal desiderata, there would still remain ample room for improvement in the types of draught cattle used in the greater part of India. This point is discussed in our chapter on Animal Husbandry.

Recent work at Rothamsted has thrown valuable light on the lines on which the experiments we suggest above should be carried out. The study of the cultivation processes at Rothamsted has been greatly facilitated by the measurement of the resistance offered by the soil to the passage of the implements used in cultivation. This measurement is done by means of a specially designed dynamometer which is inserted in the hitch between the implement and the tractive force. The records thus obtained are of direct use in comparing the working efficiency of different implements and of different types of the same implement provided that the heterogeneity of the soil has been previously ascertained and that due allowance has been made for it. The records are also of further value, after analysis in the laboratory, in ascertaining the part played by such factors as soil cohesion and plasticity and by surface friction. The dynamometer measurements thus form an essential connecting link between laboratory and field studies and it is, therefore, necessary that the instrument itself should be as reliable as possible. Much work has been done at Rothamsted on the development of a suitable design and an instrument has now been evolved which has satisfactorily passed severe and extended tests. The instrument is light and convenient in use and, as the record is obtained on a moving celluloid strip, it is both grease and weather proof. It is capable of recording every range in draught from a few pounds to several tons. The apparatus has been placed on the market and we are of opinion that its adaptation to use in Indian conditions should be thoroughly tested.

The use of an improved plough which will permit of deeper ploughing than can be done by the ordinary country implement is frequently advocated as an agricultural practice the adoption of which would prove of immense benefit to the Indian cultivator. That such ploughing is essential to the proper cultivation of improved types of sugarcane and that it is advantageous in conserving moisture for the *rabi* crop in certain conditions is unquestionable. But it has certainly not been established that it would pay the cultivator in all *kharif* conditions. Indeed the contrary is more probable for, on the one hand, in areas where the rainfall is light, there is great risk that deep ploughing

will disperse the moisture received from the first showers to such an extent that the seed will not germinate; on the other hand, in areas of heavy rainfall, deep ploughing is liable to cause the retention of so much moisture that again germination may fail or be defective, while, if sowing is unduly delayed, the yield may be adversely affected. This, again, is a point on which sound advice can only be given to the cultivator on the basis of exhaustive trials of the comparative merits of the country and of the inversion plough, carried out under his conditions and extending over a period of at least five years. Such trials should be combined with the investigation into the draught capacity required for different implements suggested above and the results would require very careful analysis with reference to the climatic conditions under which they were carried out.

Several witnesses before us, including the representatives of important manufacturing interests, expressed the view that the spread of improved implements in India would have been much more rapid than it has been had it not been for the efforts of agricultural officers and others to invent new types. Such efforts, though entirely praiseworthy in intention, have been distinctly unfortunate in effect if for no other reason than that they have involved a waste of time and money on the evolution of types which have already been experimented with by manufacturers and condemned on the ground of cost or other disadvantages. We consider that there is a certain amount of justification for this view, and that one of the reasons why the work of the Agricultural Department on improved implements has so far been disappointing is that the idiosyncrasies of individual inventors have been allowed too free play and that the advantage of a continuous series of experiments, fully recorded and handed on from one officer to his successor, has been sometimes lost sight of. The excessive multiplication of improved types of implements is open to very much the same objections as the excessive multiplication of improved varieties of crops. It merely confuses the cultivator and makes him suspicious of the whole policy of the Agricultural Department. It is open to the further objection that it prevents mass production, with the reduction in cost that results therefrom, and also the standardisation of spare parts on any large scale. We were informed by one large firm of manufacturers in England that, of the 350 types of ploughs they were making, mass production had only proved possible with a dozen types and that this was the experience of the trade as a whole. It will, however, be obvious that notwithstanding the great diversity of local conditions, a country such as India, in which the total number of ploughs is about 25 millions, presents great possibilities of advance in this respect. We trust that the reorganisation of the engineering sections of the agricultural departments which we have advocated in the preceding paragraph will lead to greater continuity of policy and we would again emphasise that the aim of these sections should be the evolution of a small number of types, suitable for a wide range of conditions, and, therefore, suitable also for mass production. We realise that the number of types eventually put out under the

auspices of the department must vary in different provinces and that provinces such as the Punjab, the United Provinces or Bengal, with their large tracts of comparatively homogeneous soil, should need fewer types than provinces in which conditions are so varied as they are in Madras, the Central Provinces and Bombay.

The improvement of existing agricultural implements and machinery offers, in our view, a more promising field for the activities of the agricultural engineering section than the introduction of new implements or machinery. But, whilst we think that the most important part of the work of this section should be the careful testing of different types of implements, of cane crushing mills, of water-lifts and buckets and so on, and their adaptation, where necessary, to local conditions, we do not wish it to be inferred that we are of opinion that there are no possibilities of introducing new implements or machinery. We were informed by the Director of Agriculture, Madras, that a cheap automatic seed drill which would enable the cultivator to take the fullest advantage of the first fall of rain was badly needed. Strong and cheap threshing and winnowing machines which were also mentioned to us as desiderata should appeal to the cultivator with a holding of moderate size in tracts where labour is scarce or dear. To assist his bullocks in treading out the corn the Egyptian fellah uses a cheap and simple implement that might prove useful in many parts of India. The improvement of the country cart with a view to make it less destructive to the roads and more humane to the cattle is also a matter which might well engage the attention of the agricultural engineering section.

POSSIBILITIES OF POWER MACHINERY.

108. We have so far dealt with agricultural implements and machinery mainly from the point of view of the small cultivator. The use of large scale machinery such as steam tackle and motor tractors, and indeed of any form of power machinery, is obviously entirely outside his purview in present conditions and the only hope of placing it within his reach is by co-operative effort. On large estates, especially on those on which the problem of the labour supply is at all acute, the question assumes a different aspect. The Indian Sugar Committee, which examined it in some detail, came to the conclusion that, given areas large enough to keep it fully employed, steam tackle could effect material economies in the cost of cane cultivation. As regards motor tractors, the committee held that on smaller estates and even on large estates where it was not a question of breaking up large areas of land, the motor tractor, whilst equally useful, would probably be found more economical than steam tackle as its capital cost would be much lower and it would not, therefore, involve such a heavy charge per acre as steam tackle does on any estate which is not of sufficient size to keep it fully employed. At the time the Sugar Committee reported, experiments to ascertain the most suitable type of tractor for different classes of land were in progress and, on the basis of the results obtained at Pusa, it was held that a tractor would displace eight to ten pairs of bullocks and that, in these circumstances, the scope for the use of tractors in India was enormous. The Sugar Committee dealt with this question solely as it affected cane cultivation

and based its conclusions mainly, if not entirely, on experiments carried out at Pusa. Since the Committee reported, some progress in the use of steam tackle and motor tractors has been made in Bombay, the Punjab and the Central Provinces, but, on the whole, it has been very small, and little evidence of value on the subject was forthcoming during our enquiries. The agricultural departments do not appear at present to be in a position to give a lead in regard to the use of steam tackle and motor tractors owing to the insufficiency of the investigations which have so far been made into the economics of cultivation by their means. There appears, for example, reason to believe that the published figures of the cost of cultivation by steam tackle and tractors are sometimes misleading owing to the failure to include an allowance for interest on the capital cost of the plant and for depreciation.

A thorough and businesslike investigation of the economics of power cultivation appears to us to be specially called for in the Central Provinces where the use of such machinery seems to offer the only hope of bringing back to cultivation the extensive areas of land at present lying desolate owing to infestation with the deep rooted *kans* grass. The tractors so far used have proved unequal to the work of removing this and steam tackle is now being employed. Whatever the type of power machinery found most suitable, a detailed investigation of the cost of employing it is essential.

RAILWAY RATES ON AGRICULTURAL MACHINERY AND IMPLEMENTS.

109. In pursuance of our desire that the manufacture in India of agricultural machinery and implements should be encouraged, we have also examined the rates charged by the railways for the transport of such goods. In the present state of industrial development in India, it cannot be expected that a factory capable of turning out the more elaborate types of machinery and implements should be established in each province. At the same time, railway transport charges to distant parts of the country are a serious matter to agricultural implement firms. While the railways are commercial undertakings and, as such, must earn a reasonable rate of interest on the capital sunk in them, it is greatly to their interest to encourage internal manufactures by charging the lowest possible rates for the movement to the factory of raw materials and from the factory of the finished article all over the country. We would, therefore, suggest that freight rates on agricultural implements and machinery should be re-examined from this point of view and that, where possible, concessions should be given.

REBATE OF THE IMPORT DUTY ON IRON AND STEEL USED IN THE MANUFACTURE OF AGRICULTURAL IMPLEMENTS AND MACHINERY.

110. A discussion of the methods which should be adopted to promote the use of improved agricultural machinery and implements in India falls more naturally in the chapter on Demonstration and Propaganda and will there be found. There are, however, two points in connection with machinery and implements which may conveniently be dealt with here. It was represented to us that, whilst agricultural implements and machinery with a few exceptions are admitted into India free

of duty, the high protective duties levied on imported iron and steel greatly increase the cost to the Indian manufacturer of his raw material, whether imported or produced in India. He is thus placed at a serious disadvantage as compared with his foreign competitors. An attempt to assess the exact extent of the disadvantage under which he labours would have necessitated an examination of technical questions of manufacture which was beyond our competence but there appear to us to be *primâ facie* grounds for holding that the representation which was made to us on this point is deserving of further investigation. In the present stage of development of Indian agriculture and of the manufacture in India of agricultural implements and machinery, we should be strongly opposed to any measures, such as the imposition of a protective duty in the interests of the Indian manufacturer, which would increase the cost to the cultivator of implements and machinery. At the same time, the scope for the use of improved implements and machinery is so great that it is most desirable that manufacture in India should be encouraged. The existence of the duty on imported iron and steel acts in exactly the opposite direction and discourages the Indian manufacturer from using the best and most durable material available. We, therefore, recommend that enquiry should be made into the effect on the Indian manufacturer of the present rates of import duty on iron and steel. If it is found that the handicap imposed by the duty on his raw material is at all serious, we consider that he might be given a rebate on any iron or steel which he can show to have been imported for the manufacture of agricultural machinery and implements. If the recommendation which we make below is accepted, all classes of agricultural machinery and implements will be imported free, and a rebate would not therefore be open to the criticism that it gives the manufacturer in India an unfair advantage over firms in India importing agricultural machinery and implements.

The second point which arises in this connection is the definition of "agricultural implements" which is adopted for the purposes of the Tariff Schedule. It appears that the pans used for boiling *gur* are regarded not as agricultural implements but as "iron or steel discs and circles." As such, they are subject to a protective duty. This differentiation is difficult to understand as these pans are much more essential to the cultivator of sugarcane than is a winnower to the cultivator of wheat. Again, whilst the pug mills and centrifugal machines used in the manufacture of sugar, when worked by power, are now admitted free of duty under the Tariff Amendment Act recently passed, such machines when worked by hand and animal power are classed under the head "All other sorts of implements, instruments, apparatus and appliances and parts thereof, not otherwise specified" and are subject to a duty of fifteen per cent. This classification bears very hardly on a subsidiary agricultural industry, the great value of which to the small cultivator came prominently under our personal observation in the United Provinces. Further, it has been represented to us that the poultry industry, another subsidiary agricultural industry of considerable potentialities, is handicapped by the duty of fifteen per cent which is levied on incubators. On

the other hand, all appliances used in the dairy industry are admitted free. There are probably other anomalies of a similar character which have not come under our notice. The existing tariff legislation clearly recognises the desirability of cheapening the cost to the cultivator of all agricultural implements, apparatus and machinery. We are strongly of opinion that this principle should be carried to its logical conclusion and that the term "agricultural implements" should invariably be interpreted in the sense most favourable to him.

SIMULTANEOUS INTRODUCTION OF IMPROVED VARIETIES OF CROPS AND IMPROVED METHODS OF CULTIVATION.

111. A word should here be said in regard to the contention which has frequently been put forward that, where the standard of cultivation is not already comparatively high, no permanent advantage can be expected from the spread of improved varieties of crops without the simultaneous adoption of improved agricultural methods. The Indian Sugar Committee was specially emphatic on this point, and went so far as to hold that, in attempting to achieve lasting improvements by the substitution of new varieties of cane in northern India, where the standard of cane cultivation is notoriously low, without any complementary improvement in the treatment they receive, the Coimbatore Sugarcane Station was pursuing a chimera. We consider that this is a much exaggerated view. We have stated our opinion that there is considerable justification for holding that improved varieties of crops require more liberal manurial treatment than those ordinarily grown because of their more rapid development and larger yield, and it is not open to argument that improved varieties of crops will not give the best results unless their introduction is accompanied by that of improved methods of cultivation. But it has, we think, been abundantly established that even where the standard of cultivation falls far short of that which is desirable, there are a number of improved varieties which can be grown with advantage to the cultivator. In putting forward this view, we do not, of course, wish it to be understood that the agricultural departments should in any way relax their efforts to ensure that such varieties are grown in conditions which will enable them to yield the maximum return.

PROBLEMS OF CULTIVATION IN DRY AND PRECARIOUS TRACTS.

112. Cultivators in dry and precarious tracts are those whose struggle for a livelihood is commonly hardest, and whose standards of living are most depressed. The problems of cultivation in such tracts in which crops are entirely dependent upon rainfall are, in our opinion, deserving of far closer attention than they have received from the agricultural departments. In the earlier years of their history, and for the reasons which we described in paragraph 97, the departments applied themselves first to research on those crops which offered the best prospects of success and which, in the main, with the exception of groundnut and certain varieties of cotton, were crops grown under irrigation. It happens, moreover, that those crops that have received least attention from the departments of agriculture, such as the millets, are amongst the typical crops in most unirrigated districts. Thus, the cultivator in dry areas may, we think, reasonably complain that, neither

as regards those problems of cultivation peculiar to the conditions in which he farms, nor as to the crops, with the exception of cotton and groundnut, which are of special importance to him, has he received a fair share of the time and attention of the agricultural departments. Though the problems of the farmer in unirrigated areas of sparse rainfall have, during the past half-century, received attention in many parts of the world, much more remains to be done in this area of investigation. The timely reduction of the land to a condition in which it is best able to receive and conserve the available moisture; the peculiar need of inter-culture during the development of the crop; and the possibilities of the profitable use of manures, artificial and natural, both as a means of providing plant food, and also of improving the texture of the soil, are all questions which offer a hopeful field for further systematic enquiry, and for demonstration and propaganda in the tracts in question. Another problem of much importance in the dry tracts is that of equipping the cultivator at small cost with an implement capable of rapidly breaking up the surface of land immediately after rain. The condition of the soil in which it is capable of being so treated does not long endure, and the area that a cultivator can sow in unirrigated land is frequently limited by that which he can succeed in breaking up during this brief period of time. Again, we are impressed by the possibility, particularly in dry districts, of accelerating, by means of the repeated use of the plough, those natural processes by which plant food materials are formed in the soil. This is a matter which, in our opinion, deserves the attention of the departments in the fields both of experiment and of advertisement.

CROP PROTECTION—(a) EXTERNAL.

113. Closely bound up with the subject of crop improvement is that of crop protection. The Indian agriculturist is protected against the importation of pests and diseases from outside the country by an all-India Act—the Destructive Insects and Pests Act II of 1914. This legislation appears to be satisfactorily fulfilling the objects with which it was enacted and the only criticism of its working that was made in evidence was that disinfection at the port of entry sometimes took so long that the plants treated did not survive to reach their destination. So far as such complaints are justified, they merely point to administrative defects which it should not be difficult to rectify. A suggestion was made to us that the exemption from the operation of the rules framed under the Act which has been made in favour of the Imperial Sugarcane Expert and the Secretary of the Sugar Bureau at Pusa, who are allowed to import material direct, should be extended to directors of agriculture who also have mycological and entomological assistance readily available. In these circumstances, it was urged that exemption would not lead to any undesirable results. It is, however, in our opinion, so important that India should be safeguarded against the introduction of new pests and diseases that we are unable to support this proposal. The history of the boll-weevil in the United States has shown how great are the risks that would attend any relaxation of the present restrictions.

The Destructive Insects and Pests Act of 1914 governs the import into British India only of material likely to cause infection to crops. It would seem that, when the Act was passed, the importance of securing the co-operation of the maritime Indian States was not sufficiently realised. The necessity for obtaining this has recently become prominent owing to the occasional importation of East African cotton seed into ports in the Kathiawar States and the consequent danger that the Sudan boll-worm (the African red boll-worm, *Diparopsis castanea*) may be brought into this country. The Indian Central Cotton Committee has under consideration the question of enlisting the interest of the Darbars of the Kathiawar States in making at their ports arrangements designed to prevent the occurrence of a calamity of this nature. We trust that the Government of India will take steps to draw the attention of the Darbars of all maritime States to the urgent need of guarding against a danger that threatens the agricultural prosperity of the whole of India, including that of the States in question. We also hope that it may be found possible at an early date to secure the co-operation of the maritime States in measures designed to give security against the possible introduction into India of plant pests of whatever nature, and not only of those peculiar to the cotton plant. Otherwise internal measures against infection may become necessary in future and these will give rise to problems of far greater difficulty than those presented by protection against infection from outside India. Burma is, however, specially favourably situated geographically in respect of infection from outside. It is at present free from certain pests which attack Indian crops such, for example, as the *chilo* insect which attacks *juar* and certain grasses, the *emmolacra* which attacks sugarcane and the stem borer which attacks cotton. In these circumstances, there appears to us considerable force in the proposal which was made to us in the course of the evidence which we took in Burma that the Destructive Insects and Pests Act should be amended in order to permit the control of the import into Burma from India of any material likely to cause the infection of a crop grown in that province. The object desired could, we think, be more satisfactorily secured by provincial legislation. The exact scope of this legislation would require careful examination by a small expert committee on which any trade interests involved should be suitably represented.

(*b*) INTERNAL PROTECTION—

(1) PROTECTION AGAINST PESTS AND DISEASES.

114. The problem of internal protection falls under three main heads. These are protection against pests and diseases, protection against deterioration of a superior variety which results from the mixing of seed and protection against wild animals and vermin. There are two methods of dealing with the problem of protection against pests and diseases. The first is by purely agricultural measures such as the strengthening of the entomological and mycological staffs of the agricultural departments, the evolution of varieties which are resistant to disease and the general improvement of the environmental conditions under which crops are grown. The extent to which pests and diseases can be controlled by attention to the two last of these factors has been very strikingly illustrated in Java where the Research Station

Association of the Java Sugar Industry has found that proper methods of cultivation and the introduction of immune or highly resistant varieties of sugarcane are the most important factors in the control and elimination of pests and diseases. It may be doubted whether this satisfactory condition of affairs is capable of attainment in India even in regard to a particular crop such as sugarcane or cotton. The agricultural departments are, however, fully alive to what is required in this direction and, except to the extent mentioned below, we have no special recommendations to make under this head. We consider that each of the major provinces should have its own entomologist and mycologist and where financial considerations have prevented the addition of these appointments to the cadre of the Agricultural Department, we trust that the omission will be supplied at an early date. As regards the Imperial staff, the Indian Sugar Committee recommended that an entomologist should be added to the staff of Pusa specially for work on insect pests of sugarcane. The necessity for this appointment still continues and we would, therefore, support the recommendation of the Sugar Committee in this regard as also that for more mycological work on diseases of cane.

The second method of dealing with destructive pests and diseases is by legislation. So far, the only province which has taken concerted action to deal with these by legislation is Madras in which an Agricultural Pests and Diseases Act was passed in 1919. This Act has been used very successfully in combating a fungoid disease of the palmyra palm, an insect pest of coconut palms and the spread of the water hyacinth but has not proved so successful in dealing with the pests at which it was principally aimed—the insect pests which attack Cambodia cotton. The failure in this respect does not appear to have been due to any defect in the Act itself, but to the fact that lack of popular support has prevented its provisions being put into full operation. Cambodia cotton is sown in October, usually about the middle of the month. The first or main picking of the previous season's crop is taken in May. The June rains produce a new flush which is followed by a second picking. If the rains are late, this picking is delayed till August. The Agricultural Department holds, for what we consider to be sound reasons, that the only hope of eradicating the pink boll-worm and the spotted weevil, which cause so much damage to the Cambodia cotton crop, lies in the fixation of a minimum period of two months between the time the old crop is off the ground and the new crop is sown. In ordinary conditions, this minimum period can only be secured if the old crop is uprooted before August 1st, that is usually before the second picking is complete and sometimes before it has even commenced. It is in these circumstances that the Act has, ever since it was introduced, met with considerable opposition from those affected by it who have failed to realise that any loss resulting from the failure to obtain a picking of badly diseased and stained cotton—for the second picking is always very markedly inferior to the first—would be far more than counterbalanced by the higher prices that would be obtained as the result of the better quality of the following year's crop. Owing to the opposition which has been encountered, the date by which Cambodia

cotton has now to be removed has been fixed at September 1st and the provisions of the Act have been largely rendered nugatory. Whilst we consider that the Madras example in passing an Agricultural Pests and Diseases Act is one which deserves general imitation, we are strongly of opinion that, once such an Act has been placed on the Statute Book, its provisions should be rigidly enforced and should not be rendered ineffective by half-hearted application.

(*ii*) PROTECTION AGAINST DETERIORATION DUE TO MIXING OF SEED.

115. The only crop in respect of which the deterioration resulting from the mixing of seed has been so marked as to necessitate special measures for dealing with it is cotton. The reason for this is that cotton has so far been the only crop in India for which it has proved worth while to import an inferior variety from one tract into another with the deliberate purpose of adulteration. In the Punjab canal colonies, where two distinct species of cotton, one comprising the short stapled indigenous varieties and the other the longer stapled American varieties, are grown in the same tract, a recent survey conducted by the Indian Central Cotton Committee has shown that mixing by the cultivator is negligible and that the two species are marketed separately but mixed deliberately at the ginning factories. Deterioration owing to mixing has thus been due to commercial rather than agricultural conditions In these circumstances, the grower of cotton cannot be held responsible for it.

Under the Cotton Transport Act III of 1923, an all-India Act, based on the recommendations of the Indian Cotton Committee as modified by the Indian Central Cotton Committee, a local Government, with the approval of the Legislative Council, may notify any area in which cotton of superior quality is grown and may prohibit the importation by rail, road or sea into such an area, except under license, of ginned or unginned cotton, cotton seed or cotton waste. The provisions of the Act were put into force soon after it became law in two areas in the Bombay Presidency and have recently been enforced in three areas in the Madras Presidency. In the areas in which it has been enforced, the Act is proving effective in checking the more flagrant forms of abuse but it cannot be applied to conditions such as exist in the Punjab canal colonies, where, as stated above, short and long staple varieties are grown in the same tract. It is hoped that the Cotton Ginning and Pressing Factories Act, also an all-India Act, which became law in 1925, and under the provisions of which mixed, adulterated or damped cotton can be traced back not only to the factory which ginned and pressed it but also to the original owner will enable such malpractices as those which have led to the deterioration of Punjab cotton to be stopped. The Act has not, however, been in force sufficiently long to show how far this anticipation is likely to be realised. Should it prove unfounded, other means of dealing with the situation will need to be devised. We do not consider it necessary to discuss the form these should take as we have every confidence in the ability of the Indian Central Cotton Committee to deal adequately with this and all other questions affecting Indian cotton. We feel it necessary, however, to state that the evidence we have received

entirely supports the view taken by that committee of the seriousness of the deterioration of Punjab cotton which has resulted from the mixing of seed in the ginning factories.

(iii) PROTECTION AGAINST WILD ANIMALS AND VERMIN.

116. The extent of the damage to crops from wild animals varies greatly from province to province but that it is considerable for India as a whole is evident from the fact that a committee which investigated the question recently in the Bombay Presidency estimated the direct loss for that province alone at Rs. 70 lakhs annually. It is probably as great in the United Provinces and even greater in the Central Provinces but, on the other hand, we received no complaints in regard to it from Madras. Tracts adjacent to forests are the worst sufferers especially as both cattle and crops in such tracts are laid under toll. But the damage done is by no means confined to such tracts and the crops of cultivators in areas remote from forests are often subjected to the unwelcome attentions of wild pigs, jackals and black buck whilst, in some parts of India, notably in parts of the United Provinces, monkeys are an unmitigated nuisance. Concerted action against wild animals in this country is rendered difficult by the aversion of a very large section of the community from taking animal life. Mainly for this reason, many witnesses before us held that the only satisfactory method of combating the evil was by fencing.

Fencing is, however, in most cases beyond the means of the small cultivator ; and co-operative societies for fencing, which have met with some success in parts of the Bombay Presidency, encounter great difficulties owing to the fact that the interest of the cultivator in communal fencing varies inversely with the distance of his fields from the forests or waste lands in which wild animals find harbourage. We were informed that sugarcane in the Central Provinces can be adequately protected by woven fencing and that there is a steady expansion in the use of such fencing. Where stone is readily available, as it is in parts of the Bombay Presidency, stone walls, provided they are properly maintained, have been found cheap and effective. Speaking generally, however, the problem of devising a satisfactory form of fencing is one which requires further investigation. On the whole, therefore, whilst we consider that the agricultural departments should persevere in their efforts to find such a fencing and should more especially experiment with live fences in areas in which suitable material for these is available, and that co-operative action in this direction should be encouraged in all possible ways, we are of opinion that fencing can only, at the best, be regarded as a palliative. We revert to this point in our chapter on Animal Husbandry, paragraph 202. The remedy most generally advocated in evidence before us was the grant of gun licenses on a more liberal scale than that now in operation. There is an obvious danger not only that fire-arms so licensed might be misused but that they might not be used at all but merely retained as a mark of dignity. We doubt, however, if the latter risk would really be appreciable, if care were taken to grant licenses for crop protection only to persons competent and willing to use guns. The

number of gun licenses issued for crop protection within the last fifteen years has grown from about 49,000 to over 81,000, that is by 65 per cent.

Operations on a large scale against vermin are at present confined to the Punjab and lower Sind. In the Punjab, a staff of two agricultural assistants, four temporary *mukaddams* and eight fieldmen are now being employed in extirpating rats, mole rats and porcupines. Grants are in some instances given by district boards and over 700,000 rats were killed in 1926. The operations in lower Sind are directed chiefly against rats. A small staff of three agricultural assistants is employed and zamindars in the areas where work has been done have offered to defray the whole cost of the continuance of the operations.

In view of the damage admittedly done to crops by wild animals, we have been careful in the course of our inquiries to watch for any indication that the interests of the cultivator are being sacrificed to the interests of sport, and we have also examined from this point of view the provisions of the Wild Birds and Animals Protection Act (No. VIII of 1912) and of the Indian Forest Act (No. VI of 1927). As a result, we are satisfied that there is no evidence to justify any such allegation over the country as a whole. Where reserved forests are close to cultivation, it may, however, be desirable to review the question of the grant by the competent forest officer of the permits without which no person is entitled to enter such forests for purposes of destroying wild animals. Provided that no damage is done to the forest as a timber reserve, permits should, we consider, never be refused for the destruction of harmful animals in such of these forests as are close to cultivation or to areas frequented by cattle, where it can be shown that damage is being inflicted. This recommendation does not apply to forest villages situated in high forests remote from extensive cultivation. In such cases, the preservation of a certain number of the larger fauna may be a legitimate object of forest policy in the interests of the country as a whole.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

117. The conclusions and recommendations in this chapter may be summarised as follows :—

(1) A soil survey of the whole of India at the present time is not recommended (paragraph 76).

(2) Soil surveys should only be undertaken when there is a specific problem to solve or when laboratory examination of soils is required to interpret information already on record (paragraph 76).

(3) The Council of Agricultural Research should undertake the collation and publication of all the available information regarding the composition and characteristics of Indian soils (paragraph 76).

(4) No sensible diminution in the fertility of long cultivated soils is to be anticipated (paragraph 77).

(5) There is much scope for work in many directions on soils and soil conditions, more particularly where rice is grown (paragraph 78).

(6) For this work additional staff will be required (paragraph 78).

(7) A rapid expansion of the afforestation of ravine lands in the United Provinces as a means of preventing soil erosion is justified by the results so far obtained (paragraph 79).

(8) The exact extent of soil erosion in the Bombay Presidency should be investigated and schemes for preventing it should be prepared (paragraph 79).

(9) The feasibility of combining the methods adopted in the United Provinces and Bombay for the prevention of soil erosion in western Bengal and the submontane districts of the Punjab should be investigated (paragraph 79).

(10) The methods of preventing soil erosion in Bombay appear specially applicable to Chota Nagpur (paragraph 79).

(11) There is justification for the view that improved varieties of crops require for their fullest development more liberal manurial treatment than those ordinarily grown, but the subject is one which requires the most careful study by the agricultural departments (paragraph 80).

(12) The agricultural departments in India are not at present in a position to give the cultivator, whether of irrigated or unirrigated crops, definite advice in regard to the economic use of fertilisers (paragraph 81).

(13) The existing material bearing on this point should, therefore, be carefully studied and the results obtained correlated so far as the nature of the material permits (paragraph 81).

(14) A programme of experiment with the object of ascertaining with exactitude the extent to which fertilisers can profitably be used should be formulated (paragraph 81).

(15) Manurial experiments on unirrigated land are specially important (paragraph 81).

(16) The Council of Agricultural Research should be in a position to advise as to the manner in which experiments with fertilisers can best be conducted so as to secure uniformity of method and to render results obtained in one province of value to other provinces (paragraph 81).

(17) The evidence has not suggested any alternative to the use of farmyard manure as fuel for domestic purposes where coal and wood are dear (paragraph 82).

(18) In some tracts the refuse of crops could be used for fuel to a far greater extent than at present (paragraph 82).

(19) Steps should be taken to promote the better preservation of such farmyard manure as is not diverted to consumption as fuel (paragraph 83).

(20) The Indian cultivator has much to learn from the Chinese and Japanese cultivator in regard to the use of composts (paragraph 83).

(21) A beginning has been made in investigating the possibilities of manufacturing synthetic farmyard manure in India on the lines worked out at Rothamsted, but more investigation is required (paragraph 83).

(22) The use of poudrette is preferable to that of night soil (paragraph 84).

(23) The methods of converting night soil into poudrette adopted at Nasik and elsewhere deserve study by municipalities (paragraph 84).

(24) The agricultural departments should themselves conduct experiments in the conversion of night soil into manure and arrange for demonstrations (paragraph 84).

(25) The activated sludge process provides a means of overcoming the objections of the cultivator to the use of night soil. The possibilities of adopting this process, however, depend on local circumstances (paragraph 84).

(26) The agricultural departments should investigate the best methods of employing leguminous crops in increasing soil fertility (paragraph 85).

(27) Experimental work is required to discover the green manure crops which can best be included in the cultivator's rotations (paragraph 86).

(28) The possibility of growing crops which will supply green manure without impairing the commercial value of the crop is worth consideration (paragraph 86).

(29) The continuance of the remission of the charge for water from government sources of irrigation in certain provinces and its extension to other areas as an encouragement to grow green manure crops should be conditional on its being accompanied by active propaganda. All areas in which the concession is given should be kept under regular examination (paragraph 86).

(30) Neither an export tax on oil-seeds or oilcakes nor the total prohibition of such export can be justified (paragraph 87).

(31) The only method by which the advantages of the supply of combined nitrogen available in the large crops of oil-seeds grown in India can be secured is by the natural development of the oil-crushing industry and the possibilities of an extension of the industry should be investigated (paragraph 87).

(32) The development of the manufacture of, and the local market for, sulphate of ammonia in this country is satisfactory (paragraph 88).

(33) No further investigation under government auspices of the possibilities of manufacturing synthetic nitrogen in India is at present required (paragraph 89).

(34) The objections to the establishment by the Government of India of a central fertiliser organisation subsidised by firms dealing in fertilisers are such that this course cannot be recommended, but the establishment by fertiliser firms of their own research stations working in co-operation with the agricultural departments and other bodies interested in the fertiliser question is to be welcomed (paragraph 90).

(35) Neither an export tax on bones, bone meal or fish manures nor the total prohibition of such export can be justified (paragraphs 91 and 92).

(36) A thorough investigation of the economics of the bone-crushing industry is required before the establishment of bone-crushing factories at suitable centres can be recommended (paragraph 91).

(37) The known deposits of natural phosphates in India offer no important possibilities as a source of fertilisers (paragraph 93).

(38) No necessity at present exists for legislation against the adulteration of fertilisers (paragraph 94).

(39) The railway authorities should keep under constant review the possibility of given further concessions for the transport of fertilisers (paragraph 95).

(40) There is still very great scope for further work in introducing improved varieties of crops, especially in regard to millets, pulses and oil-seeds (paragraph 97).

(41) Of the methods of obtaining varieties superior to those ordinarily grown, selection is that which still, in general, offers the greatest possibilities in Indian conditions (paragraph 97).

(42) Hybridisation should only be undertaken by officers who, in addition to special training, have had the necessary experience of Indian crops and conditions (paragraph 97).

(43) It will as a rule be advantageous to the research worker to combine his main work on a particular crop with work on a crop of secondary importance (paragraph 98).

(44) Experiments in the introduction of new crops should continue but work on exotics should, in no circumstances, take precedence of work on crops already grown in India (paragraph 99).

(45) Seeds, seedling plants and cuttings of exotic species and of exotic varieties of indigenous species imported for experimental sowing or planting should be exempted from import duty (paragraph 99.)

(46) No new variety should be put out unless it has been thoroughly well established that it possesses marked advantages over those already grown (paragraph 100).

(47) The agricultural departments should carefully consider the trend of the world's markets in framing their policy in regard to plant breeding (paragraph 100).

(48) Improved varieties should be thoroughly tested in the conditions under which they would be grown by the cultivator (paragraph 100).

(49) Seed merchants of proved integrity and enterprise should be encouraged by agricultural departments but for a very long time to come seed distribution must continue to form one of the most important branches of the work of the agricultural departments (paragraph 101).

(50) Co-operative agency offers the best prospects of assistance to the departments in seed distribution. Use might also be made of private seed agents (paragraph 101).

(51) The selection and distribution of pure seed of all crops should be controlled by the agricultural departments in the manner best suited to the local conditions of each tract and it would be unwise to lay down any rigid lines of policy to be followed (paragraph 103).

(52) A considerable increase in the number of seed farms is desirable in all provinces and such farms should be established as rapidly as funds and staff permit (paragraph 103).

(53) The establishment of seed farms for crops such as millets, pulses and oil-seeds must proceed *pari passu* with the evolution of pure or improved strains (paragraph 103).

(54) Whilst material assistance in regard to seed distribution should be rendered to the agricultural departments by the co-operative movement and by well managed associations of cultivators, the burden on those departments will remain a heavy one, and a separate organisation within the department for seed distribution and seed testing is accordingly recommended (paragraph 103).

(55) This organisation should be in charge of a deputy director working under the Director of Agriculture (paragraph 103).

(56) The work of seed distribution should, in normal circumstances, be self-supporting (paragraph 103).

(57) The financial rules governing the transactions connected with seed distribution should be so framed as to admit of the greatest possible turnover of seed during the year (paragraph 103).

(58) Continued research and experiment on rotations and methods of tillage are required but the more important problem in regard to methods of tillage is that of bringing home to the cultivator knowledge which is already available (paragraph 104).

(59) In so far as cost is a deterrent to the adoption of even comparatively inexpensive implements, the agricultural departments would do well to consider the possibilities of mass production of the wooden parts of such implements (paragraph 105).

(60) The agricultural engineering sections of the agricultural departments should be completely reorganised and should be, in all respects, integral parts of the departments (paragraph 106).

(61) In all provinces in which pumping and boring operations are in progress on a considerable scale, the engineering section should be divided into two branches, one for work on agricultural machinery and implements and the other for pumping and boring (paragraph 106).

(62) Work on water-lifts should be entrusted to that branch of the engineering section from which it is likely to receive the greatest attention. In provinces where wells are numerous, it might be desirable to entrust the work to a separate branch (paragraph 106).

(63) All branches of the agricultural engineering section should be under the control of a senior engineer who would himself be under the general control of the Director of Agriculture (paragraph 106).

(64) The officer in charge of the work on agricultural machinery and implements should be primarily an engineer and secondarily a farmer (paragraph 106).

(65) The relation of the capacity of the draught cattle in India to the implements they are required to draw is a problem which requires investigation (paragraph 107).

(66) Exhaustive trials under the cultivator's conditions should be carried out in order to test the comparative merits of the country and the inversion plough (paragraph 107).

(67) The aim of the agricultural departments should be the evolution of a small number of types of implements and machinery suitable for a wide range of conditions and suitable also for mass production (paragraph 107).

(68) A thorough investigation into the economics of power cultivation is specially called for in the Central Provinces with a view to the possibility of reclaiming areas infested with *kans* grass (paragraph 108).

(69) Railway freight rates on agricultural machinery and implements should be re-examined and, where possible, concessions should be given (paragraph 109).

(70) The claim by manufacturers in India for a rebate of the import duty on iron and steel used in the manufacture of agricultural implements and machinery should be investigated by the Indian Tariff Board (paragraph 110).

(71) The term "agricultural implements" in the Tariff Schedule should be interpreted in the sense most favourable to the interests of the cultivator (paragraph 110).

(72) Even where the standard of cultivation falls far short of that which is desirable, there are a number of improved varieties which can be grown with advantage to the cultivator (paragraph 111).

(73) The agricultural departments should pay greater attention to the problems of cultivation in dry and precarious tracts (paragraph 112).

(74) No modification of the rules framed under the Destructive Insect and Pests Act is called for (paragraph 113).

(75) It is desirable that the co-operation of the maritime Indian States in preventing the importation of pests and diseases from outside India should be secured (paragraph 113).

(76) Legislation to prevent the importation of pests and diseases from India into Burma is desirable. The exact scope of such legislation should be examined by a small expert committee (paragraph 113).

(77) The Imperial and provincial entomological and mycological staff requires strengthening in certain respects (paragraph 114).

(78) Legislation on the lines of the Madras Agricultural Pests and Diseases Act should be enacted in other provinces (paragraph 114).

(79) There has been serious deterioration of Punjab cotton as the result of the mixing of seed in the ginning factories but this and other questions affecting Indian cotton are being adequately dealt with by the Indian Central Cotton Committee (paragraph 115).

(80) The grant of gun licenses on a more liberal scale appears the most effective method of dealing with the damage done to crops and

cattle by wild animals but the agricultural departments should endeavour to discover a cheap and efficient method of fencing (paragraph 116).

(84) There is no evidence that the interests of the cultivator are being sacrificed to the interests of sport, but the practice in regard to the grant of permits to shoot destructive animals in reserved forests should be reviewed (paragraph 116).

CHAPTER V

THE SUBDIVISION AND FRAGMENTATION OF HOLDINGS

SCOPE OF THE CHAPTER.

118. For several years past, much attention has been paid to the subject of the subdivision of holdings of agricultural land and to the connected subject of the fragmentation of these holdings. Inasmuch as we are here concerned with a sub-continent within which are to be found a great variety of tenures, and almost every possible grade between the large landed proprietor with complete rights in the soil and the agricultural labourer with some sort of hereditary attachment to the fields of particular cultivators, it is necessary that the terms we propose to use should be defined with some precision. By "subdivision" we mean the distribution of the land of a common ancestor amongst his successors in interest, usually in accordance with the laws of inheritance, but sometimes effected by voluntary transfers amongst the living by sale, gift or otherwise. Thus, a man holding twelve acres and having four sons may be succeeded by the four sons, each holding three acres; if three of these sons leave two sons apiece and the other die childless, the next generation may show six grandsons each holding two acres. But if the childless holder had sold his land, for instance, to a moneylender, there would be six grandsons with one-and-a-half acres each, and a moneylender with three acres. There are other causes contributing to the process. but subdivision includes the general result of an increase of holders within a family or community.

Fragmentation is quite different from subdivision and refers to the manner in which the land held by an individual (or undivided family) is scattered throughout the village area in plots separated by land in the possession of others. If all the fields held by an individual are contiguous so that he can pass from the one to the other without traversing any land but his own, his holding is said to be compact; and if this feature has been brought about by design, it is said to be consolidated. In the illustration given above, if the first son had his three acres in twenty different places, his holding would be said to be fragmented; if the second son had inherited his land in one place, it would be called compact; if the third son had had his inheritance in twenty different places, but by process of barter and exchange had succeeded in getting it in one place, he would be said to have consolidated it.

The discussion on this subject has centred round the areas possessed by persons with some kind of permanent right in the land. Unfortunately, where systems of tenure are so diverse, it is not easy to find a term which without definition will suit all cases. In this chapter, we propose to use the term right-holder to denote those who possess some permanent

hereditary right in land, whether as owner, occupancy tenant or *patta* holder; the common link is the possession of a right, the inheritance to which is governed by law or by custom having the force of law, and which, therefore, cannot be altered except by the enactment of some new law. Those possessing no permanent hereditary rights are here called tenants; it is true that many hold from generation to generation and even follow the ordinary law of inheritance in the division of a tenancy on the death of a holder, but such succession is no more than a customary continuation of cultivation subject to the landlord's admitted right to evict and to rent to whomsoever he pleases. To alter the allotment of land to such people does not require any change in law. The term "cultivator" is used to denote all who cultivate land in any of the above capacities, whether as owner, *patta* holder, occupancy tenant or tenant-at-will, or lessee, but not as hired labourer.

There are many right-holders who do not cultivate all the land held in permanent right, but let to others, who may be either right-holders in other land or not; there are many right-holders, including some of these just mentioned, who take land on rent as tenants-at-will; there are all grades between the big landlords who hold but do not cultivate and the small tenants who rent from year to year without any permanent right. The subject of the subdivision of areas held by right-holders is different from that of the subdivision of areas in the possession of cultivators who may or may not hold permanent rights in any part of the land they cultivate; but the questions are simplified in some respects and complicated in others by the fact that, in most provinces, the actual cultivators have permanent rights in part at least of the area they cultivate. One result is that subdivision of right-holders' holdings tends to be reflected in a corresponding subdivision of the area cultivated. This makes for simplicity: another result, however, is that any scheme for correction of subdivision of right-holders' holdings will not itself suffice to correct the subdivision of cultivators' holdings. The introduction of the rule of primogeniture, for instance, would put a stop to much further subdivision of right-holders' holdings, but it would not stop the subdivision of cultivators' holdings.

Similarly, the fragmentation of the holding of a right-holder tends to be reflected in the fragmentation of cultivation; but there is fragmentation of cultivation even on large compact estates. A right-holder with six or eight scattered plots may cultivate all of those plots but, in the alternative, he may cultivate only some and rent the rest, or cultivate all and still take more on rent, or, if he is a non-agriculturist, he may cultivate none and give all on rent to one or more tenants.

In most discussions, the evils arising from subdivision and fragmentation of holdings are ascribed to difficulties of cultivation; but the subdivision of right-holders' holdings is apt to be carried to such an extent that the resultant holdings become too small to maintain the right-holder and his family in a standard of comfort vaguely described as "reasonable," and the term "uneconomic holding" appears in

discussions without reference to whether the holder can get extra land on rent or not.

There are thus four distinct problems to be dealt with :—

(*a*) the subdivision of holdings of right-holders,

(*b*) the subdivision of holdings of cultivators, who may or may not be right-holders of the whole or part of the land they cultivate,

(*c*) the fragmentation of the holdings of right-holders, and

(*d*) the fragmentation of the holdings of cultivators.

Except where large owners predominate, the greater part of the land is cultivated by right-holders, and accordingly in this chapter we are chiefly concerned with their problems ; but it must not be forgotten that, even in tracts where peasant proprietors or ryots prevail, a large proportion of the land, approaching one-half, is cultivated by persons in tenant right only, although these may for the most part be themselves proprietors or ryots of other land in the immediate neighbourhood.

SUBDIVISION OF HOLDINGS OF PERMANENT RIGHT-HOLDERS.

119. The subdivision of the holdings of permanent right-holders is chiefly due to the laws of inheritance customary amongst Hindus and Muhammadans, which, except where the Hindu joint family system is in operation, enjoin the succession to immovable property by all the heirs, usually in equal shares. But the acquisition of land by moneylenders and others has accentuated the evil by creating a number of petty holdings and by reducing the total left to be divided amongst the heirs. There is, also, apart from visitations of famine and pestilence, a general tendency over most of India for the population to increase and, therefore, for the number of right-holders to increase. The effects of this may be offset by an increase of cultivation either from the expansion of the area in the home villages or by the colonisation of extensive tracts such as has been made possible in the Punjab by the construction of large irrigation works. In that province, the area of cultivated land held by each owner is increasing on the whole, although in numerous villages there is a tendency in the opposite direction. There are tracts in which there has been a decline in both population and in cultivated areas and, where the decline in population exceeds that of cultivation, there is a tendency for the average area of cultivated land per cultivator to increase, but, as right-holders who forsake their villages to seek employment in the towns usually retain their rights in their land, it is not so clear that the average area of cultivated land per right-holder is on the increase.

Mere averages may prove misleading. An increase in the number of right-holders would usually lead to a reduction in the average area held by each right-holder, but, in some cases, the reduction may be due to the intrusion of new petty holders, while the ancestral holders retain their position. In the village of Bairampur in the Punjab, Mr. Ramlal Bhalla* found that, in the period from 1885-86 to 1918-19, the number of Jat owners had increased from 48 to 49 and their land had only slightly

*Report on an Economic Survey of Bairampur (Punjab Board of Economic Inquiry).

decreased from an average of 5·1 acres to 4·9, but, in the same period, the number of non-agriculturist owners, such as moneylenders, had increased from 3 to 18, and their small plots brought down the village average of land owned per owner from 4·9 acres in 1885-86 to 3·6 acres in 1918-19.

The non-official "Social and Economic Survey of a Konkan Village"* records that of a culturable area in the village of 192 acres, 24 non-agriculturists own 113 acres, or an average of 4·71 acres, while 28 agriculturists own 78 acres or an average of 2·85 acres. Almost all the acquisitions by non-agriculturists had been effected within the last fifty or sixty years on account of the indebtedness of the old ryots, "who were forced to dispossess themselves of their rights in their ancestral lands.....and hand them over to the present owners, most of whom are shrewd *sowcars* from the neighbouring parts."

Dr. Mann, in his detailed inquiries into the villages of Pimpla Soudagar and Jategaon Budruk,† found that the number of landholders had fluctuated throughout a century or more but that, as conditions became more settled, the tendency was towards increase with the consequent development of subdivision. Mr. Keatinge has expressed the opinion that "the agricultural holdings of the Bombay Presidency have to a large extent been reduced to a condition in which their effective cultivation is impossible" and Dr. Slater found that similar conditions prevailed in parts of Madras. In other provinces, conditions are much the same, except in Burma, where there is still a large area of culturable land available, but even in that province, the proportion of holdings under five acres is 55 per cent in Lower and 62 in Upper Burma.

The most complete figures for the size of holdings have been prepared for the Punjab as the result of a special inquiry into 2,397 villages scattered throughout the province. This disclosed that 17·9 per cent of the owners' holdings were under one acre; a further 25·5 per cent were between one and three acres; 14·9 per cent between three and five acres, and a further 18 per cent between five and ten acres.

The holdings under one acre were the subject of special inquiry; a large number are agricultural holdings; others are the result of gifts to Brahmins, or to village menials; others again represent petty acquisitions by non-agriculturists.

No other province has supplied similar statistics but Madras and Bombay classify their holdings and it appears that an inquiry on the lines followed in the Punjab would not disclose results markedly different. The average area held by right-holders is small, and there are a very large number of such holdings under two or three acres. The proportion of holdings under one acre is high; in Pimpla Soudagar, Dr. Mann found 9 per cent and in Jategaon Budruk 5½ per cent under one acre. In the Konkan village above referred to, twelve out of the fifty-two

*A Social and Economic Survey of a Konkan Village by V. G. Ranade. (The Provincial Co-operative Institute, Bombay, Rural Economics Series, No. 3.)

†Land and Labour in a Deccan Village. University of Bombay, Economic Series, Nos. I and III.

holdings were below one acre. In a description of the "Economic Life in a Malabar Village," * it is stated that 34 per cent of the holdings in the village investigated were under one acre.

SUBDIVISION OF CULTIVATION.

120. The subdivision of cultivation differs somewhat from that of right-holders' holdings inasmuch as many right-holders do not cultivate at all and many more cultivate only part of their land, while there is an undetermined number of landless cultivators in every province. Here we are speaking of those who cultivate only, irrespective of the nature of the interest in the land they till; in number they exceed the number of right-holders, as there are generally more cultivators with no permanent rights than permanent right-holders who do not cultivate. The result is that subdivision is more pronounced amongst cultivators. The Punjab figures, which are the only ones available for a province, indicate that 22·5 per cent of the cultivators cultivate one acre or less; a further 15·4 per cent cultivate between one and two-and-a-half acres; 17·9 per cent between two-and-a-half and five acres and 20·5 between five and ten acres. Except for Bombay, which would probably show a very similar result, and Burma which would give higher averages, all other provinces have much smaller average areas per cultivator. In the Census Report for India (1921), the number of cultivated acres per cultivator is given as follows:—

Bombay ..	12·2	Madras ..	4·9
Punjab ..	9·2	Bengal ..	3·1
Central Provinces and Berar ..	8·5	Bihar and Orissa ..	3·1
Burma ..	5·6	Assam ..	3·0
		United Provinces ..	2·5

The figures are probably not strictly accurate but they serve to indicate the extent to which subdivision has proceeded amongst cultivators' holdings. Conditions in Burma are probably better than the above figure would suggest, but the average is not above twelve acres.

The subdivision amongst cultivators is a reflection of conditions existing amongst permanent right-holders, but it is aggravated by the lack of alternative means of livelihood which drives multitudes to grow food for bare subsistence. Undoubtedly, many of the smallest cultivators are really in the position of allotment holders, cultivating tiny plots to eke out their earnings from industry or trade. In this case, purchases by moneylenders do not appreciably affect the figures as this class does not usually cultivate but leases its acquisitions to tenants.

FRAGMENTATION OF RIGHT-HOLDERS' HOLDINGS.

121. Fragmentation amongst right-holders' holdings is chiefly due, not to the laws of inheritance but to the customary method by which the law as to division of property amongst the heirs is carried into effect. The distinction becomes important when we come to discuss proposals (for

* By S. Subbarama Aiyar, M.A., University of Madras, Economic Series, No. II. The Bangalore Printing and Publishing Co., Ltd., Bangalore City, 1925.

legislation designed to check the evil, for it is one thing to alter a method of partition and quite another to alter the law on which the partition is based. The custom in dividing property amongst heirs is to give to each heir a proportionate share of each item of the inherited property and not a share of the whole equivalent to his portion. Thus, if a father with three isolated fields of one acre each, dies leaving three sons, the latter will take not one field each but one-third of each field each. The custom is due to the fact that each plot of land may vary in quality, and so, to secure an equitable division, each plot must be divided; each heir seeks to ensure his getting a portion of the best land even if this involves his taking a share of the worst. In the result, successive generations descending from a common ancestor inherit not only smaller and smaller shares of his land (subdivision) but inherit that land broken up into smaller and smaller plots. This continuous partition of each field amongst heirs leads to what is known as fragmentation, as the holding inherited is scattered throughout the village area. Fragmentation is accentuated by the expansion of cultivation irregularly over the waste, by purchases and sales, and by the extinction of families in default of direct heirs and the division of their property amongst a large number of distant relatives. It has been also the result of the break up of the joint family system and its custom of cultivation in common. In parts of Madras, fragmentation has not proceeded as far as elsewhere. The reason for this would seem to be that the joint family system has survived to a greater extent in that province than in any other. In Berar, we were told that fragmentation was not acute but no adequate reason was given. In extreme cases, the result is ludicrous: in Ratnagiri, for instance, the size of individual plots is sometimes as small as 1/160th of an acre, or 30¼ square yards; in the Punjab, fields have been found over a mile long and but a few yards wide, while areas have been brought to notice where fragmentation has been carried so far as effectively to prevent all attempts at cultivation.

Where the soil is of uniform quality or where the differences in quality are not great, fragmentation is an evil of the first magnitude. Of Bombay, Mr. Keatinge wrote that it "is an unmitigated evil for which no advantages can be claimed"; and Dr. Mann in Pimpla Soudagar found fragmentation "to be a disadvantage without any redeeming quality." In a village in the Punjab, an owner was found with his land in two hundred different places whilst, in the same village, there were five owners with over one hundred plots each. But where the soil varies markedly in quality, moderate fragmentation finds defenders; each holder secures land of different qualities and is thus in a position to produce a greater variety of crops and to find occupation for more days in the year than he could on a compact homogeneous block. Such an argument can only hold where the number of blocks does not exceed the number of distinct varieties of soil, and, in general, fragmentation beyond this is a serious evil. In the Punjab, the results of consolidation indicate that five per cent of the land which would normally be cultivated is lying useless owing to fragmentation being so excessive as to prevent any agricultural operations, while another one per cent is lost in

boundaries which could be abolished on consolidation. (Even where cultivation is possible, fragmentation involves endless waste of time, money and effort; it restrains the cultivators from attempting improvements; it enforces uniformity of cropping, and especially restricts the growing of fodder crops in the period when cattle are usually sent out to graze on the fields. The total effects are great and it is only when the burden is removed that the full results this evil practice has produced are revealed.)

FRAGMENTATION OF CULTIVATION.

122. Fragmentation of cultivation is a far worse evil than fragmentation of the land of permanent right-holders. It is also much more extensive and has been carried to greater extremes. The smaller right-holder attempts to secure any addition he can to his scanty holding wherever it may be situated; the tenant class, unable to rent all they wish from single owners, search the village for more. In Pimpla Soudagar, Dr. Mann found that 62 per cent of the cultivators' plots were below one acre, and in Jategaon the percentage was 31. In Bairampur, Mr. Bhalla found that 34·5 per cent of the cultivators had over 25 fragments each. Other village inquiries have yielded evidence to the same effect. The stronger owners attempt to keep in their own hands land near to their largest block and rent the rest, but the weaker must take what they can. The evil of fragmentation of cultivation is not limited by the joint family system; in Madras, where fragmentation of right-holders' holdings is not so acute as elsewhere, the existence of one-and-a-half million tenants must result in much dispersal of cultivation.

Although tenants may hold on a yearly lease or contract only, it is usual for them to cultivate the same land for long periods and even from generation to generation; the result is a considerable amount of fragmentation even where there is no legal obstacle in the way of the large owner who wishes to consolidate the cultivation of his tenants. This matter is important because, although the majority of right-holders possess only small holdings, a large part of the cultivated land is possessed by right-holders who rent to tenants.

REMEDIAL MEASURES.

123. The facts that the greater proportion of right-holders cultivate their own land, that some rent a part or whole of it to tenants, and that others take extra land on rent from their neighbours, all contribute to produce an element of confusion in the discussion of the evils of subdivision and fragmentation and of the proposed remedies. Further complication is introduced by the fact that the revenue records are more concerned with revenue payment than with tenants paying only rents, with the result that accurate information as to the landless tenant class is difficult to secure. It is generally tacitly assumed that, if subdivision amongst right-holders could be stopped, then further subdivision of cultivation would cease and that, if fragmentation of the holdings of these right-holders could be abolished by consolidation, then fragmentation of cultivation would disappear. From what has been said, it will be seen

that these assumptions should not be accepted unless they are based upon detailed enquiries such as have been made in the Punjab but not at all elsewhere.

Furthermore, it must be remembered that figures alone do not necessarily afford a true picture of the economic situation. For instance, if, at one time, three brothers own jointly nine acres but later partition their holding into equal shares, the relative economic position of the three brothers is not altered while the figures for subdivision have undergone a change.

Various attempts have been made to cope with the problems arising from subdivision and fragmentation of holdings. In Bombay, it was at one time thought that if partitions resulting in holdings below a certain limit were ignored in the revenue papers, this would act as a deterrent against such partitions being made in practice. This merely meant that Government did not recognise division of land beyond the fixed minima for the purpose of their record. The occupants were not legally debarred from actually dividing the land beyond the minima and holding it in separate plots, and the law courts freely recognised such divisions for the purposes of all suits before them. The result, we were told, was that, in a short time, the records bore no resemblance to the facts and the authorities had to adopt a completely new system of records.

In the Punjab canal colonies, subdivision has been checked by restrictions on alienation, and, in the case of certain grants, by the limitation of succession to a single heir; so far as right-holders are concerned, the policy has proved successful, but it has not served to prevent joint cultivation or even subdivison of cultivation; the single heir, when the elder brother, is not in a position to refuse a livelihood to his younger brothers even though he cannot give legal rights in the land. Subdivision is retarded wherever restrictions on the alienation of land are imposed; we have already mentioned the case of the Konkan village in Bombay where increasing subdivision was due, in part at least, to acquisitions by moneylenders, and that of Bairampur where non-agriculturists began to acquire land, but were stopped from further purchases by the Alienation of Land Act and so subdivided amongst themselves, the agriculturist owners maintaining their average holding. It needs no argument to show that if the five million acres which non-agriculturists in the Punjab have acquired in the last eighty years had remained in the hands of the original owners, the average holding would be much higher than it is.

Mr. Keatinge proposed to deal with the evil of subdivision of holdings by giving to right-holders in an "economic holding" power to register it as such in the name of one right-holder only. The Collector was to decide in each particular case what was an economic holding and the Bill drafted to give effect to the proposals only applied to holdings which the Collector decided were "economic."

The draft Bill was purely a permissive measure. The initiative was to come from the right-holder, and the right-holders had to agree to registration in one name only. On registration as an economic holding,

the holding became impartible and not liable to further subdivision, and was to be held absolutely and in severalty by the one person entitled for the time being. Partition or transfer to two or more persons was prohibited. Further, every agreement purporting to provide for the cultivation or occupation of any economic holding or any part of it by more than one person was to be void. No penalties were attached, but the Collector was to be given summary power to evict anyone in possession of any part of an economic holding contrary to the provisions of the Bill. The objections to such a measure have been well stated by the Madras Board of Revenue :—

(*i*) there would be the utmost difficulty in determining what constitutes an economic holding ;

(*ii*) the aim was the creation of a vast mass of petty impartible holdings all over the country, in defiance of the social system of Hindus and Muhammadans alike ;

(*iii*) its operation would, as a rule, be confined to those families which are rich enough to compensate such members as are excluded from the economic holding, that is to say, to the very cases in which there is the least need for any special arrangements. In so far as the Bill could be applied to poor families, it must tend to create a landless proletariat which is always a danger, and doubly so in a country where industries are so little developed that they cannot absorb the surplus agricultural population ;

(*iv*) it would afford an opportunity to co-sharers to effect collusive registration thereunder for the purpose of defrauding creditors ;

(*v*) its general effect would be to impair the credit of the agricultural classes ;

(*vi*) all transactions relating to land would be complicated by the question whether the condition of impartibility existed ;

(*vii*) it would involve the revenue establishment in troublesome and often infructuous inquiries on applications for creating economic holdings and on complaints that the rule of impartibility had been breached ;

(*viii*) it would undoubtedly prove a fertile source of strife in families.

In his evidence before us, Mr. Keatinge maintained that there would not be any population displaced from the land, but that the land would be better tilled and better cultivated and for this more labour would be required. Some of those who otherwise might be owners would become labourers, but it would be mainly a change in status and not in occupation.

On a small scale, prohibition of partition and of succession by more than a single heir has been successful in the case of large landowners whose estates have been declared by special Acts to be subject to the law of primogeniture ; but such landlords are usually prominent people,

members of well-known families, and evasion by them would at once be brought to light; moreover, in such rich families, provision for younger sons is a practicable proposition, a fact which entirely distinguishes their case from that of the majority.

It would thus appear that interference with subdivision by restrictions on alienation has been practicable and successful; interference with the ordinary laws of inheritance has not been tried, except in new colonies where special conditions can be attached to new grants or in the case of large owners rich enough to provide for the younger branches; interference with such laws in other cases has been suggested but rejected.

Other suggestions for dealing with subdivision are the prohibition of partition of a holding below a certain size, the compulsory acquisition of petty and uneconomic holdings and their distribution to those whose holdings would thereby be made "economic," and so on. It has been suggested that Muhammadans might find relief in the Egyptian custom whereby, although the land is nominally divided amongst the heirs, it is actually left in the hands of one to cultivate on behalf of the whole number, or may be handed to trustees to manage for all. Joint farming of the inheritance without partition has been advocated for Hindus. The Belgian custom, whereby one heir, usually the eldest son, buys out the rest through the agency of mortgage bonds would, if adopted, check both subdivision and fragmentation, but it is not likely to meet with favour until more occupations alternative to the cultivation of land become available.

In the evidence given before us, no practical suggestion was put forward for the prevention of further subdivision without interfering with the laws of inheritance.

CONSOLIDATION OF HOLDINGS.

124. The only measure that appears to promise relief from the evils that arise from fragmentation of right-holders' holdings is the process which is generally known as the consolidation of holdings, though it is in reality the substitution—by exchange of land—of a compact block for a number of scattered fragments. By this process, all the land of one holder may be formed into one plot only, or into a few plots of different kinds of soil.

Some very striking results have been achieved on these lines in the Punjab through the agency of the Co-operative Department and we found that the experiments which have been made in that province have attracted much attention in other provinces which suffer from the same evil. Although, for many years, settlement officers in the Punjab had made repeated attempts to use their influence to bring about consolidation, no success was attained and it was not until the scheme now in operation was devised that people could be persuaded to give consolidation a trial. Co-operative officials carry on steady propaganda and educate the right-holders in the advantages of the scheme. Meanwhile, a specially selected staff is trained to carry on the work in any village the right-holders in which express their readiness to submit their lands to the process. It is only where the co-operative spirit is strong that success is hoped for and, to ensure this, the usual co-operative principles

are observed; all important matters are decided in general meeting and confidence is gained by strict adherence to democratic principles, so that it becomes as important to please the smallest right-holder as the largest. To bring the scheme to a successful conclusion, careful education in its advantages and unending patience in attending to every grievance and objection and in combating obstinacy and suspicion are called for. Failures are many; months of painstaking work may be brought to naught by the recalcitrancy or obstinacy of one individual and, even when the object is ultimately gained, progress is slow. Yet, although those in charge of the movement fully realise that compulsion will be necessary for a wide extension and that its introduction is, therefore, only a matter of time, they prefer to await the growth and development of a strong public opinion in its favour rather than to incur the risk of a premature resort to legislation which might bring the scheme into odium. As the result of patient work which has now extended over eight years, the movement for consolidation in the Punjab has assumed the dimensions of an important agricultural reform. It is steadily gaining in popularity, and, as more staff is trained and the people become better educated to the advantages of the system, the figures for the area consolidated are mounting year by year. The total area dealt with in the first five years was 39,757 acres; in the following year alone the area consolidated was over 20,000 acres, and last year the area was over 38,000 acres. The total staff employed at present is 8 inspectors and 85 sub-inspectors, and the cost last year was just under one lakh of rupees. The cost per acre varies from Rs. 1-6 to Rs. 2-11 and will probably decrease as the staff becomes more expert and the people more willing. The last official report gave the total area consolidated up to July 1927 as 98,000 acres and the number of villages dealt with as 314; since then the work has been completed in 47 more villages, of which 34 were tenants' villages in the Mamdot Estate. In all, over 133,000 blocks have been consolidated and their number reduced to about 25,300. The average area of each block has increased from 0·7 to 3·8 acres. It may, however, be pointed out that, in the case of the Punjab, consolidation is facilitated by the comparative homogeneity of soil and by simplicity of tenure.

In the Punjab scheme, no one loses; everyone receives not less land than he held before. No attempt is made to oust holders of petty plots; no compulsion is used; no restrictions are imposed; and the whole process is kept as simple as possible and is easily within the comprehension of the right-holders. No one is asked to agree to the re-arrangement until he has seen his new holding marked out on the ground.*

This work deals with right-holders' holdings only; it aims at the removal of fragmentation, and not at checking subdivision. Inasmuch, however, as the land of families is usually brought together, future changes due to inheritance will take place within this compact block, and it is hoped that, with the lesson once well learnt, heirs will accept single parcels instead of several plots. Should future right-holders

*A detailed account was given by Mr. C. F. Strickland, I.C.S., in the *Agricultural Journal of India*, March 1927.

prove to be so blind to their own best interests as to insist upon a renewal of fragmentation, the advantages gained through consolidation must to this extent be lost. Fragmentation of cultivation is not separately dealt with. But experience amply indicates that consolidation of cultivation is largely achieved by consolidation of right-holders' lands. Where, however, the right-holder owns a large estate, the case for consolidation of his tenants' holdings is recognised. Last year, in the big estate of Mamdot, 12,564 acres of cultivators' holdings were consolidated and the work is being continued.

We found that the work being done in the Punjab was known in other provinces and we are definitely of opinion that it should not be regarded as unsuited for adoption elsewhere without very careful and persistent inquiry into the local difficulties.

THE CENTRAL PROVINCES ACT.

125. In the Central Provinces, some success in consolidation has been achieved in the Chhattisgarh division without any assistance from the Co-operative Department; an officer has been placed on special duty with a small staff which he is training to carry out the work. The difficulties are enhanced by complexities of tenure as well as by differences in the quality of the soil and it has been found desirable to resort to legislation. The Central Provinces Consolidation of Holdings Act has recently (1928) been passed by the Legislative Council and will for the present be applied to the Chhattisgarh division only. Any two or more permanent holders in a village holding together not less than a certain minimum prescribed area of land may apply to the consolidation of their holdings but the outstanding feature of the Act is that it gives power to a proportion, not less than one-half, of the permanent right-holders' holding not less than two-thirds of the occupied area in a village to agree to the preparation of a scheme of consolidation, which scheme, when confirmed, becomes binding on all the permanent right-holders in the village and their successors in interest.

The scheme prepared by the consolidation officer may be confirmed by the settlement officer or deputy commissioner if all objections are removed, or by the Settlement Commissioner in other cases. No appeal lies but the local Government has power to revise. Civil courts are barred from jurisdiction.

The Act is aimed at the consolidation of fragmented holdings, and will at the same time achieve consolidation of cultivation to a very large extent owing to the high proportion of cultivators who hold permanent rights as tenants. It contains the minimum required to facilitate consolidation and possesses the advantages of directness and simplicity.

In view of conditions in Chhattisgarh which we had opportunities of appreciating during our visit, we consider that this legislation should prove of value. The proportion of right-holders whose consent is required is low, but we understand that it is the intention of the local Government to proceed with caution and to gain experience before attempting anything like a campaign of compulsory consolidation on a large scale.

THE BOMBAY SMALL HOLDINGS BILL.

126. The Bombay Government have designed a Bill to deal with certain features of this very difficult problem; the Bill has been introduced in the Legislative Council and referred to a select committee; it is thus far from being in its final form and we refrain from offering criticisms in regard to points of detail which may already have been met before this Report is published. The problem is, however, so important, that we may with advantage state what, in our opinion, should be the main points in such legislation.

The need for caution in any attempt to interfere with rights in agricultural land needs no stressing, and we trust that, in any scheme involving the uprooting of people from their ancestral fields, full provision will be made for the utmost possible consideration of their opinions and prejudices. The scheme should be free from ambiguity and be formulated in as simple language as possible so that it may be understood by the persons most closely affected. We recognise that the introduction of an element of compulsion may be inevitable; but compulsion should not be regarded as dispensing with the need for the most scrupulous attention to the wishes of the people. It would be unsafe to lay down a rigid rule as to the majority to be required, but this should be as large as is compatible with successful working of the measure.

In view of the novelty of such a scheme in present circumstances, we think that the element of compulsion should be reserved till the latest possible stage, and it will probably be found that the most suitable time to resort to this step is when the scheme for consolidation has been fully worked out in the closest consultation with the right-holders and when every reasonable attempt has been made to reconcile conflicting interests and wishes. When all that persuasion, perseverance and skill can do has been exhausted and a beneficial scheme of consolidation has been completed, we think that compulsion may be applied to secure for the majority advantages which an obstinate minority might otherwise withhold.

We recognise that if any scheme of consolidation is to be final, the civil courts must be barred from jurisdiction on matters arising under the special legislation; but if persons are to be thus deprived of their constitutional right to seek redress in the civil courts, their interests must be carefully safeguarded by provision for consideration of all objections at various stages, and by allowing a resort to arbitration and power to nominate one arbitrator.

In our opinion, progress will be more rapid if consolidation is not complicated by being combined with other objects, however desirable in themselves. But we see no objection to the inclusion in one and the same Act of a scheme designed to prevent fragmentation and a scheme for the consolidation of holdings.

The main policy of any government embarking upon a campaign for the consolidation of holdings must be to achieve progress by education;

compulsion is a supplement to education and not a substitute for it. The risks attendant upon the use of compulsion in a matter so vitally affecting the ancient rights of the people will be largely diminished if reliance is chiefly placed upon the steady, patient, persuasive education of the right-holders, and if compulsion is regarded, not as a regular part of the procedure but as a last resort to be applied only when a carefully drawn up scheme is in danger of being wrecked by a recalcitrant minority. When confidence is gained by a judicious application of compulsion and the advantages of reconstituted villages with better amenities are seen by the people, we trust that the movement will gather force, and that the people will themselves demand consolidation, either on a voluntary basis or under the law.

GENERAL RECOMMENDATIONS.

127. In other provinces, the evil effects of subdivision and fragmentation are recognised but measures to cope with them have not yet been decided upon. In several provinces, opinion seems to be in favour of action somewhat on the lines which have proved so successful in the Punjab. Fragmentation of holdings is in many parts of India one of the most important of the factors tending to prevent agricultural improvement. There seems to be common agreement that its evil effects are so great that the administration should not rest until a remedy has been found. We strongly hold that the initiative should not be left to the spontaneous action of the right-holders but that the State should undertake propaganda work, should explore the whole situation and should also bear the costs in the early stages. Progress may be slower where tenures are more complex or qualities of soil more varied, but difficulties should not be allowed to become an excuse for inactivity.

Where it is customary for the landlord to demand a fee on transfer, the advisability of reducing, if not entirely remitting the amount on consolidation should receive consideration. Where a mutation fee is levied for the entry of the results of consolidation in the revenue records, this should be remitted. Care should be taken to see that consolidation is not made a ground for enhancement of land revenue at the next settlement.

We have received much evidence in favour of drastic legislation, but, in view of the natural attachment of all cultivators to their land, we think that State action in favour of consolidation should be taken in guarded manner. As is contemplated in Bombay and the Central Provinces, special areas should be selected for notification under a permissive Act and full inquiry should be made by local officers into the opinion of the right-holders before any measure of compulsion is enforced. Where, as in the Punjab, the consent of all interested has to be obtained before any scheme of consolidation can be ratified, such piecemeal notification is not necessary. But if compulsion is to be introduced into that province also, as some witnesses favoured, we recommend that it be limited to villages or tracts where inquiry has shown that the people generally are prepared to accept it.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

128. The conclusions and recommendations in this chapter may be summarised as follows :—

(1) The four district problems to be dealt with are : the subdivision of the holdings of right-holders ; the subdivision of the holdings of cultivators ; the fragmentation of the holdings of right-holders ; and the fragmentation of holdings of cultivators (paragraph 118).

(2) The subdivision of the holdings of permanent right-holders is chiefly due to the laws of inheritance customary amongst Hindus and Muhammadans (paragraph 119).

(3) In some parts of the country, agricultural holdings have been reduced to a condition in which their effective cultivation is impossible (paragraph 119).

(4) The average area held by each right-holder is small, and there are a very large number of such holdings under two or three acres (paragraph 119).

(5) Subdivision is more pronounced amongst cultivators than amongst right-holders (paragraph 120).

(6) Subdivision amongst cultivators is aggravated by the lack of alternative means of livelihood, which drives multitudes to grow food for bare subsistence (paragraph 120).

(7) Fragmentation amongst right-holders' holdings is chiefly due to the customary method by which the law as to division of property amongst heirs is carried into effect (paragraph 121).

(8) Where the soil is of uniform quality or where the differences are not great, fragmentation is an evil of the first magnitude (paragraph 121).

(9) Fragmentation of cultivation is a far worse evil than the fragmentation of land of permanent right-holders. It is also much more extensive and has been carried to greater extremes (paragraph 122).

(10) Subdivision is retarded where restrictions are imposed on the alienation of land (paragraph 123).

(11) The proposal to form impartible " economic holdings " is open to objections (paragraph 123).

(12) The only measure that appears to promise relief from the evils arising from fragmentation of right-holders' holdings is the process known as consolidation of holdings (paragraph 124).

(13) Some very striking results have been achieved on these lines in the Punjab through the agency of the Co-operative Department (paragraph 124).

(14) The work being done in the Punjab should not be regarded as unsuited for adoption elsewhere without very careful and persistent enquiry into the local difficulties (paragraph 124).

(15) An Act has been passed in the Central Provinces which gives power to a proportion of not less than one-half of the permanent right-holders holding not less than two-thirds of the occupied area to agree to the preparation of a scheme of consolidation, which scheme, when confirmed, becomes binding on all the permanent right-holders. This legislation should prove of value (paragraph 125).

(16) Certain principles which should be embodied in any legislation designed to promote consolidation are laid down (paragraph 126).

(17) In several provinces, opinion is in favour of action somewhat on the lines followed in the Punjab (paragraph 127)

(18) The initiative should not be left to the spontaneous action of the right-holders, but the State should undertake propaganda work, should explore the actual situation, and should also bear the cost in the early stages. Difficulties should not be allowed to become an excuse for inactivity (paragraph 127)

(19) Fees on transfer and mutation fees should be remitted in cases of consolidation, and consolidation should not be made a ground for enhancement of land revenue at the next settlement (paragraph 127).

(20) State action in favour of consolidation, where it is introduced under a permissive Act, should be taken in a guarded manner. Special areas should be selected for notification and full enquiry should be made into the opinion of the right-holders before any measure of compulsion is enforced (paragraph 127.)

CHAPTER VI

DEMONSTRATION AND PROPAGANDA

SCOPE OF THE CHAPTER.

129. Agricultural research can be of no help to the cultivator until its results are given to him in a form in which they may become a part of his agricultural practice. The force of this elementary principle was realised by the Board of Agriculture from its inception. The best means of bringing improved methods of agriculture to the notice of the cultivator were discussed at seven of the meetings of the Board held from 1905 to 1919. All the methods of propaganda which were possible in the conditions of the time came under review and the reports which were adopted by the Board contain many suggestions of great value. The report of 1917 was made the last of the series. It was felt that the lines of work in demonstrating and in disseminating agricultural improvements which were likely to lead to success had been more or less determined. We cannot but regard the decision to discontinue the review of the work done in the provinces in this direction as an unfortunate one. The review kept the provinces in touch with methods which had proved successful elsewhere, and, by so doing, furnished a most useful stimulus to provincial activities. The Board had enunciated many principles of the greatest importance which have continued to guide the work of the provincial departments up to the present time, but it had left unsettled one or two important problems such as the comparative value of demonstration farms and demonstration plots and the extent to which the agricultural departments can use organised bodies to further their propaganda work. Moreover, the experience gained during the war has shown that there is no finality about methods of propaganda. It is plain that the possibilities of the cinema and of wireless could not have come within the purview of the Board in its early days.

The field for demonstration and propaganda is as vast as that which remains for agricultural research. The area under improved crops can now be measured in millions of acres and the land tilled by improved implements in hundreds of thousands; yet the area on which these improvements have been adopted is but a small fraction of the total cultivated area of India. We propose in this chapter to discuss how, and to what extent, the agricultural departments can hope to reach the small and the large landholder through their own staff and the assistance which they may expect to receive from organised associations in their work of popularising agricultural improvements.

ESSENTIALS FOR SUCCESSFUL DEMONSTRATION.

130. The agricultural departments, throughout their existence, have not failed to realise that, in a country in which illiteracy is widespread as it is in India, the only hope of convincing the cultivating classes of the advantages of agricultural improvement is by ocular demonstration.

As Mr. and Mrs. Howard have recently pointed out, the extent to which the agricultural advance of India has been hampered by the illiteracy of the cultivator will be realised "if the spread of the new varieties of Pusa wheat is compared with that of Marquis in Canada and the northern States of the Union. As regards the degree of improvement there can be no question. The Pusa varieties are a much greater advance on the average types grown in India than Marquis is above the kinds it replaced in North America. In fifteen years, the Pusa wheats have covered a little over 2,000,000 acres. In about the same period, the area under Marquis has exceeded 20,000,000 acres*." Hitherto, the departments have had mainly to rely on their own staff to push the improvements they have been in a position to recommend and the strength of the staff employed on this work has continued steadily to increase. They have also never lost sight of the essentials to successful demonstration work. These have been stated, time and again, in the reports adopted by the Board of Agriculture and elsewhere, but it is, perhaps, worth while to repeat them here. The improvement must be thoroughly tested on a government farm, before it is recommended for general adoption. It must be within the means of the cultivator to whom it is recommended. It is this latter consideration which, as we have pointed out in Chapter IV, has made the spread of improved varieties of crops far more rapid than that of improved implements. The improvement demonstrated must mean a substantial financial advantage to the cultivator, either in the shape of increased outturn or in that of reduction of his cultivation expenses. When demonstrating the advantages of improved seeds or implements or of using artificial manures, arrangements must be made to enable the cultivator to obtain them without any difficulty. The demonstration must be given by an officer who not only possesses experience; he must also have the ability to win the confidence of those amongst whom he is working. There is reason to believe that, in respect of this last essential, practice has not always been in accordance with principle. Heavy demands upon a limited staff have occasionally led to officers being employed on demonstration and propaganda work immediately on appointment. Demonstration and propaganda carried out by such officers is calculated to do more harm than good and we cannot believe that their employment on such work can, in any circumstances, be justified. We consider that a recruit should not be employed on work which brings him into direct contact with the cultivator until his capacity for such work has been gauged by considerable practical experience. We revert to this point in Chapter XV, paragraph 476. The several methods of propaganda employed, their relative cost and the claim of each upon the time of the staff should be frequently reviewed in the light of recorded results. A constant adjustment of practice to meet changing conditions, and a readiness to abandon any method proved by experience to be ineffective, are essential to efficiency with economy.

* Indian Agriculture (Vol. VIII in the "India of To-day" series).

THE DEMONSTRATION FARM AND THE DEMONSTRATION PLOT.

131. We found almost unanimous agreement, amongst both official and non-official witnesses, that by far the best and quickest method of influencing the practice of the cultivator is to demonstrate an improvement in crop or method on a small plot cultivated under departmental control or direction. Even the Director of Agriculture in the United Provinces who expressed a preference for the demonstration farm, that is for a farm with suitable buildings and of fairly large area, in the permanent possession of the Agricultural Department, admitted that the work done on such a farm was slower in influencing the cultivators than demonstration on their own land. The main objection to the demonstration farm is the ingrained suspicion of the cultivator that the methods by which it is cultivated are not applicable to his means and conditions. He sees the farm buildings, which are often of a somewhat elaborate character, the superior cattle, the up-to-date implements and the careful lay-out, and not unnaturally concludes that the results obtained are largely due to the capital sunk in these and that the methods adopted are entirely beyond his means. He has no way of making certain for himself that the superior yields secured on such a farm are not due to the soil being more fertile than that of his holding. This, though the most important, is not the only objection to the demonstration farm. Its influence in the nature of things is very limited and can only reach the cultivators in its immediate neighbourhood. These cultivators may in their turn influence others but the process is a slow one. Again, there is always the possibility that the site of a demonstration farm may be badly selected and that, by the time the mistake is discovered, so much capital may have been sunk in the acquisition and development of the land and in the erection of buildings on it that the department may be unwilling to admit that the farm is not suitable for the purpose for which it was intended.

Demonstration on the cultivator's own land is open to none of the objections which can be urged against the demonstration farm. It is for this reason that the agricultural departments in Bombay, Burma and Madras have decided to pin their faith entirely to the demonstration plot. Even in Bengal, the United Provinces and the Punjab, where demonstration farms are numerous and the policy is to increase their number, the advantages of the demonstration plot are fully recognised and this method of popularising agricultural improvements is extensively adopted. They are also recognised in the Central Provinces, where the so-called "seed and demonstration farms" have been established, primarily for the multiplication of pure seed and, only secondarily, for demonstration purposes.

We entirely approve the policy, which has been adopted in present conditions by the agricultural departments in Bombay, Burma and Madras, of concentrating the demonstration work on the demonstration plot in preference to the demonstration farm. We hold that this is the method best calculated to enable the departments to reach the largest number of small cultivators in the shortest time and that such staff and funds as are available for demonstration work are much better employed in this

way than on the establishment and maintenance of permanent demonstration farms. The main argument in favour of demonstration farms which was adduced in the United Provinces was that the zamindar, who is contemplating capitalistic farming, is more influenced by a well run demonstration farm than by anything else. From this point of view, it would seem that the demonstration farms in the United Provinces have served a useful purpose. We were informed that, twenty years ago, no large zamindar in the province had a farm of his own. There are now over 600 privately owned farms which are managed with the assistance of the Agricultural Department. None the less, we are inclined to doubt whether the establishment of demonstration farms on the scale on which they have been established in the United Provinces, where there are now eighteen of them, has not involved some sacrifice of the interests of the smaller landholder to those of the large zamindar. The policy is that such farms should pay their way but, even where they have done so, they have meant the locking up of staff, the activities of which could have covered a much larger area, if it had been employed in supervising demonstration plots rather than in running demonstration farms. It is open to question whether the possibilities of capitalistic farming require demonstration on the scale adopted in the United Provinces. The existence of two or three farms for this special purpose would seem sufficient. The zamindar, who is in a position to take up commercial farming, should not require to be convinced of its possibilities by the establishment of a farm at his door. Distance does not present the same obstacle to him as it does to the small cultivator and he is intelligent enough to appreciate the force of arguments based on balance sheets. We, therefore, recommend that the policy adopted in the United Provinces in regard to the establishment of demonstration farms should be re-examined from this point of view.

A somewhat different argument in favour of the demonstration farm was adduced in the Punjab. There, we were informed that the establishment of such farms was desirable as they constituted definite centres to which landholders could go for supplies of implements and seeds. The staff of the Agricultural Department could also carry out on them demonstrations of work, which could not be easily done on the cultivator's fields at times and seasons which were convenient to them and to him. We agree that there is considerable force in this argument. There is much to be said for the establishment of a small farm with inexpensive buildings in each district, and later on in each tehsil or taluk, as a focus for the propagandist activities of the agricultural department in the tract. Such a farm, in addition to serving as a centre for the distribution of improved implements and seeds and for demonstration work which could not be conveniently carried out on the cultivator's own fields, would be the natural centre for the short courses for cultivators which we regard as a most valuable means of propaganda. But, in present conditions, we cannot but regard farms of this character as somewhat of a luxury. We would repeat that, in our view, the staff and funds available can be much more usefully employed in demonstration on the cultivator's

own fields than on such farms. The district and tehsil farms can come later as staff expands and funds permit. We are, therefore, strongly of opinion that the programme of expansion in the Punjab should be examined with a view to ascertaining whether a large proportion, if not the whole, of the amount provided for district and tehsil farms should not be devoted to the expansion of demonstration work on the cultivator's own fields. This programme involves an expenditure on district farms of Rs. 17·65 lakhs, capital and recurring, during the next five years and a recurring expenditure thereafter of approximately one lakh of rupees; and on tehsil farms a corresponding expenditure of Rs. 12 lakhs and Rs. 74,000 respectively. We are, further, of opinion that no more farms solely for demonstration purposes should be opened in Bengal, until demonstration work on the cultivator's own fields has been expanded to a much larger extent. We make no recommendation in regard to the closure of the existing demonstration farms as the desirability of this step must depend upon the local conditions. We would add that we see no objection to the establishment of demonstration farms for a special purpose such, for example, as that of demonstrating the advantages of using a particular method of curing tobacco or of a small plant for making white sugar or high quality *gur*. In other words, we realise the necessity for special farms for demonstrations which involve industrial as well as agricultural operations.

THE USE OF EXPERIMENTAL FARMS FOR DEMONSTRATION WORK.

132. It is, perhaps, hardly necessary to explain that our strong preference for the demonstration plot over the demonstration farm does not imply any disapproval of farms established for the purpose of carrying out experiments such, for example, as the testing of new varieties before they are given out to the cultivator, or of farms established for the purpose of multiplying improved seed. We have considered the question whether the experimental farm should be utilised for demonstration work. thus enabling it to serve a dual purpose. We regard this combination of functions as undesirable. The conditions imposed by the experimental character of the work carried out on such farms are often of such a nature as to render the practices followed on them inapplicable to ordinary cultivators. The demands of demonstration work might also make undesirable inroads upon the time of the staff. We are, therefore, of opinion that experimental farms should be confined to the purpose for which they are intended. We make one reservation. There may be, on experimental farms, areas of land unsuitable for experiments or of land which is being held over for experimental work at a later season. In such circumstances, there would be no objection to demonstrations which did not interfere with experimental work.

THE USE OF DEPARTMENTAL SEED FARMS FOR DEMONSTRATION WORK.

133. The objections to the utilisation of experimental farms for demonstration work do not apply to seed farms. In Chapter IV, we have described the organisations for the distribution of seed of improved varieties which have been built up in the various provinces. We have pointed out that, whilst the agricultural departments should be

able to look, in increasing measure, to co-operative and other organisations for assistance in the distribution of seed, they must, for a long time to come, depend mainly on their own exertions for the development of this work. We have expressed the view that a considerable increase in the number of such farms, both departmental and private, is very desirable in all provinces and that such farms should be established as rapidly as funds permit. There is no branch of the activities of the agricultural departments which brings them in closer touch with the cultivator than the distribution of pure seed. This is work which is eminently calculated to induce in him a frame of mind which makes him ready to listen to suggestions that he should adopt other agricultural improvements. For this reason, we see no objection to the seed farm being used also as a demonstration farm, provided that its primary purpose is not detrimentally affected thereby. Indeed, there are positive advantages in its being so utilised. The seed farm affords special opportunities to the cultivator of seeing the extent to which the adoption of improved methods of cultivation or the use of manures can improve the outturn of the seed issued to him. The policy of using the seed farm for demonstration purposes has been specially successful in the Central Provinces and to it must be largely attributed the fact that the distribution of improved seed in that province is on a larger scale than it is elsewhere.

FINANCIAL RETURN FROM DEPARTMENTAL FARMS.

134. The question whether departmental farms should pay their way has been frequently discussed. Farms which have been established solely for experimental work cannot be expected to do so. Receipts are an entirely secondary consideration in their case. In Chapter IV, we have stated our view that the work of seed distribution has reached a stage at which it may legitimately be expected to pay its way. We consider, therefore, that seed farms should, ordinarily, be expected to be at least self-supporting, so far as their seed work is concerned. Where a demonstration farm has been established to demonstrate the possibility of commercial farming, it is obviously failing in its purpose if it does not yield a substantial profit. Where district and tehsil farms exist to further what may be termed the general propagandist work of the department, we do not consider it essential that receipts should cover the whole expenditure which a commercial accountant would debit to it. Every visitor to a departmental farm should be told whether such farm is, or is not, expected to pay its way, and should be given the reasons for the policy adopted. A short printed statement should be prepared and handed to all who inspect the farm.

SHORT COURSES ON GOVERNMENT FARMS.

135. It is generally agreed that the provision of short courses in particular subjects on government farms is an admirable method of popularising desirable agricultural practices. The objections to demonstration work on experimental farms apply equally to their use for this purpose. If short courses are held on them, special care must be taken, on the one hand, to ensure that the success of the experiments is not endangered and, on the other hand, that the cultivator should not be misled by the experimental

character of the work on these farms. Whilst we do not consider that there would be any justification for establishing demonstration farms to promote this form of educational activity, we concur in the view that short courses for cultivators given on demonstration or seed farms provide an excellent opportunity for the establishment of closer touch between the agricultural departments and the cultivator. Where these courses are given, they should be assigned as a definite duty to a particular member of the staff of the farm. They should not be regarded as work which can be carried out in such time as the farm superintendent can spare from his other duties. We mention this point as we found, in one province, that the work had hitherto been carried out in a somewhat haphazard manner, though steps were being taken to rectify this. It may be desirable to attract cultivators to such courses by the payment of a small stipend as is done in Burma or to erect quarters for them as is proposed in the United Provinces, but these are matters which can best be determined in the light of the local demand. As in the case of short courses given at the agricultural colleges, we consider that the courses given on the farms should ordinarily terminate in a formal test which should, so far as the nature of the subject permits, be of a practical character.

THE DEMONSTRATION PLOT.

136. The methods adopted in carrying out demonstrations on the cultivator's own fields are not the same in all provinces. Broadly speaking, one of two systems is adopted. Under the system which is favoured in Bengal, Bombay, Madras and the Punjab, the cultivation is carried on by the cultivator himself from start to finish under the close supervision of the agricultural demonstrator. Where new implements are being tried, these are lent without charge. Where the advantages of improved seeds or manures are being demonstrated, these are usually given free in the first instance. A cultivation sheet, in which all expenditure is noted, is kept not only for the demonstration plot but also for an adjacent plot of equal size on which cultivation is carried out by the local methods. The cultivator himself supplies the data for the profit and loss account thus maintained which, at the end of the demonstration, shows the exact monetary gain which has been secured by the adoption of the improvement. Under the other system, which is that favoured in the Central Provinces and the United Provinces, the Agricultural Department hires the land on which the demonstration is carried out. In the United Provinces, the area taken up varies from half an acre to an acre in extent. In the Central Provinces, the area of the plot is approximately that which the local cultivator would normally cultivate. The plots in the United Provinces are retained for a year. The demonstrator is provided with bullocks, improved ploughs and all the necessary tools for cultivation in order that there may be as little interference as possible with the ordinary routine of the village. Labour is supplied by the part-time work of a few intelligent village youths, who ultimately become fieldmen and propagandists themselves. In the Central Provinces, work on the same plot is carried on for five years and is then closed down. During that period, the plot is farmed by the departmental staff in the

manner recommended by the department for the area in which it is situated. It should be mentioned that, in the Central Provinces, demonstrations directed to specific points are also carried out by the cultivator himself under the supervision of the agricultural demonstrator.

The advantage of the method adopted in the Central Provinces and in the United Provinces is that, as the work is carried on by the departmental staff throughout, more reliance can be placed on the data which are collected in the course of the demonstration. The advantage of the method adopted in the other provinces is that, as all the work is done by the cultivator himself, he is placed in a better position to realise the true value of the improvement which is being demonstrated. The adoption of this method is, therefore, more calculated to leave a lasting impression on the individual. Both systems have much to recommend them and we consider that both might well be adopted in all provinces and the results compared.

GUARANTEE AGAINST LOSS

137. In Bengal and Bombay, the cultivator whose land is used for the purposes of demonstration is guaranteed against any loss which may result. We were informed that, whilst no specific guarantee against loss is given in Burma, there is an implied guarantee that, should the demonstration unexpectedly end in failure, the cultivator will not suffer thereby. It would seem that the agricultural departments in these provinces have very seldom, if ever, had to incur any expenditure under the guarantee. Indeed, if it had been otherwise, it would have been tantamount to a confession of failure on their part, as it would have meant that the improvement had not been properly tested before it was recommended for incorporation in general agricultural practice. On the whole, we are inclined to doubt the wisdom of giving a guarantee in these cases and a guarantee should only be given if, without it, demonstration plots are not procurable. The exact appraisement of any loss incurred is a matter of considerable difficulty and the existence of a guarantee may furnish motives for dishonest practices. Even if no guarantee is given, some compensation should, of course, be made if, for any reason, failure in the methods adopted involves the cultivator in loss.

DEMONSTRATION OF IMPROVED IMPLEMENTS.

138. There is no respect in which the short courses, the establishment of which on government farms we have recommended in paragraph 135 above, should prove of more value than in promoting the use of improved implements, more especially if they include instruction not only in the use of the implements but also, as they do at the Lyallpur Agricultural College, in their repair. For the reasons we have given in Chapter IV, propaganda in favour of improved implements is probably the most difficult part of this branch of the work of the agricultural departments. The work on the demonstration plot or demonstration farm can well be supplemented by peripatetic demonstrations. The agricultural demonstrator can, and should, put his improved plough or improved implement on a bullock cart, take it out into the area

round the plot, or the farm, and there demonstrate its advantages. A travelling lorry could be utilised in this class of work where, and as soon as, suitable roads exist. In such cases, the officer in charge of the lorry would take with him a supply of spare parts, in addition to a supply of the implements or an example of the machinery it was proposed to demonstrate, for we would repeat that there is no greater obstacle to an extension of the use of improved implements and machinery than inability to obtain spare parts immediately they are required. He should, also, be accompanied by an instructor, who would teach the village smiths how to fit new parts and make adjustments and repairs.

In this connection, we consider it possible that the use of the more expensive implements and machinery might extend more rapidly if suitable arrangements for hiring them out could be made, either by the agricultural departments or by the manufacturers in consultation with the departments. This appears to be the best method of overcoming the obstacle presented by the capital expenditure involved in outright purchase or even in payments due under the instalment or hire purchase system. That much can be done in this direction has been shown by the extent to which the iron sugarcane mills and boiling pans manufactured and hired out by Messrs. Renwick are now used in Bengal and Bihar. The firm charges a considerable hiring fee but at the same time makes arrangements for the prompt replacement of any parts that may be broken, with the result that their implements are now to be found wherever sugarcane is grown in Bengal and Bihar.

AGRICULTURAL SHOWS.

139. As successful research must be the basis of successful demonstration, so successful demonstration must be the basis of all the propagandist work of the agricultural departments It cannot be too strongly emphasised that all other forms of propagandist activity can only supplement ocular demonstrations whether they are carried out on government farms or on the cultivator's own fields No other form of propaganda can furnish a satisfactory substitute for demonstration. It can, at best, merely provide a method of following it up. One such method which is being increasingly made use of by the agricultural departments is that of the agricultural show. The participation of the agricultural departments in shows takes various forms. It may take the form of an agricultural show for a whole province, as it did in the case of the very successful show at Poona, which we visited in October, 1926, or that of a smaller show for a part of a province or even a single district or tehsil. Such shows may be organised by the department itself or, with its assistance, by outside bodies such as a district board. Participation may, again, be confined to the organisation of an agricultural stall, or an exhibit at a show of a wider character, or at one of the big fairs or festivals which are so common in India. Such shows, as has frequently been pointed out, provide a valuable means of demonstrating to a large crowd of people either improved methods or improved produce which it is desirable that they should know about, of creating local enthusiasm and of bringing a larger number of cultivators into touch with the staff of the agricultural departments than could, otherwise, be

collected together. The evidence we received, and also the instances which came under our personal observation at Poona, Dacca and Lyallpur, show that the agricultural departments are fully alive to the value of this form of propaganda and that care is taken to make their demonstrations and exhibits both attractive and instructive. The exhibition of livestock is more effective than that of produce, though the latter cannot be omitted, and demonstrations of the actual working of machinery and implements are essential, if a show is to be a success, but they should be limited to a demonstration of such machinery and implements as are suitable to the tract in which the show is held. Again, it is, obviously, no use attracting attention or arousing enthusiasm unless this is followed up in every possible way. More use might be made of markets in this connection and a permanent agricultural stall should form a prominent feature of the regulated markets, the establishment of which we have recommended in our chapter on Communications and Marketing. If shows are to yield their full effect in educating opinion among local cultivators, it is essential that they should be held year after year, if not at one centre, at least in the same part of the country. In such matters as the improvement of cattle, it is only by the cumulative effect of a succession of shows that any lasting influence can be established over the policy of breeders. In order to secure the continuity recommended, it will be desirable to make every effort to secure from profits and from private donations a surplus from which could be formed, for each tract, a fund to be carried on from year to year to defray the preliminary expenses of the shows. The arrangements to be made for this purpose will necessarily depend upon local circumstances. A taluka development association, agricultural association, or other collective body interested in agriculture would be the natural trustees of the fund. In cases, however, where additional financial assistance was needed, we think that, if the provincial Government were satisfied with the management of the shows, a contribution from provincial revenues to the fund would be fully justified. Further, with a view to popularising the shows, we consider that railway companies should issue cheap tickets, as a matter of course, and without waiting for an application from the organisers.

As regards prizes at agricultural shows, experience has shown that medals are greatly valued by the recipients. These, however, should only be given sparingly and for exhibits of outstanding excellence. For ordinary exhibits, prizes are better given in kind than in money; for example, in the case of exhibits of cattle, the prize might suitably be an improved plough or other agricultural implement.

PUBLICATIONS.

140. Varying views as to the usefulness of publications are held in the different provinces. In some provinces, it is considered that vernacular leaflets, even when confined, as they should be, to an explanation in the simplest possible language of one point, and of one point only, are of little value. In other provinces, great use is made of them. In Madras, 120,000 copies of a leaflet on the single-seedling planting of paddy have been issued and other

leaflets on such subjects as the castration of cattle by mulling, the ill-effects of communal grazing and home made remedies against some common plant pests have had a circulation of 60,000 copies. In that province, 7,520 copies of a digest of the work done by the Agricultural Department are issued monthly both in English and in three principal vernaculars of the province, and the Villagers' Calendar, which is published by the department every year, is becoming increasingly popular. The other publications issued by the department include bulletins of a more comprehensive character than the leaflets. These bulletins are usually issued in English only, but, like the vernacular leaflets, deal with one specific point. A Year-Book on the research and experimental work of the department, and various text-books and notes, are also published.

Other provinces rely mainly on leaflets supplemented to some extent by bulletins. Burma has also a Villagers' Calendar. The Bengal Agricultural Department issues a journal in English and Bengali. The Punjab Agricultural Department publishes twice annually a departmental magazine entitled "Seasonal Notes" in English and the vernacular. The Agricultural Department of the United Provinces also publishes a vernacular journal. The Bombay Agricultural Department subsidises two monthly agricultural magazines, one in Marathi conducted by the Deccan Agricultural Association and one in Kanarese conducted by the Dharwar District Agricultural Association. The agricultural departments in most provinces supply regular material to the English and vernacular press. The efficacy of this form of propaganda must depend on the standard of literacy which has been reached and it is, doubtless, the fact that Madras stands high in this respect which has led to its adoption on such an extensive scale in that province. The spread of general education, to which we look forward with confidence, should enable the printed word to be used with increasing advantage. Meanwhile, we would point out that, whilst the other publications issued by the Madras Agricultural Department undoubtedly serve a valuable purpose in stimulating general interest in the work of the Agricultural Department and, on that account, are deserving of imitation elsewhere, the leaflets circulated in that presidency, as in other provinces, are of little real value, unless they are issued in connection with a definite demonstration of their subject matter. The results of leaflets advocating the single-seedling planting of paddy are likely to prove very disappointing, unless the cultivators to whom they are given are provided with ample opportunities of seeing for themselves the advantages arising from the adoption of this practice. Again, the advocacy, by the circulation of leaflets, of more humane methods of castration is bound to prove ineffective unless it is accompanied by a demonstration of those methods. We think that local interest in the work of the department would be aroused, if a brief and popular account of what it has done were issued annually for each tract. We need hardly point out how essential it is that leaflets should be written in a manner which will enable them to be readily understood by the cultivators. Where the leaflets are published in the vernacular,

we would suggest that agricultural or taluka development associations, where they exist, should be consulted as to the suitability of the language used.

OTHER FORMS OF PROPAGANDA.

141. The comments we have made on publications in the preceding paragraph apply equally to other forms of propaganda such as lectures, with or without the stimulating adjunct of lantern slides, and to the display of cinema films. A beginning has been made with the latter in the Punjab, and we have had opportunities of seeing films relating to the co-operative movement and to the campaign for village "uplift," which is being carried on in the Gurgaon district. These films have, for the most part, been prepared by the Co-operative Department and by the Railway Board. While we welcome this initiative, we think that the departments of agriculture should consider the advisability of themselves embarking upon this important branch of propaganda. As each film is produced, steps should be taken carefully to assess its instructional value by such means as discussion with villagers who have seen it on the screen. A film designed to appeal to an audience of cultivators must possess very special qualities and we are persuaded that even a skilled professional producer could not successfully undertake its preparation without a considerable knowledge of village life and of the mentality of the average villager. It will be necessary to select with the utmost care those officers who are to be responsible for this work. We look forward to an increasing use of wireless as a means of conveying useful information to the cultivating classes, but, here again, information conveyed in this way should always be accompanied by information as to where the cultivator can see things for himself. We would mention an interesting experiment which has been made in Bengal and the Punjab. Early in 1927, at the initiative of the Eastern Bengal State Railway, a demonstration train was arranged which made a tour of eastern Bengal lasting for about a month. The train was fitted up as a travelling exhibition by the Railway, Public Health, Agricultural, Industries, Co-operative and Veterinary departments and by the Indian Tea Cess Committee. Each department was allotted a bogey carriage which was appropriately fitted up with pictures, models and samples illustrating its activities. Open air lectures, accompanied by films and lantern slides, were given at each stop. A similar train was arranged by the Government of the Punjab in collaboration with the North-Western Railway in December last, and made an extensive tour throughout the province. The Government of the United Provinces have provided a demonstration carriage for the use of Mrs. Fawkes, the Secretary of the United Provinces Poultry Association, to assist her in the work of popularising improved breeds of poultry. We would suggest that other provincial governments should obtain a report on the results of these experiments from the governments of Bengal, the Punjab and the United Provinces with a view to considering whether a similar experiment could not usefully be undertaken in their provinces. The method has been used in other countries with success. We have already referred, in paragraph 138, to the use of a travelling lorry for demonstrating improved implements. It is worth considering

whether the use of motor lorries for other forms of propaganda might not also be advantageous.

AGRICULTURAL ASSOCIATIONS.

142. We have pointed out that the area on which improvements introduced by the agricultural departments can be seen in actual operation, is still but a small fraction of the total cultivated area of India. We anticipate that the district staff of the agricultural departments will expand rapidly in the near future but, even if the ideal which some agricultural departments have set before themselves, that of having one agricultural demonstrator with two fieldmen in each taluk or tehsil, is reached, it may be doubted whether the departments will be in a position to make their influence sufficiently felt upon the bulk of the cultivating classes. It is obvious, therefore, that the propaganda work of the departments requires to be supplemented by other agencies. This was recognised when the departments were reorganised and, in some provinces, it was hoped that the lever with which they could move the cultivator to an extent far beyond anything that could be achieved by their own unaided efforts would be found in agricultural associations, that is, in organised bodies which would act as agencies for the dissemination of knowledge of agricultural improvement. Several associations of this character were formed in the Central Provinces, Bengal, Bombay and Madras but the hopes formed of them have not been fulfilled. In Madras, they soon became extinct and, as early as 1911, the Board of Agriculture found that they showed few signs of life except in the Central Provinces. The reasons for their failure are not far to seek. The area from which the members of the associations were drawn was usually too large to permit of a concentration of activity sufficient to produce any positive results. The lack of a definite task often meant that nothing at all was done. The associations were often composed of men whose direct interest in the land was small. In some cases, too much depended on the enthusiasm of a single member, the loss of whose presence on the association for one reason or another resulted in the association lapsing into inanition. And, above all, the staff of the agricultural departments in those early days was so limited and its energies were so taken up with the work of research and experiment that it was unable to give the associations the close attention without which they could hardly have been expected to thrive. The result was that, whilst the associations lingered on in Bombay and the Central Provinces, they achieved but little until recent years when they were reorganised in the light of experience and converted into active bodies. There are now a large number of them in the Central Provinces, where they vary greatly in activity, some being very progressive and others almost moribund. Associations have been formed for districts, for tehsils and for the divisions of tehsils known as circles. As was to be anticipated from the previous history of the associations, it has been found that the tehsil associations are more effective than the district associations and that the circle associations are more effective than the tehsil associations. The tendency now is to develop the smaller unit, with the intention of building up the tehsil associations by the election of

representatives of the circle associations and the district associations in like manner from the tehsil associations. There are now eleven agricultural associations in the Punjab which are reported to be doing increasingly useful work. Agricultural improvement committees have been formed in five districts in Burma. In addition to advising Government in matters relating to the agricultural development of the district, the committees arrange for the holding of shows and exhibitions. It is, however, in Bombay that the most striking developments have occurred. These developments are of special interest and importance as they represent the most systematic attempt which has yet been made to co-ordinate the propaganda work of the agricultural and co-operative departments in respect of agricultural improvement. Before we pass on to describe the activities of the taluka development associations and the divisional boards of agriculture in some detail, it will be convenient to discuss the relation of the co-operative movement in general to the subject matter of this chapter.

THE CO-OPERATIVE MOVEMENT IN RELATION TO AGRICULTURAL PROPAGANDA.

143. The Co-operative Credit Societies Act of 1904, which limited the activities of societies to the supply of funds to their members, was repealed in 1912. The Co-operative Societies Act of that year removed the restrictions which had been imposed by its predecessor, and permitted the formation of societies for the promotion in any direction of the economic interests of their members. The passing of the new Act resulted in the immediate utilisation of co-operative societies for the dissemination of agricultural improvement. The beginnings which were made were so promising that the most optimistic anticipations of the possibilities of this new method of propaganda were entertained by the Board of Agriculture of 1913. These anticipations have unfortunately not been realised. We have mentioned in Chapter IV that the sum total of the efforts of co-operative agencies in regard to the distribution of improved seed has so far been disappointing. This, with certain striking exceptions, is equally true of their agricultural activities in other directions. There would, *primâ facie*, appear to be no organisations better fitted to further the propagandist work of the agricultural departments than co-operative unions and societies for the joint purchase of the requirements of their members, for production and sale, either singly or in combination, for the sale and hire of implements and similar objects. But the history of such societies is, on the whole, melancholy reading. What can be accomplished in this direction is shown by the success which has been achieved by the co-operative cotton sale societies in Bombay, the value of cotton sold by which amounted in 1925-26 to Rs. 62½ lakhs, and by the commission sale shops in the Punjab and the co-operative jute sale societies of Bengal which, in the same year, sold produce for their members to the value of Rs. 25 lakhs and 20 lakhs respectively. But these are very exceptional cases, and, in general, it has to be admitted that societies of this character have done little to advance agricultural improvement. Much more hopeful are the societies for the consolidation of fragmented holdings and the Better-Farming societies of the Punjab. The former the work of which we have

described in the preceding chapter, are rather a means to the end of securing better cultivation; the influence of the latter in bringing it about is more direct. There are now over one hundred Better-Farming societies in the Punjab, with 2,400 members controlling 42,000 acres. These members pledge themselves to follow the advice of the Agricultural Department in cultivating their own land; if the area under control of a society is, or is likely soon to be, 2,000 acres or more, a trained fieldman (*mukaddam*) is allotted to assist. Valuable propaganda is carried on and useful work is being done. Improved ploughs, harrows and chaff-cutters, selected seed of wheat and cotton and setts of Coimbatore cane are in general use, whilst, in selected areas, new vegetables and fruits are being tried. The Co-operative Department accepts the function of making the knowledge of the agricultural expert productive by organising the people to adopt it. In five more societies, there are tenants in charge of small areas of thirty acres each, and an agricultural assistant has been placed on special duty to instruct them. Government are also giving grants to societies of the latter type to pay for trained fieldmen for three years.

The co-operative organisations so far discussed in this chapter have been organisations formed for definite purposes connected with agricultural improvement. Some use has also been made by the agricultural departments of the ordinary co-operative credit societies in the work of spreading improved seeds, improved implements and artificial fertilisers, but sufficient has perhaps been said to show that the departments have failed to exploit the possibilities offered by the co-operative movement. While this failure has been largely due to the fact that the co-operative movement in several provinces in India has not yet reached a stage at which it can undertake any activities other than credit on an extensive scale, there can be no doubt that the lack of sufficiently close touch between the agricultural and the co-operative departments has been a contributory cause. We, therefore, proceed to describe the methods of overcoming this obstacle which are being adopted in Bombay.

THE TALUKA DEVELOPMENT ASSOCIATIONS AND DIVISIONAL BOARDS IN BOMBAY

144. The taluka development associations in Bombay have been constituted under a Resolution issued by the Government of Bombay in 1922. As soon after the constitution of an association as possible, a survey of the taluka is to be carried out by the Agricultural and Co-operative departments. Where such associations exist, they have taken over the work formerly done in the taluka by agricultural associations, co-operative development committees and similar bodies. Membership of an association is open both to co-operative societies and to individuals who are willing to pay a small subscription. The associations are mainly deliberative bodies which meet two or three times a year to appoint office bearers, sanction the budget and approve the programme of work. The execution of the programme is entrusted to the secretary and a small working committee of which two members are representatives of co-operative societies in the taluka. The main object of the associations is the demonstration of improved implements, improved

seed and manures. They do not, however, undertake the demonstration of any improvements unless they have already been successfully demonstrated on the cultivators' own fields by the staff of the Agricultural Department. They are not expected to undertake any large purchases and hiring out of implements or the extensive financing of the purchase and distribution of seed and manure, the intention being that they should merely advance development to such a stage that this can profitably be done by co-operative societies. If an association asks for them, the services of a fieldman are placed entirely at its disposal by the Agricultural Department, the cost being met from the funds of the association. The funds required for the work of the association are provided by a capital fund raised by annual subscriptions from co-operative societies, individuals, and villages as a whole, and by an annual grant from Government which is equal to the income from other sources up to a limit of Rs. 1,000.

The taluka development associations work under the supervision of divisional boards, of which there are six. Each of these boards consists of two official and four non-official members, of whom two represent the co-operative movement and two represent agriculture. The board is expected to meet at least once a quarter and to submit a report of its proceedings to the Director of Agriculture and the Registrar of Co-operative Societies jointly. One of the official members is ordinarily the chairman of the board. In addition to distributing the government grants allotted to the taluka associations on the principle described above, the board controls the distribution of the portion of the government grant for loans to co-operative societies which was formerly in charge of the Registrar of Co-operative Societies. The board also undertakes the distribution of the discretionary grant for propaganda purposes which was formerly administered by the Director of Agriculture. The board has also certain advisory functions. It is expected to advise local officers as to the way in which the policy laid down by Government or by the Director and the Registrar is to be carried out in its division. It is also expected to discuss questions of general importance, and to bring to the notice of the department concerned such measures as it thinks should be taken for the economic advancement of the division.

The Government of Bombay have laid down that the propaganda work of the Agricultural Department should be carried on, as far as possible, through co-operative unions where these exist and, where they do not, through individual co-operative societies. The work of both agricultural and co-operative propaganda is distributed between the agricultural overseers working under the Agricultural Department and the agricultural organisers working under the Co-operative Department. It is intended that the charges of these officers should not overlap and that each should be responsible for both agricultural and co-operative work in his own area.

A report on the work of all the propaganda staff is submitted to the divisional board by the departments concerned every quarter and is forwarded to the Director of Agriculture and the Registrar

of Co-operative Societies with the board's remarks. Any recommendations made by the board are considered and orders on them are issued by the Director and the Registrar jointly.

There are now nearly sixty taluka development associations in Bombay started either on the initiative of the people of the taluka or on that of the revenue officer in charge of it (the *mamlatdar*). The evidence we received showed that they were, on the whole, functioning successfully, though there have been some failures. We were informed that these have occurred mainly in the Konkan tract of the presidency in which a special class of landholders known as *khots* is to be found. The failure in this tract is attributed to the fact that, owing to the peculiar nature of the tenure and the excessive subdivision and fragmentation of land, neither the landholders, who are frequently absentees, nor the tenants take any great interest in the land.

APPLICABILITY OF THE BOMBAY SYSTEM TO OTHER PROVINCES.

145. The work of the taluka development associations and of the divisional boards in Bombay has been in progress too short a time to enable its effect in stimulating agricultural development to be gauged with any certainty. We have thought it useful to describe their organisation and methods of working in some detail, not because we consider them suitable in every way for general acceptance, but because we are convinced that it is only by the adoption of this, or of some similar system, that the agricultural departments can effectively utilise the help of co-operative and other associations. The details of the organisation to be built up for this purpose must vary in different provinces. Much depends upon the efficiency of the agricultural and co-operative departments, much on the personality of the heads of the departments and their ability to work together, even more on the existence of a sufficient number of intelligent cultivators willing to form an active association. That closer association between the agricultural and co-operative departments for agricultural propaganda work is desirable, we have no doubt. The more elaborate course in rural economics, which we have suggested in Chapter XV for inclusion in the curriculum of the agricultural colleges would include instruction in co-operative principles, whilst, amongst the short courses given at the colleges, would be one in rural economy for the staff of the co-operative departments. The instruction of agricultural officers in the principles of co-operation and of co-operative officers in rural economy should assist in bringing about closer touch between the two departments. But something more than this is required. It is essential that there should be a definite system of co-ordinating their work in the districts. It is our view, therefore, that the Bombay organisation is well worth the study of other provincial governments. It is worthy of consideration whether the taluka should be the unit of organisation or whether, in some cases, a smaller area would not be a more appropriate unit. We would also suggest that Government might place at the disposal of the association the services of a more highly trained officer than a fieldman. The Bombay organisation might be held to be open to the criticism that

too much depends upon official initiative and supervision but we think that reliance on such initiative and supervision is unavoidable in present conditions. In this connection, we wish to stress the part the district officer can play in advancing agricultural and other improvements in the area in his charge. His influence is such that any interest he displays in rural development is bound to be specially fruitful in results. Advantage of it is taken in some provinces, notably in the Central Provinces, by attaching an agricultural assistant to the camp of the district officer during his tours in the district. In Bombay, demonstrations of agricultural improvements by expert officers of the Agricultural Department have been given in conjunction with the annual settlement of revenue accounts (*jamabandi*) which is a feature of the revenue system in the *ryotwari* provinces of Bombay and Madras. We consider that both these methods of propaganda might be more widely adopted.

UTILITY OF THE CO-OPERATIVE CREDIT SOCIETY IN ADVANCING AGRICULTURAL IMPROVEMENT.

146. The formation of development associations, whether on the lines followed in Bombay or on others better adapted to local conditions, will take time, whilst there are tracts which are not sufficiently advanced to hold out any prospects of successfully establishing associations in the near future. In the meantime and in such tracts, the agricultural departments should, we think, make far greater use of co-operative credit societies than they are now doing. The Co-operative Department in Bihar and Orissa has perhaps done more in this direction than any other. In that province, several central banks have been instrumental in introducing new crops or varieties, such as tobacco or Pusa No. 4 wheat, in the area to which their operations extend. In South Bihar alone, some eighty societies affiliated to such banks have rendered material assistance in distributing and demonstrating Coimbatore canes, groundnut, potatoes and sulphate of ammonia.

NECESSITY FOR THE CONCENTRATION OF DEMONSTRATION AND PROPAGANDA WORK.

147. The necessity for the concentration of the energies of the district staff of the agricultural departments and of the associations through which it works, both in regard to the area in which operations are carried on and the subjects selected for demonstration, cannot be too strongly insisted on. The conversion of the cultivators of a whole village to the adoption of a particular form of agricultural improvement is of far more value to the Agricultural Department, in the long run, than that of a number of isolated cultivators in a wide area. Once an improvement has thoroughly established itself in the agricultural practice of a small area, the knowledge of it spreads naturally over contiguous areas where conditions are similar. In the early stages of propaganda, it was perhaps not practicable to confine work to particular areas, and, in consequence, efforts were dispersed over a province and enterprising individuals were sought for, who would undertake to carry on their operations in accordance with the advice of the departments. We are emphatically of opinion that such dispersal of effort is no longer justified and that, everywhere, concentration should be the policy. We agree with the Report of the English

Agricultural Tribunal of Investigation that "State assistance to agriculture is more effective and economical where the agricultural community is co-operatively organised than where it remains in a condition of dominant individualism; and, if for no other reason, the State would be justified in assisting the growth of agricultural co-operation, by which it will be enabled the more effectively to promote its educational and other services." * Where, then, there are efficiently managed co-operative societies with members willing to adopt the advice of the agricultural expert, we consider that these should always be given preference over the unorganised individual.

The advisability of concentration in regard to the distribution of the seed of improved varieties needs no elaboration. The individual cultivator who grows an improved variety may derive little benefit from so doing owing to the difficulty of disposing of his produce. Where the improved variety is one of such crops as cotton, the millets and tobacco, which are liable to cross fertilisation in the field, he runs the risk that his crop will rapidly deteriorate owing to contamination from the inferior varieties grown by his neighbours. We have pointed out, in Chapter IV, that an obstacle to the spread of improved implements is the natural dislike of the individual to be marked off in any way from his fellows, and this is equally true of other forms of agricultural improvement. Whilst we realise the difficulty of refusing requests for assistance from individuals and consider it desirable that these should be complied with as far as possible, the fact must be recognised that the staff which the agricultural departments can employ on demonstration work under its own control or lend to associations is limited. Associations should, therefore, be encouraged to send their own men to be trained by the departments. We regard it as most important that no more demonstrations should be carried on than can be effectively supervised and brought to a satisfactory conclusion. The work should be carried out on a definite programme and should be of an intensive rather than of an extensive character. It appears to us that Better-Farming societies such as those established in the Punjab are useful centres for a campaign of this kind and we are, therefore, of opinion that the demonstration staff allotted by the agricultural departments for work in areas in which societies of this kind exist and are efficiently conducted should work preferably through them.

APPOINTMENT OF AN EXPERT OFFICER FOR PROPAGANDA WORK.

148. The supervision of all demonstration and propaganda work within his charge is, and must remain, one of the most important duties of the deputy director of agriculture in charge of a circle but we consider that an officer of the standing of a deputy director might well be attached to the office of the Director of Agriculture, whose sole duty it would be to organise and systematise activities throughout the province. His task would be to watch the various schemes of propaganda in operation, to record their results and to suggest methods of making them more effective. He would be

*Final Report 1924. Cmd. 2145, paragraph 178.

expected to familiarise himself, as far as possible, with experiments in demonstration and propaganda conducted in provinces other than his own and to keep himself informed of the methods adopted in other countries. It would be his duty to bring to the notice of the research staff points which the work of the district staff revealed as specially requiring their attention. He would also act as a liaison officer between the Agricultural Department and the Press and would be in charge of all departmental publications which had as their object the furtherance of agricultural improvement and the stimulation of popular interest in the work of the department.

PROPAGANDA OF OTHER DEPARTMENTS CONNECTED WITH RURAL WELFARE

149. Throughout this chapter, we have dealt with the work of demonstration and propaganda from the point of view of agriculture. We have done so, mainly because this is the aspect with which we are more immediately concerned, but, in part, because demonstration and propaganda in favour of agricultural improvements present special problems of their own. The principle that, if propaganda in Indian conditions is to be effective, it must be based mainly on ocular demonstration is, however, one of general applicability to all departments concerned with rural welfare. It is also true generally that the propaganda carried on by such departments will be far more fruitful in results, if it is conducted through the medium of organised associations. It is the realisation of this which has led to the formation of co-operative societies for purposes connected with education, irrigation and the prevention of disease. Whilst we see no objection to the use of agricultural associations and of taluka development associations for veterinary propaganda and, indeed, consider that they should be able to render material help in any campaign which is undertaken to stamp out cattle disease, we are averse from invoking their assistance in any other form of propaganda work less directly connected with agricultural improvement. To do so might end in diverting their attention to an undesirable degree from the objects for which they have been established. For this reason, we consider that the propaganda work of departments concerned with rural welfare, other than the agricultural and veterinary departments, is best carried on through associations organised for more general purposes such as co-operative bodies and the rural community councils of the Punjab, to which we refer in our chapter on The Village.

PRIZES FOR AGRICULTURAL IMPROVEMENT.

150. We consider that a valuable stimulus to agricultural development in India would be given if the Government of India were to award an annual prize for the most striking agricultural improvement of the year. The value of such a prize in arousing interest in concrete forms of agricultural improvement would, in our opinion, lie even more in the prestige that would attach to its receipt than in the monetary amount, though we are of opinion that this should be substantial and would suggest Rs. 10,000 as a suitable figure. The conditions governing the award of the prize should be made as definite as possible and

we would instance the invention of new or improved implements, or the introduction of new or improved varieties of crops as examples of the class of work which would constitute a claim to it. We think it desirable that officers in the public service should be declared to be ineligible to compete for the prize. We would suggest that claims to the award should be submitted to, and adjudicated by, a small committee constituted expressly for the purpose. The Chairman of the Council of Agricultural Research would be a suitable chairman of such a committee and it should, in our view, consist of an equal number of officials and non-officials. The Government of India scheme for such an award might advantageously be supplemented by similar provincial schemes. A valuable lead in this direction has been given by our late colleague, Sir Ganga Ram, who founded a prize which is to be awarded, at intervals of not less than three years, for a discovery of an invention or a new practical method which will tend to increase agricultural production in the Punjab on a paying basis.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

151. The conclusions and recommendations in this chapter may be summarised as follows :—

(1) The discontinuance by the Board of Agriculture of its review of the methods of demonstration and propaganda adopted in the provinces is to be regretted (paragraph 129).

(2) The only hope of convincing the cultivating classes of the advantages of agricultural improvement lies in ocular demonstration (paragraph 130).

(3) The several methods of propaganda employed, their relative cost and the claim of each upon the time of the staff, should be frequently reviewed in the light of recorded results and any method proved ineffective should be abandoned (paragraph 130).

(4) Demonstration on the cultivator's own fields is preferable to that on a government demonstration farm (paragraph 131).

(5) It is doubtful whether the possibilities of capitalistic farming require demonstration on the scale adopted in the United Provinces (paragraph 131).

(6) The establishment of a farm in each district for the general purposes of the Agricultural Department, including demonstration, is desirable but the staff and funds available can, in present conditions, be much more usefully employed in demonstration on the cultivator's own fields (paragraph 131).

(7) The policy in regard to the establishment of demonstration farms in the United Provinces and the Punjab should be re-examined (paragraph 131).

(8) No more demonstration farms should be opened in Bengal until demonstration on the cultivator's own fields has expanded to a much larger extent (paragraph 131).

(9) There is no objection to the establishment of special demonstration farms for demonstrations which involve industrial as well as agricultural operations (paragraph 131).

(10) Experimental farms are unsuitable for demonstration work and should, therefore, be confined to the purpose for which they are intended (paragraph 132).

(11) Departmental seed farms can be used with advantage for demonstration work (paragraph 133).

(12) Demonstration farms, established to demonstrate the possibilities of capitalistic farming, should be run at a profit. Seed farms should be at least self-supporting. It is not essential that farms established for other purposes should work at a profit (paragraph 134).

(13) Short courses in particular subjects should form an important part of the work of demonstration and seed farms (paragraph 135).

(14) The two systems of carrying out demonstrations on the cultivator's own fields, that under which a plot is hired and the cultivation is carried on throughout by the departmental staff and that under which the land is cultivated by the cultivator himself under departmental supervision, should be adopted in all provinces, and the results compared (paragraph 136).

(15) The policy of guaranteeing the cultivator against loss arising out of demonstration work on his land is one of doubtful expediency (paragraph 137).

(16) Peripatetic demonstrations of the use of improved implements should be given (paragraph 138).

(17) Suitable arrangements should be made by agricultural departments, or by manufacturers in consultation with them, for hiring out the more expensive implements and machinery (paragraph 138).

(18) Agricultural shows provide a useful means of following up the demonstration work of the agricultural departments (paragraph 139).

(19) For exhibits of outstanding excellence at such shows medals might be given. Prizes for ordinary exhibits are better given in kind than in money (paragraph 139).

(20) A permanent agricultural stall should be established in the regulated markets, the establishment of which is recommended in Chapter XI (paragraph 139).

(21) The various publications issued by the agricultural departments serve a useful purpose in stimulating general interest in the work of the departments. The vernacular leaflets, which are issued in large numbers, are, however, of little value, unless they are issued in connection with a definite demonstration of their subject matter (paragraph 140).

(22) Other forms of propaganda such as lectures, the cinema and wireless are of little value, unless used in conjunction with actual demonstrations of results (paragraph 141).

(23) The agricultural departments should consider the advisability of undertaking the production of films (paragraph 141).

(24) The possibilities of a demonstration train as organised recently in Bengal and the Punjab should be considered in other provinces (paragraph 141).

(25) Agricultural associations hitherto have, for various reasons, proved failures in most provinces (paragraph 142).

(26) The agricultural departments have failed to exploit the possibilities offered by the co-operative movement for propaganda work (paragraph 143).

(27) The divisional boards and taluka development associations in the Bombay Presidency constitute an organisation for the co-ordination of the propaganda work of the agricultural and co-operative departments which is worthy of study by other provincial governments (paragraph 145).

(28) Agricultural assistants for propaganda work should be attached to the camps of district officers (paragraph 145).

(29) The agricultural departments should make far greater use of co-operative credit societies in their propaganda work (paragraph 146).

(30) Demonstration and propaganda work should be concentrated, both in regard to the area in which operations are carried on and the subjects selected for demonstration (paragraph 147).

(31) Better-Farming societies should have the first claim on the services of such of the district staff of the agricultural departments as is allotted for demonstration work in the areas in which they are established (paragraph 147).

(32) The appointment to the office of the Director of Agriculture of an officer, whose sole duty would be to organise and systematise propaganda work throughout the province, is desirable (paragraph 148).

(33) The propaganda work of departments concerned with rural development, other than the agricultural and veterinary departments, is best carried on through associations organised for general purposes and through co-operative bodies (paragraph 149).

(34) A valuable stimulus to agricultural development in India would be given if the Government of India were to award an annual prize for the most striking agricultural improvement of the year (paragraph 150).

CHAPTER VII

ANIMAL HUSBANDRY

SCOPE OF THE CHAPTER.

152. In this chapter, we deal with the numbers, management, uses and improvement of livestock, by far the most important of which, from the point of view of the cultivator, are cattle. Incidental reference only is made to diseases of animals; the control and treatment of disease are discussed in Chapter IX.

TOTAL NUMBERS OF LIVESTOCK IN INDIA.

153. In the Central Provinces and Burma, a livestock census is taken yearly. In other provinces, livestock are enumerated at intervals of five years. The year in which the quinquennial census is taken is not the same in all provinces; but this does not affect the value of the figures for our purpose. The latest statistics available are those given in Volume I of "Agricultural Statistics of India, 1924-25." It is to these that the references in this chapter are made.

The numbers, in millions, of the different groups of livestock in British India are as follows:—

Cattle and buffaloes	151·0
Sheep and goats	62·5
Horses, mules and donkeys	3·2
Camels	0·5

In those Indian States for which statistics are available,* there were, in 1924-25, over 36 million cattle and buffaloes, 25 million sheep and goats, one million horses, donkeys and mules, and 262,000 camels.

RELATIVE IMPORTANCE OF THE DIFFERENT CLASSES OF LIVESTOCK.

154. In comparing figures for cattle and sheep, it is usual in western countries to allow from six to seven sheep as the equivalent of one cattle unit. The cattle and sheep of India vary so greatly in size that a suitable factor for this country could only be determined after careful enquiry, and no such enquiry has yet been made. If, however, for the purposes of a rough estimate, the figure seven were adopted, it would follow that, from the point of view of their size and the total quantity of food required for their maintenance, cattle and buffaloes occupy a place in Indian agriculture nearly seventeen times as great as that occupied by sheep and goats. In the actual life of the people and in the rural economy of the country, the relative

*Statistics are available from 51 States, having an area of 252 million acres and a population of 46 millions. The total area of Indian States is 461 million acres, and the total population is 72 millions.

importance of bovine animals is indeed, much more marked than the above figure would suggest.

In any classification of the countries of the world from an agricultural point of view, India would appear as essentially a crop-growing country. Its jute, rice, wheat, cotton and oil-seeds occupy a large place in world markets; while, with but rare exceptions, its livestock are never seen beyond its shores. (For a time there was a limited export of dairy products to eastern markets; but of such products India has none to spare, and indeed imports them to supplement the home supplies.)

The only livestock products in which a modest external trade is carried on are hides and bones. Of these two commodities India has an abundant supply, but the export is not of appreciable advantage to the owners of stock.

Although the exports of cattle and cattle products are very small in comparison with those of such nations as the Argentine, Australia or the United States of America, in none of those noted stock-rearing countries are cattle of more importance to the home population than they are in India. In most parts of the world, they are valued for food and for milk; in India, their primary purpose is draught for the plough or the cart. The religious veneration accorded to the cow by the Hindu is widely known. To at least half of the population of India, the slaughter of the cow is prohibited, and this outstanding fact governs the whole problem of the improvement of cattle in this country. It is necessary to recognise the obligation under which the country stands to the cow and to her offspring, the trusty ox. Without the ox, no cultivation would be possible, without the ox, no produce could be transported. This statement is almost universally true, for other animals, such as the camel, the horse and the donkey, and mechanical vehicles are rarely used.)

The total number of sheep and goats is considerable, but they are very unevenly distributed, and, as a rule, they are not so much the characteristic stock of the ordinary cultivator as of nomadic flock-owners or of the landless villager in districts where scrub jungle abounds. A horse or a mule is rarely seen at work on the land and, except in the hills, these animals are almost as rarely employed for transporting produce. In some localities, donkeys are utilised in carrying agricultural produce, but nowhere are these animals used to the extent that they are in Egyptian agriculture. In arid tracts in the north and north-west, the camel occupies a leading place as a transport animal.

Sheep and Goats

155. Since, in India, of all domestic animals, cattle are incomparably the most important, we propose to discuss cattle problems at some length; but before doing so it will be convenient to refer briefly to one other minor class of livestock, namely, sheep and goats.

DISTRIBUTION OF SHEEP AND GOATS.

The distribution of the 23 million sheep and 39 million goats of British India is as shown below :—

	Sheep (in 000's)	Goats (in 000's)
Ajmer-Merwara and Manpur	258	272
Assam	44	879
Bengal	711	6,007
Bihar and Orissa	1,239	5,765
Bombay { Presidency Proper	1,768	2,622
Bombay { Sind	624	1,511
Burma	74	263
Central Provinces and Berar	358	1,330
Coorg and Delhi	8	30
Madras	11,220	8,049
North-West Frontier Province	491	571
Punjab	4,266	4,472
United Provinces	2,153	7,473

The reason for the small numbers of sheep found in Bengal, Burma and Assam is sufficiently clear ; the climatic conditions in these provinces are ill suited to sheep. The small number of sheep in the Central Provinces is less readily explained, but the causes at work need not be examined here.

From the point of view of numbers, much the most important sheep-breeding province is Madras. The sheep kept in the central districts of Madras alone are not far short in number of those found in the Punjab, and much exceed those of any other province. Unexpectedly, too, sheep-breeding is largely followed in all parts of the presidency, except in the very wet districts on the west coast. The general importance of sheep appears to be associated with the rainfall distribution of the province which is better suited to them than it is in most other parts of India. It may be noted that sheep are found in the largest numbers in those districts of Madras in which the south-west monsoon is light. In contrast to most other provinces where sheep are usually owned by nomadic herdsmen, the majority of the owners of flocks are settled in villages and graze their flocks, which vary in size from a few dozen to over a thousand, at no great distance from their homes. The sheep are usually of very poor quality. They produce at most two pounds of wool annually and the fleeces consist of hair rather than wool. In some parts of the central districts, especially in Coimbatore, better animals are bred and the wool is of fair quality. Sheep in the north-west of India generally belong to nomadic shepherds ; a number of breeds are recognised, the two most interesting being the *dumba* or fat-tailed sheep with long coarse wool, mainly valued for its mutton, and, in the south of the Punjab, the Bikanir breed which is reputed to grow the best wool in India. The whole of the Rajputana Agency, from Bikanir southwards,

contains sheep of a relatively good class; but, except in Ajmer-Merwara, where the number of sheep is large in relation to area, the land on which these flocks graze lies outside British India. Large flocks belonging to nomadic shepherds are common in several parts of the Bombay Presidency. Bombay wool, though at one time considered good, is now classed by buyers as of low quality. It is, in fact, very variable; some animals grow fair wool, others little more than hair. Herdsmen expect to make from twelve annas to a rupee for fleeces, and a considerable part of their income is derived from sheep-folding. The best sheep in the United Provinces are found in districts such as Muttra, Moradabad and Bundelkhand in which the rainfall is light: there are also some good breeds in certain Himalayan tracts; but the sheep of the province are generally very poor. With the exception of Patna sheep, which have long had some local reputation, the sheep of Bihar and Orissa and Bengal are of small size and produce wool of little value.

The numerous breeds of sheep recognised in India cannot be described here, nor can we examine their management. It may, however, be noted that it is usual to shear flocks twice yearly; that the average yield of wool is about two pounds per annum; that, in most localities, mutton is regarded by sheep breeders as of more importance than wool, and that the general management of flocks is very poor.

As in the case of sheep, Madras heads the list of Indian provinces in the number of goats kept. The United Provinces come second, Bengal third, and Bihar and Orissa fourth. Wherever sheep are largely kept, goats are associated with them; but only in Madras do general conditions cause sheep to be the favourite; in most provinces, the hardier goat is much the more common. Climatic conditions are not the only reason for this preference which also arises from the value of the goat as a milk producer. Many breeds of goats are kept on the plains of India but they may be grouped into three types; the milking goat found nearly everywhere in villages; the nondescript animal which accompanies the flocks of sheep and, like them, is used for providing meat and skins, and for folding; and goats kept for the valuable hair which they produce. The *pat* (*pattu*) goat is a distinct breed found in the Himalayas; but at lower elevations, in Sind, Rajputana and Baluchistan, may be found breeds of goats producing hair varying in value from little more than that of the common goat of the plains to a quality approaching that of the *pat* goat of the Himalayas.

EARLY SHEEP BREEDING EXPERIMENTS.

156. The East India Company gave long and assiduous attention to the subject of wool improvement:* indeed it would appear from old records that, if our enquiry had been held a century ago, we should have had more proposals for sheep improvement placed before us than appear in the volumes of evidence we have published.

* See Watt's *Dictionary of the Economic Products of India*; Calcutta, 1893. Article—Sheep and Goats.

One or two of the many experiments made in the past may be mentioned as an indication of the attention formerly given to livestock improvement in India, and because of their bearing on the policy which should now be adopted. About the year 1826, the Bengal Government spent Rs. 9,450 in acquiring a flock of country ewes and importing forty merino rams and ewes. An experiment in crossing was carried on with these animals in the United Provinces, but the cross-breds did not stand the climate well and, in 1832, the experimental flock was dispersed by distributing it to hill chiefs. About the time the Bengal Government's experiment terminated, a Bombay military officer drew the attention of the Directors of the East India Company to the possibilities of sheep breeding in Gujarat and the Deccan. In 1835, the Directors sent a consignment of 120 selected sheep of several breeds from England; two farms were opened near Ahmednagar, and a Bombay officer, who had "a good practical acquaintance with the management of sheep," was placed in charge of them. For a time, success appeared likely; as a marked improvement in wool resulted from crossing, neighbouring sheep owners sent their ewes to the farm rams, and many half-bred rams were distributed. Prospects were favourably reported on in 1843, but the experiment seems to have been abandoned soon afterwards. The inference from the information on record is that the country-bred rams failed to give satisfaction.

Many similar experiments both by the State and by private individuals were made elsewhere, especially in the Punjab, Bengal and Madras; but except that they established that the merino breed is, in general, better suited than the mutton sheep of England for crossing with Indian sheep, none of them led to any useful results. It is clear that the enthusiasm of some of the early experimenters was greater than their knowledge of sheep breeding. One, for example, established a flock at Cherrapunji which has a rainfall of some 450 inches! But it is also clear that quite a number of those taking part in the experiments were careful and observant flockmasters. The reasons why the many experimental flocks established and the hundreds of sheep imported, during a period of experimental work which lasted over half a century, should have exercised so slight an influence seem to us well worth careful examination by livestock experts beginning similar experiments at the present time.

REASONS FOR PAST FAILURES.

157. Lack of organisation, with consequent lack of continuity in the work, was certainly in part responsible for failure. The efforts, in most cases, centred round individuals and, when they disappeared, the flocks disappeared also. But organised work was not always lacking; in Bengal, there was a cattle committee of the Agri-Horticultural Society whose members took much interest in sheep breeding and whose efforts were long continued. In Bombay, too, interest seems to have been fairly widespread, and the indications are that it was the flocks, not the interest, that failed. And to keep provincial breeders at their task there was, in the earlier years, the Board of Directors of the East India Company in London, looking expectantly

for good Indian wool, ready, as we have seen, to incur considerable expense, and not likely to let experiments drop if results of permanent value seemed probable.

(We are of opinion that the failure of the efforts we have described was largely due to the eagerness of all concerned to secure immediate results. Early breeders were flattered by the favourable reports of wool buyers, for the improvement in wool produced by a cross was remarkable. For example, in the case of the Bombay experiment, London wool brokers reported the fleece of a Deccan ewe as being worth 3d. per lb., while that of a shearling merino-Deccan cross from Poona was valued at 15d. The truth indeed appears to be that in watching the wool, breeders forgot the sheep.)

The temptation to secure immediate results besets the breeder in India. Most kinds of livestock in this country are of low quality and the change produced by the use of imported superior sires is pronounced in the half-bred. Improvement by selection, on the other hand, is a slow business. It did not appeal to the enthusiastic sheep breeders of last century, who no doubt realised that they themselves would see but little of the results of their labours. Thus they failed to secure, by selection, a solid foundation for their flocks, and nothing now remains to testify to the efforts they made to effect improvement.

CONDITIONS NECESSARY FOR SUCCESS IN SHEEP BREEDING.

158. Thus is the principal deduction which we consider is to be drawn from the sheep-breeding work done in India in the nineteenth century, and we, therefore, recommend that the main energies of livestock experts now resuming the work should be concentrated on a study of the best indigenous types, and that the building up of a ewe flock with definite characteristics should be aimed at, before modification of these characteristics by crossing is decided upon.

In most provinces, livestock experts have already established flocks of considerable size, or are in process of building them up. The expressions of opinion we heard on the prospects of sheep breeding were sanguine ; more sanguine indeed for the immediate future than the existing position and the difficulties to be encountered seem to us to warrant. We recognise the great scope for improvement, and we believe that, in spite of obvious difficulties, great improvements are possible ; but the prospects of the "get-rich-quick" adventurer are no better in the twentieth than they were in the nineteenth century.

Space will not permit of an examination of the position in the different provinces, and we propose only to refer to recent experiments in northern India.

Between 1912 and 1923, sheep breeding experiments were in progress in the United Provinces. The lessons to be drawn from the failures of the early breeders were noted, and, in this case, the crossing experiments were made on selected country ewes. Merino and Romney Marsh rams

were used. The merino rams were used on country ewes, and also on the crossed progeny, grading up by stages to the pure bred sire, until lambs of seven-eighths merino strain were obtained. The country ewes were of two breeds, Bikanir and United Provinces. An interesting report by the Veterinary Adviser to the Government of the United Provinces, published in 1926, describes these experiments and gives a number of useful particulars regarding the conditions under which sheep are kept in the United Provinces. The experiments showed a very marked improvement in the first cross with the merino; the wool was four times the value of the country product. Half the three-quarter-bred merino sheep were a distinct improvement on their dams, others showed no advance, and—a significant point—a few deteriorated. The best three-quarter-bred merinos, when mated with a pure merino, produced very good wool which was valued at merino rates, but the sheep began to lack "carcase and robustness." It was at this stage that Romney Marsh rams were introduced to confer size and mutton qualities; but, owing to financial reasons, this series of experiments came to an end soon afterwards. One further significant point must be noted. Bikanir ewes gave better results than those of the United Provinces. Experiments in crossing with merinos are now being carried out at Hissar, where the conditions are favourable for sheep breeding. The half-bred sheep produced there is a very useful animal but, when these have again been crossed with merinos, the same defects in substance noted in the United Provinces have appeared. Light is thrown on the quality and character of native flocks by the fact that Hissar half-bred rams used on local ewes have proved to be distinctly useful. There can be no question that, in improving the very poor sheep of most parts of the country, crossing can be resorted to with advantage. In these circumstances, the first objective of the breeder must be to secure rams that can stand Indian conditions, and these rams must be bred within the country and based largely on indigenous stock. In spite of the satisfaction which has been expressed with the first results of using half-bred Hissar rams, we are of opinion that no half-bred ram is likely to be of real use to the stock breeder in India. It is true that one case has been discovered in which half-bred rams give satisfaction in Britain; but the chances of this occurring in this country are remote. We do not, therefore, recommend that livestock experts should aim at producing half-bred rams for distribution. But if the half-bred is rejected, a difficulty arises; for, as we have seen above, when attempts have been made to grade closer to imported rams, defects at once appear which result in an unsuitable breeding sheep. Thus, at the moment, there is no obvious method of securing rams suitable for distribution, The difficulty we believe to be due to the mongrel character of the ewe stock; the useful contribution which the breeder desires them to make to the new type of sheep at which he aims is not forthcoming; and the point we wish to emphasise is that it will not be forthcoming until, by a process of continuous selection, some degree of purity is acquired by the ewes forming the foundation stock with which experiments in crossing should begin. The ewes used in the experiments in the United Provinces

were ' selected ' only in the sense that they were picked out as resembling each other ; they were not ' selected ' in the sense in which the term is used by the breeder of pure-bred stock. It has been noted above that the ewes selected in the United Provinces failed ; this failure was not, however, so marked with the Bikanir ewes, and the inference is that the Bikanir ewes were less mongrel in their constitution than those of the United Provinces.

GOAT BREEDING.

159. Our conclusions in the preceding paragraph apply also to goats. There are obvious directions in which the goat might be improved both as a milking and a hair-producing animal. In many parts of this, as of other countries, the goat is the poor man's cow ; and there can be little doubt that, like the cow, its milk yield could be raised with little difficulty by selection. Since many breeds, or types, of goat have been recognised in different parts of the country, there is reason to suppose that, in the case of this animal, resort to crossing might also result in considerable improvement in the milk yield. Very little attention has been given to the subject and, in view of the hardy character of the animal, and the great need for increasing the milk supply, the possibilities of the improvement of milking strains should be explored. With the object of improving the quality of the hair, suggestions have been made from time to time that the Angora goat should be tried for crossing. So far as we have been able to discover, this has not been done in India, at least on any considerable scale. This breed has been used with highly satisfactory results in South Africa and elsewhere and we recommend trials of it in this country. It may be found possible to grade up to the pure Angora strain In that case, improvement would be easy and straightforward ; but, if the same difficulties arise as in the case of sheep, a beginning must be made with a selected strain of Indian she-goat. Fortunately, in some hill districts, there is reason to believe that relatively pure bred goats are to be found. On the plains, they may be expected to be as mongrel in constitution as sheep, and would have to be dealt with in the same way.

Cattle and Buffaloes

TOTAL NUMBER OF CATTLE AND BUFFALOES.

160. We now turn to the main subject of this chapter. In no part of the evidence we received was the disposition to generalise more marked than in the replies relating to cattle, their quality and their management. The great importance of cattle , the miserable condition of so many of them, the obvious difficulties encountered by stockowners, all tended to induce general statements from which it was not always an easy matter in cross-examination to disentangle facts. So many factors have to be taken into account in considering the improvement of cattle that we feel a preliminary review of the position is called for, before we proceed to formulate our own conclusions. With this object we have examined the livestock census statistics for each

province, as well as certain other figures which assist in explaining the difficulties of the Indian stockowner.

We recognise that there are imperfections in the published figures, but we believe they are sufficiently reliable to deserve careful analysis by those responsible for cattle improvement. For obvious reasons, we cannot treat them in the detail that they deserve. We attempt no more than to discover certain broad facts concerning the distribution of cattle and the main factors responsible for differences in the total number of cattle found in different parts of the country.

Thirty years ago, the cattle census figures, which were then very imperfect, accounted for fewer than ninety millions of cattle and buffaloes in British India. Ten years later, some 115 millions were enumerated. Improvements in the methods of collecting statistics were introduced about this time and there was a steady increase in the numbers, until, by the year 1914-15, 147 millions were recorded. It is clear that, up to this time, although an increase may actually have taken place, the main reason for the higher figures recorded was the expansion and improvement of statistical work. In the last ten years, the fluctuations have been no more than are to be expected in a country where the livestock depend largely on the produce of widely varying seasons. The number of cattle recorded in 1919-20 was 146 millions and, in 1924-25, 151 millions.

DISTRIBUTION OF CATTLE IN INDIAN PROVINCES.

161. From the census returns, it is obvious that the distribution of cattle is very unequal. (Inequalities depending on the nature of the land to be tilled, the extent of irrigation from wells, the amount of scrub and jungle, the rural population and the size of the holdings are indeed to be expected, but, when all allowances have been made for such causes, the census figures show that surprising differences exist between provinces.)

The provinces vary so widely in extent and the total number of cattle is so large, that a valid comparison of the livestock position is not easily made, unless the figures are reduced to a common denominator. Of the various common denominators open to us, we believe that, for India as a whole, the best basis of comparison is " per 100 acres of net sown area " which is the basis adopted in the Agricultural Statistics of India."

The statement given below shows, for each of the major provinces and for British India as a whole, the total numbers of cattle, the relation between that number and the human population, and the number of ordinary cattle and of buffaloes maintained for every one hundred acres of net sown area. An estimate of the total area of natural grazing land in each province is also included. This has been

arrived at in a manner which is explained subsequently. As for livestock, the grazing area is stated per 100 acres of net sown area :—

Distribution of cattle and buffaloes in the major provinces of India and in British India in 1924-25

Province	Net area sown	Total number of cattle and buffaloes in the province	Percentage of cattle and buffaloes to total population	Per 100 acres of net sown area			
				Estimated grazing land	Cattle	Buffaloes	Cattle and buffaloes
	Acres (in 000's)	(in 000's)		Acres	No.	No.	No.
Assam	5,975	5,785	76 1	242	87	10	97
Bengal	23,528	25,491	54 6	33	104	4	108
Bihar and Orissa	25,269	20,728	61·0	56	69	13	82
Bombay — Presidency Proper	27,492	8,480	53 0	33	24	7	31
Bombay — Sind	4,425	2,326	70 9	195	42	11	53
Burma	17,046	6,267	47 4	374	30	7	37
Central Provinces and Berar.	24,895	11,671	83 9	107	39	8	47
Madras	33,339	22,111	52 2	79	49	17	66
Punjab	26,940	15,237	73 7	62	37	19	56
United Provinces	35,121	31,046	68 4	52	64	24	88
British India (including Minor Administrations).	226,980	150,978	61 1	92	53	14	67

The great difference between province and province in the cattle population, especially in the number of ordinary cattle, is very remarkable, and an examination of the estimated areas of natural grazing land shows that the figures under this head throw no light on the reasons for it. In paragraph 164 below, we separate the cattle into six different classes and we shall then refer again to their numbers. Before we do so, it is necessary that we should explain the method we have adopted in estimating the grazing area, and should also discuss the quality and the value to the ordinary cultivator of the great so-called grazing areas nominally at the disposal of cattle in India. It will also be necessary to refer to the value of the statistical returns from which the livestock figures are derived. The estimate of the natural grazing land available in each province has been arrived at by adding to the area of forest land open to cattle grazing, three-fourths of the area of culturable waste and one-fourth of the area of unculturable waste found in each province. It should, however, be noted that no inconsiderable part of the fodder which the cattle pick up for themselves is to be found not on the areas which we have termed natural grazing lands in the statement given above, but on cultivated fields after the crop has been harvested, and on current fallows. Indeed, in many parts of the

country, the weeds growing on cultivated land, the grasses on field borders and along water channels, the cultivated plants which spring up from seed falling before harvest, and the stubble of crops, furnish the main grazing available to cattle.

CHARACTER OF GRAZING LANDS IN INDIA.

162. Agriculturists unacquainted with conditions in India would at once challenge the basis of the comparison we have made in the above statement; their attention would be attracted to the vast areas of uncultivated land found throughout this country, and, on the analogy of the experience of stockowners in temperate climates, they would advance the opinion that since grazings form the natural food of cattle, the grazing area, rather than the tillage area, should be used in comparing the numbers of cattle existing in each province.

The vast uncultivated tracts of India do, undoubtedly, in the aggregate, afford a large amount of grazing, and, in certain brief periods of the year, there is an abundance of grass; but, except on the common grazing land near villages, where the early grass is devoured by starving animals, and the later growths never get a chance to develop into anything to which the term "pasture" could be applied, the growth of grasses is extremely rapid; and they quickly become unpalatable to stock. Were these grasses to be cut and stored either as hay or silage, at a suitable stage, great quantities of cattle food could be provided; but for many reasons, which need not for the moment be given, they are rarely stored for use; and when the dry months of the year set in, the class of fodder to be found on grazing land is very poor. The long spells of dry weather hinder the development of the smaller grasses and prevent the formation of a close sward. The hard and dry grasses can indeed keep life in the cattle which have access to them, but very rarely can they keep cattle in good condition. As compared with grazing lands in temperate climates, Indian grazing lands are of very little use to the cultivators of tillage land, even when they are readily accessible, not because the grasses are bad but because they are only abundant and of high feeding value for a very short period in the year. At the time of year when the grower of field crops most needs fodder to supplement his own supplies, the fodder to be found on natural grazing land has little value for stock feeding. But, poor as grazing lands generally are from the point of view of economic stock husbandry, exceptions are to be found, and it is unquestionable that grazings influence both the numbers and the management of the livestock of the country. It is in certain of the grazing areas that the better cattle of the country are bred, and the conversion of the best grazing land of the past into tillage land to meet the needs of a growing population has probably increased the difficulty of maintaining the quality of cattle.

The natural grazing lands of India are, as we have seen, to be found within the areas classed for statistical purposes as "forests," "culturable waste" and "not available for cultivation."

A large proportion of the land which is classed as forest is open to grazing, either throughout the year or for that part of it when grazings are of most value. We have assumed that the whole of these open forests are available for cattle. Though grazing fees are charged, they are very low, and do not exclude cattle. We have not made a deduction from the total area of forests open to grazing, as we have in other cases, because, although we recognise that much of the area so classed can produce little or no grass, and much is inaccessible, we think that the average quality of the open forest areas is substantially better than that of the average land included under "culturable waste," and very much higher than that of land "not available for cultivation." Though the whole of the land falling within the category "culturable waste" is open to grazing, there is much of it which, though nominally "grazing area," does not produce any useful herbage. In some districts, there are extensive areas of laterite soils yielding nothing of value; in others, prickly pear, bushes of many worthless kinds such as lantana, and coarse herbaceous weeds cover much of the ground. In assuming that three-fourths of the culturable waste is available as grazing, we believe that we have adopted a full figure. The grazing value of land "not available for cultivation" is still more difficult to assess. A very large proportion of it, because rocky and distant, is quite inaccessible to cattle, or it may be absolutely barren from absence of soil in the hills or of water in the plains. Its general character is such that we do not think it likely that more than one-fourth can be classed as grazing land.

For British India as a whole, we are of opinion that the total of 209 millions of acres which we have arrived at by the method explained above may be regarded as an approximation which over-estimates rather than under-estimates the extent of the natural grazing land accessible to cattle. As the quality of grazing land varies widely, we recognise that the totals arrived at in this way for each province cannot be regarded as strictly comparable. The figures supply, indeed, but a very rough index of provincial resources in the matter of grazing land, but we think them sufficiently near the mark to prove that the extent of natural grazing land available does not explain the differences which exist in the number of cattle maintained in the different provinces.

VALUE TO BE ATTACHED TO STATISTICAL FIGURES.

163. These differences are, indeed, so remarkable that they necessitate some reference to the trustworthiness of the statistical figures. In the permanently settled provinces of Bengal and Bihar and Orissa, where no village accounts are kept, and where the task of collecting the original livestock figures falls, not on a village accountant, but on a village watchman, the figures are admittedly much less reliable than in provinces where they are collected by revenue officials. Even in provinces where the village accountant is employed, we have had evidence that the work of enumeration is sometimes very imperfectly done. On the other hand, it may be pointed out that the census has now been taken

for a number of years, that rules for the guidance of those concerned have been carefully framed, that checks are imposed on the subordinate officers responsible for the primary collection, and that there is no special reason why a subordinate officer should seek to exaggerate or reduce the numbers of livestock kept in his area. It is no doubt the case, as witnesses have asserted, that many enumerators, instead of actually counting cattle, resort to information collected from villagers, or to copying previous figures; but since the work is inspected and checked, this is to some extent a risky method of enumeration and it is unlikely that it is followed by a large percentage of the enumerators employed. While, therefore, it may be admitted that difficulties connected with the taking of a livestock census are considerable and that errors must be numerous, it should be pointed out that, in dealing with such very large numbers of village returns, errors due to exaggeration on the one hand and understatement on the other should tend to cancel out. It may also be claimed that the totals returned in recent years have been consistent.

Where enumerators have failed, and to this failure many of the criticisms of their work must be due, is in the classification of the various groups of cattle. This is not altogether a matter for surprise, for, in asking subordinate officials to follow the classification prescribed, a difficult, indeed an impossible, task has sometimes been set them. In the Punjab, for example, where the village accountant is expected to compile his list of cattle under some twenty different categories, we find that, at the last census, 12,594 bulls were enumerated. The livestock experts of the province estimate the requirements at 50,000 bulls and, as there are nearly 2,800,000 cows, this seems a conservative demand. The figure for "bulls" in this province would be inexplicable were it not that, in another column, we find about 1,460,000 young uncastrated males recorded. It is evident that the Punjab village accountant has been set a perplexing problem by the authority responsible for the headings of the column in his village record.

If we go to the other end of India, we find that the village accountant of Madras has been given a less invidious task than his fellow in the Punjab. His "return" of the cattle kept in his village contains eight columns only; but even he is asked to make a distinction which leads him into difficulties between "breeding bulls" and "other bulls." The Madras totals show that there are about 5,500,000 cows, but only 65,663 "breeding bulls." On the basis of the conservative estimate made by the Punjab livestock experts, it would seem that Madras should possess about 100,000 bulls fit for service. Animals under three years old are separately classed, so that the 2,134,000 "other bulls", which Madras village accountants distinguish from "breeding bulls," may contain from 30,000 to 50,000 animals which, in well regulated stock management, would be allowed to remain entire. In point of fact, in the conditions prevailing in Madras, many bulls are used for draught purposes and many of those enumerated among "other bulls" would

subsequently be castrated and employed in the plough and cart; but the existence of over two million surplus bulls exceeding three years of age throws a significant light on the condition of animal husbandry in the presidency.

DISTRIBUTION OF CLASSES OF CATTLE IN INDIAN PROVINCES.

164. We have seen that the number of cattle kept in the different provinces, when related to the net area of land sown, shows a surprising variation. Before discussing the causes for this variation, it will be desirable to separate the total number of cattle into different categories. Since it is impracticable to distinguish " breeding bulls " from " other bulls " and " young uncastrated males," we class cattle of the ox tribe as " bullocks," " cows " and " others." For buffaloes we have adopted the census headings in preparing the following figures :

Classes of cattle maintained in the major provinces of India and in British India compared with the net area sown in 1924-25

Province	Per 100 acres of net area sown in 1924-25						
	Estimated grazing land	Ordinary cattle			Buffaloes		
	Acres	Bullocks No.	Cows No.	Others No.	Adult males No.	Adult females No.	Young stock No.
Assam	242	27	29	31	1	1	2
Bengal .. .	33	36	36	32	1	1	..
Bihar and Orissa .	56	27	23	19	1	6	4
Bombay { Presidency Proper.	33	10	6	8	1	1	1
Bombay { Sind ..	195	10	18	14		7	5
Burma	374	11	9	10	2	3	2
Central Provinces and Berar.	107	15	12	12	2	3	3
Madras	79	15	17	17	4	8	5
Punjab ..	62	16	10	11	1	10	8
United Provinces .	52	29	17	18	2	12	10
British India (including Minor Administrations)	92	20	17	16	3	6	5

For British India as a whole, we estimate that for each 100 acres of net area sown there are 92 acres of uncultivated land available for grazing, to which should be added 21 acres of fallow and that on this total area of 213 acres there are supported 20 bullocks, 17 cows, 16 other cattle, 3 male buffaloes, 6 she-buffaloes and 5 young buffaloes, a total of 67 cattle, in addition to 27 sheep and goats and some other stock.

Having regard to the very poor quality of the grazing available, and to the fact that it fails to afford adequate maintenance for cattle at the season of the year when fodder grown on cultivated land is scarcest, we are of opinion that this number of cattle is a heavy stock for land to

carry. If the cattle are to yield a profit which would be accepted as satisfactory in countries where stock keeping is strictly economic, the bullocks would require to be fully employed, the cows to be of a heavy milking strain and the manure to be carefully conserved and returned to the land.

The number of bullocks employed in different provinces may next be discussed. The number of bullocks actually employed on the land is, in all cases, less than is stated in the Table above, for the figures include bullocks utilised in towns, or by Government, or carting contractors. Although, in the aggregate, the number of these must be large, they can, in general, form but a small percentage of the total and their inclusion should not, therefore, cause any appreciable change in the relative position taken by the different provinces. The possible influence of large cities should, however, be borne in mind, in examining the figures.

As is to be expected, the number of bullocks bears a close relationship to the number of cultivators and to the average size of holdings. If the provinces are arranged in order of the number of bullocks maintained per hundred acres, as is done in the following statement, it will be seen that the number of cultivators follows the same order fairly closely, and also that the number of cultivators who do not own bullocks must, in some provinces, be very large. If, again, the average area cultivated per yoke of oxen is compared with the average size of the holding, a close relationship is usually disclosed.

Province	Per 100 acres of net sown area		Average	
	Bullocks	Cultivators (male workers)	Area cultivated per yoke	Area of holding
	No	No.	Acres	Acres
Bombay (including Sind) ..	10	8 1	20·0	12·4
Burma	11	11·5	17 9	8·7
Central Provinces and Berar .	15	7·6	13·3	13·2
Madras	15	17 3	13·0	5 8
Punjab	16	11·2	12 9	9 0
Bihar and Orissa	27	26·8	7 4	3·7
Assam	27	27·5	7 3	3 6
United Provinces	29	29 1	6·9	3·4
Bengal	36	35·2	5·6	2·8

The number of bullocks required in agriculture is also affected by the character of the soil, by the cropping adopted, by the length or shortness

of the season available for ploughing and sowing, by the size of the cattle, and by the extent to which irrigation, especially from wells, is practised. Having regard to all these factors, it is to be expected that the number of plough bullocks should vary widely in different provinces. But, even when allowance has been made for all these causes, the differences disclosed by the census figures are surprisingly large. In order to bring out in concrete form some of the main causes of variation in numbers in this and other classes of cattle, a reference is subsequently made to the position in a few selected districts. Meantime, attention may be directed to certain other points emerging from the figures given above. If it is assumed for the moment that all the bullocks found in India are necessary, the question arises, what number of cows should suffice to rear the required number? On the assumption that the twenty bullocks per hundred acres of net sown area, which the census figures show to exist, begin work between three and four years of age, and have an average working life of ten years, it follows that there should be seven young male cattle under 3½ years of age to replace wastage. The census figures show sixteen "other" cattle of which the proportion of bulls would be between two and three. When allowance is made for the fact that approximately half the calves born will be heifers, and that casualties must occur, it will be seen that the number of young male cattle available for replacing wastage is likely to be between five and six. In view of the very poor quality of many calves, the census figures thus lend support to the complaint frequently made by witnesses, that the price of bullocks was rising because the supply was not equal to the increasing demand. In any case, if it were assumed that all the bullocks now kept by cultivators are necessary, no reduction in the number of young male cattle would seem to be desirable. But when the number of cattle of about three years of age and under is compared with the number of cows, a very unsatisfactory feature in cattle management emerges. Indian cows, if properly fed and managed, might be expected to calve about once a year, as do the cattle of Europe; but it is well known that, in the conditions usual in India, calving is very irregular. We were informed that cows in this country might be expected to calve at intervals of about eighteen months. The census figures suggest that the average interval may be nearer three years than two. It is again necessary to draw attention to the need for caution in interpreting the census figures which, under the heading 'cows', include many old and barren animals. Moreover, although errors in classification do not exist in the columns for bullocks and cows to anything like the same extent that they do in the column for bulls, it is unquestioned that they may, and do, exist, and a liberal margin of error must be allowed for. But when the census figures are used with the caution that is required, they clearly point to the conclusion which was borne out by the evidence which we heard all over India, that the cow, when dry, is the most neglected animal among cattle. In discussing the management of cattle, we shall return to this subject; in the meantime, it may be stated that the census figures support the view that it is the demand for good bullocks, and the poor average quality of

cattle, which lead breeders to keep many more cows than should be necessary to provide the number of bullocks required for draught.

It should be explained that, if India were a dairying country, and if calves and young cattle under three years old were commonly slaughtered, as they are in most countries, the criticism of the relationship which exists between the numbers of the different classes of stock which has been made above would not hold good; and in the case of buffaloes, the treatment of which in India more nearly approaches European cattle management, the figures must be differently interpreted. The "adult male" buffalo of the census shares, in every province, the labour of the bullock, but the extent to which it is used in the cart, the plough, or the water lift varies widely in different localities. The requirement for buffalo bulls is small, and it is substantially correct to say that, in India as a whole, the labour of twenty bullocks is supplemented by that of three buffaloes. Wherever an important market for butter and *ghi* exists, it is the she-buffalo which mainly supplies it, and, in most provinces, the more substantial cultivators keep buffaloes for producing *ghi* and milk for their own use, or occasionally for sale. Thus it is the number of she-buffaloes, not the number of cows, that has to be taken into account, when seeking an index of the milk production of a province. In parts of India, young male buffaloes are frequently slaughtered, and the figures for young stock have not the same significance as in the case of ordinary cattle.

While the census figures for cattle in the different provinces, when reduced to terms of the net area of land sown, show that wide differences in the total number of animals occur and also show a remarkable range in the number of buffaloes kept, they do not disclose such differences between the proportions in which the several groups of ordinary cattle exist as might have been anticipated. In both Burma and Assam, for example, the number of "other" cattle, as compared with bullocks and cows, is higher than in India as a whole; but the difference is much less than the great areas of grazing land in these provinces would have led us to expect. Again, the census figures give little or no indication of the fact that large numbers of cattle are bred in Bihar for export to Bengal, and they certainly do not suggest that Bengal is not self-supporting, but requires to import many cattle. It may be stated that, while there is a surprising difference in the total numbers of ordinary cattle between province and province, there would appear to be a general similarity throughout India in the methods of management followed by owners of cattle. Thus, the relative numbers of bullocks, cows, and other cattle vary much less than might be anticipated in a country where physical features and climate differ so widely.

INFLUENCE OF SOILS AND CROPS ON CATTLE DISTRIBUTION.

165. This general similarity in management, though unquestionably significant, is in part due to the large size of the areas compared. Within the confines of a single province, many different types of agriculture are found, and a closer analysis shows that the soils and the crops grown on them exert a marked influence on cattle husbandry.

This we now proceed to illustrate. It is not possible for us to make the full enquiry that is called for into the position occupied by the cattle industry in the different Indian districts. This must be left to local investigators; but, as an indication of the differences that occur, and to show how easily general statements about Indian cattle may be contradicted by the experience of particular areas, we have selected for comparison three pairs of districts in the United Provinces, the Central Provinces and Madras. The selection has been made almost at random, but for each province, we have included one district with a light rainfall (from 23 to 28 inches) and one district with a medium rainfall (from 45 to 50 inches). Livestock and other figures for these districts will be found in the Table below. For a reason which will appear subsequently, figures for Lyallpur in the Punjab have been added to those for the three pairs of districts :—

District	Average annual rainfall	Total area of district	Net area sown (1925-1926)	Percentage of net area sown to total area	Area irrigated (1925-1926)	Percentage of area irrigated to net area sown
	Inches	Acres (in 000's)	Acres (in 000's)		Acres (in 000's)	
Meerut (U. P.)	28	1,473	1,079	73	521	48
Gorakhpur (U. P.)	48	2,888	2,149	74	77	36
Akola (C. P.) ..	28	2,620	1,929	74	6	....
Raipur (C. P.) ..	51	4,063	2,121	52	230	11
Bellary (Madras) ..	23	3,641	2,390	66	57	2
Tanjore (Madras) .	45	2,386	1,339	56	994	74
Lyallpur (Punjab) .	13	2,035	1,550	76	1,534	99

District	Number per 100 acres of net area sown						Total oxen and buffaloes
	Oxen			Buffaloes			
	Bullocks	Cows	Bulls and young stock	Males	Cows	Young stock	
Meerut (U. P.) .	24	10	14	.	15	15	78
Gorakhpur (U. P.)	33	18	18	. .	7	6	82
Akola (C. P.) .	10*	7	7*	..	3	1*	28
Raipur (C. P.) ..	17*	17	14*	7	2	3*	60
Bellary (Madras) ..	5	4	7	.. .	3	2	21
Tanjore (Madras)	28	21	14	4	9	4	80
Lyallpur (Punjab)..	13	5	7	1	12	11	49

*In the Season and Crop Report for the Central Provinces bulls and bullocks are included under the same head and young stock of both oxen and buffaloes are shown together For the purposes of this Table, it has been assumed that there are 2 bulls to 29 bullocks. Young stock have been divided in the proportion of 5 to 1 which is, roughly, the proportion of adult oxen to adult buffaloes, the figures for which are given separately.

In addition to Lyallpur, which, for the moment, we exclude from consideration, the northern districts selected are Meerut and Gorakhpur, both in the United Provinces.

The main crop of Meerut is wheat ; roughly one-third of the net cropped area is under this cereal. Gram is also extensively grown and the area under it is about one-third of that under wheat. The chief agricultural features of Meerut are, however, the large areas of sugarcane (140,000 acres) and of fodder crops (180,000 acres). The large amount of sugarcane grown explains why the number of bullocks kept is high. The figures for the other kinds of cattle kept show that, although the land is heavily stocked, the balance is satisfactory, and the inference from the census figures and from the large area under fodder crops is that the condition of cattle in the Meerut district is much above the average level for the country as a whole.

In Gorakhpur, over a million acres are under rice and about 650,000 acres grow wheat and barley. Sugarcane is again an important crop (137,000 acres). Fodder crops are grown on 20,000 acres. A very large head of stock is kept. The cattle are much smaller than in the Meerut district ; the holdings, too, are smaller, and, as in most other rice growing tracts, the number of plough bullocks kept is very large. Livestock owners in this district are fortunate in having access to grazing of relatively good quality in sub-montane tracts, and the cattle, though small, are reported to be of good quality. The conditions in the north of the district are typical of those in the better natural breeding grounds. The relation between the different classes of livestock kept in Meerut and Gorakhpur differs considerably and suggests a higher level of stock farming in the former, but Gorakhpur, like Meerut, represents conditions more favourable to cattle raising than those usually found.

A sharp contrast in numbers marks the next district to be examined. Akola in Berar is typical of the conditions prevailing on black cotton soil in this part of India. The net area sown in the district is rather less than 2,000,000 acres, but cotton covers 1,000,000 and *juar* nearly 600,000 acres ; other crops are thus of small importance. The grazing in this dry district is of little account, and cultivators are forced to grow most of the rations fed to their cattle. The result is that cattle are reduced to a minimum. There are only 28 per 100 acres of the net area sown, as compared with 82 in Gorakhpur, and a pair of bullocks tills over 20 acres of land. Although circumstances would not appear to favour the cattle owner, we were informed that the cattle of Berar are the best in the province. They are expensive to purchase and cultivators take care of them. On the other side of the province, in Raipur, there is again a sharp contrast. A first glance at the census figures suggests that here conditions must be more favourable for the maintenance of livestock, for twice as many animals are found per 100 acres of sown land. There is, too, a very extensive area (about 560,000 acres) of scrub jungle and grass, and a still larger area under forest. Again, while Akola is almost without irrigation, Raipur has 230,000 acres of irrigated land. The main crop of the district is rice, which occupies 1,500,000 acres. Very little land appears to be reserved for fodder crops, and cattle depend mainly on rice straw and what they can find in the jungle. A closer scrutiny of the cattle figures shows, however, that the position in Raipur

is far from satisfactory. Cows are as numerous as bullocks, but they are unable to provide the number of plough cattle required, and male buffaloes are largely used. In spite of the demand for male buffaloes, she-buffaloes are few, again suggesting the poverty of the stockowner. The herds of Raipur cattle which we saw were among the worst we met with in the course of our tours, and our opinion of them was confirmed by the witnesses who appeared before us.

The lightest, and with the exception of Gorakhpur, the heaviest, stock of cattle in the group of contrasted districts are both to be found in Madras. The figures for Bellary and Tanjore respectively show very clearly the extent to which soil and crops may influence the numbers of livestock. In both districts, there is much land nominally available for grazing. Ten per cent of the total area of the Bellary district is classified as culturable waste, ten per cent as forests and seven per cent as not available for cultivation. For Tanjore, the corresponding figures are six per cent, one per cent and twenty-seven per cent. We have so far assumed that about three-fourths of the area of culturable waste and one-fourth of the unculturable waste may be available as grazing land. Even if it be granted that this estimate may be wide of the mark, no explanation of the fact that Tanjore supports about four times as many cattle as Bellary is to be found in the figures of the areas of uncultivated land in the two districts. It is the character of the tilled soil and of the crops grown in Bellary and Tanjore respectively that decides the number of cattle kept. In respect of the types of cultivation followed, the two districts present as strongly marked a contrast as they do in numbers of cattle. Bellary grows hardly any rice; its chief crops are millets (1,500,000 acres) and cotton (500,000 acres). In Tanjore, on the other hand, about seventy-seven per cent of the gross sown area is occupied by rice (1,116,000 acres); compared with it other crops are of very small importance; and here, as in other rice-growing tracts, we find a large number of bullocks. It would further appear that male buffaloes are freely used for draught, as are also a smaller number of bulls. It is unlikely that the total number of draught cattle available in Tanjore falls below 32 per 100 acres of net area sown. In Bellary, the stock of cattle is remarkably small: in all, 21 per 100 acres of the net sown area, as compared with 66 for the whole of the Madras Presidency and 108 for Bengal. It would appear from the number of "other bulls" recorded in the census that three or four of these animals should be added to the five bullocks and that the draught cattle in this district amount to eight or nine per 100 acres of net area sown.

Even the few cases which we have examined above suffice to show that great differences in the numbers of cattle kept by cultivators are to be found in different districts. In cotton and millet growing tracts, the total number may lie between twenty and thirty per 100 acres of net sown area, with from eight to ten plough cattle; whereas, when rice is the predominant crop, between three and four times these numbers are to be looked for. Where grazing land of fair quality exists, as in the sub-montane tracts of the north, it may be expected to show some influence on the numbers of cattle kept; but, elsewhere,

it would appear that grazing land as contrasted with tilled land has relatively little influence on numbers. In the closely settled districts, the total number of ordinary cattle would appear to be primarily determined by the number of animals needed for work on the land.

In the case of buffaloes, the local demand for milk and *ghi* and the prosperity or poverty of the cultivators are the main factors affecting the numbers of females. Where, owing to unusually adverse conditions, there is a shortage of bullocks, the she-buffalo may be required to supplement the progeny of the starved and infertile cow, and there may be a considerable use of male buffaloes on the land.

CATTLE POPULATION OF INDIA, HOLLAND AND EGYPT.

166. These statistical notes on Indian cattle may be supplemented by references to the cattle population of two other countries, Holland and Egypt, which some of us visited in the course of our enquiry. We choose Holland because it possesses the largest number of cattle in relation to the size of the country. In Egypt, the number of cattle is very small. Except for the large place which cattle take in the life and economic position of the two countries, there is little in common between Holland and India. On the other hand, the conditions in Egypt and in certain provinces of India are very similar.

The figures given below compare the number of cattle maintained per 100 acres of net sown area in India, where there are extensive fallows, and per 100 cultivated acres in Holland and Egypt where fallows are of small account. In the two eastern countries, buffaloes as well as ordinary cattle are included.

	Cattle
British India, per 100 acres net sown area	67
Holland, per 100 acres cultivated land	38
Egypt, per 100 acres cultivated land	25

In Holland, horses, and, in Egypt, donkeys are largely used in agriculture. Full-grown Dutch cattle may on the average weigh twice as much as Indian, and Dutch cows may give anything from five to ten times as much milk as Indian cows. In Egypt, half the cattle consist of she-buffaloes. Ordinary cattle are probably, on the average, somewhat larger in size than those of India. From these figures, the conclusion may be drawn that, in whatever respect Indian cattle may be lacking, they do not lack numbers. Conditions in Holland and India are so different that no further analysis of the cattle position in these two countries need be attempted. The general conditions under which agriculture is carried on in Egypt and parts of India are, however, so similar that the clue given by the crude comparison made above is worth following up. The disparity between the Indian and Egyptian figures for cattle is, indeed, greater than is suggested above for a very much larger percentage of Egyptian, than of Indian, land is cropped more than once, and intensive cropping increases the cattle power required to till the land.

COMPARISON OF LYALLPUR (PUNJAB) AND GHARBIEH (LOWER EGYPT).

167. A statistical comparison will best serve our immediate purpose if, instead of comparing the figures for Egypt and British India, we contrast the livestock situation in two areas in the respective countries in which the general agricultural position presents a strong resemblance. Moreover, while at the moment primarily interested in cattle, we cannot separate these from other animals maintained and used on the land. Sheep and, to a small extent, goats compete for food with cattle and buffaloes, especially in Egypt, and, in that country, both donkeys and camels are extensively used. Further, the whole of Egyptian cultivation depends on irrigation, and much land carries two or even three crops in a year.

With these considerations in view, we propose to compare the Egyptian province of Gharbieh, situated about half way between Cairo and Alexandria in Lower Egypt and typical of rural conditions in that tract, with the Punjab district of Lyallpur. Gharbieh is wholly, and Lyallpur almost wholly, dependent on canal irrigation. In both, the soil consists of a deep fertile alluvium, and in both, the indigenous wooden implements which are in common use call for cattle of about the same strength, though a careful survey would probably show that Lyallpur cattle are larger and stronger than those of Gharbieh. In both areas, the cultivating classes are chiefly Muhammadans, and in both the standard of cultivation is high. The remaining comparisons and contrasts may best be shown by figures. The crop figures are for 1924-25 in Gharbieh and 1925-26 in Lyallpur.

		Gharbieh	Lyallpur
Rainfall	Inches	2 to 4	12 to 14
Gross area ..	Acres	1,734,000	2,035,000
Do. cropped ..	,,	1,475,000	1,600,000
Total area of cereals ..	,,	667,000	687,000
Do. of leguminous crops	,,	318,000	151,000
Do. of cotton ..	,,	477,000	324,000
Cattle per 100 acres of gross area sown	No.	7·1	24·2
Buffaloes do.	,,	9·4	23·3
Sheep do.	,,	10·3	11·0
Goats do.	,,	1·5	9·6
Donkeys do.	,,	9·1	1·3
Camels do.	,,	·8	·6

The 318,000 acres of leguminous crops in Gharbieh includes 289,000 acres of fodder crops, mainly Egyptian clover (*berseem*). The very extensive area under this crop in Gharbieh is the main difference to be noted between the cropping of the Egyptian province and that of the Punjab district.

As the Egyptian statistics do not differentiate young stock as do those for India, an exact comparison of the classes kept is unfortunately, impossible; but, if the young stock of Lyallpur are separated into males

and females as in Gharbieh, then the cattle in the two areas may be further compared as follows :—

Per 100 acres of gross area sown		Gharbieh	Lyallpur
Ordinary cattle,	males	3·0	17·5
Do.	females	4·1	6·7
Buffaloes,	males	0·4	1·8
Do.	females	9·0	21·5

The cultivators of Lyallpur district are perhaps the most prosperous in India and they are able to afford all the cattle they require. In comparing the numbers of livestock kept in the two areas, there is, in this case, no reason for holding that the number of cattle kept in Lyallpur is greatly in excess of the numbers which should be kept; the indications are rather that the zamindars of Lyallpur are much better off than the fellaheen of Gharbieh. The chief point of interest that emerges from the comparison is that with such a very small number of draught animals as are kept in Gharbieh, the Egyptian fellaheen should be able to maintain so high a standard of cultivation as they do.

Since, in both Lyallpur and Gharbieh, a large proportion of the land is cropped more than once, the above comparison is made on the basis of the gross area sown; a comparison on the basis of "net area" would have been unfair, especially to Egypt. But as we have adopted the "net area sown" as a basis for India, we have included figures calculated for the net area of Lyallpur in the Table on page 185. It will be seen that Lyallpur makes an economical use of draught cattle as compared with other Indian districts. Fewer are used in Akola and Bellary, but the labour required by the unirrigated crops of those districts cannot be compared with that necessary for the irrigated crops of Lyallpur.

Gharbieh, as we have shown, is an Egyptian province which can challenge comparison, in respect of its cultivation, with an Indian district that bears so high a reputation as Lyallpur. The contrast in the cattle position of the two brings out clearly the extent to which it might be possible to reduce the number of working bullocks in India without necessarily reducing the existing standard of cultivation.

EXISTENCE OF A VICIOUS CIRCLE IN INDIA.

168. In the foregoing discussion of the numbers of cattle found in different parts of the country, little has been said of the relative sizes of the animals. It is, of course, necessary that full allowance should be made for differences of size and of quality, and had we here been concerned with a comparison of the value of livestock in the several provinces, we should have had much to say on this subject; but this was not our purpose. Nor must it be supposed that, because of differences in size and value, the counting of heads by census enumerators can be of little practical use. We believe that careful scrutiny of the figures would bring out much useful information of a kind likely to correct the numerous and contradictory opinions expressed by persons having experience only of the conditions in particular districts. As the result of our examination of the subject, we may state that we agree with those

witnesses who expressed the opinion that India is attempting to maintain an excessive number of cattle ; but it should be observed that this view is not inconsistent with the other, namely, that good cultivation in many parts of the country may now be hindered, because of a deficiency of bullock power. There are areas in the Central Provinces, for example, infested with *kans* grass, where cattle, though sufficiently numerous, are not strong enough for the work required of them.

We are of opinion that the census figures suggest the existence of a vicious circle. The number of cattle within a district depends upon, and is regulated by, the demand for bullocks. The worse the conditions for rearing efficient cattle are, the greater the numbers kept tend to be. Cows become less fertile, and their calves become undersized and do not satisfy cultivators, who, in the attempt to secure useful bullocks, breed more and more cattle. As numbers increase, or as the increase of tillage encroaches on the better grazing land, the pressure on the available supply of food leads to still further poverty in the cows ; and a stage is reached when oxen from other provinces or male buffaloes are brought in to assist in cultivation. This stage has been reached in Bengal. The cows of that province are no longer equal to what, in any reasonably managed herd, would be an easy task. But, as the male buffalo is either not available or is not suited to ordinary field work, large numbers of oxen are imported to supplement those locally bred. As cattle grow smaller in size and greater in number, the rate at which conditions become worse for breeding good livestock is accelerated. For it must not be supposed that the food required by a hundred small cattle is the same in quantity as that needed by fifty of double the size. As cattle become smaller, the amount of food needed in proportion to their size increases. Thus, if a certain weight of fodder maintained one hundred cattle weighing 10 cwts. each for a year, the same supply would last two hundred cattle weighing 5 cwts. each only for about eight months. Large numbers of diminutive cattle are, therefore, a serious drain on a country in which the fodder supply is so scarce at certain seasons of the year as it is in India.

The process has gone so far, India has acquired so large a cattle population and the size of the animals in many tracts is so small that the task of reversing the process of deterioration and of improving the livestock of this country is now a gigantic one ; but on improvement in cattle depends to a degree that is little understood the prosperity of agriculture, and the task must be faced.

DETERIORATION OF INDIAN CATTLE.

169 The complaint that cattle in India are deteriorating is an old one. It is mentioned by a traveller* in India at the end of the eighteenth century and it was a common topic of discussion throughout the nineteenth century. It is impossible either to prove or to disprove that average specimens of Indian cattle are better or worse than they were a century, or ten centuries, ago. No full records of their former condition exist, and, if records did exist, it would not be possible to use them so as to show how the 150 million cattle of to-day compare with the 100 millions of a former period. On the evidence

*Dr. Buchanan-Hamilton's "Journey through Mysore, Canara and Malabar" (1800), quoted in Watt's *Dictionary of the Economic Products of India.*

placed before us, we can, however, state that the difficulty of securing good bullocks and good cows has increased in recent years; thus, in relation to the existing demand, the quality of the supply has deteriorated. There was also much evidence to the effect that conditions for breeders of cattle are now more difficult than formerly. While the evidence of witnesses points to the probability that deterioration is going on, our own examination of the position, created primarily by the increasing demand for bullocks owing to the extension of cultivation, leads us to the conclusion that conditions have arisen, and are already at work, which cannot fail to prejudice livestock, and that cattle such as the deplorable animals now to be seen, for example, in parts of Bengal and of the Central Provinces, must become more common unless substantial changes in the existing management take place.

ESSENTIAL POINTS IN A POLICY OF CATTLE IMPROVEMENT.

170. Many suggestions for improvement have been made and the subject is now engaging the attention of experts in all provinces. To these suggestions and efforts we shall later allude. In the meantime, we would emphasise two cardinal points in any policy of cattle improvement. The first is the necessity for attention to all matters that would tend to decrease the number of bullocks required for cultivation. Improvement in this respect would be secured by any measures calculated to check the subdivision and fragmentation of holdings, to increase the efficiency of the cultivator's tillage implements or to facilitate transport, whether by improvement of his roads or by other means, as well as by measures aiming at an increase in the strength of the bullocks themselves. The second is the necessity for efforts to secure for dry cows and cows in-calf better treatment than they now receive. Before developing this latter point, it will be necessary to refer to the management of cattle.

THE CULTIVATOR AS A STOCK MANAGER.

171. The horizon of the Indian peasant is narrowly bounded by his poverty and his illiteracy. Like the poor in all countries, he is lacking in foresight and prudence, and he prizes a rupee in the hand more than two, or for that matter ten, at some future period of time. He adheres strictly to this policy in managing his cattle. He feeds his bullocks as well as he can while they are at work; if they have cost him dear and he is proud of them, as many cultivators are, he will even go to some expense and trouble to keep up their condition during slack seasons. But the expense must make no heavy inroad on his small means, and the trouble must not cause a serious encroachment on his time during his own slack season.

Among the many millions of cultivators of British India, there is no one type. But it is only the minority who contrive, in spite of their difficulties to keep their plough cattle really well. Others keep their cattle in condition when seasons are good and out of condition when seasons are bad. Others, again, never show reasonable care for their plough cattle.

THE RATIONS OF PLOUGH CATTLE.

172. To turn from general statements to detail, we have obtained from the agricultural departments in each province an account of the way in which the average cultivator in typical districts feeds his plough cattle, and an

estimate of what this costs him. A summary of this information will be found in Appendix IV on page 697. We shall here cite some examples which will convey an indication of the variations which occur in practice.

In the first place, it may be observed that, in asking the agricultural departments what it costs the average cultivator to feed his plough cattle, we set them a difficult task and their replies must be regarded more as an answer to the question "How would the average cultivator like to feed his plough cattle?" than to the question "How does he feed them and what is the cost?" In many instances, the shortage of bulky fodders, because of dry seasons or the small area of land available for growing cereals, and the insufficiency of concentrated feeding stuffs, because of lack of money to buy oil-cakes, etc., must prevent the average cultivator from giving his cattle the rations he would like to provide. Again to the question "What does it cost?" it is seldom possible to give a satisfactory answer, or at least an answer suitable for tabulation. In Appendix IV, the value of the foodstuffs used has been set out under two headings, "roughage" and "concentrates." It is not difficult to estimate the price to be attached to the concentrated foods used, for, whether grown or purchased, these have a readily ascertainable market value. It is otherwise with the roughage or bulky fodders. Near centres of population, such foodstuffs as the straw of wheat and rice, or the stalks (*kadbi*) of *juar* and *bajra* may be readily salable; but, in the majority of cases, these fodders can only be sold in small quantities, and the bulk must be used by feeding them to livestock. The value of the small percentage actually sold varies widely in different parts of the country. Thus, for example, in Burma, rice straw has been priced at the low figure of three annas per *maund*, whereas in the Central Provinces, a price of eight annas and in Madras of thirteen annas has been assigned to it. It will be evident that it is very difficult to arrive at the cost of such material as weed grasses collected in the fields by members of the cultivator's family, or of sugarcane tops which, if not consumed by cattle, would be burned. But while such considerations indicate that a wide margin of error must be allowed for in comparing the estimates of the cost to the cultivator of the roughage fed in different districts, it would be entirely erroneous to assume that, because a cultivator pays no money for such fodders, they are valueless. They have in every case what agriculturists term a "consuming value," and although, in Indian conditions, it is not an easy matter to assign to them a money value that will stand criticism, it is clear that the intrinsic value of the material must often be high. If, throughout India, there were (as there is in parts of Burma) a surplus of coarse fodders readily accessible to cultivators, it would be permissible to ignore the values attached to roughage, but this is far from being the case. The scarcity is such that, in many districts, there is great difficulty in bringing bullocks through the hot season in a condition fitting them for hard work in the monsoon. In most districts, the allowance of the better fodders available for cows is much too small; indeed it frequently happens that none of the stored fodders can be spared for cows. Wherever such conditions exist, the coarse fodders have a value which may be closely estimated when the cost of purchased

oilcakes, etc., is known. For example, in the Gurgaon district of the Punjab, where a mixture of gram and oilcake is the usual concentrated food used, and where wheat and barley are common cereal crops, if a cultivator's stock of straw were no more than sufficient to carry his bullocks through the dry season, and the price of concentrated foods averaged Rs. 3-8 per *maund*, the value of straw to him would be approximately fourteen annas per *maund*.* The rate per *maund* charged in the estimate for this district is eight annas.

The total values placed upon the rations fed to a pair of bullocks during the year will be found in the last column of the Table in Appendix IV. The figures vary widely, but an examination of the details will show that this, in itself, need be no reason for distrusting them. The lowest cost, Rs. 15 per annum per pair of bullocks, is returned from the Sibsagar district of Assam. The cattle of this district are very small. They receive meagre rations of rice straw and rice bran while at work; but it is clear that they must find the greater part of their food for themselves in the jungle, or in fields where rice straw remains uncut after the ears of paddy have been harvested. Next in order of cheapness comes a Sind district in which cattle work for 2½ months in the year only, and again find much of their food for themselves. Although *kadbi* is given them for about seven months, both the ration fed and the rate per *maund* allowed for the fodder are very low. Among the higher costs returned are Rs. 234 from Montgomery in the Punjab, Rs. 224 from a cotton tract in Madras and Rs. 211 from a wheat and cotton tract in the Central Provinces. If the very small cattle of Bengal and Assam and those in the parts of Burma where fodder is plentiful are excluded from consideration, it may be said that the cost of feeding the ordinary cultivator's cattle, as he himself would like to feed them, may range from about Rs. 100 to about Rs. 200 per pair per annum, according to the crops locally grown, and that, in most cases, the cost would lie between Rs. 125 and Rs. 175. If nothing is allowed for the value of the roughage grown or collected by the cultivator, and a price is attached only to concentrated foods such as grain and oilcakes, the outlay per pair of bullocks is estimated to range from nothing at all to about Rs. 110. A common figure would be Rs. 40 to Rs. 80 according to the work done. To the cost of feeding there must be added interest on purchase price and a figure for depreciation in value, which, in the case of a pair of young bullocks costing Rs. 200, would add to the cost of feeding a sum of not less than Rs. 25 per annum.

We have seen from the figures on page 181 that, for British India as a whole, there are 20 bullocks per 100 acres of the net sown area. This figure includes bullocks not employed in agriculture, but does not include he-buffaloes and bulls working on the land. We are, therefore, more likely to understate than to overstate the case, if we conclude that, for British India as a whole, a pair of bullocks suffices for the tillage of not more than ten acres of the land sown in any year; and,

* Valued on starch-equivalent basis of 65 : 16.

from the figures we have discussed above, it is obvious that the cost of bullock labour per acre must be very heavy.

In a question bearing so intimately on the economic position of the cultivator as the cost to him of his bullocks' labour, we recognise the objections that may be urged against resorting to estimates of cost; but, in the absence of figures giving the actual cost, no other course is open to us. We believe that the estimates we have given fairly represent the cost of keeping bullocks in reasonably good working condition and we are warranted in this belief by reference to actual costs as determined in one province.

Under the auspices of the Board of Economic Inquiry of the Punjab, Mr. H. R. Stewart, Professor of Agriculture, and Mr. S. K. Singh, Assistant Professor, at the Lyallpur College, have recently been engaged in determining the cost of feeding plough cattle in certain Punjab districts. To the actual cost of feeding, they have added twenty per cent of the value of the cattle for interest and depreciation. This rate, which is substantially larger than the rate we have assumed in our estimate, is based on the experience of the localities investigated. The results of the enquiries may be summarised as follows. In the Lyallpur district, on a holding of 111 acres worked by the owner with hired labour, thirteen bullocks were kept, and the cost of maintenance per pair worked out at Rs. 271 in one year, and at Rs. 283-3 in the next. The average cost per acre of bullock labour was Rs. 16-9. On a holding of 46½ acres worked on a partnership (*siri*) system, four bullocks were kept; the cost of maintenance per pair came to Rs. 338 and the cost of bullock labour per acre to Rs. 14-9. In this instance, the high cost of maintenance is largely attributable to the work demanded from the cattle; the usual area cultivated by a pair of bullocks in the Lyallpur district is from 12 to 16 acres, in this case it was 23. On a holding of 28 acres worked on the *batai* (half share of produce) system, four bullocks were kept; the cost per pair was Rs. 175, and per acre Rs. 12-8. On a larger property of 88 acres cultivated by three tenants (employing six pairs of bullocks) on the *batai* system, the cost of maintenance per pair varied from Rs. 188 to Rs. 240, and the average cost of bullock labour per acre was Rs. 14-5.

In the Montgomery district, where the cattle were of poorer quality than in Lyallpur and the feeding was inferior, the cost of maintaining a pair of bullocks on a holding of about 175 acres held by six tenants on the *batai* system varied from Rs. 86 to Rs. 145. The cost of bullock labour per acre ranged from Rs. 7-7 to Rs. 12-9, and averaged Rs. 9-6. These figures show how widely the cost of maintaining cattle may vary in two adjacent districts; and even as between the tenants on a single property. Similar investigations, so far as we are aware, have not been made in other parts of India; but the estimate we received from the farm at the Coimbatore Agricultural College must approximate closely to the actual cost of maintaining bullocks there. It may be noted, therefore, that at Coimbatore, where cattle are in regular work for from seven to eight months in the year, the cost of feeding comes to Rs. 260 per pair per annum.

BULLOCK LABOUR: A HEAVY ITEM IN THE COST OF PRODUCTION.

173. In paragraph 164, we have pointed out the very heavy tax which the large number of cattle maintained per 100 acres of sown area imposes on the produce of the soil of the country. The angle from which we there approached the subject was that of the stockowner concerned to provide for his animals the necessary supply of fodder. We have here approached it from another point of view, that of the husbandman thinking of the profits that can be made from tillage, and concerned to keep down the costs of production. Whichever standpoint is adopted, whether it is desired that cattle should be adequately fed, or that the land should yield a better livelihood to the cultivator, the same conclusion emerges. India must endeavour to effect a reduction in the numbers and an increase in the efficiency of its plough cattle.

INFLUENCE OF EXCESSIVE NUMBERS ON TREATMENT OF COWS.

174. There is a third point of view from which this subject may be discussed, a point of view which should make special appeal to the people of this country; it is that of the welfare of the cow, than which there is no domestic animal more mismanaged. It has been necessary to refer at some length to the feeding of bullocks; but, unfortunately, it is not necessary to describe at any length the treatment of the cow. Broadly, it would be true to say that, if there is any fodder available after the draught cattle are fed, she gets it, or shares it with young stock; for the rest she is left to find food where she can. Where the cow provides some milk for the household, as well as for her calf, cultivators try to spare her two to three pounds of a mixture of cotton seed and bran, or oilcake, or pulse; but, when her milk fails, the ration is withdrawn, and she is turned adrift to find a living for herself on "grazings". To the quality of the "grazings" we shall presently refer; but, before doing so, a reference to buffaloes is necessary.

MANAGEMENT OF BUFFALOES.

175. The she-buffalo, rather than the cow, is the milk producing animal of India. Her milk is richer, containing as it does from two to three per cent more butter-fat than that of the ordinary cow, and, wherever there is a good market for milk and its products, it is the buffalo that is kept to supply it. Her treatment is very different in most localities from that of the cow. She is carefully tended by the women of the household, and not infrequently selection is exercised in her breeding. Little attention to buffalo breeding has so far been given by the newly appointed livestock officers; their efforts are mainly, and rightly, directed to the more pressing problem presented by ordinary cattle; but the cultivator himself, though he keeps no milk records, is well aware of the quantity of milk and *ghi* produced by the buffalo, and when specially good specimens exist in a village, there is, at least in some districts, a "waiting list" for the female calves that may be to spare. Moreover, in northern Gujarat—which, if any part of the country can claim to be a dairying district, is entitled to be so described—we understand that cultivators are most careful to mate their buffalo cows with selected bulls; and from what is known of the quality

of buffaloes in certain other tracts, it is likely that the same practice is followed.

The male buffalo, unless he is set aside for breeding in those districts where good buffaloes are appreciated, shares the fate, so far as management goes, of the ox tribe. Indeed, his position may be worse. No special sanctity attaches to the buffalo. When milk is of no special value, he may survive to take his chance on the common pasture, but we were informed by an expert witness familiar with northern Gujarat that the male calf of no special merit is allowed to die a natural (*sic*) death from starvation. The fate of the calf, in cases where there is a keen demand for milk, is a point that seems to have been overlooked by those who find in the development of dairy farming a prime solution for the problem presented by the improvement of cattle in India.

THE OVERSTOCKING OF THE COMMON GRAZING LAND.

176. We have now reached a point at which the position of cattle management may be summarised. The ordinary cultivator does what he can for his plough cattle and his she-buffaloes; quite often he does well for them, but bad seasons create difficulties for even the best cultivator, and the best of his cattle. The cow is less fortunate; she gets little stall feeding and has to seek the greater part of her food where she can; young cattle and the male offspring of her rival, the she-buffalo, share her fate and pick up their livelihood on common grazing ground, or by raiding crops, and who that knows these common grazings can blame the raiders! But this raiding of crops, which is an almost universal consequence of the mismanagement of cattle in India, is a very serious matter for the cultivator himself; it frequently presents to him the alternative of heavy losses, or of sleepless nights.

We have already referred to grazing land, but, for a clear understanding of the position in respect of the common grazing land near villages, some further remarks are called for. We were informed in evidence that there is no shortage of grass in India. In a sense, this is true. But it is also true that, in existing conditions, this grass is of little use to the stock of the ordinary cultivator, for it is not accessible. Cattle can, and do, travel considerable distances in search of fodder; but the effort involved in walking calls for a corresponding increase in the amount they must consume in order to maintain their bodies. As a minimum supply of fodder must be secured, if not daily at least weekly, a point is soon reached when the energy expended in collection exceeds the energy which the fodder consumed is capable of yielding up to the animal's body. The greater the natural demand made on the body by the production of milk or the support of the growing fœtus, the more difficult becomes the task of collecting within a day or a week the fodder that is essential to maintain existence. It is this difficulty that confronts stock owners in the more closely settled districts. In nearly every part of the country, the common grazing lands, and all grass lands close to villages, are hopelessly overstocked. This view was impressed upon us by many witnesses. Expressions such as "every village overstocked with herds of wretched starving cattle," "deplorably poor cattle,"

" weedy animals eating up food " were repeated with variations almost everywhere ; and that these statements were true we had many opportunities of seeing for ourselves.

The reasons given by witnesses for this overstocking were many : the keeping of cattle by others than cultivators ; the keeping of cattle to produce manure for fuel, or for enriching the tilled land, on which, in some districts, they are folded ; the practice adopted by landowners of letting grazing land to contractors, whose interest it was to secure as many head of cattle as possible at a fixed fee ; the action of landowners in permanently settled tracts in letting out all their land for tillage ; similar action by Government in temporarily settled tracts ; the abundance of free grazing land ; the demarcation of forest areas ; the high fees charged for forest grazing ; the low fees charged for forest grazing ; the absence of enclosures ; the effect of indiscriminate grazing on the quality of the herbage ; Hindu sentiment ; the growth of industrialism ; the lack of education ;—but we need not continue the list which the special knowledge or the lively imagination of our witnesses has supplied. Nor do we propose to discuss these opinions here ; our purpose is to show how many are the causes that may contribute to the overstocking of grazing land in India and how widely views differ on the subject. We would only point out that, in existing conditions, it is impossible for the cow to breed regularly and to bring up the kind of calf which will develop into the strong active bullock for which the demand is so keen. Many " misfits " must result from the deplorable conditions which now exist. The cultivator cannot get the quality of bullock he seeks ; the effort to compensate by quantity for lack of quality continues ; further turns are taken in the vicious circle as the years pass, and the condition of cattle tends to become worse.

HIGH QUALITY OF MANY INDIAN BREEDS.

177. To conclude a review of cattle management in India on this pessimistic note would be to convey a wrong impression. We have throughout had in mind the cattle of the ordinary cultivator, whose business is not that of the stock breeder but that of the crop grower, whose interest centres mainly in his plough cattle, or in the buffaloes tended by his women-folk, and who has never had more than a very few animals in his charge. After what has been said, it may appear to be inconsistent to state that there are in India many fine cattle belonging to a number of well recognised breeds. Where are these cattle to be found and how have they been bred ? To the first of these questions, the answer is that they can be found in widely separated parts of the country, from the hilly tracts where the North-West Frontier Province meets the Punjab—in which as one witness put it, bulls of the Dhanni breed " walk the pasture in kingly flashing coats "—to Madras, where the quality of the Kangayam cattle of the Pattagar of Palayakottai has won for his herd more than local fame. To the question " How have they been bred ? " it is more difficult to give an answer ; but our evidence points to the conclusion that these fine breeds of cattle have, in recent years at least, owed little to the great landowners of the country. Some of them, it may be, are endeavouring

to improve their cattle, but we mention the Pattagar of Palayakottai because his was almost the only herd which was brought to our notice as an outstanding example of careful cattle breeding. If enquiry were to be made into the history of such breeds as the Ponwar of the United Provinces, the Hariana and Sahiwal of the Punjab, the Thar Parkar and Sindhi (Karachi) of Sind, the Malvi of Central India, the Kankrej of Gujarat, the Gir of Kathiawar, the Gaolao of the Central Provinces and the Ongole of Madras, we believe it would be found, in most cases, that their excellence was due to the care bestowed on them by the professional cattle breeders, usually nomadic, who were formerly common in India, but who are now abandoning grazing as the result of the spread of cultivation. Many references to these herdsmen and to the part they took in supplying cattle to cultivators will be found in gazetteers describing former conditions in India. In some localities, their disappearance has been welcomed, for they frequently combined the professions of crop raiding with that of cattle rearing ; but, in districts in which they adhered to their legitimate business, their loss is to be deplored. They were the only members of the rural population who paid attention to breeding and understood the management of cattle ; they usually worked under unfavourable conditions, but their skill in selecting and tending cattle was so considerable that they were able to show good herds.

IMPROVEMENT OF CATTLE : DIFFICULTIES FACING THE CULTIVATOR.

178. We now turn to examine the many suggestions for the improvement of cattle which have been placed before us. Before we deal with these suggestions or describe the action which is being taken by agricultural departments, it will be useful to examine the subject of livestock improvement from the cultivator's point of view. That the cattle of India are deteriorating for reasons partly, though not entirely, outside his control is the view of a number of experienced witnesses who gave evidence before us. This process must be arrested, if the cultivator's position is not to suffer. It can be assumed by those responsible for attempting to secure improvements that he will play his part, if he is made to understand that part clearly, for, although no breeder, he tends his plough cattle carefully enough, so long as food is provided by his holding, or can be procured without much personal effort. But he is by no means willing to make an unusual sacrifice on behalf of his cattle. It is in this last respect that he differs from the peasant of many western countries. In western lands, the stockowner is held responsible for finding food for his cattle. If, with all his exertions, he is unable to keep them in a fairly efficient condition, he sells them. His personal responsibility has been fixed on him by tradition and custom.

In India, the position is entirely different ; the custom is that the animal, when not working, should find its own food on the village common, or on uncropped land, or in the jungle, when there is no fodder available on the holding. The by-products of cereals and pulses are stored and fed to cattle as long as they last ; but very rarely indeed do cultivators resort to outside sources, for example, to the

supplies of baled dry grass available in forests. Thus, we were informed in the Central Provinces, where much grass is baled in the forests, that in one locality only did cultivators purchase it, or cut it for themselves. In Bihar and Orissa again, we were told of a case in which an abundance of grass could be got for the taking, but no use was made of it by local cultivators. In other provinces, we were informed that, in accordance with the general policy favoured by the forest departments, forest officers would gladly encourage grass cutting by villagers, but that no demand for it existed. These forest supplies are looked upon as famine reserves, not to be used in normal times. This difference between the cattle owners of the East and West must be kept in mind in considering all suggestions for cattle improvement. Actions which in many countries have by tradition become reprehensible, and which by law would now render owners liable to prosecution, are here regarded in an entirely different light; the neglected state of a poor man's cattle may win for him his neighbour's sympathy in his misfortune, but evokes no criticism.

The unfortunate effects, from the point of view of livestock improvement, of the attitude of mind we have described above need no emphasis. This attitude can only be combated by education and by leadership. The cultivator himself can scarcely be blamed if he finds it difficult to alter a point of view which has been inherited from a long line of ancestors. The handicaps imposed by nature add heavily to the handicaps imposed by tradition. Calamities such as drought followed by fodder famine in peninsular India, or floods in Bengal and Assam, have to be faced at frequent intervals, and in every season, in most parts of India, there is a period when fodder is so scarce that the generous feeding of cattle becomes almost impossible.

Apart from fodder shortage, the cultivator's efforts to improve his stock may be nullified by an outbreak of contagious disease. It is, indeed, the fear of loss from disease that tempts many to keep a larger stock than is absolutely necessary and thus increases the difficulty of feeding cattle properly. Finally, in only one tract in India, the north Gujarat districts of Bombay, is the enclosure of fields usual, so that a cultivator desirous of improving his cattle is faced with the formidable obstacle presented by common grazing. In pointing to the example of Britain, as was done by one of the most prominent scientific men in India when giving evidence before us in Bengal, it must be recalled that it was not until British cattle were, in the eighteenth century, protected by the introduction of root crops from the semi-starvation which, until then, had been the fate of many of them during the winter months, and not until enclosures made it possible for farmers in Britain to control the promiscuous mating of animals, that the breeding of the livestock for which that country is now famous became possible.

Let there then be no misunderstanding of the situation in approaching the subject of cattle improvement. It is not only his conservatism, his entirely natural inclination to follow the methods of his ancestors, that

handicaps the cultivator in bettering the condition of his cattle. The climate in which he works and the open-field system of the vast majority of his villages make the task of the would-be improver most difficult.

SUGGESTIONS FOR IMPROVEMENT IN CATTLE FEEDING.

179. The suggestions for the improvement of livestock which were made to us group themselves under the two heads, feeding and breeding. We shall deal first with those relating to the feeding of stock, for we are satisfied that no substantial improvement in the way of breeding is possible until cattle can be better fed. The crux of the situation is the period of scarcity which, in most, though not in all, parts of the country, is the two or three months preceding the break of the south-west monsoon. It is the hardship endured throughout this period that, more than anything else, makes the cow an irregular breeder, that reduces her natural milking qualities until she is unable to suckle a healthy calf, that leads to the scarcity of good bullocks, and that creates the urge which covers the village grazing grounds of India with the cattle deplored in every one of our volumes of evidence.

THE QUESTION OF ADDITIONS TO GRAZING AREAS.

180. Since it is the curtailment of uncultivated land as population has increased during the past century that is the most obvious cause of the present overstocking of village grazing grounds, it is not surprising that many witnesses have advocated the extension of grazing land. It is unquestioned that, given certain conditions, such an extension would relieve the situation. If the number of cattle were not to increase, if a sufficient area of grazing land could be found to carry the existing stock easily in normal seasons, if provision were made for supplementary fodder in years of scarcity, then it would not be a difficult task for skilled graziers, first of all to add greatly to the output of the grazing grounds by stocking them in rotation, and subsequently to effect marked improvement in the quality of the cattle. We have already alluded to the effects of climate on the grazing lands of India. They must always be poor, as compared with the pastures of moist temperate countries, but there is no question that they could be improved, and that, if part of the grass growing luxuriantly in the monsoon could be harvested and converted into good hay or silage, for use after vegetation dries up, they would carry more, and would certainly carry better, cattle than they now do. Some countries are so fortunately situated as regards climate that their grazing lands produce herbage of a kind capable of supporting good cattle at all seasons of the year. India does not come within this category. A few limited areas in the north supply fair grazing, but, in most parts of the country, the grass which grows in the monsoon either shrivels up entirely in the dry season or becomes so coarse as to be incapable of nourishing cattle properly. (Thus it is clear that, even if it were a practicable measure to extend grazing lands largely in populous districts, and means could be found for restricting the increase in cattle which, in the absence of restrictions, would certainly follow, no adequate solution

of the problem set by cattle improvement would be forthcoming merely as a result of extending the grazing areas.

Those who point to the difficulties created by the extension of cultivation at the expense of natural grazing lands forget that it is not solely the contraction of these lands that has accentuated the difficulties of cattle owners ; but—and this is the more important cause of the conditions which they describe—with the breaking up of land for tillage, the local population has increased, the need for draught cattle has become greater and, following an increase in draught cattle, cows and young stock have become more numerous. Where, in the past, the relatively few animals required in some particular area may have been supported without difficulty, the larger herds of stock now existing could not be maintained in equally good condition even if the grazing lands were restored to their original extent. In short, the former conditions could only be reproduced by depopulating the area and turning men adrift in order to make room for cattle. This is, indeed, a change which has been forced upon some countries by economic pressure ; but, in India, apart from the sociological evils which a clearance of the rural population would create, a change in this direction would be absurd from the economic point of view. To effect an improvement in the conditions of the livestock, it would be necessary to drive cattle as well as men off the land, and the scanty produce of the acres restored to grass would leave the tract poorer, not richer, than before. It would be possible to make a close estimate of the loss in produce per acre which the conversion of cultivated land into grazing ground would be likely to involve in typical cases ; but we are of opinion that such estimates would serve no useful purpose, for it is clearly impracticable to give effect to the wishes of those who desire to restore the former position and to dispossess cultivators of their fields in order that grazing grounds may be extended.

A number of witnesses suggested that the additional grazing areas required could be found by throwing forests open to cattle. In our chapter on Forests, we express the view that more use should be made of forests for grazing ; but that the complete removal of all restrictions on grazing would have little effect in extending the existing grazing areas may be demonstrated by a reference to figures.

There are in British India (excluding Burma) about 300 million acres not occupied by crops. If current fallows are excluded, the area is about 256 million acres ; of this area, forests closed to grazing account for 15 million acres, or about six per cent, of which about 7 million acres are open to grass cutters. A large proportion of the remaining area is either distant from cultivated tracts, or so densely occupied by forest trees that no grass grows on it. If an attempt were made to amend the estimate of the area actually available as grazing land in British India (which, excluding Burma, we put at about 146 million acres) by adding to it all the useful grazing land included in forests in which neither grazing nor grass cutting is now permitted, it is improbable that the addition could exceed five per cent ; it is indeed likely that it would be much less.

181. Thus, when we come to examine the advice given by so many witnesses that provision should be made for extending grazing areas for the purpose of improving cattle, we find that no large additions are possible; there is no need, therefore, to examine the contention of other witnesses who stated that an extension of grazing areas would, in existing conditions, merely aggravate the evil which it was sought to cure.

NECESSITY FOR IMPROVEMENT OF EXISTING GRAZING RESOURCES.

(It follows that, since relief cannot be found by adding to the area of grazing lands, efforts should be concentrated on measures likely to increase the usefulness of the land already growing grass.) Although the difficulties in this direction which confront the seeker after improvement are formidable, the scope for an increase in the production of cattle food is undoubtedly very great. (The principal methods of improving the output of cattle food from grass land mentioned by witnesses were restriction of the right of grazing on waste land, enclosure and controlled grazing, and fodder storage.)

182. It is frequently asserted that the difficulties of cultivators are intensified by the extent to which landless villagers and residents in towns keep cattle but do not feed them. Such cattle not only compete with those of cultivators on the common grazing lands but, at times of the year when these afford no food, raid crops and cause much damage. In some localities, this evil is found to such an extent that legislation was suggested with the object of restricting the numbers of cattle kept. Where common rights exist in the village grazing grounds, it would probably be impracticable to restrict the keeping of cattle to occupiers of tillage land; but, with the consent of a majority, it should be possible to regulate the grazing on the common land, if enabling Acts were in force giving, to a majority of those who have rights in such lands, power to make regulations laying down the number and description of animals which could be turned out to graze by individual villagers. In cases in which grazing rights are of an indefinite kind, and especially where the area of grazing land attached to a village is considerable, it should further be possible to divide up the grazing land so that a co-operative society of villagers wishing to improve their cattle might secure entire control of a part of the grazing lands, leaving the balance available for common use.

CATTLE OF NON-CULTIVATORS.

183. Conditions in India vary so widely that no one policy or method of meeting the difficulties created by the keeping of cattle by non-cultivators, or by the overstocking of grazing lands for other reasons, would be applicable throughout the country. We propose, therefore, to examine three typical sets of conditions which are likely to be met with frequently, and to suggest the lines along which the obstacles to cattle improvement presented by each set might be attacked. In the first, the village common lands represent little more than exercising grounds for cattle, and little, if anything, can be done to improve the grazing they provide, for every grass plant is gnawed bare as soon as it begins to make fresh leaves and is given no

REGULATION OF GRAZING.

chance of producing the herbage which, under more favourable conditions, it would supply. In such circumstances, the extra fodder which cattle need must be grown on the cultivated land, or must be imported from outside. In the second type of village, a type which is very frequently met with throughout the plains of India, the grazing area is more extensive, and the cattle are able to pick and choose their food during the monsoon, with the result that much grass develops into coarse dry fodder of very little feeding value. Here a great improvement could be effected by grazing the area in rotation, and in order to secure that this is done, authority must be conferred on some group of villagers, a *panchayat*, or a co-operative society, for example, which would enable them to regulate grazing. The third set of conditions which we have in mind is that which is found in hilly districts such as are common in Assam and Burma. The conditions we have described immediately above occur here in a more pronounced form. Grass is so abundant in the rainy season and grows so strongly that the dry season finds extensive tracts covered with fodder which is not only uneaten, but uneatable. Such districts differ from those in the plains in that the extension of free grazing areas would be possible ; but extension would be of little or no use in improving cattle. We recommend that an attempt should be made to demarcate those areas likely to be most suitable for grazing, and to assign them to groups of occupiers of tillage land at nominal rates, on condition that they graze the land in rotation, exclude cattle not owned by the group, and cut grass from part of the area for use in the hot season. What should, in fact, be aimed at is the creation throughout the dry season of "oases" of grazing grounds of real value in the existing deserts of dry, coarse and valueless herbage.

The subject of regulating grazing lands has hitherto received but little close study from the Agricultural Department; but, since the report of the Bombay Cattle Committee of 1923, attention has been paid to it in certain talukas of that presidency. It is mainly from forest officers that we have heard of the importance of regulating grazing grounds. The Chief Conservator in the United Provinces, for example, emphasised the fact that the produce of unreserved waste lands could be greatly increased by protection, and he suggested that, if such areas were divided into blocks and grazed in rotation, the existing difficulties would be much reduced. Other forest officers pointed out that even extensive forest tracts were, in some cases, over-grazed, and the Chief Conservator of Bengal explained how this might occur through neglect of rotational grazing in forests where the total amount of fodder is sufficient. In referring to the deterioration of forests through excessive grazing, he observed "what appears to be light grazing in terms of the head of cattle per acre is, in practice, concentrated near the village, in stream beds and grassy blocks ; the last two being just where it does most harm." We are well aware of the difficulties likely to be met with in practice in getting owners of cattle to adopt more rational methods in utilising the diminishing grazing areas of India, but the poverty of so large a proportion of the breeding herds of the country is such a serious handicap to the improvement of agriculture,

and the management of the available grazing lands is so bad, that a great effort to alter existing conditions is necessary, and is indeed long overdue.

In this connection, attention may again be called to professional graziers. Two kinds are to be found in India. One is represented by the villager to whose care cultivators in many districts hand over their cattle at the end of the busy season. This type is to be found in those districts in which the poorest animals are kept. The men belonging to it are cattle herdsmen rather than graziers and need no encouragement. The other type is found in the tribes of nomadic graziers, themselves in the past owners of herds of cattle and breeders of the best that India could show. As cattle breeders, they have disappeared from many districts in the course of the past half century; in others they still exist, but are losing ground. These men possess a knowledge of cattle that would make them useful allies in any fresh attempts to make better use of the natural grazings of the country; and, where they are still to be found, efforts are required to enlist their hereditary skill. Special consideration, which might take the form of allotting them new grazing areas from disafforested reserves, or from waste land not classed as free grazing areas, should be shown to them in all schemes for cattle improvement.

One further point may be referred to in connection with the better utilisation of existing grazing lands. In some parts of India, there may be considerable tracts of grass land which are not being fully utilised for a reason which might be remedied. The Bombay Cattle Committee drew attention to an instance of this kind. They pointed out that, in the Satpura tract, there exists much good grass which is of little value to stock because, during the dry season, there is no drinking water, and suggested that an irrigation engineer should examine the tract in order to ascertain whether a remedy was possible. The difficulties in providing a sufficient water supply may prove insuperable; but the quantity of water required by grazing stock is not considerable as compared with the amount that an irrigation officer is normally expected to provide, and the water supply of natural grazing lands is a subject well worth investigation. (It is not unlikely that much of the unequal grazing of which forest officers complain may be associated with a difficulty in finding water for cattle near at hand.)

DRY FODDER STORAGE.

184. We turn now to the subject of fodder storage. (Indian hay is seldom "hay" in the sense in which that term is understood in western countries; it consists of dry grass, on which seed has ripened and usually has been shed. It corresponds in feeding quality to the straw of cereals rather than to hay made before seed has ripened. The reason for this inferior condition is that, during the latter part of the monsoon season, when grass is ready to be cut for hay, the weather is often so wet that hay-making cannot be attempted; and, at the end of the monsoon, when there is still a chance of making fair hay from grass not greatly over-ripe, cultivators are very busy with their cultivated crops.) Thus the would-be hay-maker of India

has greater difficulties to face than have farmers in even the wettest parts of Britain. It is only in districts of exceptionally light rainfall that the weather is not a serious obstacle to hay-making in India, and unfortunately in such districts there is little natural hay to be made.

These difficulties, and the quality of the material that passes for hay, largely explain the attitude of the Indian cultivator to hay-making. It is an attitude that may have been reasonable enough in the distant past, when his theory of agriculture took shape; but it is an attitude which is no longer reasonable, for even dried grass, though seldom better, and usually worse than the *bhusa* and *kadbi* on which he relies, is of much value to hungry cattle, and, if supplemented by concentrated foods, would bring them through the dry season in good condition. Nor is it always impossible for the cultivator to make real hay. If he used his opportunities as diligently as, for example, the Welsh farmer does, his cattle would quickly improve. In all districts where grass land is abundant, cultivators should be expected to provide themselves, if not with hay, at least with dried grass; and even where grass land, without being abundant, exists in excess of the needs of cattle during the period from July to November, a portion of the land now used as grazing would be used to better purpose if it were reserved for grass cutting.

The evidence we have heard suggests that the cultivator rarely makes the most of his opportunities for grass cutting, and that it is very seldom indeed, that he secures the full value of the grass which he cuts, by harvesting it when its feeding value is good. It is not that he is unaware of the poor quality of over-ripe grass. This he knows well, and his objection to baled hay made in the forests is that its quality is so poor as to render it useful only in famine conditions. The most formidable obstacle to be overcome before the cattle owner can be induced to provide hay for his stock is, indeed, to be found neither in lack of sunshine, nor in surplus of shower, but in custom. A grass cutter he has been, but a hay-maker never; and he finds it hard to begin.

GREAT POSSIBILITIES OF SILAGE.

185. It is a fortunate circumstance, however, that sunshine is not essential to the process of storing good fodder, and within the past few years, since livestock experts have been appointed and the improvement of cattle has received their thought, much attention has been given to the subject of ensilage. A great many trials of different types of silo have been made, and the suitability of many different crops for filling them has been tested. The making of silage is, indeed, no new process in India. It has been regularly practised at Hissar ever since, in 1899, this farm was taken over from the Commissariat Department. At Pusa also, silage has always been an important fodder; but it is within the last ten years that interest in the subject has become widespread. The results of this widened interest in one respect have been more than encouraging, for very definite success has been achieved. On many government farms all over the country, silage is now regularly made and has proved of great value in feeding cattle during the dry season. In another respect, however, the results so far met with have been disappointing, inasmuch

as cultivators, though not the cattle, show a great disinclination to take to silage. Around Pusa, for example, where silage has been made for more than a dozen years, where the stock are largely fed on it, and where cultivators have had many opportunities, at the annual sales of cattle, of seeing the excellence of animals fed on silage, they themselves will not touch it. Elsewhere, agriculturists have been less conservative, and a few large landowners have begun to use silage. Some of the zamindars who gave evidence before us testified from personal experience to its value; and the ensiling of crops seems now to be commonly resorted to by the small number of progressive dairy farmers who have begun to keep herds in rural surroundings for the supply of milk to large towns.

The experiments made in all parts of the country show that, except where the soil is waterlogged, the cheapest form of silo, *viz.*, the earthen pit, is also the type best suited for cultivators. When properly constructed, filled and weighted, it keeps silage as well as, if not better than, the tower silo built of brick or concrete, and though there are objections to pits when silage in large quantities is made, these objections are of little account when silage on the scale needed by cultivators is the object. If the cultivator wishes to store his fodder, therefore, there is no initial outlay; he has merely to dig a pit of suitable dimensions. Experiments made in Bombay show that, for each foot of its length, a pit dug eight feet wide at the surface, seven feet wide at the bottom, and eight feet deep would hold about one ton of green fodder and produce about five-sixths of a ton of good silage. Thus, a pit with the above cross section and ten feet long would hold all the silage that a cultivator, owning three or four cattle, would be likely to need for the purpose of bringing his stock through the hot season in good condition.

The choice of plants suitable for ensiling is a wide one, and investigators in India have already recorded the results of their experiments with a large number of products. Among cultivated crops, maize, *juar* and oats are specially suitable. There is some advantage in cutting such fodders into short lengths before ensiling them, and in demonstrations of the process in the Central Provinces, a motor lorry with a silage cutter driven by a 3-H. P. engine has been successfully employed. Several coarse grasses, such as *Sorghum halepense*, *Panicum antidotale* and *Andropogon contortus* have also been found to make satisfactory silage. The last of these is the common spear-grass which, when dry, is a very poor cattle food, but has been found to be much improved in palatability and feeding value by ensiling. At this stage of development, the prudent course when recommending the use of ensilage is to assume that only recognised fodders, readily eaten by cattle when fresh, or those inferior grasses which experiments have proved suitable, can profitably be ensiled. Leaves of trees and strong growing weeds of various kinds can be converted into useful silage, and many suitable plants are likely to be found, but, with so large a selection of plants which can undoubtedly be used with good results, the immediate policy should be to concentrate on efforts to get the cultivator to make silage of these, for his cows and young stock.

There is sufficient experience available in India to show that it is here that the agricultural departments will encounter a real difficulty. (Silage is essentially a fodder for milking, or for idle, stock.) Like succulent fodders in general, it is less well adapted for bullocks while at hard work. The cultivator is quite prepared to make an effort to feed his working cattle; but, as we have seen, he expects his cows—especially when they are yielding no surplus milk for household use—and also his young stock to look after themselves. (The preparation of silage, therefore, makes little appeal to him; it is this indifference that those trying to introduce the new process must combat.)

We are of opinion that propaganda on the lines of that carried on in the "village uplift" campaign in the Gurgaon district in the Punjab, a description of which will be found in Chapter XIV, is called for with the object of inducing cultivators to adopt the making of silage, and that, in conducting this campaign, an appeal should be made to the "cow-protection" instincts which are so strong among the Hindu population, with the object of securing voluntary local assistance. But, in conducting a campaign of this character, it is very necessary to observe caution and to ensure that district officers and voluntary assistants who may be prepared to help, should, before they engage in propaganda, have some practical experience in silage making. The process is so simple—consisting as it does merely in the making of a pit of a given size, the cutting of green succulent fodders, the filling and tight trampling of the material and the weighting with earth or stones—that persons anxious to popularise the making of silage may easily suppose that reading and following instructions are sufficient to ensure success. But as is the case with very many simple agricultural processes, attention is required to small points of detail in dealing with which printed instructions are an inadequate guide, such as the necessity in sunny weather of pitting as soon as possible after cutting, and, until a silage maker has had at least one season's successful experience, he should not demonstrate to the cultivator; for a very slight error which resulted in spoiled fodder would mean the end, for the time being, of all propaganda work in the locality.

Small rations of silage fed to the hungry cows and young stock of the country during the season of fodder scarcity would, we think, do more than anything else to bring about a rapid change in the quality of Indian cattle. There is no real difficulty in providing the pit silo required for storage in most parts, but there would be difficulty in securing suitable green material for filling the pit in many parts of the country. This difficulty would seldom be insuperable, however, if cultivators realised how greatly this stored fodder would add to the value of their cattle. A campaign for the extension of the use of silage should, moreover, appeal to many among the educated of all communities, and not to Hindus alone; for no lover of animals can fail to deplore the sufferings which millions of cows and young cattle have to face every season in their struggle for existence on the burnt up grazing grounds of India.

186. (While more attention to the management of grazing grounds, to the making of hay, to the collection of dry grass, and to the ensiling of the many kinds of suitable material that is, or might be, grown in this country would all contribute to the solution of the stockowner's difficulties, they do not exhaust the directions in which the fodder supply might be improved. Practice in regard to the storage of dry fodders, especially the straw of cereals, varies widely.) Where cultivators are careful of their cattle, as in the cotton tracts, storage is systematically practised, and the surplus of a good year is often carried forward to ease the troubles of a bad. In other districts, no thought is given to the future. Something, too, might be done to effect economy in the use of millet stalks (*kadbi*), which are the cultivator's stand-by in so many districts. This fodder, especially *juar kadbi*, is often coarse, and, when it is fed whole to cattle, much of it that would be of the utmost value later in the year is likely to be wasted in the early part of the season. The use of the chaffcutter has spread rapidly in some parts of the country, and, wherever *kadbi* is the main fodder, attempts should be made to get its use extended.

POSSIBILITY OF IMPROVING THE QUALITY AND UTILISATION OF FODDERS.

It is likely that some coarse fodders might be put to better use if they were harvested at a more suitable time. It is well known that the value of the straw of cereal crops is increased if they are harvested at the earliest time that the state of the grain renders possible. (When the grain becomes 'dead ripe,' the quality of the straw is always inferior.) The correct period at which to harvest, in order to get the maximum value from grain and straw, varies with different cereals. We are not satisfied that this subject has received enough attention from the agricultural departments, and we would suggest that, in districts in which cattle waste a considerable part of the coarse fodders to which they have access, the possibility of securing a (better and more palatable straw by earlier harvesting should be considered,) and that experiments should be made to determine the earliest stage at which the crop can be safely cut. Where the straw of wheat, barley or rice, when supplied liberally, is rejected by stock, measures for increasing its palatability should be investigated. Methods which suggest themselves are moistening the straw in water in which a trace of *gur* has been dissolved, or sprinkling it with salt, or with any cheap meal or condiment likely to tempt the appetites of cattle.)

187. (Even when all possible use has been made of existing sources of supply, a shortage of fodder is likely to arise in many parts of the country. In these circumstances, the only remedy is the cultivation of fodder crops on the cultivator's holding. For this there would appear not only to be much need, but much room, since the total area under fodder crops is somewhat less than nine million acres, or 3·5 per cent of the total area sown, as compared with 16·6 per cent in Egypt. Moreover, India provides a wide choice of crops suitable for this purpose, from the indigenous fodder *juar* and *senji* to the introduced maize, lucerne, *berseem* and Guinea grass. New and promising fodders like fodder *bajra* (*Pennisetum purpureum*) and Japanese

GREEN FODDER CROPS.

millet (*Panicum cruxgalli*) are frequently discovered as the world is being explored. In no direction is the introduction of exotic crops likely to prove more valuable in adding to the resources of India than in the case of those intended for cutting green as fodder. We observe with satisfaction that in the North-West Frontier Province, in the Central Provinces and also at Pusa, the agricultural departments have succeeded in ripening the seed of *berseem* freely; for, if the seed of this crop can be cheaply grown in quantity, there is at least some ground for the hope that, in tracts such as the Punjab and Sind, it may add greatly to the fertility and wealth of the country. Its value as a fodder in Indian conditions is shown by Pusa experience where, in the cold weather of 1925-26, 103 acres sown with *berseem*, and irrigated, supplied pasturage for 350 cattle from November to May and in addition provided 410 tons of green fodder for cutting. The high value of this crop both directly in stock feeding, and indirectly in increasing the yield of other crops, is shown by the experience of Egypt, where it is very extensively used both as fodder and green manure. The cultivation there is of the simplest kind; it is sown between the cotton rows before the final picking of that crop, or on the bare land immediately after the cotton stalks have been pulled; it grows luxuriantly, keeps down weeds, and leaves the land in good condition for succeeding crops.

The difficulty which we foresee is not the discovery of suitable crops for growing as green fodder, or for making into silage; it is in persuading the cultivator to grow them. His first line of reasoning is that, if he pays land revenue and water rates and grows a crop, it must be a money crop or a food for himself, not a fodder crop or one that may be ploughed in as green manure. He cannot be expected to know, nor, if he were told, could he envisage, the effect which the introduction of red clover into the rotations of western countries had on both the live-stock and corn-growing industries; or the effect of *berseem* in Egypt on the rich crops of maize and cotton which follow. But these indirect effects of leguminous fodder crops on the fertility of land, and the lasting value of their introduction in association with large irrigation schemes must be recognised, and should receive the fostering care of governments concerned with the development and permanent welfare of their countries' resources. The Indian agricultural departments are well aware of the value of fodder crops but an extension of the area under them has been hard to secure. In Madras, the Punjab, the North-West Frontier Province and Sind, efforts have been made to encourage the cultivation of such crops by the remission of the charge for water from government sources of irrigation or by the grant of concession rates for the use of such water. As in the similar case of crops grown for green manure, the results have so far proved disappointing. We recommend, however, as we have done for green manure crops, that the concession should be continued and extended to other areas provided that this is accompanied by an active campaign of propaganda and that all areas in which it is granted are kept under regular examination. Where the concession is at present granted, it applies to all fodder crops. Where it is being extended to new areas, we think that the concession might advantageously

be limited to the growing of specific fodder crops of proved value, such as *berseem*. The further recommendation we have made in regard to green manure crops would apply both to existing and to new concessions. If, after a period of five to ten years, it should appear that the concession has failed to achieve its main purpose, it should be rescinded.

The cultivator's second reason for limiting the area sown with fodder crops is the great trouble involved in protecting them from raiding animals. The risk his crop would run if he were the sole grower of fodder in a village is, indeed, so great that an enterprising cultivator, otherwise anxious to grow a new fodder crop, would almost certainly refuse to make the attempt. In introducing fodder crops to a new district, it becomes necessary, therefore, to persuade several cultivators to make the attempt simultaneously, so that they may share both the risk and the work of protecting the growing crop. We have here another reason for advocating the fencing of land, a subject we have discussed in Chapter IV.

IMPROVEMENT OF CATTLE BY CAREFUL BREEDING.

188. We turn next to examine the efforts which are being made to improve Indian cattle by careful breeding. This is a task which in one sense is straightforward and easy as compared with the difficulties encountered in attempts to improve the management of cattle by feeding them properly; but after the initial stage has been accomplished and superior animals have been raised, the difficulties are the same. The supply of fodder must in general determine whether the cattle improved by the efforts of the breeder can, or cannot, be maintained in India; since larger or more productive animals would depend for their welfare on proper feeding to an even greater extent than those now in existence. The best Indian cattle already have remarkable powers of endurance and of recuperation after long periods of hardship. The most skilful breeder could scarcely improve on the best of them in this direction. The improvements which are possible are in the direction of form, size and average constitution in both sexes, and in that of productiveness, both of offspring and of milk, in the case of the cow. And, with the exception in certain cases of the grading up of the average animal, these qualities are conditioned by food supply. The exception to the general statement just made is important and must be explained. As compared with the cattle of other countries, the best Indian cattle excel as "foragers," that is, in their capacity to maintain themselves in good condition on the scanty grazings to which they have access. Their quality in this respect, however, varies widely. It follows that the efforts of a breeder who made foraging qualities his goal might result in improvements of a kind that would make no additional demands on food supply or on the ordinary stockowner's powers of cattle management. This exception is one which the breeder should never lose sight of; it offers the one possibility of improvement which is not dependent either on an increase in food supply or a decrease in the number of cattle to be fed. In general, however, the rule that increase in production must be preceded by an increase in the food supply holds good. In cattle of

both sexes, the larger the animal the greater must be the ration, and, in the female, regular breeding is impossible without proper feeding; while, though, for a time, a good cow would produce milk at the expense of her own tissues, the yield could not be maintained unless the food supplied was in proportion to the milk produced.

The task of the agricultural departments in improving cattle has been easy in the sense that, as has already been pointed out, the country contains a number of fine breeds which, in spite of all fodder difficulties, have, in most provinces, provided foundation stocks of comparative excellence with which to begin the work of improvement. The first task of livestock experts has been to recognise and classify breeds of merit, and this has now been done generally; the next has been to establish farms for the breeding of bulls of those breeds which display outstanding merit, with a view to the isolation of the best types, where the breed has become mixed or indefinite in its characteristics. This work is now in progress and will take time; for, as the result of neglect in past management, a number of the breeds are much less uniform than is desirable. Lack of what a stock breeder describes as "type" is indeed very noticeable in existing herds; and it was the possession of this quality by young stock at Hissar that marked out the Punjab herd among those seen by us in our tour. What has already been accomplished at the long established Hissar farm will, in time, be accomplished at the other cattle breeding farms, and there can be no doubt that they will be able to supply bulls for distribution which will show a great improvement over the foundation stocks with which the farms started.

We were able to visit a small number only of these cattle breeding farms, and the impression we formed was that they are now well managed but that, at an earlier stage, some of those in charge of breeding herds were too much given to making experiments in crossing and did not possess the patience that the building up of a good herd by selection calls for. It cannot be too strongly emphasised that the variety which may be in place on an educational farm for the purpose of demonstrating differing qualities in cattle is out of place on a farm the object of which is the breeding of bulls. This is now recognised by agricultural departments and "type" is receiving the attention required. It is endangered by one circumstance only, the quest almost everywhere for dual purpose cattle, that is, for breeds of which the bullock would be suitable for draught, and the cow for milking and *ghi* production. The desire for such breeds is laudable, for good dual purpose cattle would, no doubt, meet a strong demand; but the would-be improver of cattle is confronted by most complex problems, and, in such circumstances, there is much to be said, and that not only in Indian conditions, for the policy of one thing at a time.

NUMBER OF BULLS DISTRIBUTED FROM CATTLE BREEDING FARMS.

189. Whilst, in all provinces, cattle breeding is now receiving attention and cattle farms have been provided, it will be seen from the following statement of the number of breeding bulls supplied in the three years ending with 1925-26 that, except in the Punjab, little progress has as yet been made and that even in that

province, although a fairly substantial number is now being sent out annually, the total contribution to the 10,000 young bulls which that province needs each year is relatively small :—

Number of bulls issued from government farms in the major provinces for the three years ending 1925-26

Province	1923-24	1924-25	1925-26	Average
Assam	5	6	9	7
Bengal	8	..	7	5
Bihar and Orissa	3	1	21	8
Bombay	36	27	27	30
Burma	2	..	3	2
Central Provinces	46	50	59	52
Madras	40	13	6	20
Punjab	241	296	422	320
United Provinces .. .	72	54	99	75

If we take note of the fact that India, which, according to the statistical returns, has some five million bulls (and would, if its cattle were properly managed, need one million, with an annual supply of some 200,000) it will be apparent how small is the direct influence which government cattle breeding farms can exercise on the cattle of the country. This is recognised by the livestock experts responsible for the work, and it is to the indirect rather than the direct effects that they point in justification of their efforts and of the expenditure which cattle breeding farms involve. It may further be observed that, in all provinces, those in charge of cattle improvement insist on the fact that, in Indian conditions, the breeding of bulls cannot be directly remunerative at this stage, and that, if Government does not intervene to provide pedigree cattle, no private breeder will. We agree with this view. The conditions in this country are totally different from those in Britain, where the initiative in livestock improvement was taken by landowners and farmers, and where Government did not intervene until—after a century and a half of private effort—highly valuable herds were in possession of a large number of private owners. When the British Government began to share in the work of livestock improvement some fifteen years ago, it was not necessary for them to breed bulls; suitable animals were already there; what was needed in Britain was to make these valuable cattle available to small farmers, who were, in many districts, unable to afford to use them. With this object the "premium bull" system was introduced. In India, as we have seen, really good cattle, once the property of professional breeders, are disappearing from many parts of the country and, when agricultural departments began, as one or two did thirty years ago, or more, to introduce into India the "premium bull" system, they found it impossible to purchase useful animals. Thus, in India, the expensive but essential work of building up herds of pedigree cattle, which in Britain was accomplished by private enterprise, must fall on the tax-payer.

Since, in a number of provinces, little progress has yet been made in breeding pedigree cattle, we propose to confine our review of this branch

of activity to the work done in the Punjab, the United Provinces, Bombay, the Central Provinces and Madras, where most experience has been gained. We do so partly with a view to illustrating the methods employed in improving cattle, and partly because in these provinces certain points arise on which we desire to comment.

THE HISSAR CATTLE FARM, PUNJAB.

190. The Punjab Government's cattle breeding farm of Hissar has an area of 42,000 acres and is much the largest stock breeding farm in British India. It is also the oldest, having been established in 1809 as a centre for camel breeding. In 1815, cattle and horse breeding were added. Although horse breeding was carried on for about thirty-five years, cattle breeding soon became the more important object and, from 1850 onwards, nearly all the work centred round the raising of artillery and ordnance bullocks. Until the end of the last century, the farm was at different times in charge of the Commissariat and Stud departments; but, in 1899, it was transferred to the care of the Civil Veterinary Department. On the abolition, in 1912, of the post of Inspector-General, Civil Veterinary Department, the farm was handed over by the Government of India to the Punjab Government, but no change was made in its management. The size and importance of the farm has justified the employment of skilful stock breeders to superintend it. For nearly thirty years, cattle breeding at Hissar has been in charge of two officers of the Civil Veterinary Department, Colonel Farmer, who reorganised the farm after it was handed over by the Commissariat Department, and Mr. Branford, the present Superintendent. Hissar has thus had the advantage of continuity of policy in recent years. This policy has aimed at the formation of a herd exhibiting in the greatest possible perfection the qualities which have made the Hariana or Hansi-Hissar cattle of the south-east Punjab noted as a draught breed. There had, unfortunately, been a good deal of crossing of this with other Indian breeds before the farm came under the management of the Civil Veterinary Department and the stock was not pure, but undesirable traits have been gradually eliminated, until the Hissar cattle now represent a special strain of the Hariana breed.

In addition to a small number of horses, donkeys, mules and sheep, Hissar maintains from 5,500 to 6,000 cattle. The herd contains about 1,500 cows, and some 300 to 400 young bulls of about three years old are auctioned annually. They are purchased chiefly on behalf of district boards, who supply them to villagers. It is now recognised that concentration of good cattle in particular areas gives the best results and efforts are directed to securing proper treatment for the cows and the castration of undesirable males in the villages in which the bulls are placed. Largely through the personal efforts of the Deputy Commissioner, the district of Gurgaon is at present securing a considerable proportion of the young bulls and a noteworthy improvement of the local cattle is taking place.

In the three years ending March, 1927, the receipts from the Hissar farm averaged Rs. 2·67 lakhs; excluding any sum by way of rent for the land, the average annual profit was about Rs. 76,000.

The Hariana breed of cattle, for which the south-east Punjab and the adjacent districts of the United Provinces have long been noted, is essentially a breed of fine draught cattle ; a number of the cows are also good milkers, yields of 3,000 to 4,000 lbs. per lactation appear to be not uncommon and the breed is recognised as having dual purpose value. Until recently, the single purpose at Hissar was to breed cattle of a good draught type and this is the policy that still applies to the general herd. In the view of some livestock experts, this single purpose aim was a mistake, and at Hissar, and other cattle farms, attention is now being given to the improvement of the milking properties of the breed with the object of producing bulls for districts suitable for milk production. At Hissar, the draught and the dual purpose herds have been separated, as they require different treatment. To us it appears that advocates of dual purpose breeding have sometimes failed to give sufficient consideration to the need for different treatment, and that caution is required lest, in seeking to improve the milk yield, other qualities which give special value to the breed may be sacrificed. A reference to Hissar experience will serve to illustrate this point. The grazings on this farm are fairly are presentative of those to which Hariana cattle are accustomed. The quality of the grass is, for India, very good ; but the grazing is sparse. The Superintendent of the Hissar farm informed us that breeding cows might have to travel ten to fifteen miles daily to secure the rations they required. The cows maintain themselves on these grazings in excellent condition and bring up strong calves. In ordinary years, they get no food beyond what they pick up for themselves. In years of fodder scarcity, a little hay is supplied to them. To maintain her body weight, an average Hissar cow weighing 1,100 lbs. must collect some 40 lbs. of grass daily in the dry season and each *seer* of milk which she gives would add nine per cent to her grass requirements ; moreover, the additional effort required to collect this grass adds to her need for food. Grazing ground, which is capable of supporting good draught cattle might thus starve the cows, if their output of milk were raised. At Hissar, the cows in the dual purpose herd are not expected to find all their food on the grazing grounds ; they also receive rations of concentrated feeding stuffs carefully adjusted to body weight and milk yield. But the cultivator rarely feeds a balanced ration to his cow. Thus, were bulls of high milking strains produced at Hissar and used in districts where the grazing lands were of similar character and in which cultivators were not accustomed to hand feed their cattle, there would be no small risk that the stock produced would deteriorate on the grazings and cease to give satisfaction. Until fodder crops and concentrated feeding stuffs are much more commonly used by Indian cattle owners than is now the case, care must be taken not to distribute strains of cattle having markedly different milking properties from those already occupying grazing tracts. For districts in which cultivators are already accustomed to feed cows in proportion to their yield of milk, heavy milking strains of the Hariana breed would be particularly suited. A dual purpose animal obtained, by selection, from a breed in which strains combining good milking with

good draught qualities have long existed, may be regarded as being relatively pure bred in respect of both qualities. Bulls so bred would be much more likely to give satisfaction than animals which had resulted from the blending of strains by crossing in recent times.

To supplement the supply of bulls of Hissar strain, leases of tracts of land in the Punjab have been granted on favourable terms in three cases. These farms maintain about 900 cows, so that the addition to the Hissar supply of bulls should be substantial. We were informed, however, that the results were not satisfactory, as there was a tendency on the part of the grantees to regard cattle breeding as a side line, and we do not recommend this particular method of encouraging cattle breeding. Reference to the other breeding schemes of the Punjab Government in connection with the improvement of Montgomery (Sahiwal) and Dhanni cattle is made in the introduction to the volume of evidence for the province.

CATTLE BREEDING IN THE UNITED PROVINCES.

191. In the United Provinces, there are, at present, two cattle breeding farms. The larger of these, that at Madurikund near Muttra, extends to about 1,400 acres, and breeds Hissar cattle and Murrah buffaloes; the area of the other, which is at Manjhra, in the Kheri district, is at present 550 acres, but an extension of 2,000 acres is contemplated. The stock consists partly of milking breeds—Sahiwal cattle and Murrah buffaloes—and partly of Kherigarh cattle, a small draught breed much in favour in the east and north-east of the province. When bulls were first distributed in this province, they were supplied to district boards and co-operative societies, but neither agency gave satisfaction, as under a system of general distribution it was not possible to secure proper treatment for the bulls. It was, therefore, decided to concentrate the work in selected areas, of which there are at present two. The cows kept in these areas and their progeny, as well as the bulls placed out, are regularly inspected, and an attempt is being made to raise the quality of all cattle within each area. Later on, the superior cattle so bred will be used for improving the stock of other districts. We attach great importance to the inspection of the stock in all districts to which bulls are supplied, and commend this policy of concentration in controlled areas. Experience in the province has already shown that, when areas are carefully selected, villagers are not only willing to subscribe part of the purchase price of bulls and make the best possible use of the animals, but are prepared to maintain them without assistance. In the Muttra district, *taccavi* advances at 7½ per cent interest are being made to enable villagers to pay for the bulls they require.

From the experience already gained, it is estimated that the cost of providing a farm carrying 275 cows and turning out from 80 to 100 bulls annually, after the full output is reached, would be about Rs. 2 lakhs for capital and Rs. 23,000 annually for recurring expenditure.

CATTLE BREEDING IN BOMBAY.

192. In the Bombay Presidency, there are now three cattle breeding farms. At Chharodi in north Gujarat, about 200 cows of the Kankrej breed are maintained on some 2,300 acres; at Bankapur in the southern Mahratta country, there is a herd of 50 cows of the Amrit Mahal breed; and at Phihai near Karachi, one of Sindhi cattle. The first two are essentially draught breeds, the last is one of the best milking breeds of India. In the Bombay Presidency, the subject of milk supply has received much attention from those responsible for cattle improvement. This is partly due to the fact that Bombay city creates a large demand for milk, and is provided with a very poor supply of it, and partly because north Gujarat produces large quantities of buffalo milk and, at the same time, maintains a good class of draught cattle. The wide grass borders of the enclosed fields in this district provide the only approximation to "pasture" in association with tillage land to be seen in India and the lot of the cultivators' favoured animals, she-buffaloes and draught oxen, is relatively a happy one. The double demand in Gujarat for good plough and good milking cattle has, naturally enough, suggested the desirability of combining draught and milking properties in one breed of animal, and the importance of replacing buffaloes by good cows of a 'dual purpose' type was urged upon us. As a goal—a distant goal—something is to be said for this policy of replacing the buffalo. We shall refer to it again. In the meantime, it may be stated that the policy adopted in practice in the presidency would appear to be satisfactory. As placed before us, it is (*i*) to breed "milk and more milk" into each breed, (*ii*) to breed for early maturing qualities and (*iii*) to breed regularity of calving into stock. We make one reservation with respect to this policy, and, from the evidence, we believe that it is being acted upon; it is that in "breeding in more milk," care must be taken to preserve the qualities which have hitherto given to each draught breed its special value. For we are of opinion that, in the case of a number of breeds (though not in all, the Amrit Mahal being a prominent exception) the very poor milking qualities are due to bad management quite as much as to breed. In many draught breeds, there are not a few individual cows which have the full characteristics of the breed and are at the same time fair milkers. That this is true in the case of one breed at least is proved by the experience on the Chharodi farm with Kankrej cattle which are essentially fine draught animals. Five years' selection has resulted in raising the annual average yield from 438 lbs. per cow in a herd of 100 animals to 1,330 lbs. per cow in a herd of 93; both figures of yield are in addition to the supply for the calf which is estimated at about 450 lbs. In the same period, the percentage of births to cows increased from 49 to 85; and heifers calved at a much earlier age than before. These changes in a five-year period could not have been brought about if the qualities changed were breed characteristics. The herd, when taken over, must have consisted of a mixture of animals in respect of the three characters in question. Improvement, no doubt, partly resulted from changes in management; but it must also, and largely, have been due to the separation of good

from poor individuals. If systematic selection resulted in the raising of the average production of milk by Kankrej cattle to some such yield as has already been reached at Chharodi, not only would there be a great gain to cultivators, but an improvement likely to be maintained would have been effected. For, during the process of improving cattle gradually by selection, there would be a prospect of securing corresponding improvements in the conditions under which cattle are kept. Improvement by crossing, so much favoured in some parts of India, while more rapid, is a much more risky method of breeding.

The few pure bulls at present available in the presidency are being distributed to *pinjrapoles, gowshalas* and co-operative breeding societies, on conditions securing that they shall be properly used. The experiment of converting *pinjrapoles* from havens for useless beasts to breeding centres is worthy of mention. It is, however, recognised that no great effect on Bombay cattle can be produced by the present restricted distribution of bulls. The Bombay Cattle Committee of 1923 went carefully into the question and came to the conclusion that the improved bulls from the government cattle farms should be located in a series of talukas, which they selected as being natural breeding areas. Their plan was to locate a cattle breeding farm in each tract, to stock it with the best cows available, to provide it with selected bulls from the central cattle breeding farms and to breed young bulls for local issue. The farm manager would exercise a general supervision over the bulls placed out within the selected area, follow the progress of the progeny, and compile a register of all good cows in his district. Ultimately, when the stock in the selected talukas was of sufficiently good quality, bulls would be chosen from within these breeding areas for general use. The Bombay Government, in a Resolution on the Cattle Committee's report issued in August, 1924, gave their general approval to the schemes suggested by the Committee for starting new farms, and for the grant of additional financial help to existing farms, but added that these schemes could only be taken up gradually as financial conditions permitted. With reference to the suggestion that intensive breeding operations should be conducted in selected talukas, they asked for a further elaboration of the proposals, but so far no definite action in this direction appears to have been taken.

We are of opinion that, if any real influence is to be exercised by the work at the central breeding farms, it must be followed up by intensive breeding in a controlled area, and that effect should be given to the recommendations of the Cattle Committee. Talukas or other convenient areas should be selected, the pedigree bulls produced at the government cattle farms should be located in them and the progress of the work should be carefully supervised. If, as suggested by the Committee, an ancillary farm were established in the selected area and the manager of the farm were entrusted with the supervision of all the bulls placed out within this area, we believe that success would be met with; for, although the professional cattle breeder is fast disappearing, there are still talukas in which some skill in cattle management is to be found, and in which natural conditions favour breeding.

As the extension of the Bombay programme is governed by financial considerations, we may observe that, if the choice lies between setting up farms for other breeds and intensifying operations in connection with the breeds now being raised at the existing cattle farms, we should strongly favour the latter course. While the wide distribution of the few good bulls which the Chharodi and Bankapur farms can supply might provide an object lesson and assist propaganda, it could effect but little improvement in the existing position.

The cost of ancillary farms in selected areas can only be determined after a specific scheme has been prepared; but from the experience already gained in Bombay, the capital expenditure on a farm maintaining a herd of 100 cows may be estimated at Rs. 40,000 and the annual recurring expenditure at Rs. 12,000. The full output from such a farm, which would be reached after four years, would be from 25 to 30 good bulls annually. With this annual supply of young bulls, a stock of 130 to 150 bulls fit for service would ultimately be available, or enough for a district containing from 7,500 to 10,000 cows. Young bulls from the controlled breeding area would be available for sale and distribution in other localities.

CATTLE BREEDING IN THE CENTRAL PROVINCES.

193. Although there are nine cattle breeding farms in the Central Provinces, two of which have been in existence for some twenty years, the actual output of pedigree bulls is still very small, and it is only now that schemes are being discussed for multiplying the effect of the stock animals raised at central farms by concentration of effort in selected areas. Conditions in this province make the work of cattle improvement peculiarly difficult. There appears to be only one local breed, the Gaolao, possessing any distinctiveness of type. The cultivators of the cotton tract, who treat their draught cattle well, are not breeders; local conditions are unfavourable and they rely largely on bullocks imported from the grass tracts to the north. Cultivators in the wheat-growing tracts keep such poor cattle that extensive areas may be seen infested with *kans* grass and left untilled because the bullocks are too weak to pull the implements required to clean the land; whilst the cattle of the rice growing tracts are even worse than those in which wheat is the main crop. Cattle of fair quality are to be found only in the tract in the north-west of the province which borders on the extensive cattle breeding tracts of Central India and these owe their origin to tribes of professional herdsmen keeping Malvi or similar cattle. An attempt has been made to give the nondescript animals to be found in most areas some definite character by grading up. The Montgomery bull has been used as a sire and the policy has been to transmit the milking qualities of this breed into the local cattle. The type of animal raised is appreciated by milk-sellers, but the Montgomery type is not favoured by cultivators. Much attention has been paid to the milk supply of Nagpur city and the surrounding district. A herd of pure Sahiwal (Montgomery) cattle is being raised at the Telinkheri farm in Nagpur and the local milksellers (*gowalas*) have been formed into a successful co-operative society to improve both the feeding and breeding of their buffaloes and cows. At the

dairy farm attached to the agricultural college and at Adhartal, the more ambitious object of creating new breeds is being attacked. At the college, a milk animal suited to the district is being sought from the progeny of Montgomery bulls and cross Ayrshire-Hansi cows. At the Adhartal farm, it is hoped that an experiment, which consists in crossing Montgomery and Malvi cattle in the first instance and then mating the crosses together, may produce a breed in which the milking properties of the former may be combined with the draught qualities of the latter. It should be observed that this effort to create new breeds falls in a different category from the ordinary methods of pure breeding and grading, that no immediate results can be expected, and that the two herds in which the process is followed are to be regarded as experimental rather than as part of the ordinary cattle breeding work in this province.

It is possibly because the cattle of Berar are relatively good as compared with those of the wheat and rice growing tracts that attention hitherto has been concentrated on improving breeds for the latter tracts; but the policy was one of doubtful wisdom, for until greater attention is given to feeding, the distribution of a few "premium" bulls in the wheat and rice growing areas of the province cannot be of value. It appears to us that, in the Central Provinces, the breeding of types of draught cattle likely to be appreciated in Berar should be taken in hand, and that associated with any cattle farm provided for raising pedigree bulls, there should be a controlled area in which the improved strains of stock can be multiplied for distribution.

The obstacles to improvement in this province are much more formidable than in the Punjab, the United Provinces and Bombay, and it is therefore gratifying to find that much attention is now being given to the subject.

CATTLE BREEDING IN MADRAS.

194. In Madras, efforts to improve the urban milk supply have led, in the past, to much crossing of breeds, with results appreciated by milkmen, but of little interest to cultivators requiring better draught cattle. Recently, however, the Agricultural Department has acquired from the Army Remount Department a large farm, 1,635 acres in extent, at Hosur near Bangalore and draught breeds are there engaging attention. Two fine herds of Ongole and Kangayam cattle are being built up at Hosur and room has also been found for a dairy herd of Sindhi cattle. A second farm at Chintaladevi in the Nellore district is maintained for the breeding of Ongole cattle, the most valuable of the Madras breeds. There is also a farm at Guntur for the improvement of buffaloes, and, at the college farm at Coimbatore, experiments are made in cross-breeding in the herd kept for teaching purposes. Much work has been done on this farm in mating cross-bred bulls with cross-bred cows; Ayrshire, Sindhi and Sahiwal cattle being the parent breeds. Some success was apparently met with in the earlier stages, for, in 1924, it was recorded that the average milk yields of the cows obtained by mating cross-breds with cross-breds was "far better" than the average yield of the dams. We

had an opportunity of seeing elsewhere specimens of cattle which had resulted from this method of breeding. They appeared to us to be hopeless animals from the point of view of utility, and we should strongly deprecate the use of bulls thus bred on cows of any of the better types.

It will be seen from the Table given in paragraph 189 that the distribution of pedigree bulls in the Madras Presidency is still very small. The Hosur farm has only recently been acquired and its herds have not yet had time to influence the output of pedigree animals. It was suggested by the Director of Agriculture that selected bulls should be distributed to district boards, to which grants of Rs. 100 per annum would be paid for the maintenance of each animal. Free services were contemplated. The bulls would remain the property of Government and be transferred from one board to another at intervals to prevent the risk of in-breeding; after eight years of age they would be castrated, and sold as bullocks. It was estimated that good Ongole bulls could be provided at Rs. 300 to Rs. 350, and, after castration, could be sold for Rs. 200 to Rs. 250.

The sale (not the grant) of bulls to district boards has been successful in the Punjab in localities where much interest is taken in cattle breeding; but, in the United Provinces, this policy has not given good results. In centres where the Ongole breed is prized, district boards in Madras might no doubt be safely entrusted with the care of bulls. But, as we have pointed out in dealing with the position in the Bombay Presidency, no substantial result can be expected to follow from the general distribution of a few bulls raised on government farms. These expensive and valuable animals should be used to raise the quality of stock in selected areas, and the improved cattle of those areas should be placed at the disposal of district boards, co-operative societies, and other suitable agencies.

CATTLE BREEDING IN INDIAN STATES.

195. It is to be noted that, in addition to the work now being undertaken in the five provinces referred to above and in the other provinces of British India, cattle breeding is engaging the attention of a number of Indian States. Of chief importance is the work in Mysore, which, in its famous herds of Amrit Mahal cattle, carefully guarded since the middle of the eighteenth century, can lay claim to the possession of the oldest pure bred cattle of India. Until 1923, when they were transferred to the Agricultural Department, these herds, numbering about 9,000 head, were in charge of a special department of the Mysore State, and were bred for army transport purposes. Milk has never been an object; the cows can rear their calves and supply a small surplus for the use of cultivators keeping them as plough cattle; but they would be quite unprofitable as dairy cattle. It has been decided not to try to raise milking strains from Amrit Mahal cattle by crossing; and the process of breeding good milking strains by selection would involve so long a period of work that it is not being attempted. To raise cattle for urban milk sellers another herd of cows consisting partly of a local milk breed (Hallikar) and partly

of Sindhi (or Karachi) cattle has been established, and these are being crossed with Holstein bulls.

The Mysore State has tried the experiment of using itinerating bulls, which travel through the districts as stallions do in western countries. Although the services possible under this system are fewer than when bulls are stationary, it is claimed that this is the better way of reaching the ryot. It is stated that the calves sired by these bulls are all carefully tended, while many of those got by stationary bulls belong to non-agriculturist cow owners who take no care of the young stock.

In the Baroda State, a herd of selected Gir (Kathiawar) cattle was established some thirty-five years ago, but this original herd was, unfortunately, dispersed. It has recently been replaced by a new herd. This valuable breed of milk cattle had, in the interval, almost disappeared. Much difficulty was experienced in securing typical specimens, and it is fortunate that the breed has not been altogether lost.

In the Dhar State, a herd of Sindhi cattle is maintained and special action is taken to encourage the breeding of the local Malvi and Nimari breeds. Herds of pure bred cattle are also maintained in Hyderabad and Gwalior.

The subject of cattle improvement is one which calls for co-operation between all Indian administrations. Cattle pass freely across geographical boundaries; those bred under one administration may be intended for sale to, and use in, the territory of another. In this way, the State of Mysore and some of the States of Central India do, in fact, confer substantial benefits on the cultivators of adjacent British provinces by exporting good cattle.

We are glad to observe that interest in cattle breeding is growing in Indian States; but we could wish that the subject received a still greater measure of attention. There is here, indeed, a wide and fertile field open to those who desire to serve their country. Not only the rulers of States, but large landowners throughout India have resources and opportunities for engaging in livestock improvement that no other section of the community can command; and if they were to follow the example of the large landowners of Britain, or the Argentine, or any other country noted for its cattle, there can be little doubt that, in years to come, India might possess herds of the highest quality. At the present time, the world's demands for improved cattle are met mainly from strains which were originally evolved in Britain and a few European countries, and all such breeds were evolved to meet the needs of temperate climates. The finest stocks of tropical cattle now existing are probably to be found in India.

A great obstacle to cattle improvement hitherto confronting large landowners has been the existence of epidemic diseases. No breeder in any country would willingly face the task of building up a fine herd, if the work of a lifetime were liable to be wiped out by disease. This has hitherto been the position in India, but, as is pointed out in regard to diseases of livestock in Chapter IX, cattle can now be protected from rinderpest and, similarly, buffaloes can be protected from buffalo plague.

The ruler, or large landowner, who followed the example of the great patrons of cattle breeding in other countries, would find, moreover, not only that the pursuit was just as interesting as a hobby as is, for example, the breeding of horses and dogs, but that as time went on and his herd became notable, his cattle would become a highly valuable property. The existing price of good milking cattle is such as to make it probable that any competent breeder, who has resources at command, and is prepared to wait for a return on his investment, would find his herd profitable; and, if the breeding of fine cattle became even moderately common among landowners, the prices likely to be made by the best specimens would be prizes worth striving for. Already, we have been informed that prices of Rs. 10,000 have been paid for a Kankrej bull for export, and Rs. 1,500 for a Dhanni bull, for use within the country.

THE MARKET FOR MILK AND MILK PRODUCTS IN INDIA.

196. Milk and milk products bulk largely in the dietary of the people of India as a whole, although very little fresh milk or *ghi* is used by the Burmese and related peoples in adjacent parts of India.

The climate makes the keeping and transport of fresh milk difficult. There are no statistics on the subject but it would appear that the greater part of the milk produced is consumed in the form of *ghi*, curds and sweetmeats. In all the larger towns, the supply of fresh (liquid) milk is small; in Bombay, it has been estimated at about seven gallons and in Calcutta at about eight gallons per head per annum. The price of pure milk is high and, if it was reduced to half the current rates, there is little doubt that the consumption would be more than doubled. Owing to an increase in the habit of tea drinking in recent years, the demand for milk in urban centres has increased, and there are now considerable imports of condensed milk, especially into Burma. The average imports in the three years 1924-27 amounted to 6,965 tons, of which 4,903 tons went to Burma.

Throughout India generally, the supply of fresh milk in villages is stated to be defective. In the Central Provinces, the supply is estimated at less than 3 ounces per head daily, or 6½ gallons per head per annum; in Bombay, most villages are short of milk; in Madras and in the United Provinces, the supply of fresh milk in villages is said to suffice for the demand. In Bihar and Orissa, the supply is considered to be too small for the cultivator's household needs.

All the evidence available points to the conclusion that the consumption of fresh milk in India is very small when compared with such countries as the United States of America, Denmark, Sweden and Switzerland. Since the desire for milk is widespread and the consumption is relatively small, it would appear that the difficulties in the way of economic milk production and distribution in India are formidable.

For children fresh cows' milk is preferred, and in certain areas, as in Sind, adults also prefer it; in general, however, the demand in villages is for buffalo milk, since the milk of the buffalo contains on the average from one-third to one-half more fat than that of the cow and thus produces much more *ghi*. Both buffaloes and cows are kept by milk sellers engaged in city trade. In Bombay, the supply comes largely from buffaloes. In

Calcutta, there is a larger demand for cows' milk than in Bombay and many cows are kept within the city boundaries.

The position may be summed up by stating that there is unquestionably a large unsatisfied demand for *ghi*; there is a relatively small unsatisfied demand for butter; there is also, in all cities, an unsatisfied demand for milk at lower prices; it must, therefore, be inferred that consumers, in general, are not able to pay the prices which, in existing conditions, are required to produce the supply. We shall mention some of the difficulties created for producers by the state of the milk trade in towns when referring to city milk supply. Meantime we may observe that the need for a larger and a better supply of milk is so obvious that it is apt to prevent the public from looking at this subject from the point of view of the cultivator himself. We can only state that a large market exists, but that there is no information which enables us to make any trustworthy estimate of the extent to which this demand should affect the policy of the cultivator as a producer.

The Imperial Dairy Expert, who has had long experience in this country and has given the subject close attention, is definitely of opinion that the dairy industry in India has a great future before it; so much so that he would not restrict dairying to definite tracts, but would make the milk industry an important one wherever cattle are found.

On *a priori* grounds, no less than because of the source from which they come, these are views that command attention. In a country so largely vegetarian, the room for an expansion of milk consumption ought to be very great; a cow producing more milk for household use would be of great value to the cultivator in raising his standard of living; if there were a surplus for sale, there would be an increase in his cash receipts. But at this point in the argument we must go a stage further, and discuss the question whether there would be an increase in the cultivator's profits.

CATTLE BREEDING POLICY IN RELATION TO DAIRYING: DUAL PURPOSE BREEDS.

197. There is, as has been stated in the preceding paragraph, evidence that, in many parts of India, the quantity of milk now produced by the cattle kept by cultivators is not sufficient to provide their owners with the supply desirable for their own use. In such circumstances, measures to improve the milking qualities of cattle are very desirable. The type of cow likely to suit the average cultivator would be one capable of rearing a strong calf and of supplying in addition some 1,000 to 1,500 lbs. of milk per lactation, for household use. For cows of this kind there is no doubt much need throughout India. There are some districts in which such animals are already common; there are others where, by selection, they could be produced from the existing breeds and, if produced, might be maintained; but there are many districts in which cows can with difficulty rear their calves, where the bullocks are of very poor quality, and where fodder is so scarce that cows capable of rearing good calves and providing any considerable surplus could not be expected to thrive. The improvement of cattle in such conditions is

most difficult, and, in these circumstances, it seems to us that, desirable though it be to secure a surplus of milk for the cultivator himself, the first step should be the production of cows which are capable of rearing calves that will make useful draught bullocks.

In the conditions commonly found in villages, we think it unlikely that the selling of dairy produce would be more remunerative to cultivators than the types of agriculture in which they are already engaged. If profitable dairying were not a difficult business, the existing shortage of milk and milk products could not have arisen among a people desirous of using milk freely in their diet. We are of opinion, therefore, that the attempt to provide dual purpose cattle, equally suitable for draught and for milking and *ghi* production should only be made in those districts in which the prospects for successful milk production are markedly better than, on the average, they now are ; and that, even in such districts, the question whether it is expedient to develop high milk production in cows, or to resort to buffaloes should always receive careful consideration. The condition of cattle in many parts of the country is, as we have pointed out, deplorable. We are impressed with the difficulties confronting the breeder, and we are anxious that dual aims should not complicate his task.

We do not criticise the work which has so far been done. The study of the problem by provincial livestock experts has, in most cases, only been begun within the past few years ; these experts have been faced everywhere with an insistent demand for more milk production. The natural milking qualities of Indian cattle have been much neglected ; the best milking stock in the country has been lamentably abused, very little attention has been paid to their selection by stockowners, good cows have been extensively purchased for city dairies and slaughtered when their milk dried off. In such circumstances, it was right that efforts should be concentrated on increasing the production of milk ; but we do not share the view that dual purpose breeding should continue to be the sole aim of those who are endeavouring to improve the cattle of India regardless of the tract in which they are working. More milk is badly wanted in all Indian cities ; but the paramount need of India is the cultivator's bullock ; and in attempting to secure more milk from the fine types of draught cattle still to be found in many parts of India, there is a real danger that the qualities which in the past have commended them to cultivators may be lost. There is little to be gained by citing the example of other countries It can be shown that, in northern Europe, Holstein cattle, celebrated for their milk yield, provide good plough cattle ; but it can also be shown that, in southern Europe, which depends largely on oxen for draught purposes, the milk supply comes from one breed of cattle, and bullocks for the plough from another. Italy, for example, is now paying much attention to questions of milk supply. It possesses a fine type of draught cattle which are said to be of eastern origin and bear a strong resemblance to the cattle of the south-east Punjab. It does not, however, look to this breed for an improved milk supply, but to animals of a dairy cow type.

In breeding cattle, it must not be forgotten that the evolution of fair milking animals does not solve the problem of urban milk supply. Cheap milk for a dairy business depends essentially on the keeping of productive cows in localities in which suitable fodder can be grown cheaply. This combination of cheap raw material and efficient conversion of fodder into milk must always exist in successful dairying districts.

An argument placed before us in support of dual purpose animals is that the cultivator will feed a good cow if he is given one. We agree that he will try to do so if it brings him a profit; but there is no evidence that for India as a whole there would be a profit. If the cultivator is prepared to treat his good cows and their female calves well, why, it may be asked, are good dairy cattle so scarce and why was it relatively easy to secure good cows formerly in districts in which they are now difficult to purchase? That this is the case, all those witnesses best qualified to speak on the subject have informed us. We repeat, then, that, where there is a shortage of fodder, the fodder problem must be faced and solved before any widespread improvement in milk production is a practicable proposition.

We agree that there are tracts of country—northern Gujarat, the south-eastern Punjab and parts of the United Provinces, for example—where a dual purpose breed would meet local requirements, and there are irrigated areas, such as those of the western Punjab and Sind, where the abundance of fodder should enable cultivators to keep heavy milking strains successfully; but, in general, we believe that better progress will be made with livestock improvement if the needs of the ordinary cultivator and the milk seller are considered separately. Above everything else, the cultivator wants a strong and active bullock of a breed that can forage for itself and endure hardship when seasons make hardship inevitable. He also wants a cow giving enough milk to rear a good calf and a surplus for his own use, but, in the interest of his young stock, it is undesirable that the ordinary cultivator in tracts where fodder is scarce should be a milk seller. We do not wish to see the calves of improved breeds dying "a natural death from starvation" like the male buffaloes of Gujarat: and although the process would not be as speedy for the progeny of the cow as for that of the buffalo, starvation, if not death, would undoubtedly be the fate of many calves if a good market existed for fresh milk in districts in which fodder is difficult to provide. *Ghi*-making would be much less objectionable from the point of view of the calf than the sale of milk, and when there is a surplus of milk in districts breeding good cattle, it is the making of *ghi* rather than the selling of milk which should be encouraged by agricultural departments.

As a general rule to be followed in the breeding of draught cattle, we are of opinion that milking qualities should be encouraged only in so far as these are entirely consistent with the maintenance of the essential qualities which good draught cattle must possess. The improvement of cattle is a slow and difficult business and the more definite the aim, the greater are the chances of success.

198. As we have already stated, a process of selection is now applied to buffaloes in parts of the country. The milk yield is, in consequence, relatively good and the production of milk fat by buffaloes is high. The small amount of experience gained by agricultural departments seems to suggest that the buffalo is less responsive to selective methods than the cow, but as compensation for this difficulty—if indeed it is a difficulty—which faces the breeder, there is the fact that cultivators in many districts much appreciate attention to buffalo breeding. The view has been expressed that, since the buffalo is a rival of the cow, the best policy for the cattle breeder would be to concentrate effort on the improvement of ordinary cattle, inasmuch as it is wasteful to retain two species of domestic animal where one of them might supply the demand for both milk and draught. We have already stated that, in our opinion, the time is far off when the cow will supersede the buffalo. There are over 14 million she-buffaloes in British India alone. and to replace them it would be necessary to provide at least twice this number of good dual purpose cows. It is evident that, both in the economy of the ordinary village and on the holdings of those engaged in dairying, room should be found for both species There should, in our view, be no relaxation in the efforts to improve the buffalo on the lines that we have indicated above for the ordinary cattle. There is here a clear-cut issue, namely, an increase in the productiveness of the she-buffalo and the maintenance of a sound constitution ; for the buffalo is not so hardy as the cow, and the demand of the villager is for a less delicate animal than some of the heavy milking strains are reputed to be.

THE NEED FOR GREATER ATTENTION TO BUFFALO BREEDING.

199. The production of milk for urban consumers presents a different set of problems from those confronting the ordinary cultivator in the growing of his crops. These problems are complex and urgent, and, in our opinion, the demands of the cities can only be met when the representatives of consumers resolutely face the situation now existing in the retail milk trade. Regulations bearing on the supply and distribution of milk exist in many towns but the evidence we have received is that adulteration is almost universal. Moreover, supplies are insufficient and milk is very dear. We refer later to the subject of municipal control. In the meantime, we are concerned with supply, and, in this connection, would only observe that until some limit is placed on adulteration, the milk sold in cities must continue to be not only bad, but very expensive.

PRODUCTION OF MILK FOR CITIES.

Because of the character of the supply, the consumption of milk in towns is small. We have already noted that in Bombay and Calcutta it appears to be from seven to eight gallons per head per annum, and this is probably an ordinary amount for cities. The only other figures we have met with is a recent estimate of 7½ gallons for Lahore, and an estimate for Poona made by Dr. Mann in 1913. The Poona supply was then about eight gallons per head ; four-fifths of this quantity was produced within the city and practically all of it came from within a nine-mile radius. The large extent to which the supply is produced

within the city itself, or in its immediate neighbourhood, is a noteworthy feature of the urban milk trade. About four-fifths of the milk of Bombay comes from buffaloes stabled within the city. In both Calcutta and Madras, large numbers of cattle are kept, and we were informed in the United Provinces that, although milk is fairly plentiful and sells at eight *seers* to the rupee within eight miles of the towns, it is difficult to market it in cities, where the price may be twice as much, because the trade is in the hands of city *gowalas* who place obstacles in the way of village competitors.

In Calcutta, a very promising co-operative movement has recently been started, partly to improve the city milk supply and partly to enable cultivators in neighbouring villages to break the *gowalas'* ring, and thus secure a fair return for their produce. A co-operative milk union within the city, with a well equipped dairy, pasteurises and bottles milk for delivery to hospitals, baby clinics, hotels and private customers. The union has received substantial financial aid from the Calcutta Corporation. The supply comes from affiliated village societies, of which there were seventy-one in 1925-26; the membership of these societies was about 3,600, and they sent in approximately 850 gallons of milk daily between February and July, and 500 gallons between August and January. The central society employs a veterinary surgeon to attend to the cattle of members, the cowsheds are inspected, the milking is carefully attended to, and milk goes from each village to the nearest collecting depôt, of which six are maintained; thence it is railed in sterilised cans to Calcutta. The central society is run at a profit. The rural societies are doing well. In five years, their membership has gone up fifty per cent, but in this period the supplies of milk have been trebled, for the average quantity per member has risen from 0·56 to 1·15 *seers* per day. The experience of this Calcutta co-operative society shows what can be done by very small producers situated near railways and engaged in a high class trade. As a first contribution to the solution of the difficulties experienced by urban consumers, it is worthy of imitation wherever possible. Municipalities should follow the lead of the Calcutta Corporation, encourage the formation of central distributing societies, and endeavour to arrange for groups of producing societies in all localities suited for milk production and having a good rail service. Although there is nowhere else such a complete organisation as around Calcutta, co-operative societies for the supply of milk have at one time or other been organised near a number of towns, as, for example, round Benares, Bombay, Ahmedabad and Nagpur. The successful and long established society at Telinkheri, mentioned in paragraph 193 is an example of co-operation among *gowalas* as distinguished from ordinary cultivators, which might be imitated extensively in the neighbourhood of towns.

These efforts to organise small producers co-operatively, though of much value both to producers and consumers, cannot be expected to solve the problem of providing a cheap and pure supply for towns. To make milk cheap it must be handled in bulk in India as in other countries, and, unfortunately, India cannot depend on pastures as the

source of cheap city milk; since, owing to the long periods of drought occurring in this country, pastures on which cows could produce large quantities of milk do not exist. Such grazings as the country does provide are usually distant from railways, and the mere collection and transport of the small yields which cows on Indian grazing grounds are capable of producing would make city milk dear, even if it were a free gift from producers. There would, however, be no inherent difficulty in producing cheap milk from fodders grown on cultivated land; for there are many localities in which fodder crops could be grown more cheaply than in most western countries. Moreover, although distances are great, it should not be difficult to find districts suitable for fodder growing, from which the transport of milk could be arranged at rates which would not make a large addition to retail rates. Milk is now carried by passenger train at half parcels rates, or Rs. 2-8 per *maund* for 500 miles, but if a large trade existed, special rates would undoubtedly be given. The East India Railway, for example, now carries milk in cans at owner's risk 500 miles for thirteen annas and 1,000 miles for Rs. 1-7 per *maund*.

Given a tract of country in which fodder growing presented no difficulty, given also suitable arrangements for transport, the third, and most important, factor for the success of schemes which have a good city milk supply as their object is the type of cow or she-buffalo used. Fodder crops raised on tillage land cannot provide cheap milk unless the animal employed is a highly efficient converter of fodder into milk. In dairying countries, cows yielding from 8,000 to 10,000 lbs. and over per annum are selected for this purpose. In India, it should often be possible to run a profitable dairy farm on a much smaller output; but the cost of production would fall rapidly as the higher yield was approached. The owner of dairy cattle should not rest content with less than 5,000 lbs., the breeder of improved dairy cattle should therefore aim at the cow producing 8,000 lbs. of milk per annum, and not at the dual purpose animal giving 2,000 to 3,000 lbs. For, if the latter were kept in herds fed on fodders grown under irrigation on cultivated land, a profit could only be expected by supplying selected customers with a high priced article.

That, in Indian conditions, it should not be an impossible task to create herds averaging 5,000 to 6,000 lbs. of milk per head is suggested by the experience of the military dairy farms. The yield of the cows and buffaloes on these farms in 1924-25 is contrasted with the yield in 1912-13 in the figures below :—

Animals giving	Cows		Buffaloes	
	1912-13	1924-25	1912-13	1924-25
	No.	No.	No.	No.
10,000 lbs. milk and over ..	..	1	..	..
8,000 to 10,000 lbs. ..	..	34	1	..
6,000 to 8,000 lbs. ..	9	116	12	25
4,000 to 6,000 lbs. ..	84	438	117	354
2,000 to 4,000 lbs. ..	834	685	778	605
Under 2,000 lbs. ..	1,257	233	859	124
Total number of animals ..	2,184	1,507	1,767	1,108

The number of cows yielding over 5,000 lbs. has risen in the short period of twelve years from 1·3 to 20·5 per cent and the number of buffaloes from 1·6 to 10·8 per cent of the herds.

The Military Farms Department has effected this large improvement chiefly by cross-breeding and selection, although no doubt, as experience has accumulated, changes in the feeding and management of the cattle have contributed to the result. We do not, of course, suggest that an ordinary cultivator could, with the resources at his disposal, achieve such results as have been secured by the Military Farms Department, though large landholders should be able to do so. This illustration is used to show what might be done if large well-managed farms were organised for the supply of milk to cities, in the way that they have been for the supply of milk to troops.

CROSS-BREEDING AND URBAN MILK SUPPLY.

200. Any commercial dairy farms that may in future be set up for supplying milk to cities would be likely to resort to cross-breeding with the object of securing first cross heavy milking cows, and they would benefit by the very useful work being done on the military dairy farms in testing the merits, for Indian use, of different breeds of imported bulls. Meantime, we do not think it desirable that the agricultural departments should experiment in this direction. If they are under contract to deliver milk from their farms, there is no objection to their breeding first crosses for commercial purposes; but their cattle breeding endeavours should centre round the improvement of the milking qualities of indigenous breeds like the Sahiwal and Sindhi which are already noted for their milking properties, or on specially selected strains of other breeds like the Hariana. The work recently begun at Hissar suggests that, by selection for milk, it would be possible to evolve fine strains of dairy cattle from this breed. If the adulteration of milk can be effectively dealt with and the time is reached when the supply of milk to cities becomes a business in which honest men can compete with prospects of success, the existing keen demand for good cows will be intensified; and much useful work lies before livestock experts in developing the milking qualities of these valuable breeds of cattle.

MUNICIPAL CONTROL OF MILK AND GHI SUPPLIES.

201. No other branch of agriculture is more influenced by its markets than the dairy industry. In no other markets is honest dealing so difficult to secure and protect, and in none are unchecked malpractices more disastrous. It is for this reason that all countries which desire a good milk supply have given close attention to the control of the trade in milk.

Under various Municipal and Sale of Food and Drugs Acts, the larger Indian cities have powers to license and control persons who keep cattle within their boundaries for the sale of milk to the public, or who own milk shops and dairies. By-laws have been drawn up and their enforcement has been entrusted to the health departments. In reply

to communications which we addressed to the secretaries of eight large municipalities, we have received information relating to the steps now being taken to enforce these by-laws. Some figures bearing on the extent to which adulteration of milk is practised are given below, and, as regards procedure, it will suffice if we give a few general particulars respecting the methods of enforcing by-laws adopted in Bombay. This municipality has given much attention to the subject of adulteration of dairy produce and takes many more samples of milk for analysis than any other. As we have already stated, the milk supply of Bombay is poor, and there is much adulteration. Continuous efforts have been made to effect an improvement since, in 1912, the provisions of the Bombay Act No. II of 1899, dealing with the adulteration of *ghi* and some other foods, were extended to include the adulteration of milk. The whole position of the milk supply was carefully investigated by one of the Corporation's officers (the late Dr. Joshi) and the results of his analysis of the milk situation in Bombay, and of the attempts made in European and American cities to improve urban milk supply, were comprehensively dealt with in a book published in 1916. The city now maintains a staff of seventy sanitary inspectors for all purposes, under the Health Officer and five assistant health officers. The sampling of milk is carried out by twenty of the senior sanitary inspectors, assisted by seven sub-inspectors. Three veterinary surgeons are employed in the inspection of stables; in addition to horses and bullocks, these Bombay stables house about 16,000 milk buffaloes. It is recognised that there are many objections to the housing of milk buffaloes in the city and a scheme has been prepared for the erection of new stables some miles from Bombay, but it has been held up for the present because there is no statutory authority for the expenditure of municipal funds on the scheme.

The quality of the milk supply of Bombay may be judged, and that of other cities (some of which have not even taken powers to sample milk) may be inferred, from the following statement showing the number of samples analysed and the results of completed analyses in the latest year for which figures are available —

	Samples analysed	Found adulterated	Percentage found adulterated
Bombay, 1926	3575	1630	45·6
Calcutta, 1926	1003	349	34·8
Do. 1927 .. .	945	246	26·0
Patna, 1925-26	29	?	....
Lucknow, 1927	11	8	....
Allahabad, 1927	2	0	....
Madras	Nil	....	....
Nagpur	Nil	....	....

These figures do not disclose the full extent to which adulteration is practised. In order to give milk sellers the benefit of the doubt, the custom in all milk prosecution cases is to presume adulteration on a

standard representing the lowest quality milk which a healthy animal is likely to yield. The standard in respect of milk fat usual in India is for buffalo milk not less than 5 per cent, and for cow milk not less than 3·5 per cent: but the mixed milk of three or four buffaloes in the Bombay Presidency will usually contain 7·5 per cent of fat, and will rarely fall as low as 6·5, while for cows' milk the corresponding figures would be 4·7 and 4 per cent.

In estimating the extent to which the above figures represent the real percentages of adulterated produce sold, the administration of the law must also be considered. In Bombay, in 1926, the number of prosecutions instituted was 1250. In 225 cases the prosecutions were withdrawn, 136 cases were pending at the end of the year and there were 889 convictions, with an average penalty of Rs. 15. The maximum penalty was Rs. 92, the maximum allowed under the Act being Rs. 100. We are informed that fines are inflicted in proportion to the amount of water added. In similar cases in Britain, the authorities seek to check the offence of tampering with milk, and, although in gross cases, or for repeated offences, heavy penalties may be inflicted, the fine is not proportionate to the amount of water added. If the offence of adulteration is proved, even should the amount of added water be small, the penalty is usually substantial, since arithmetical attempts at making the punishment fit the crime would obviously render the prudent "toning" of milk a safe and lucrative business.

A Bombay milkman who contented himself with the addition of 15 per cent of water to buffalo milk would rarely get into trouble, and even if twice this quantity were added, and he were detected, the penalty would be small. We cannot therefore draw the conclusion from the Bombay figures that 54·4 per cent of the samples taken in 1926 were free from added water; the percentage of samples of pure milk was probably very much less; and if, in Bombay, where great efforts are being made to check adulteration, so much watering of milk exists, it is evident that, where no control is attempted, the position must be very bad.

There are other sanitary aspects of city milk supply of special importance to consumers, to which municipalities are now giving attention. We do not propose to discuss them as they bear less directly on questions affecting producers than does this subject of adulteration. We believe that the almost universal practice of watering milk has been largely responsible, not only for the wretched condition of the urban supply, but for the neglect of milk cattle. We have in India an illustration of Gresham's well-known law; here it applies to milk, not to money, but it is no less true of milk than of money that the bad drives out the good. Watered milk has been driving pure milk out of Indian cities throughout a long period, until at the present day, the price of pure milk is higher than in the large towns of Britain; and even at the price of six annas per Bombay *seer* (ten pence per quart) very small supplies are forthcoming.

The facts are well known, and the position has been deplored for years, but no remedy has been found. In the cities, the blame is laid on the

producer; he must be educated, he must be taught to provide pure milk, his cattle must be improved. We do not assert that the producer in India is perfect; in fact, we agree with most of those who know him in regarding the *gowala* as a highly imperfect specimen of the producer class; but as between the city consumer and the ordinary villager, we doubt if either has any reason to complain that the fault lies with the other; and as the village producer is unable to provide cities with a large and cheap milk supply, we have come to the conclusion that no solution of the difficulty will be found until a lead is given in efforts to establish large scale dairy farming by the representatives of the consumers, through the action of the municipalities themselves.

It is generally held that, if municipalities were to attempt to enforce their by-laws against adulteration too rigidly, there would, in the present circumstances, be a rapid rise in price which would bear hardly on the poor. While we do not think that the cost of pure milk would be affected for any considerable time, if the selling of watered milk could be suddenly checked, we agree that a temporary rise in price is possible; for the richer classes might consume milk more freely, and the new demand might force up prices against the poor. For this reason, and also because many of the consumers can only be educated gradually to appreciate the importance of pure milk, we think that, at an early stage of the campaign to eliminate the debased product which now passes as "milk," there should be an effort to provide a pure supply at a reasonable price. In the conditions now existing, a substantial increase in supply, sufficient in amount to lower prices, would call for dairy farming on a scale that would require the command of much capital and business ability; and the problem for municipalities is to devise means by which capital and business ability may be attracted to large scale milk production. We are satisfied that there must be some large organisation, such as that of which the Military Farms Department is the best example, to act as pioneers in the movement for producing cheap milk for cities. This organisation could not at first be run at a profit, and it is clear to us that the cost of promoting such enterprises should not fall on the general tax-payer, but on the city for whose benefit the work is undertaken.

The supply of milk obtained from large farms, established as the result of municipal schemes, should be used for supplementing and steadying the prices of the milk reaching the city from all other sources. In addition to adopting measures for the purpose of increasing the supply, it would probably be found necessary for municipal authorities to take a share in the distribution of milk within the city by opening municipal dairy depôts. As the city's controlled supplies increased, the task of eliminating adulteration would become easier, and it should not be impossible to secure a state of affairs in which adulteration, in place of being the rule, would become the rather uncommon exception. There is little doubt that, as in other countries, if the methods of the milk markets were reformed, and if the milk and morals of the trade were both reasonably pure, the supply of milk to cities would present an attractive field for private enterprise.

We suggest, therefore, that with the view of providing the urban population with the supplies of milk for which they ask, which the vegetarian habits of many make so necessary for health, and of which growing difficulties have deprived them, municipalities should take such action as may be required to augment and cheapen the milk supply. We further recommend that the necessary statutory authority should be conferred on them to enable them to provide cowsheds outside municipal limits, to promote or assist schemes aiming at large scale milk production, and to establish depôts for the collection, pasteurising and cooling of milk in localities in which milk in quantity is offered to them by co-operative societies, or other sellers.

The purity of *ghi*, like that of milk, is a subject affecting the interests of the producer. *Ghi*-making is not only a widespread village industry, but an important aid to successful dairy farming on a large scale. Many complaints of the adulteration of *ghi* have been made to us, and our attention has also been directed to the increasing sale of substitutes known as "vegetable *ghi*." No exception can be taken to the sale of substitutes for *ghi*, if these are properly described, and are sold under names which do not lead the public to suppose that they are *ghi*; for in all countries such substances are recognised as cheap and wholesome foods; but there are grave objections to mis-description. The position in India is now very similar to that which arose in the British butter market when margarine was first introduced. To protect the producer of butter from unfair competition, and the consumer from imposition, the sale, under the name of butter, of any article composed partly of fat from other sources than milk was prohibited; and to prevent sellers of margarine from using names which might lead customers to think that they were being served with some kind of butter, the law required that names under which manufacturers proposed to sell their margarine must be approved by the Department of Agriculture.

We are of opinion that similar action is required to protect producers of *ghi*, and we believe that, unless municipal authorities possess and exercise powers of control, the difficulty already experienced by persons desirous of purchasing pure *ghi* will increase, for the certain effect of unrestricted adulteration and substitution would be to drive the genuine product out of the market.

CO-OPERATIVE BREEDING SOCIETIES.

202. Incidental reference has already been made to co-operative breeding societies. They have been in existence for some years in the Punjab, where they have already achieved considerable success, and we were informed that their prospects were good in parts of the Bombay Presidency. In the United Provinces, they have been tried without much success and, in the Central Provinces, the only two societies formed failed after a brief existence. While the experience so far gained has not always been encouraging, we are strongly of opinion that societies of this kind should be supported. Nothing is more badly needed than co-operation by villagers to improve their cattle, and the successes have been sufficiently numerous to show that, when the societies are carefully organised, they

are capable of valuable work. Conditions which make for success naturally vary from district to district; but wherever cultivators evince a real interest in their livestock, the organising of a society should be attempted. Provided that they undertake to get rid of inferior cows, to feed the others reasonably well, and castrate the scrub bulls, such societies should be lent, or given, a good bull by the agricultural departments. Further, if as a result of the reclassification of forest land, additional grazing ground becomes available, breeding societies should be provided with grazing ground for the use of their members on terms more favourable than those offered to cultivators who do not combine to improve their cattle. There are many places in which good plants suitable for hedges exist,* so that it should be possible for societies to fence their grazing lands at little cost. This is a possibility which promoters of co-operative breeding societies should keep in view. Should the fencing of grazing land prove too heavy a task, it might still be possible, in those grazing areas in which *kadbi* or *bhusa* is unobtainable, to fence small areas for growing hay or silage.

LIVESTOCK SHOWS.

203. In Chapter VI, we have already referred to the educative effect of agricultural shows. Here we need only comment on the value of shows and fairs in connection with livestock improvement. In most countries, the feature of an agricultural show which makes the greatest appeal to the villager is the exhibition of livestock, and India is no exception. At the shows which we visited, the opportunities afforded cultivators of examining collections of good cattle were clearly appreciated. In tracts in which intensive efforts are being made to improve the indigenous breeds, local shows should be arranged, and when preparing the list of prizes open for competition, special attention should be given to classes for cows, calves and yearling cattle; for, as we have already stated, the ordinary management of such cattle is much worse than that of bullocks, and no opportunity of enforcing the need for better treatment should be missed.

EXPORT TRADE IN LIVESTOCK.

204. There exists a demand from other countries for certain breeds of Indian cattle. In at least one case, that of the Ongole breed in Madras, this demand has been so strong that, to prevent the impoverishment of the local stock, export has been prohibited in recent years. An export trade in cows and heifers should always be closely watched by Government, for it may easily attain undesirable dimensions. When the demand is for bulls for export to a distant country, it is rarely that such export can unfavourably affect the home supply. On the contrary, for every bull sold at a high price for export, it is likely that several extra animals of good quality will be bred, and remain to improve the home breed. As a rule, it is only by the occasional sale of an animal at a high price that a pedigree cattle breeder can make his business pay,

*A plant known as *thor* in northern Gujarat is there used largely in fencing fields. It is an ideal hedge plant, easy to propagate (it strikes from cuttings) and to maintain; when well grown, it forms a tall, narrow and impenetrable fence. This plant, *Euphorbia nivulia* (or its near relatives *E. nerifolia* and *E. antiquorum*), is widely distributed in India.

and it is certain that no other circumstance would more favour private enterprise in breeding in India than the existence of an export market for high class stock. We recommend, therefore, that, unless the extinction of some valuable breed seems possible, Government should not prohibit an export trade in bulls which would be of much value to the country. As a safeguard, in the case of certain breeds, exporters might be required to obtain a licence from an authority designated for the purpose.

HERD BOOKS.

205. It has been suggested to us that the institution of herd books on the lines of those maintained by cattle breeding societies in other countries would assist the improvement of Indian breeds.

All cattle breeding farms should, and no doubt do, maintain herd books, and in districts where intensive breeding operations are undertaken, efforts should be made to compile registers as complete as may be of the matings. But we fail to see that public (as distinguished from private) herd books would be of any advantage at the present stage. To be of value it is essential that the entries in a herd book should be accurate, and, in the conditions obtaining in this country where animals graze in large herds on unenclosed land, it would not be possible to guarantee the accuracy of the entries sent in by members of the public.

MILK RECORDING SOCIETIES.

206. Several witnesses have drawn attention to the very valuable results that have followed the formation of milk recording societies in other countries, and have recommended the organisation of similar societies in India.

The keeping of milk records is already the common practice on those government farms on which milking cattle are kept, and such records should be kept by all owners of herds of dairy cattle who desire to make the best use of their animals We are, however, of opinion that it would be impracticable to set up milk recording societies of the western type at present. Such societies are essentially groups of producers, who agree to have the output of each of their cows measured at stated intervals by a recorder in the employ of the society. The society certifies the output of each animal. The records are useful to owners as they learn from them which cows are most profitable ; but their more immediate purpose is to provide independent evidence of the quality of the cow, when the animal, or her progeny, is offered for sale. Care has, therefore, to be taken to ensure that the records are accurate. The cost of inspection and recording is considerable, and it is only when a large number of herds exist in a limited area that the work can be carried out economically. In Indian conditions, such milk recording societies, useful as they might be, would prove too expensive to run. A modified form of village milk recording society could, however, be introduced, and should be promoted wherever possible. Members of co-operative societies should be encouraged themselves to keep records of the yield of their cows, and societies should arrange to

maintain registers of the records made by their members, but there should be no certification of the record of any particular cow except after careful inspection and check. (There are twenty-three milk recording societies in the Punjab and some interesting information is being collected, but it is too early yet to say whether such societies will prove successful.)

THE SCRUB BULL PEST.

207. In all districts in which efforts to distribute good bulls are in progress, attention is being given to the elimination of worthless males. These inferior animals are of two kinds. The first and least numerous, but the most difficult to deal with, is the animal known as the "Brahmini bull". In former times, most of these bulls were of a good class. On certain occasions, as, for example, on the death of the head of a family, a bull was dedicated either as an act of piety or as a public service; and in some, if not in many, parts of India, the selection of the animal was carefully made by a village committee. We received evidence to the effect that, while the practice is still observed, it has now become common to dedicate the cheapest type of animal that can be secured; thus, what was in former days a gift to the community has now become a curse. Occasionally, where bulls bred on government cattle farms have been introduced, it has been found possible to have worthless 'dedicated' bulls removed to *pinjrapoles*. In a few districts, too, they have been emasculated in castration campaigns; but, in most localities, castration cannot be resorted to and they continue to be a source of hindrance to cattle improvement. (Where castration is possible, this is, undoubtedly, the readiest remedy for the evil: but where public opinion resents interference with a dedicated animal, however worthless, we think that a strong effort should be made to restore the former practice of dedicating good bulls only.) The leaders of the Hindu community could, we think, do much to improve the existing position, were they to state the facts in plain terms. The practice of dedicating inferior bulls is a modern corruption of an ancient rite, which is as unworthy of the living as it is dishonouring to the memory of the dead.

The second type of bull which presents an obstacle to cattle improvement is the young animal that, at a later stage, will be castrated and used for draught, or in some cases may be so used without castration. The time at which castration is usually carried out varies greatly in different parts of the country. We were informed that, in the Punjab and the western divisions of the United Provinces, the better plough cattle are castrated early; but, in most parts of the country, cultivators favour late castration, the reason being—as explained by a witness referring to the cultivators of the Bombay Presidency—that they think cattle castrated as calves become effeminate and lose in powers of endurance; they are also said to lose in form, as the neck does not develop in the way desired. The result is, as we have seen when analysing the statistical returns of cattle, that very large numbers of young bulls are to be found on village grazing grounds. Wherever cattle improvement is going on, efforts are now being made to reduce the numbers of these young uncastrated males, and in the Punjab alone about 218,000 castrations were effected in 1926-27.

The efforts of veterinary officers to reduce the number of useless bulls have been much assisted by the introduction, some four years ago, of an instrument which enables them to carry out the operation effectively without shedding blood. (This instrument, the invention of an Italian (Signor Burdizzo), is now being extensively used in castration campaigns, and the religious objections to castration formerly raised by Hindus are reported to be disappearing.)

It is essential, in the interests of cattle improvement, that castration should be resorted to at the earliest stage consistent with the proper development of the animal. Experiments were made in the Bombay Presidency a number of years ago, with the result that no harmful effects from early castration were observed; but in view of the strong opinions held on this subject by cultivators in many districts, we think that the subject of the relation of the animal's subsequent development to the age at which castration takes place requires closer investigation. It has been alleged that, at one period, Amrit Mahal bullocks suffered much deterioration from the widespread adoption of early castration. Similar experience has been recorded elsewhere. It may be that differences in this respect exist between breeds of cattle, or that organic or mineral deficiencies in the natural grazings of some areas prevent the proper development of cattle castrated too early in life. It is most important that those engaged in cattle improvement should not antagonise cultivators by any methods they adopt; and complaints to the effect that animals are rendered less useful by treatment, which experience acquired elsewhere might suggest as desirable, should always be carefully considered.

Subject to this reservation, we strongly support the policy of early castration, which is especially necessary on the unenclosed grazing grounds of India, if satisfactory results are to be secured from schemes for distributing good bulls. We are, however, of opinion that, in carrying on local campaigns to eliminate scrub bulls, it would be undesirable to resort, as some witnesses recommended, to compulsory measures. Not only would attempts to enforce castration be likely to stir up opposition on the part of some who would otherwise welcome measures for cattle improvement; but, in addition, there is the practical difficulty that compulsion would involve fixing a standard quality of animal which would be exempted (for a stock of bulls must be maintained) and the question whether an animal did or did not reach the required standard would, in our view, be likely to create difficulties between subordinate local officials and cultivators.

India is not the only country troubled by the scrub bull, as the following extract from Mr. Strickland's "Studies in European Co-operation" will show:—"The Swedish Government proposes to prohibit the owner of a non-approved bull from allowing it to cover any other cows than his own; the policy is supported by breeders, though it is less popular among the dairy-farmers, who will accept milk from any animal which can supply it. The Irish Free State's Commission on

Agriculture recommends that, after a short interval, all bulls not licensed by the Ministry of Agriculture be compulsorily destroyed or castrated at the owner's expense, and the possession of such a bull be made a penal offence. Northern Ireland has actually passed an Act to compel licensing, and some prosecutions have taken place; the complaints are of leniency in the matter rather than of severity."

THE CONTROL OF LIVESTOCK IMPROVEMENT.

208. In castration campaigns, and when diseases attack livestock, the work of the agriculturist is brought into intimate contact with that of the veterinary surgeon, and the question whether livestock improvement schemes are better placed under the Agricultural, or under the Civil Veterinary Department, was frequently raised in the evidence we received. In the Punjab, where cattle breeding has made most progress, it has been controlled by the Civil Veterinary Department, since the Hissar farm was taken over in 1899, and, as the large size of this farm has justified the employment there of highly capable stock breeders, very satisfactory results have been obtained. In some other provinces, the work was initiated by the Civil Veterinary Department which handed it over, at a later stage, to the Agricultural Department. The general trend of the evidence given before us was that the agricultural departments were more directly concerned with this subject than the veterinary departments, and that the control of livestock improvement schemes should rest with them; as, except in the Punjab and Bihar and Orissa, it, in fact, now does. In this general conclusion we agree. When, as has been the case at Hissar in recent years, the knowledge and instincts of the farmer and cattle breeder are combined with the professional training of the veterinary surgeon, the position is ideal and we do not advocate any change so long as these conditions remain; but, in general, the training of the agriculturist should render him better qualified to manage stock breeding farms than the training of the veterinary surgeon. Moreover, the veterinary departments in India have such onerous and responsible functions to discharge in combating disease and these involve so heavy a tax on their resources that, on departmental grounds, quite as much as on those relating to the early training of officers, we consider that the decision adopted by most provinces is a sound one. It is, however, clear that the association of the two departments must in all cases be close, and we favour the appointment of veterinary officers who display a special bent or aptitude for stock improvement to posts at livestock farms. We think it likely that graduates of Indian veterinary colleges would often prove useful recruits to the staff of such farms.

In six of the nine major provinces, a special officer has been placed in charge of livestock improvement. In view of the great importance of the work, we are of opinion that at least one whole-time officer should be employed on it in each province. Where the improvement of several distinct types of cattle is being attempted, carefully trained experts should be placed in charge of each section of the work.

209. It will have been gathered from the preceding pages that both aspects of animal husbandry—feeding and breeding—which have been discussed, offer much scope for the scientific investigator. Within the past few years, the problems of nutrition have begun to receive the attention they deserve, and both the Animal Nutrition Section of the Imperial Institute of Animal Husbandry and Dairying at Bangalore and the Coimbatore and Lyallpur agricultural colleges have made substantial contributions towards the better understanding of certain questions, as, *e.g.*, the composition and digestibility of important feeding stuffs. At Coimbatore, the very interesting work, which the Agricultural Chemist, Mr. B. Vishwanath, is carrying out in association with Lieut.-Colonel R. McCarrison on the influence of manures on the nutritive value of crops, is at its present stage more directly linked with crop production studies and with problems of human nutrition than it is with cattle feeding; but its bearing on the feeding of livestock is obvious. The work which is being done at Lyallpur owes its character to the special interest taken by the Professor of Chemistry in nutrition questions. Digestion stalls for six animals have been provided, the digestibility of important fodders is being determined by trials conducted on both cows and bullocks, and the effects of various fodders on milk production have been recorded and studied. The quality of the work done at Lyallpur depends on the special qualifications of the members of the college staff at present employed in the Chemical Section. Feeding trials would, no doubt, be conducted on the farm in any circumstances; but a change in personnel might at any time give a different orientation to the work of the Chemical Section. This is a circumstance—it can scarcely be termed a drawback—inseparable from the association of teaching and research. The head of the department must be allowed to choose those lines of work for which he has special aptitude and special qualifications; it is only by granting this liberty that effective scientific work can be associated with teaching. But it should be noted that, in spite of the changes in scientific policy thus associated with work at educational centres, by far the greater part of the world's scientific achievement may hitherto be claimed by institutions combining education with research. As we have said elsewhere, we regard it as essential that, in developing scientific work, full advantage should be taken of the special aptitudes and qualifications of the teachers in higher educational institutions.

SCIENTIFIC INVESTIGATION.

(*i*) ANIMAL NUTRITION.

The institute—or rather the nucleus of an institute—which has been established by the Government of India at Bangalore, represents another type of scientific organisation. The research institute is a modern development, rendered necessary by the specialisation of knowledge, in which the attention of a group of workers, trained in different branches of science, is concentrated on one group of problems. It is necessary to stress this elementary fact, because it appears to have been lost sight of in the provision which has been made for work on the wide subject of animal nutrition at Bangalore.

It is true that the institution at Bangalore is not termed a " Resear Institute "; it is the " Animal Nutrition Section of the Imperial Institute of Animal Husbandry and Dairying "; but the subject allotted to it is one which, in Britain (where there is a much narrower range of types both of animals and fodders), calls for the attention of two large and well equipped research institutes.

The work of the Animal Nutrition Section began at Pusa in 1921. A large herd of cattle is maintained at Pusa, and from this herd animals should readily have been obtainable for experimental purposes ; there is also an extensive area of land from which ordinary, or specially grown, fodders could easily have been obtained. In 1923, for reasons which we consider inadequate, the Nutrition Section was transferred to Bangalore. A disused dairy store-house was converted into a chemical laboratory, a cattle-shed was built for the animals used for experimental purposes and a small store-room and a preparation room were provided. The area of land which adjoins these buildings is quite insufficient and there is no adequate provision for the supply of animals of a suitable kind for experimental work. The staff consists of the Director (a physiological chemist), one senior and three junior chemical assistants, a clerk and a fieldman. The average expenditure on the Animal Nutrition Section for the three years ending March 1926 was Rs. 50,000.

The output of work by this small staff has been most satisfactory, both from the point of view of technical excellence and from that of practical value ; and we imply no disparagement of their efforts when we say that the work accomplished, since the section started, would not have been possible did there not exist, within India, many subjects from the study of which important deductions follow almost as soon as they are systematically attacked. As an indication of the kind of work that is being done at Bangalore, four subjects which have recently engaged attention may be alluded to. The powers of digestion possessed by Indian breeds of cattle have been investigated, and compared with the digestive capacity of European cattle. It has been ascertained that Indian cattle digest rather more fibre than those of western countries. The character of the diet required by growing calves has been investigated by feeding to animals, averaging about 210 lbs. in weight, rations of three types, supplying low, medium and high quantities of protein respectively. The conclusion drawn was that the total amount of organic matter digested, and the percentage of digestion, are important measures of the actual value of a ration, and that the proportion of protein in a diet may vary within wide limits without affecting the rate of growth. Very little is known about the digestibility of Indian coarse fodders, and this work has been taken up. Preliminary investigations have been made on the subject of mineral deficiency in fodders, and it has been found in a calf-feeding experiment that the addition of lime to the diet is beneficial. For particulars on the character of the work on which the Nutrition Section

is engaged, reference may be made to the evidence* of Mr. Warth, the Physiological Chemist, and a fuller description of part of the work will be found in "Bangalore Maintenance Experiments."†

It may be claimed that it is very necessary for all engaged in animal breeding in India to take account of the specific qualities which enable Indian breeds to digest and assimilate coarse fodders. Similarly, those concerned with feeding animals must take account of such matters as the composition and varying quality of concentrated and bulky feeding materials; or the digestibility of fodder plants at different stages of growth, and their specific effect on each other when used in combination. Again the protein, and total energy, maintenance requirements for both growing and adult animals, and, in the latter case, the additions made necessary by work or milk production must be ascertained; the risk of a deficiency in the supply of necessary mineral constituents must be investigated and the consequences, as in the case of potash in rice straw, of an excess of mineral substance must be examined.

These are subjects which now receive attention in those western countries which are endeavouring to make the best use of their livestock, and they require equal attention in India, overcrowded as it is with cattle, the difficulty of maintaining which in a fit condition has induced in so many of their owners an attitude of despair.

It is evident that no one institution can hope to deal successfully with so wide a range of problems and that, when the organisation which we have recommended in Chapter III comes into being, a combined attack on animal nutrition questions should be planned. In the meantime, however, we are satisfied that the staff and equipment of the Nutrition Section of the Imperial Institute of Animal Husbandry and Dairying requires enlargement. With this object in view, we recommend that Mr. Warth should be deputed to study the organisation of the research institutes recently created at Cambridge and Aberdeen. Much experience has there been gained of the essential requirements for work of the type in which the Animal Nutrition Section is engaged; and this experience should be utilised in planning further extensions in India. Until this has been done, and a scheme submitted, the question of the site of the institute cannot profitably be discussed. In selecting a permanent home for the institute, we think that an effort should be made to bring together workers on human and animal nutrition; or at least to secure sites within easy distance of each other, so that conferences between investigators may be arranged at frequent intervals.

(*ii*) Animal breeding.

210. Research into the breeding of animals, although in one sense as desirable as research into nutrition, stands in quite a different category from the point of view of organisation and administration, and we do not recommend that a research institute for the study of animal genetics should be established in India at the present time. In Europe and America, much attention has, in recent years, been given to the study of

* Evidence Volume I, Part II, pp. 49-54.

† *Memoirs of the Department of Agriculture in India*, Chemical Series, Volume II.

genetics, both in the case of plants and animals; but in the work on animals, quick breeding animals have been used in all cases, and it is only now that a research institute at Edinburgh for work on the larger domestic animals has been made possible by international co-operation. The obstacles to the creation of a special institute in this country are twofold. The first is the expenditure involved—for research on the larger animals is very expensive; the second is the difficulty of finding persons qualified by training and experience for investigations of this kind. From a purely scientific point of view, much could be said in favour of an Institute for Animal Genetics, for India provides first rate raw material for the student, and the work could be conducted at less cost on a large Indian grass farm than in western countries; moreover, it is certain that results of much scientific interest would emerge. But we are quite unable to predict how long it would take to produce results of sufficient value to the cultivator to justify the expenditure involved in the establishment of a genetics institute. We can only point out that, in the parallel case of plants, in the breeding of which general experience greatly exceeds that in the breeding of animals, and where—a most important consideration—the breeder directing the work can, within five or ten years, acquire a large amount of personal experience, results of value to the cultivator may be predicted after some seven to ten generations have been raised. If it were assumed that the knowledge of the laws governing the inheritance of characters in animals were equal to that of the laws governing the inheritance of characters in such plants as wheat, and that the personal experience of the breeder were as great, that is, that he had been breeding cattle for from fifteen to thirty years; if it were further assumed that the breeder of cattle could discard unsuitable individuals as easily as the breeder of wheat—clearly an impossible assumption—then a positive result, in the case of cattle, might be predicted in from twenty to thirty years. A fallacy in this argument, on which those who adopt a contrary view from that which we have put forward may lay stress, is that it assumes improvement to be equally difficult in wheat and cattle. It may be the case—indeed on *a priori* grounds there are reasons for supposing it is the case—that cattle would respond more rapidly than wheat, but this remains to be proved.

It is this last consideration—and also the expectation that, a generation hence, experience in animal breeding will be very different from what it now is—that leads us to recommend the policy we set out below as the most suitable in present circumstances.

We are of opinion that much valuable work might be done in cattle breeding even without the establishment of an institute for research. What is now required is close observation of the results of the matings made for ordinary cattle breeding purposes, whether in the breeding of pedigree bulls at cattle farms or the breeding of useful cows at military dairy farms. Observers should be encouraged to communicate their notes to the Cattle Bureau, and points of interest should be discussed at periodical conférences of those engaged in cattle breeding. When

breeders of experience have formed definite views as to the probable results of particular matings, the question of making special grants in order that their views may be tested, should be considered by the Council of Agricultural Research.

We recognise that, from the point of view of the student of genetics this line of work may be regarded as unsystematic and unsatisfactory ; it would certainly lead to the recording of many observations which the cattle breeder engaged at a research institute could not make use of ; but, at this stage, we do not consider singleness of design or outlook necessary, or, indeed, desirable. Our object is to encourage a form of preliminary work which is essential to further progress. Before scientific methods can usefully be employed at some central station in India, it is necessary to encourage accurate observation on cattle breeding subjects, and for work of this character many opportunities already exist. An increase in the information and experience of breeders must precede the improvement of breeds.

In the preliminary work which we have in view, we think that officers of the Military Farms Department should be expected to take an important part. This department now controls some thirty dairy farms. We were, unfortunately, only able to visit two of them. We were much impressed both by the excellence of cattle management on these farms, and by the opportunities which the possession of large herds gives for advancing knowledge of cattle breeding. It may be argued that the function of such farms is cheap milk production, and that the funds at the disposal of the department ought not to be used in making experiments. While we agree that the economical production of milk is their objective, we are of opinion that a certain amount of experimental mating should not be ruled out of their programmes. For it is obvious that, in order to cheapen milk production, the quality of the herds must be raised ; and no pioneer cattle breeder has ever succeeded in effecting marked improvement in his livestock without resorting to experiment. The whole history of livestock improvement in Britain is a chronicle of the experiments of eminent breeders ; and many of the experiments conducted with a far-sighted expectation of profit have been abundantly rewarded. It would, in our view, be most regrettable if opportunities which these large herds give for advancing Indian experience in cattle breeding were neglected. Any additional expenditure which the making of experiments might involve would, in our opinion, form a proper charge on the fund which we recommend for the promotion of research.

We are strengthened in our opinion that experimental work on the military dairy farms would be advantageous by the history of the herds maintained by the department. It may be claimed that the excellent results we have referred to in paragraph 199 have been largely due to the information gained through experimental mating. The value of the half-bred has been proved by definite experiment ; as has also the poor quality of the Ayrshire three-quarters and seven-eighths-bred animal. Holstein-Friesian bulls have recently been tried, and the results with half-breds have been very satisfactory ;

but there are also indications that the three-quarters-bred Friesian is likely to stand the climate much better than the three-quarters-bred Ayrshire; if these early indications are correct, and a three-quarters-bred cow proved suitable for the dairy farms, an important economy would be effected. It is believed that hardiness in the offspring of the Holstein-Friesian cattle is correlated with skin-colour and thickness of hair. But skin-colour and thickness of hair vary in individual specimens; and if experimental work were to be ruled out of the programmes of the military dairy farms, it is not clear to us how those in charge are to determine the precise characters required in bulls suitable for their herds.

THE IMPERIAL INSTITUTE OF ANIMAL HUSBANDRY AND DAIRYING, BANGALORE

211. The work being done in the Animal Nutrition Section of the Bangalore Institute has already been described; that of the Dairying Section of the Institute will now be discussed. An Imperial Dairy Expert was appointed in 1920, and, in 1923, three military dairy farms, situated respectively at Karnal in the Punjab, and at Bangalore and Wellington in the Nilgiris, were transferred to his charge in order that experimental work might be carried on. The central institution was located on a farm of about 100 acres at Bangalore. A herd of cross-bred cattle, which had been taken over with the farm, was retained, and to this a herd of pure Sindhi cattle was added. Accommodation for teaching and also dairy machinery and appliances were provided, the assistance of the staff of the Animal Nutrition Section was secured and courses of study suitable for training dairy managers, and also courses for the employees on military dairy farms, were offered.

The main course of study, that for dairy managers, lasts for two years and leads to the "Indian Diploma in Dairying". Applicants for admission must be seventeen years of age or over, and as a rule must have matriculated in an Indian university, or have passed the school final examination; but, in certain cases, this requirement may be waived. The institute at Bangalore can accommodate about twenty pupils, and so far there have been from three to four times as many applications for admission as can be accepted. In announcing the arrangements for this course, the Government of India expressed the hope that, sooner or later, agricultural colleges in India would possess the necessary staff and equipment to train candidates for the diploma; but meantime, we understand that the only other institution offering a similar training is the Allahabad Agricultural Institute, which commands a missionary staff of well-qualified American graduates.

The dairy farm at Wellington is run as an annexe to the central farm at Bangalore. The stock maintained on it consists chiefly of cross-bred dairy cows sired by European bulls, but a few pure-bred Ayrshires are kept. Although the farm has been transferred to the Agricultural Department, it still functions as a military dairy and provides milk and butter for the troops stationed in the vicinity.

The farm at Karnal extends to about 2,150 acres, of which some 1,400 are irrigated from the Western Jumna Canal. Pure-bred herds of Thar-Parkar and of Hariana cattle are maintained. Students from Bangalore spend part of their course here studying dairy farm management.

A fourth institution which is at present also in charge of the Imperial Dairy Expert is the creamery at Anand in Gujarat. This creamery, which is situated in the chief milk producing district of India, was started by the Military Farms Department during the war in order to manufacture butter for troops. As it was no longer required for military purposes, it was transferred to the charge of the Imperial Dairy Expert and is used for instructional purposes. Students from Bangalore are trained in methods of cream separation, and in the manufacture of butter and *ghi* on a large scale. It is proposed that investigations into the manufacture of *ghi*, butter, condensed milk and dried milk should be conducted at Anand and experiments in condensing milk have already been begun.

Although the three institutions, at Bangalore, Karnal and Anand, are situated in widely separated parts of the country, the two-year course of study for the diploma in dairying includes a period of training at all of them. It is claimed that the experience gained in different parts of India compensates for the inconvenience and expense involved by this procedure.

It will thus be seen that the three lines of work mapped out for the Dairying Section of the Imperial Institute at Bangalore are the instruction of students in dairying, which is not at present adequately provided for elsewhere ; the breeding of cattle on lines parallel to those on which work is proceeding on the provincial cattle farms, and research into manufacturing processes of important milk products. The work of the farms has been economically and efficiently carried out. On the two farms used for instructional purposes, a capital outlay of about Rs. 2,76,000 has been incurred since they were handed over by the Military Department, and in the two years, 1924-26, the receipts have exceeded the disbursements by Rs. 27,000. The course of study provided has been approved by the Board of Agriculture, and that it is appreciated by students is shown by the applications for admission. Investigations into manufacturing processes have only recently been initiated, and we are, therefore, not in a position to comment on results.

We have carefully considered the question whether the existing form of organisation of the Dairying Section of the Bangalore Institute should be regarded as permanent, or whether it should merely be looked upon as a necessary provision during a transition stage in development. The second of these views is that which we would support.

We recognise that there were special reasons for the appointment of an Imperial Dairy Expert in 1920. The need for arousing interest in dairying questions and for providing guidance for provincial agricultural departments in extending their work was great, and an expert who had had long experience in cattle breeding and dairying in Indian conditions was available. It would have been most unfortunate if advantage had not been taken of the opportunity then presented for utilising the special

knowledge and experience of this officer. We are, however, of opinion that it will be difficult to find a successor in the appointment who has similar qualifications for carrying on the work.

But it is on the character of the work itself, rather than on personal qualifications, specially important as they are in this instance, that our conclusion is mainly based. The position of cattle breeding work has undergone a complete change since 1920. Most provinces have now their own livestock experts and their own cattle breeding farms, and it seems natural and proper that the ordinary work of cattle breeding should be undertaken by the provinces. Such research work of an all-India character as is necessary would, in our view, be conducted more profitably at Pusa or some other scientific centre, where chemical assistance is readily available, than at the Anand creamery.

The problem of instruction in dairying is a more difficult one. In the immediate future, it might prove inconvenient to arrange adequate courses elsewhere; but there ought not to be any insuperable difficulty in establishing a thoroughly efficient dairy school as an integral part of one or more agricultural colleges. In view of the present position of the dairy industry and the great scope for improvement, it is abundantly clear that the curriculum of all agricultural colleges should include instruction in cattle breeding, the feeding of dairy cows, and the handling of milk. So far as the Indian dairy is concerned, the subject of most importance is clean milk production; this and the making of good butter and *ghi* are subjects which all agricultural colleges should be expected to teach.

There would appear to be a demand for young men trained in these branches of agriculture. Of thirty-two Bangalore students who have completed the diploma course, six are now employed in their own or their fathers' dairy business, and eighteen others, whose occupations we have been able to trace, are employed in dairy management, or in connection with milking herds. There is much need in all provinces for further extension of dairy farming; and there would seem to be good prospects for young men of enterprise and education, catering for those sections of the public who are prepared to pay good prices for pure dairy produce. We are of opinion that special attention should be given to students of this class by agricultural colleges.

We do not recommend any change in the existing organisation during the tenure of office of the present Imperial Dairy Expert, but, before he retires from service, arrangements should be made to give effect to the changes we recommend above.

The farms belonging to the department, including the Anand creamery, should be retained until the arrangements which we have suggested have been made at Pusa for carrying on research work into the manufacture of important milk products, and a scheme for an enlarged Animal Nutrition Institute has been approved. We have expressed the view that much preliminary work is called for before it would be advisable to create an Institute for Animal Genetics. Some of this preliminary

work will, we hope, be carried out on the dairy farms of the Military Farms Department, and by others who have large herds at their disposal. In such work, the central Government should also take part. The area available at Pusa is likely to prove insufficient for the work of this kind that will be desirable. We recommend, therefore, that in reorganising establishments, the Karnal farm should be retained as a sub-station to Pusa and a centre at which experiments in cattle breeding, outside the scope of provincial cattle breeding farms, may be conducted. It would be possible to test there any theory of mating which, in the view of livestock experts, was deserving of experimental study. The other farms, if not required for similar purposes, will revert to the Military Department.

If effect is given to the changes which we recommend, there is one important matter which will still require consideration. It is the agency by which close contact may be maintained between all those engaged in the improvement of animal husbandry.

Through his enthusiasm for the subject of cattle improvement, the Imperial Dairy Expert, and others who share his interest, have been, successful in establishing a Cattle Bureau with headquarters at Bangalore. Mr. Smith himself acts as secretary. The chief objects of the Bureau are the collection and dissemination of information on subjects of interest to cattle breeders, especially to the livestock experts employed by the provinces and Indian States. We recommend that this Bureau should be taken over by the Council of Agricultural Research.

Cattle breeding has figured prominently among the subjects discussed by the Board of Agriculture at almost all the meetings held since 1905 and cattle conferences were held in conjunction with the meetings of the Board held in 1924 and 1925. The Board of Agriculture of 1924 recommended that such conferences should meet annually. There are many subjects relating to the experience gained in managing cattle farms, and the distribution of bulls, which can profitably be discussed at conferences. It is very desirable that livestock improvement schemes, which have only recently been introduced into India, should be reviewed at frequent intervals in the light of the experience gained by the officers working them. The precise interval that should elapse between conferences can only be determined by those responsible for preparing the agenda ; but, in our view, an interval of two years would probably be suitable. This would allow the results of any experimental matings which had been carried out in pursuance of recommendations made by any one conference to be discussed at the next meeting. In the interval between the conferences, work should be carried on through regional committees which could be convened as and when required.

CO-ORDINATION OF WORK BY THE CENTRAL GOVERNMENT.

212. The great importance to India of the subjects discussed in this chapter, and of the cognate questions referred to in our chapters on Forests and on Diseases of Livestock and their Control appears to us to demand from Government much more attention to the welfare of livestock than is now being given to it. Energetic

attempts to improve livestock have been made by individual officers in recent years; but such attempts are not new and, for at least a century, isolated efforts in the same direction have been made in different parts of the country. The history of these efforts has always been the same, optimism, marked successes, difficulties, oblivion. They have left no lasting impression behind them and the experience gained has been forgotten. Here and there only, among the herds and flocks of India, traces may be seen, or traditions may remain, of the efforts which were at one time made to improve them. We have shown that within the past few years a very marked improvement has been effected in the organisation of work on the improvement of livestock and a number of outstanding achievements have been cited. But even such achievements as the output of young bulls from Hissar, and the effects produced by concentrating these animals in the district of Gurgaon, do little more than illustrate how little has been done and how much remains to be accomplished. The number of bulls (551 in 1926-27) issued from Hissar and other sources by the Civil Veterinary Department of the province has only to be compared with the 10,000 annually required in the Punjab, and the size of the Gurgaon district with the total area of the province, to show how true this statement is of a province in which the work of livestock improvement has made much more progress than it has anywhere else in India. And when we turn from reviewing what is being done and what has been accomplished to the consideration of what remains to be done, we would again emphasise the difficulty of effecting improvements. Those attempting this work in Indian conditions are indeed confronted by a gigantic task. It is scarcely possible to convey any indication of the magnitude of that task to those who know only Indian conditions or British stock farming; but, by drawing on the experience of both countries, a glimmering, at least, of what remains to be done in India may be obtained. In Britain, unlike India, natural conditions assist the livestock industry. The climate is particularly favourable. There is, moreover, much experience to draw upon. It may be said without exaggeration that in not a few British districts, smaller than an Indian tahsil, there are to be found many more skilled stock breeders than can be found in the whole of India. Yet with these natural advantages, with much technical skill available, and with two centuries of experience to guide the stock breeder of to-day, the standard of quality desirable in all British cattle has not yet been reached. There are still many indifferent animals in that country, and the British Government have recently expended considerable sums in an endeavour to effect improvement.

These considerations, the great difficulties confronting livestock improvement in India, the large amount of experience that has to be gained by stock breeders before general improvement can be effected, the great proportion of the cultivator's wealth which is represented by his livestock, and the handicap imposed on success in crop production by the poorness of his cattle, have led us to the conclusion that no effort should be spared to make the fullest use of the few livestock experts employed by, and of the small volume of experience which is being accumulated in,

Indian provinces. It is this aspect of provincial work—the utilisation for the benefit of all India of the knowledge in process of acquirement in each province—that should engage the close attention of the Government of India.

In Chapter III, we have proposed the establishment of a Council of Agricultural Research. We have there recommended that one of the whole-time members of this Council should represent the interests of animal husbandry. As personal qualifications must be taken into account, we do not desire to lay down any conditions that might limit the selection of the officer to be appointed to one branch of the subject. It is obvious that, unless an officer had secured a leading position as an authority on questions of livestock breeding, animal nutrition or veterinary medicine, he would be unsuitable for appointment as a representative of animal husbandry. It is further evident that no one officer would be equally competent to represent all three branches of the subject, and that, as their representative, it would be his duty to take counsel with officers familiar with other branches.

In practice, duties relating to the co-ordination of work on animal husbandry should fall to this whole-time member of the Council. What we have in view is that when some matter, such, for example, as a co-ordinated plan for dealing with a particular animal disease, required attention, a special committee of experts would be constituted with this officer as chairman. Thus a definite link would be established between the central body and any *ad hoc* committees which Government might find it necessary to appoint for dealing with questions relating to animal husbandry that might demand special attention. That such a link should exist we believe to be of the greatest importance.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

213. The conclusions and recommendations in this chapter may be summarised as follows :—

(1) In the matter of sheep breeding, the main energies of livestock experts should be concentrated on a study of the best Indian types and the building up, by selection, of a ewe flock with definite characteristics before any modification of characteristics by crossing is decided on (paragraph 158).

(2) The same policy should be pursued in goat breeding (paragraph 159).

(3) While the total number of ordinary cattle vary to a surprising extent in the different provinces, the relative proportion of bullocks, cows and " other cattle " varies very much less than might be expected, having regard to the wide differences in the physical features of India and the numbers of the cattle. This points to a general similarity throughout India in the methods of management by owners of cattle (paragraph 164).

(4) In the closely settled districts of India, the total number of ordinary cattle would appear to be primarily determined by the number of animals needed for work on the land (paragraph 165).

(5) A comparison between the province of Gharbieh in Egypt and the district of Lyallpur in the Punjab brings out the extent to which it might be possible to reduce the number of working bullocks of India without necessarily reducing the existing standard of cultivation (paragraph 167).

(6) The cattle census figures suggest the existence of a vicious circle. The number of cattle within a district depends upon, and is regulated by, the demand for bullocks. The worse the conditions for rearing efficient cattle, the more cattle the cultivator tends to breed in the attempt to secure useful bullocks (paragraph 168).

(7) The prosperity of Indian agriculture is closely linked with the improvement of livestock (paragraph 168).

(8) Four cardinal points in a policy of improvement must be :

(*a*) attention to all matters that would tend to decrease the number of bullocks required for cultivation;

(*b*) an effort to secure better treatment for dry cows and cows in-calf (paragraphs 170 and 173);

(*c*) a reduction in the number of plough cattle ; and,

(*d*) an increase in the efficiency of plough cattle.

(9) In nearly every part of India, the common grazing lands and all grass lands close to villages are hopelessly overstocked (paragraph 176).

(10) Nevertheless, where their treatment is good, many fine cattle belonging to a number of well recognised breeds are to be found (paragraph 177).

(11) In India, the custom that an animal, if not working, should find its own food in the jungle, when there is no fodder available on the holding, makes the cultivator unwilling to make any unusual sacrifice for the well-being of his cattle (paragraph 178).

(12) This attitude of mind can only be combated by education and by leadership (paragraph 178).

(13) No large additions to existing grazing areas are possible and efforts should, therefore, be concentrated on increasing the productivity of the land already growing grass (paragraph 181).

(14) The scope for such efforts is very great. The productivity of the existing grazing grounds could be increased in the following ways :

(*a*) grazing on the common land could be regulated and rotational grazing established with the consent of the majority of those possessing grazing rights and by means of authority conferred on a group of villagers, for instance on a *panchayat* or co-operative society ;

(*b*) in some instances, a definite area of the common land could be separated off for a village co-operative cattle improvement society;

(*c*) in hilly districts, where the grazing facilities are better than they are elsewhere, an attempt should be made to demarcate areas to be assigned at nominal rates to groups of occupiers of village lands on the following conditions :—

(*i*) the area shall be grazed in rotation ;

(*ii*) cattle not owned by the group shall be excluded ;

(*iii*) part of the area shall be reserved for cutting grass for use in the hot season (paragraphs 182 and 183).

(15) In all schemes for improving cattle, special consideration should be shown to professional graziers. This should take the form of allotting them new grazing areas from disafforested reserves, or from waste land not classed as free grazing areas (paragraph 183).

(16) The water supply of natural grazing lands should be investigated (paragraph 183).

(17) The importance of cutting and storing dry grass in default of hay, and of making hay wherever conditions admit, should be impressed on the cultivator (paragraph 184).

(18) The possibilities of silage are great. There are, however, practical difficulties in persuading the cultivator to adopt it. The immediate policy should be to concentrate on efforts to get the cultivator to make silage for his cows and young stock, from recognised fodders and inferior grasses which experiments have proved suitable (paragraph 185).

(19) Propaganda to promote the making of silage should only be conducted by those who have practical experience (paragraph 185).

(20) The use of the chaffcutter has spread rapidly in some parts of the country and, wherever *kadbi* is the main fodder, attempts should be made to extend its use as it economises fodder (paragraph 186).

(21) The agricultural departments should investigate the correct period at which to harvest cereals so as to get the maximum value from the straw as well as the grain (paragraph 186).

(22) Measures for increasing the palatability of the straw of cereals by the addition of cheap meal, condiments, etc., should also be investigated (paragraph 186).

(23) Even when all possible use has been made of existing sources of supply, a shortage of fodder is likely to arise in many parts of India. The cultivation of fodder crops on the cultivator's holding is the only remedy for this (paragraph 187).

(24) If the seed of Egyptian clover (*berseem*) can be produced cheaply and on a commercial scale in India, this crop has great possibilities (paragraph 187).

(25) The cultivation of leguminous fodder crops should be encouraged by the remission of the charge for water from government sources of irrigation or by the grant of concession rates. The grant of such concessions should be conditional on its being accompanied by active propaganda. All areas in which concession is given should be kept under regular examination (paragraph 187).

(26) The task of the livestock breeder has been, and still is, to establish pure and improved types of good cattle. This task, in Indian conditions, is often a most difficult one even when a single purpose is in view, and should not be endangered by the quest for dual purpose breeds, that is, for breeds suited for both draught and milking and *ghi* production (paragraph 188).

(27) Very little progress has yet been made by government cattle farms towards meeting the total requirements for young bulls (paragraph 189).

(28) In India, the costly but essential work of building up herds of pedigree cattle must fall on the tax-payer (paragraph 189).

(29) Caution is required in improving the milking qualities of draught breeds of cattle, lest other qualities which give special value to the breed are sacrificed (paragraph 190).

(30) The grant of land on favourable terms is not recommended as a method of encouraging cattle breeding (paragraph 190).

(31) The policy pursued in the United Provinces of limiting the issue of breeding bulls to selected districts and of regularly inspecting the stock in all districts, to which bulls are supplied is commended for adoption in other provinces (paragraph 191).

(32) The recommendation of the Bombay Cattle Committee of 1923 that intensive breeding operations should be conducted in selected areas is endorsed (paragraph 192).

(33) The obstacles to improvement in the Central Provinces as a whole are much more formidable than in the case of the Punjab, the United Provinces and Bombay. The cattle of Berar are, however, relatively good and the policy recommended for the Central Provinces is that of breeding types of draught cattle likely to be appreciated in Berar and of establishing controlled areas in which the improved strains of stock from pedigree bulls issued from cattle farms can be multiplied for distribution (paragraph 193).

(34) No substantial results can be expected from the policy of distributing selected bulls to district boards generally which has been suggested in Madras. Such bulls should be used to raise the quality of stock in selected areas and the improved cattle of those areas should be placed at the disposal of district boards, co-operative societies and other suitable agencies (paragraph 194).

(35) The State of Mysore and some of the States of Central India confer substantial benefits on the cultivators of adjacent administrations by exporting good cattle (paragraph 195).

(36) There is a large unsatisfied demand for *ghi* and, in all cities, a demand for fresh milk of better quality at lower prices; there is also a relatively small unsatisfied demand for butter (paragraph 196).

(37) The attempt to provide dual purpose cattle, equally suitable for draught and for milking and *ghi* production should only be made in those districts in which the prospects for successful milk production are markedly better than, on the average, they now are. Even in such districts, the question whether it is expedient to develop high milk production in cows or to resort to buffaloes should always receive careful consideration (paragraph 197).

(38) As a general rule to be followed in the breeding of draught cattle, milking qualities should be encouraged only in so far as these are entirely consistent with the maintenance of the essential qualities which such cattle must possess (paragraph 197).

(39) There is room for the buffalo as well as the cow as a dairy animal. The aims of the breeder of buffaloes should be an increase in the productiveness of the she-buffalo and the maintenance of a sound constitution (paragraph 198).

(40) The essentials for a successful scheme of urban milk supply are a tract of country in which fodder growing presents no difficulty, adequate arrangements for transport and a suitable type of cow or she-buffalo. The cow for this purpose should give an average of not less than 5,000 lbs. of milk per annum and the breeder of dairy cattle should aim at a cow producing 8,000 lbs. of milk annually (paragraph 199).

(41) The livestock experts of the agricultural departments should not experiment with cross-breeding for the urban milk supply, but can do useful work in improving indigenous dairy breeds (paragraph 200).

(42) The supply of milk to urban consumers is most unsatisfactory. Lines on which action should be taken to augment and cheapen the urban milk supply are suggested. The necessary statutory authority should be conferred on municipal authorities to enable them to provide cowsheds outside municipal limits, to promote or assist schemes aiming at large scale milk production and to establish depôts for the collection, pasteurising and cooling of milk (paragraph 201).

(43) Action on lines similar to those adopted in regard to butter in Great Britain is required to protect producers of *ghi* (paragraph 201).

(44) Where cultivators evince a real interest in their livestock, the organisation of co-operative breeding societies should be encouraged by the loan or gift of a good bull, and by the provision of grazing ground, if available, on favourable terms (paragraph 202).

(45) Livestock shows and fairs have a valuable educative effect. In tracts where intensive breeding operations are being undertaken, local shows should, therefore, be encouraged and special attention given to the classes for cows, calves and yearling cattle (paragraph 203).

(46) The export of cows and heifers is usually undesirable and should be closely watched by Government. Unless the extinction of some valuable breed is threatened, the export of breeding bulls should not be prohibited. In the case of certain breeds, export might be subject to license (paragraph 204).

(47) The general institution of herd books, on the lines of those maintained by cattle breeding societies in other countries, would serve no useful purpose at the present time (paragraph 205).

(48) Similarly, the time has not yet come for the formation of milk recording societies of the western type, but owners of dairy herds who desire to make the best use of their cattle, and members of co-operative cattle breeding societies should be encouraged to keep records. These societies might keep a register of the records made by their members (paragraph 206).

(49) Animals not required for breeding should be castrated as early as possible where public sentiment allows, but care should be taken to ascertain the exact age at which castration can be carried out without interfering with the animal's subsequent development (paragraph 207).

(50) As a general rule, the control of livestock improvement should be entrusted to the agricultural departments. The position in the Punjab, where the Veterinary Department controls these operations, is

exceptional, owing to the personal qualifications of the officers who have had charge of the Hissar farm. Where veterinary officers show a special aptitude for work on livestock improvement, they should be posted to livestock farms (paragraph 208).

(51) Whole-time officers in charge of livestock improvement should be appointed in all major provinces (paragraph 208).

(52) The staff and equipment of the Animal Nutrition Section of the Imperial Institute of Animal Husbandry and Dairying at Bangalore should be enlarged. A scheme for a Research Institute for the investigation of animal nutrition problems should be prepared (paragraph 209).

(53) There should be close contact between the staff of this institute and workers on the subject of human nutrition (paragraph 209).

(54) The establishment of a research institute for the study of animal genetics is not recommended for the present (paragraph 210).

(55) Much useful observational work can be done in present conditions and in this work officers of the Military Farms Department should take an important part (paragraph 210).

(56) The Dairying Section of the Imperial Institute of Animal Husbandry and Dairying should be regarded as a necessary provision during a transition stage in the work of cattle improvement (paragraph 211).

(57) It is now unnecessary that the central Government should retain cattle breeding farms of the ordinary kind such as those at Bangalore, Wellington and Karnal but the last named at least should be retained for experiments in cattle breeding of a kind outside the scope of provincial cattle farms (paragraph 211).

(58) Such dairy research work as is necessary can be undertaken at Pusa or other scientific centre where chemical assistance would be readily available (paragraph 211).

(59) No change in the existing organisation is, however, recommended during the tenure of office of the present Imperial Dairy Expert but, before he retires, arrangements should be made for the research work into the manufacture of important dairy products to be conducted at Pusa and for the establishment of thoroughly efficient dairy schools at the agricultural colleges (paragraph 211).

(60) The three farms and the Anand creamery should be retained until an enlarged Animal Nutrition Institute has been established and the suggested changes at Pusa have been made (paragraph 211).

(61) The work of the Cattle Bureau should be taken over by the Council of Agricultural Research (paragraph 211).

(62) Cattle conferences, on the lines of those held in conjunction with the meetings of the Board of Agriculture in 1924 and 1925, should be held at intervals of about two years (paragraph 211).

(63) The great importance to India of cattle improvement and the magnitude of the problem make it desirable that the central Government

should pay much more attention in the future to this subject (paragraph 212).

(64) To this end one of the whole-time members of the proposed Imperial Council of Agricultural Research should represent the interests of animal husbandry. This representative should be an authority either on livestock breeding, animal nutrition or veterinary medicine (paragraph 212).

(65) As the representative of animal husbandry on the Council of Agricultural Research cannot be expected to be equally competent in all these three branches, arrangements should be made for *ad hoc* committees of experts under his chairmanship to deal with special questions (paragraph 212).

CHAPTER VIII

FORESTS

SCOPE OF THE CHAPTER.

214. We have limited our enquiries regarding the forest lands of British India to an examination of the uses at present made of such of them as are under the management of the Forest Department for agricultural purposes in providing fodder for livestock, fuel and timber for the rural population, and protection for soils liable to erosion There appear to be directions in which these uses might be considerably extended. Before stating the views we have reached on the subject, it will be convenient to give a brief account of the extent and distribution of these lands and of the declared policy of Government in regard to their use for agricultural purposes.

STATISTICS

215. As the Table we give below shows, rather more than twenty per cent of the area of British India is classified as land notified under the Indian Forest Act and administered by the Forest Department. This percentage would be slightly increased if forest areas in charge of other departments, and the few privately owned forests, were included.

In a circular issued by the Government of India in 1894,* the forests of India were broadly classed under four heads; forests the preservation of which is essential on climatic or physical grounds; forests which afford a supply of valuable timbers for commercial purposes; minor forests which include tracts which, though true forests, produce only the inferior sorts of timber or the smaller growths of the better sorts; and pastures and grazing ground proper which are usually forests only in name. If the forest area under the management of the Forest Department were all wooded and evenly distributed over the country, it would be sufficient to supply all the needs of the agricultural community, if those needs may be measured by the proportion between forests and cultivation usually held to be desirable in other countries. Unfortunately, much of the area consists of waste ground, often entirely devoid of trees, sometimes indeed of vegetation of any kind. Further, the distribution of the forest area as between province and province is markedly irregular, as the following Table will show :—

Forest lands notified under the Indian Forest Act and administered by the Forest Department in 1925-26

Province	Area of province	Area of forest lands				Percentage of col. 6 to col. 2
		Reserved	Protected	Unclassed	Total	
1	2	3	4	5	6	7
	sq. miles	sq. miles	sq. miles	sq. miles	sq. miles	
Assam	51,825	5,957	....	14,814	20,771	40·0
Bengal	76,755	5,278	1,806	3,445	10,529	13·7
Bihar and Orissa	82,939	1,785	994	1	2,780	3·3

* Circular No. 22-F, dated 19th October 1894 (*vide* Appendix V).

Province	Area of province	Area of forest lands				Percentage of col 6 to col 2
		Reserved	Protected	Unclassed	Total	
1	2	3	4	5	6	7
	sq miles	sq miles	sq miles	sq. miles	sq miles	
Bombay ..	123,125	11,718	574		12,292	10·0
Burma	243,207	28,372	.	95,374	123,746	67·7
Central Provinces	99,027	19,677	.	..	19,677	19·6
Madras	143,290	19,012	.	328	19,340	13·5
North-West Frontier Province	13,099	236	. .	9	245	1·8
Punjab	97,281	1,652	4,572	671	6,695	6·8
United Provinces	106,720	5,185	4	39	5,228	4·8
Minor Administrations	61,720	1,026	. ..	2,611	3,637	5·9
Total .	1,090,888	99,898	7,750	117,292	224,940*	20·4

The classification of the notified forest area into "Reserved," "Protected" and "Unclassed" needs a few words of explanation. The distinction between "Reserved" and "Protected" forests is that, in the former, there are few or no rights of user and therefore it is possible to prohibit the exercise of all such rights except those specially defined. In "Protected" forests, there are established and acknowledged rights of user, and the exercise of these is permitted, subject to such restrictions as it may be found necessary to impose in the interests of the right-holders and of future generations. The essential distinction between the two classes of forests was happily summarised by the Government of India in the circular referred to above; "speaking broadly, in a reserved forest everything is an offence that is not permitted, while, in a protected forest, nothing is an offence that is not prohibited." Cultivators and breeders of cattle are admitted to reserved forests but, in the interests of timber production, which is their main object, it is necessary to define rigidly what the cultivator and breeder may do and they are, therefore, administered under the stringent provisions of Chapter II of the Indian Forest Act of 1927. Protected forests are unimportant except in the Punjab. In practice, they are, for the most part, forests in which, for one reason or another, it has been considered impolitic to restrict rights too rigidly. They are administered under the provisions of Chapter IV of the Indian Forest Act. The area of unclassed forests is large in Burma, Assam and Bengal. These forests are for the most part situated in inaccessible and undeveloped hill tracts, and the only measure of control which is exercised over them is the prohibition of the felling of certain reserved trees. They possess very great potentialities, but their exploitation has hitherto to a great extent proved an insoluble problem.

PROTECTION OF THE FORESTS.

216. In the north and east of India, especially, the agricultural population is in a very much worse position, in respect of the benefits the forests confer on it, than the percentage figures would indicate. All over India, the forests proper are at a distance from centres of close cultivation. In the Punjab, the United Provinces and Bengal, the forests clothe the

*The difference between this figure and that (135,880 square miles) given in the "Agricultural Statistics of India" is mainly due to the fact that the statistics given in the latter do not include the 95,374 square miles of unclassed forest in Burma.

foothills and lower slopes of the Himalayas and are almost entirely out of reach of the cultivators in the plains. In the Central Provinces, Bombay and Madras, the agricultural population are somewhat better off, as a larger proportion of the forest area is interspersed among cultivated land. But, even in those provinces, the bulk of the forests is inaccessible to the vast majority of cultivators. We were told that, in Bombay, not more than one-third of the forest area is within reach of the general agricultural population. The relations between forestry and agriculture are necessarily influenced at every point by the general remoteness of the timber forests from the cultivation of the plains. The distances involved and the difficulties of transport between the hills and the plains result in the great mass of the agricultural population deriving little or no direct benefit from the forests proper. On the other hand, there is almost always some cultivation on the outskirts of these forests and areas of cultivation and of grazing, which, in the aggregate, are considerable, occur within the forest boundaries. It is the population in such areas, partly pastoral and nomadic, partly agricultural and settled, but always sparse, that is most directly affected by the manner in which the forests proper are administered. It is in such regions that the officers of the Forest Department are mainly employed. There is, therefore, apt to be lack of contact, not only with the mass of the cultivators, whose concern is with the management of such of the forest lands as lie in the plains within reach of their own cultivation, but also with the agricultural departments Many of the forests in the plains, as has already been remarked, are forests only in name. Few timber trees are to be found in them, but they provide a certain amount of fuel and grazing.

UTILISATION OF FORESTS FOR AGRICULTURAL PURPOSES (i) GENERAL PRINCIPLES.

217. In his report on the improvement of Indian agriculture, Dr. Voelcker emphasised the importance of forests in agricultural economy and, therefore, of directing the policy of the Forest Department so that it should serve agricultural interests. The comprehensive Circular on forest policy, which was issued by the Government of India in 1894, the year after his report was presented, and to which reference has already been made, was the outcome of his recommendations on this point. As this Circular still governs the policy of the forest departments, it appears desirable that a brief summary of the main propositions laid down in it should here be given. The full text of the Circular will be found in Appendix V.

The Government of India stated, at the outset, that "the sole object with which State forests are administered is the public benefit." In regulating and restricting the rights and privileges of user in a forest area, the cardinal principle to be observed is that those rights and privileges must be limited, otherwise than for the benefit of right and privilege holders, only where the advantage to be derived by the general public is great and then only in such degree as is absolutely necessary to secure that advantage. It was further laid down that, subject to certain conditions, the claims of cultivation are stronger than the claims of forest preservation. The conditions to which the application of this principle should be

subject were that the honeycombing of a valuable forest by patches of cultivation should not be allowed; that cultivation must be permanent; that it must not be merely nominal and an excuse for the creation of pastoral or semi-pastoral villages; and that it must not be allowed to extend so as to encroach upon the minimum area of forest lands of the country, and the reasonable forest requirements, present and prospective, of the neighbourhood in which it is situated. Finally, the Government of India laid down that minor forests and pastures and grazing grounds must be managed mainly in the interests of the population of the tract. In regard both to fuel and fodder reserves and to grazing areas pure and simple, especially such as lay in the midst of cultivated tracts, they asked local governments to consider whether it was necessary to class these, or, if they were already so classed, to retain them as forest areas; and, if this question were decided in the affirmative, whether it would not be better to constitute them protected rather than reserved forests.

We are in cordial agreement with the exposition of the general policy which should govern the relations between forests and agriculture as given in this important Circular.

(n) Grazing

218. Reference to grazing in forests has been made in paragraph 180 of our chapter on Animal Husbandry. Some further particulars may now be given. Grazing rights are extensive, as grazing is permitted over about 58,000 square miles out of the total area of 99,898 square miles of reserved forests, or, excluding Burma, over about 51,000 out of 71,000 square miles. Some 6,500 square miles of protected forests out of a total area of 7,750 square miles are open to grazing, as are all the unclassed forests under departmental control. The number of animals grazed in the forests of the provinces chiefly affected, in the year ending 31st March 1926, is shown in the Table below:

Province	Total number of live-stock grazed in the forests (in 000's)	Number of animals per square mile of forest lands (administered by the Forest Department)	Total number of live-stock in province (in 000's)	Percentage grazing in forests to total number
Bombay	2,398	160	17,911	13·4
Central Provinces and Berar .	3,527	179	13,723	25·7
Madras	2,445	126	41,544	5·9
Punjab	3,275	489	25,273	13·0
United Provinces	1,065	204	41,473	2 6

Complaints of definite damage to forests, as the result of permitting grazing in them, were made in the Punjab, in Bombay, and in certain areas of the Central and United Provinces. Elsewhere, the chief conservators of forests, who gave evidence before us, seemed satisfied that, on the whole, no material damage was being caused.

There can, however, be no doubt that, both from the agricultural and forest point of view, the replacement of grazing by grass cutting would, in many instances, be an improvement. The advantages from the point of view of livestock have already been explained in Chapter VII, and it is clear that the risk of damage to the forests would also be minimised. An experiment which the Forest Department in Bengal is making is of interest in this connection. Grass cutting for stall feeding is encouraged by the levy of a merely nominal fee for the cutting of fodder and by the provision of cattle sheds surrounded by fenced exercise paddocks. This applies only to the hills. In the plains, the cattle are considered to be too inferior in quality to make a similar experiment worth while. Experiments of this character might well be made in other tracts in which conditions appear suitable.

Whilst the fees charged for grazing vary greatly from district to district and province to province, they are everywhere low. For bullocks and cows the range is from one to twelve annas per animal per year. A large increase in existing grazing fees is out of the question. Even a very moderate increase would be likely to arouse resentment and react unfavourably on those friendly relations between the people and the Forest Department which are essential, if forests are to be properly protected and utilised for the general benefit. Any drastic restriction of the number of cattle allowed to graze in a given area would also be open to the same objections. We can only state our conviction that it is desirable, in the interests both of forest conservancy and of cattle improvement, that the grazing of inferior cattle in the forests should be discouraged. In all cases, the aim should be to secure a due proportion of grass cutting to grazing in each forest tract. Preference in regard to grazing should also, as far as practicable, be given to young stock and to animals of good quality. We recognise that this policy can only be carried out, if it has the support of popular opinion. We hope that that support will be forthcoming as the quality of the cultivator's cattle improves and he comes to realise that selective control of grazing exercised in favour of superior stock is essential to the promotion of improvement.

Since it cannot be doubted that grazing in forests will, for a very long time to come, be an important feature of forest economy, we consider it essential that the intensity of grazing consistent both with the proper development of the forest and the preservation of desirable grasses should be determined as soon as possible. The Chief Conservator of Forests in the United Provinces informed us that knowledge in both these respects is at present defective.

(iii) Fodder.

219. The desirability of encouraging grass cutting and fodder storage has led us to consider whether the agriculturist is getting all the assistance which forest areas are

capable of giving him in the way of fodder supplies. Grass cutting is permitted in all the areas open to grazing and in certain additional areas which bring the total area of reserved and protected forests, in which it is allowed, up to nearly 77,000 square miles.

It is necessary to distinguish, at the outset, between the two quite distinct functions which forest lands fulfil in regard to fodder supplies. They act as fodder reserves in times of scarcity and famine and they are also sources from which many cultivators draw their annual supplies of fodder. It is, however, only for the cultivator living on the outskirts of forest lands or within a distance of not more than fifteen to twenty miles from them that they fulfil the second of these functions. For the greater part of the forest area is, as we have seen, remote from cultivation and the limit is soon reached beyond which it becomes uneconomical for the cultivator to transport fodder by road or to have it brought to him by rail. The Chief Conservator in the United Provinces informed us that the freight charges made it unprofitable to send even baled fodder more than fifty miles by rail. From experiments conducted by the Forest Department in the Central Provinces in 1912-13 it seems doubtful, indeed, whether the ordinary cultivator is at present willing to purchase fodder at all. He showed no disposition to take it when it was offered at four annas a *maund* which works out at under six pence a cwt. This fodder was offered at cost price. The question of fodder supplies which will be available, in ordinary times, in those areas which will be retained as forests, after the reclassification we recommend in paragraph 229 has been carried out, requires careful examination by forest and agricultural officers in consultation. As the quality of his cattle improves, we anticipate that the present disinclination of the cultivator to purchase fodder may disappear and that an active demand for it may arise. Railways should encourage this change of attitude on the part of the cultivator by offering the lowest rates for the transport of fodder compatible with their position as profit-earning concerns. The capacity of forest lands in certain parts of the country to supply fodder in large quantities is undoubted and if, by means of propaganda, the use of dried grass for feeding increases, the railways will stand to gain by the development of a new line of traffic.

Throughout periods of fodder famine, forests assist cultivators to maintain their livestock in two separate ways; grass is cut, pressed and baled for export to affected tracts and animals from these tracts are driven to the forests to graze there. In every season, a small amount of hay is made in forest areas to supply such markets as exist locally, and, in all provinces, forest officers are most anxious to increase the demand for dried fodder, since grass-cutting is preferable to grazing from the point of view of forestry. Unfortunately, the demand for dried grass is usually very small; thus dried fodder which forests might yield is largely wasted. Since forests are usually found in districts of heavy rainfall, and the local cultivators are neither numerous nor in need of fodder, a large waste of grazing resources may often be inevitable. But much more use of forest grass might be made if cultivators were

convinced of the need for feeding their cattle better than they now do; for, as has been pointed out in Chapter VII, dried grass is commonly regarded by cultivators as being a fodder only to be used in times of scarcity. The result is that, partly because cultivators are unwilling to purchase dried grass, or even to cut it for themselves, and partly because forests are so often far removed from tillage areas, a great demand arises only in famine years. The demand is then met, so far as the grass crop of the year can be made to meet it, for very little hay is stored as a famine reserve. As hay, when properly thatched, will keep sound in stacks for several years, the question of accumulating a large stock against famine periods has often arisen. The Bombay Forest Department has given special attention to this subject and their aim now is to be able to supply about 20,000 tons in a year of scarcity. With this object in view, about 4,500 tons of hay are made annually and, when a sufficient stock has been accumulated, the surplus is sold. Unless there is scarcity, even the small quantity annually offered for sale meets with a poor demand and losses of from Rs. 8 to Rs. 10 per ton may be incurred on the amount sold. The 20,000 tons of hay available in a famine year would, if used to supplement existing resources, maintain life in some 40,000 to 60,000 cattle, and would thus be of much use, if one or two districts only suffered from famine, but would afford little protection to a precarious tract in which cattle were numbered by the million.

As a general measure for famine relief, the storage of hay would only be a practicable measure if the demand in normal years were such that very much larger quantities of hay than are at present made in the forests could be marketed annually at prices approximately covering the cost of production.

'Apart from physical difficulties imposed by distance and cost of transport, the great obstacle to be surmounted is the attitude of the average cultivator to his livestock. This subject we have dealt with elsewhere; our immediate object is to point out its bearing on famine protection measures.

(iv) FUEL FROM EXISTING FORESTS.

220. The position in regard to fuel is in some respects very similar to that in regard to fodder. A limiting factor is the cost of transport by road or rail. The Chief Conservator of Forests in the United Provinces was specially emphatic on this point. He informed us that the supply of firewood in rural areas depends greatly on the cost of transport from the forests and that the forests of Gorakhpur division were an almost solitary exception to the general position, which is that quantities of unsalable fuel are left to rot in the forest. He added that special means of transport, such as tramways, are seldom profitable when firewood alone is concerned, and that the only remedy likely to be of much value was the reduction of the rates charged for carriage of fuel by rail, which appear excessive and seriously curtail export. These rates adversely affect the export of charcoal and bamboos as well as of fuel. His evidence and that given by the Conservator of Forests, Bengal, shows the urgent need of a

thorough examination of the whole economics of the supply of fuel to the cultivator. The practice of burning cowdung cakes is partly, no doubt, the result of preference. It is a slow-burning fuel and a fire once started can be left to take care of itself. But, apart from preference, cowdung is at present the only certain supply of fuel which the great majority of cultivators can obtain. As we have pointed out in Chapter IV, before any intensive campaign of propaganda in favour of the substitution of another form of fuel can be justified, not only must a supply of that fuel be available but data proving that it is cheaper for the cultivator to use the substitute offered him than to burn his manure must have been obtained. Such data will require to be based on an investigation in each tract of the loss, in terms of the local crop production, involved in burning cowdung, and of the calorific value of the woods or charcoal available in the locality as compared with that of coal, when price is taken into consideration We would draw attention to the investigation* recently carried out by the Agricultural Chemist in the Punjab and his research assistant on the loss in terms of crop production by burning cowdung as illustrating the kind of investigation we have in mind. In this connection, we consider that the railways should review their charges for the conveyance of wood, charcoal and coal, and should pitch their rates as low as possible, so as to secure the large potential traffic resulting from the importation into the rural districts, in bulk, of any or all of these fuels. In deciding the relative cheapness of the different classes of fuels, it will be necessary to experiment with suitable cheap stoves in order to ascertain their efficiency value for each class of fuel. In any area in which it has been proved that wood is an economical fuel, steps should be taken by the forest departments, where this has not already been done, to establish fuel depôts for groups of villages. The co-operation of the railway authorities should be sought in the establishment of fuel depôts at stations.

(v) New sources of wood and charcoal for fuel.

221. If the investigation which we recommend is to be carried out with the thoroughness which its importance demands, it is essential that it should include an enquiry into the economic possibilities of establishing plantations for fuel and the creation or extension, for the same purpose, of plantations along canal banks and the margins of rivers and streams. The maintenance of plantations along rivers and streams, especially in their upper reaches, has the additional advantage of tending to confine them within definite channels and thus preventing the deposit on fertile riverain land of coarse sands and gravels as the result of frequent changes in direction. We have referred, in Chapter IV, to the value of afforestation in cases of erosion and, in Chapter X, to the possibility that Government may find, on the ground of profit alone, that it pays to place irrigated land under plantations. The investigation we have here in view is of much wider scope, but a study of the economics of both these special cases should be included in it. We consider that the Forest Department would be the most suitable agency for carrying out this investigation.

* See *Agricultural Journal of India*, Vol. XXI, Part II (March 1926), page 115.

(vi) TIMBER FOR GENERAL AGRICULTURAL PURPOSES.

222. We have received no evidence indicating that any dearth of wood for implements, carts, waterlifts, or other general purposes is experienced. The amount of wood used by the cultivator in each village for these general purposes is not large. An instance, to which we have referred in paragraph 105, Chapter IV, suggests, however, that the mass production of wooden articles required by the cultivator would effect a large saving in cost. If mass production is undertaken in or near the forests, the question of how cheaply it is possible to distribute the manufactured article will also require investigation.

(vii) SUPPLY OF LEAF MOULD.

223. Where forests are situated in districts of heavy rainfall and are of rapid growth, it does not appear that the forest departments raise any objection to the use of leaf mould. Indeed, one of the reasons assigned for the lack of interest in green manures in Madras is that humus from the forests is available. The difficulty of transporting so bulky a material must prevent its use at any distance from the forests, and the amount which can be taken annually without detriment to tree growth is strictly limited. This is not a source, therefore, from which any general supply of additional nutriment to soils under crop can be looked for.

(viii) FOREST INDUSTRIES.

224. The development, by the forest departments, of forest industries is a matter of great importance to the agriculturist. We are, therefore, glad to observe that considerable attention is being paid to the commercial possibilities of minor forest products. An important section of the Research Institute at Dehra Dun deals with this work, both generally and also with special respect to the forest products of the United Provinces. The testing of the suitability of various woods for use as containers and the treatment of bamboo for the production of paper pulp on a commercial scale are two important aspects of the industrial activities of the Institute. In the Punjab, a utilisation circle has been created which is mainly concerned with the extraction of resin. Burma also has a utilisation circle, the main object of which is to get local industries to use Burma timbers for such purposes as manufacture of matches and of boxes. In the Central Provinces, an officer has been placed on special duty for the investigation and study of new forest industries and the finding of markets for them. The Forest Department in Madras has a minor forest produce section and has also installed a modern plant at Olavakot, about thirty-five miles from Coimbatore, where woods are being tested for all purposes. Although in Bombay and Bengal there are at present no special agencies for the exploitation of forest products, the evidence we took has satisfied us that the forest departments in both presidencies are alive to the possibilities of, and the need for, industrial development. We consider it desirable that a forest utilisation officer should be appointed in every province in order that the development of forest industries may be made the definite responsibility of one officer.

In many cases, cultivators in the neighbourhood of forests are unable to win from the land sufficient to maintain themselves without some

supplementary means of livelihood. It is clear, therefore, that, if new industries can be started, or existing industries developed, in which cultivators can participate, they will derive great benefit from them. The making of charcoal as a by-product, the extraction of turpentine, the cultivation and processing of lac, all provide suitable subsidiary occupations. There is also scope for the extraction of essences from medicinal herbs, and of oils, gums, resins and dyeing and tanning materials from forest trees and plants. It has recently been shown by the Madras Forest Department that excellent barrels can be made from local woods. There is a potential demand for cheap wooden handles and frames for agricultural implements to be satisfied, especially if and when local factories are established for the mass production of improved implements. Many even of the lesser known Indian woods are of fine quality ; their suitability for furniture and other purposes is now being investigated at Dehra Dun, and when their valuable properties have been demonstrated, new markets for them may be anticipated.

We consider that there is a wide field for both experiment and development and that, in exploiting forest produce of all kinds, it is very desirable that the forest departments should work in close touch with those responsible for the development of rural industries.

In concluding our remarks on the extent to which forest products are, or can be, utilised for agricultural purposes, we desire to draw attention to the estimated value of forest produce annually taken from lands under the administration of the forest departments by free grantees, usually villagers, and by holders of various rights and privileges. In 1925-26, the value of the produce thus taken was estimated at Rs. 70 lakhs. Not all of it was taken by cultivators, but as "grass and grazing" account for over Rs. 45 lakhs and as nearly all the wood used for agricultural implements is included in the total, it is clear that the cultivators' share must be substantial. The figures for 1925-26 are reproduced in Appendix VI.

(ix) Disafforestation to promote irrigation works.

225. Owing to the reservation as forest of the slopes of hills, hill streams often have their source within forest limits. It is true that the rights of villages to use the water of such streams have been preserved, but we have noticed places where the water supply might be improved by new works, which could not be carried out without the permission of the Forest Department. In paragraph 279, Chapter X, we have recommended an investigation by special officers of the possibilities of small irrigation works and we desire to point out that, if land is required for the purpose within forest limits, it should be freely disafforested.

Soil protection and improvement.

(i) Permanent afforestation.

226. We have dealt with afforestation as a local remedy for soil erosion in the plains in Chapter IV, paragraph 79. It remains to consider the measures which can be adopted to check the remoter causes of that erosion. The important functions performed by forests in regard to the conservation of rainfall are well known.

A wooded area, especially on a steeply sloping watershed, acts like a sponge; it holds up the rainfall from immediate dispersal along the lines of the local drainage and ensures the absorption of much of it in the subsoil, thus assisting in maintaining the general water level of the district. This sponge-like action of the forest and the network of interlacing roots effectually prevent the deposition in the fertile valleys of sterile inorganic soil from the hilly slopes.

The cessation of uncontrolled "shifting cultivation," which is recommended in paragraph 228, should arrest further harmful deforestation in hill districts. But there is no province in India which has not suffered already, to a more or less serious degree, from such deforestation. In the Central Provinces, Assam and Burma, the damage has not yet affected areas of settled cultivation, and, in the Central Provinces, shifting cultivation has been stopped. In the Punjab, the United Provinces, Bengal and Bombay, serious deterioration is still taking place owing to the deforestation of the Siwalik and Kumaon Hills, of the Chittagong hill tracts, and of the Deccan outcrops and Konkan hills. In regions of heavy rainfall, that is, where the rainfall is over 60 inches, the essential remedy is protection against damage by cultivators and their goats and cattle in order to allow of natural regeneration. In tracts of light rainfall, there is no generally satisfactory remedy, but, in carefully selected areas, artificial regeneration might be possible though at heavy cost.

(ii) Temporary afforestation.

227. When the soil has reached a stage of exhaustion which requires more prolonged treatment than is provided by the ordinary seasonal fallowing, temporary afforestation may, under certain conditions, provide a suitable method of restoring fertility. Plantations of *babul* trees are made for this purpose in Sind. The *babul* is a leguminous plant, and, by means of such plantations, which are ordinarily allowed to stand on the ground for ten or twelve years, a combined form of manuring by growing a leguminous crop and by the formation of leaf mould is achieved. The cost of planting and maintenance during the period of growth is approximately set off by the sale or use of the annual crop of seed pods which are a valuable fodder for goats; the sale of the wood for fuel when the plantation is cut down realises from Rs. 70 to Rs. 90 per acre.

(iii) Shifting cultivation.

228. In many parts of India, the practice of "shifting cultivation" variously known as *jhuming*, *kumri*, *taungya* or *podu* still persists. Virgin forest is felled and burned, and the land thus prepared is cropped for two or three seasons, after which the process is repeated on a new plot.

In tracts where the population is small as compared with the area under forest, this method of cultivation, however wasteful, is comparatively innocuous, provided that it is followed by no serious erosion of the soil. Many of those tribes, whose traditional method of cultivation is by shifting cultivation, are increasing in numbers and find it each year more difficult to discover suitable areas of forest land. We think,

therefore, that the time has come when a determined attempt should be made to bring this practice under control and, by education and, possibly, by an increase in the grants given towards the labour expensse of terracing and *bunding*, such as are already in force, for instance, in the Naga Hills in Assam, to persuade the people to adopt stable methods of cultivation and to forego their migratory habits. Shifting cultivation in the Central Provinces, which used to be of considerable extent, has been gradually stopped and the methods by which this was effected may be worth studying by officers faced with this problem in other provinces.

It is scarcely necessary to state that we see no objection to the controlled system of shifting cultivation described to us in Bengal, under which the necessary labour for replanting clear felled forest is obtained by allowing a certain fraction of the forest area to be placed in rotation under temporary cultivation.

It is of some interest to note that no complaints were made to us regarding the tree loppings used in the *jhum* system of cultivation under which, in some regions of heavy rainfall, alternate layers of cowdung, loppings and leaves of trees, grass and earth are heaped on the ground which is to form the seed bed, the whole is set on fire and the ashes mingled with the soil. In 1893, when Dr. Voelcker wrote his report, one of the main grievances cultivators in Bombay had against the Forest Department was that, in their desire to exploit the forests commercially, the department restricted unduly the lopping of trees for this purpose.

FOREST ADMINISTRATION.
(i) RECLASSIFICATION OF FOREST LANDS.

229. Dr. Voelcker also pointed out that areas had been taken up in the past for growing timber which were not fitted for that purpose. Since his report was written, considerable areas of forest lands have been released and thrown open to general cultivation. In the Central Provinces, for example, the area of forest lands has, since 1906-07, been reduced by 2,500 square miles, which represents a fall of over ten per cent in the total forest area. We were informed by the Chief Conservator of Forests that disafforestation in that province had probably reached its limit. In the plains of the Punjab, where extension of irrigation is making agriculture possible over large areas which were formerly waste, disafforestation has taken place on a very extensive scale during the past quarter of a century. Of the total area of 5,500 square miles of forest lands administered by the Forest Department in the plains at the beginning of the century, 3,000 square miles have already been released, and it is proposed shortly to release a further 1,000 square miles, thus leaving only 1,500 square miles of forest land under the Forest Department in the plains. We understand that, in Burma, reconsideration of the areas reserved for forest is now in progress. Reclassification of the forest area has made great progress in Madras. Local committees for all but six districts have been appointed by Government to examine and report on the classification of the forests as "provincial" and "local" with a view to deciding

which areas should be transferred to the *panchayat* management which is described in the following paragraph. About 3,200 square miles have already been handed over to *panchayats*. It would seem that reclassification was specially needed in Madras, where we were informed by the Chief Conservator of Forests that extensive tracts of land, which had only a few trees on them and were little more than grazing grounds had been constituted forest reserves. In Bengal, the Indian Tea Association informed us that certain tracts of land eminently suitable for tea or other cultivation are still reserved as forest.

We consider that disafforestation in the Punjab is proceeding as rapidly as is desirable, and we trust that the local Government will satisfy themselves, as a result of the general investigation into the fuel position which we recommend in paragraph 220, that the disafforestation of the additional 1,000 square miles is justified in the general interest.

Forty or fifty years ago, when there were forest departments, but no agricultural departments, and when the problems arising out of the pressure of population on the soil and the necessity for cattle improvement had not assumed the importance they now possess, it was natural that the forest departments should be regarded as the only departments capable of turning to advantageous use large areas of State land which were lying neglected and which were not required for cultivation. The result was that the presence of trees or scrub jungle was considered sufficient justification for notifying, as forest, land which was, in reality, more suited for grazing or for cultivation than for the growth of trees. We consider that the time has come when a systematic reclassification of this type of land is required. The ideal to be aimed at in all provinces is to distinguish between land which is suitable for the growth of good timber trees or for fuel plantations (including land, the preservation of which under forests is desirable on climatic or physical grounds), land which is suitable neither for timber, fuel plantations nor for ordinary cultivation, but may possess possibilities for development as fodder reserves and grazing grounds, and land which is suitable for ordinary cultivation.

Subject to what is said in the following paragraphs, land of the first type should, in general, be managed by the forest departments, although there may be cases in which the pressure of population is such that indifferent agriculture is preferable to reservation for the growth of timber. Land of the second class, of which the forest departments still, in the aggregate, hold wide areas should no longer remain under the management of the forest departments, as at present constituted, except where the areas are so intimately connected with true forests as to make their separation administratively impracticable. Where good land suitable for cultivation is either actually under forest or retained by the forest departments with a view to afforestation, any proposal for its disafforestation will require careful examination from the point of view of maintaining a sufficiency of timber for the needs of the province. In any case in which disafforestation is decided upon, the suitability of the land for such uses as the establishment of a large scale cattle breeding farm should be considered before it is released for ordinary cultivation. Even

if it may be inexpedient, for various reasons, to take any immediate action on the results of reclassification, the fact that reclassification has been effected will place the provincial authorities in a much stronger position in making the best possible use of the land at their disposal.

(13) VILLAGE FOREST AND FOREST PANCHAYATS.

230. The most promising method of establishing village forests is to be found in handing over to village management certain more or less wooded areas now under the management of the forest departments. There are many forest areas so interspersed among cultivation as to make their conservation for the production of commercial timber impracticable if, in accordance with the declared policy of Government on the subject, the interests and needs of the local population are to be the first consideration of forest management. To the Madras Government belongs the credit of a bold attempt to interest the villagers in the protection and development of such areas by investing them with the responsibility for management, which is exercised through a popularly elected committee known as a forest *panchayat*. As we have mentioned, about 3,200 square miles of forest lands have already been handed over to *panchayat* management. The *panchayats* are supervised by a special *panchayat* officer who works under the Board of Revenue. The Board fixes the rent to be paid for the *panchayat* area and the number of cattle which may graze in any particular area. All other details of management are left entirely to the *panchayat*. Where the area when under the management of the Forest Department yielded a net revenue, the rent fixed is always less than this. In some cases, no rent is levied and in others, it is charged for three years only. As transfers to the *panchayats* only commenced on any considerable scale in 1923, it is not possible to pronounce a definite opinion on the success of the movement but it is reported that there is a growing improvement in the protection of the reserves and in the interest taken by the villagers in limiting the number of cattle admitted to them, in enforcing the accepted grazing rates and in closing the reserves temporarily to improve pasture. The Chief Conservator of Forests, Madras, expressed himself as hopeful of the future of the system and the Director of Agriculture regarded it as one of the best attempts which have been made in recent years to solve the problem of utilising forest lands to the fullest extent for the cultivator's needs. The forest administration of the United Provinces has recently placed an officer on special duty to study the Madras scheme. In the Central Provinces and in Bombay, we found opinion somewhat divided on the question whether popular management of this character was feasible and, in the Punjab, the view was taken that it would be impracticable. Circumstances differ so much in the different provinces, both in regard to the type of forest lands available and the character of the local population, that the experiment in Madras may prove to be unsuitable for adoption all over India, however successful it may be in Madras itself. We consider, however, that the management by the people, for the people, of the forests close to their villages possesses so many desirable features that every effort should be made to ensure its success.

231. In the preceding paragraphs, we have recommended a reclassification of the lands now scheduled as forest areas, and also the allocation of certain forest lands for the purpose of establishing village forests on the lines which are being followed in Madras. If these recommendations are carried out, some reduction in the area at present administered by the forest departments would result. In the case of village forests, the main change which would be effected would be that guidance in managing them, and propaganda directed to ensuring their being put to the best use, would replace the present methods of control. Areas classed as culturable would be transferred from the forest to the revenue departments. Areas classed as grazing lands might, in some cases, be similarly transferred; but we are of opinion that, for the most part, they should remain under the forest departments, which, even after such a reclassification as we have suggested, would have in their charge extensive tracts open to grazing in the areas still classed as forest. Some forest officers have given close attention to grazing questions, and, provided the changes in administrative machinery which we suggest below are given effect to, it does not appear that any advantage would be gained by transferring forest land, reclassed as grazing land, to the charge of some other department, except for reasons of economy.

(*iii*) NECESSITY FOR RECLASSIFICATION OF FUNCTIONS OF FOREST OFFICERS

The "cardinal principle" to be observed by the forest officer has been admirably laid down in the Government of India's Circular from which we have quoted in paragraph 217 above; as a principle it cannot be questioned, but, if examined from the point of view of administration, it seems to us to place too heavy a responsibilty on the individual officer. Although forest officers are frequently placed in a difficult position, they have generally been successful in reconciling their duty as guardians, on behalf of the public, of valuable forest property, with their other duties of affording to villagers the maximum advantages which forest grazing areas are capable of giving them. We are of opinion, however, that with the reclassification of forest areas, there should be at least an attempt - for we recognise that a sharp distinction would not always be possible - to reclassify the functions of the forest officer.

The true timber-producing forests of India and Burma are a rich possession, bringing in large revenues to the State, so that, in the public interests, they must be carefully managed; but this is not all, for, as we have seen, the timber resources of India are meagre enough, and the pressure of the world's timber supplies is increasing rapidly. Thus, in the interests of future generations, it is essential that waste should be prevented and that efforts should be made to ensure that timber supplies in the future are greater than they now are. It is with the timber forests that the work of the forest departments is, in the main, concerned; and the interests of forest officers cannot fail to be bound up in their development.

These great forests are for the most part situated in the hills; but on the plains, there are areas interspersed with cultivation, but classed

as "forest," the extent of which in the aggregate is considerable. These areas are of relatively little value as a source of revenue, but of considerable importance to neighbouring cultivators, and they are possessed of a potential value that we do not think has yet been sufficiently recognised. Because of their small commercial value, and also because the important forests give scope for all the energies of the existing forest staff, little attention has been given to the development of this second type of forest property. Nor do we think it likely that it ever will receive the attention that should be given to it unless it is placed under the management of a division of the Forest Department directly responsible for its development.

During the past half century, the population of British India has increased by some sixty-two millions or thirty-three per cent, and with this increase the time is rapidly passing when the country can afford to neglect any resources which offer opportunities of improvement. In our chapter on Statistics, we draw attention to the areas now officially classed as "culturable waste" and "land not available for cultivation," and we recommend that this classification be re-examined. We think it likely that within these vast areas, which together include about forty-five per cent of the total surface of British India, there could be found much land, which, though unsuited for commercial afforestation, might, if placed under the charge of a minor forests division, be used to grow fuel and provide better grazing than it now does, or might be added to the village forests, managed by *panchayats*, to which we refer in paragraph 230 above. As an illustration, we may cite the waste land in the Etawah district. The Chief Conservator of Forests, United Provinces, pointed out to us how greatly land of this description could be improved by protection. At the same time he explained that it would be difficult to proceed rapidly with the work of improvement since experience of the best methods of treating such waste was lacking, and there were sylvicultural problems to be solved. Until a trained staff is available for experimental work in sylviculture and grass land improvement, it is clearly impossible to expect that progress can be made in the solution of the difficult questions which would at once be met with in attempting to use to better advantage areas selected for reclamation from the vast areas now classed as waste. One line of improvement is now being experimented with by the Bombay Forest Department. Attempts are being made to increase the density of the grassy covering of waste land by controlling grazing, so as to allow grass to seed in one season and to give time, in the next, for young plants to establish themselves before livestock are admitted. It is undoubted that, if forest officers, in consultation with agricultural departments, were free to give their time to this line of work, and if their successes were assessed, not by the immediate income which the areas under their care yielded, but by the improvement effected in the quality of grazing areas, it could be claimed that a problem of much importance was being attacked by a commonsense method.

In our chapter on Animal Husbandry, it has been shown how great the need for fodder is in India, and how much waste there is in the use now

being made of grazing lands. Much of the fault is due to the cultivator; but here we are not concerned with his short-comings, and, in any case, the attitude of those whose object is to effect improvement should not be that adopted by the cultivator. Our own difficulty, like that of the forest officer in charge of a tract of grazing, is that we can give no definite assurance that, within a given period of years, the work of the improver would prove profitable to the tax-payer. The subject has received no close study and the experience hitherto accumulated has been slight. We can only say that, without close study, no improvement can be looked for, that the subject is too important to be neglected, and that officers in charge of experiments, which have as their object the improvement of grazing areas, should not feel that their principal duty is the commercial one imposed on the existing forest departments.

Similarly in the case of village forests. To begin with, at least, much experimental work will be called for, and that not only of a sylvicultural kind, for experience must be collected in methods of controlling these village forests, and in the forms of propaganda that would be effective in popularising them. Forest *panchayats* and co-operative societies formed for the planting and management of village lands are not the only bodies on the plains in need of guidance in the selection of species for planting and the management of young plantations. We have seen, in the course of our tours, plantations lining canal banks which could have been much improved, if they had been designed and planted by officers trained in sylviculture. Indeed, it is not possible to travel extensively in India without being impressed with the small use made of the opportunities which the country offers the sylviculturist. One district visited was markedly different from most others and inquiry showed that the result was the work of a single enthusiastic tree planter in charge of it some sixty years before.

In our chapter on Irrigation, we lay stress on the importance of the constitution of irrigated forest plantations in the tract that will be irrigated by the Sukkur Barrage project. Here we desire to draw attention to the importance of the establishment, in advance, of nurseries for the trees that will be required in large numbers. The selection of suitable trees and their growth to the right age for transplantation are matters in which the forest departments should be closely concerned, but in which we note with regret that they do not appear to have been invited to co-operate or even to have been consulted. So also in respect of road-side trees, we consider that the forest departments should be in a position to render more assistance than appears to have been hitherto invited.

(*iv*) FORMATION OF MINOR FORESTS DIVISIONS.

232. We do not wish it to be understood that, in every case, the differentiation of functions which we suggest above should follow the same pattern; what we recommend is that, in each province, Government should aim at establishing two divisions within the forest departments, the officers in one division to be responsible for the charge of forests, the preservation of which is desirable on climatic or physical grounds and of commercial forests, that is, of those forests managed

with a view to direct profits from the sale of timber and other forest products; the other division to be in charge of minor forests, fuel plantations, village woodlands, and waste land, now chiefly used for grazing and often included under "unclassed forests." Officers of this second division, in addition to the conservation of the natural resources of such areas, should be definitely charged with the responsibility of developing them, and with this object in view should be encouraged to make experiments in sylviculture and in the improvement of grazing areas.

We make this recommendation not because we are able to point out means by which the extensive wastes of India can easily be improved. We believe that improvement will be difficult, and that success, without careful study and experimental work, will not be possible. Nor do we suppose that, when means for effecting improvement are devised, the spread of improved conditions will be rapid. It is, indeed, because they are likely to be slow that we recommend there should be no delay in attacking the subject. Experience in such matters cannot be gained quickly; on the other hand, as population increases, the urgent demand for action calculated to increase the produce of waste land is certain to grow. We are satisfied that a share of the attention which has hitherto been bestowed on the valuable section of the country's forest property should now be spared for, and concentrated on, the problems presented by that section of the forest land now regarded and treated as "waste."

The differentiation we have recommended above is, in effect, that which is at present being carried out in Madras. The main difference between the suggestion we have put forward and the policy which has been adopted in that province is that, under our proposals, two divisions will be established within the Forest Department itself whereas, in Madras, the village forests have been transferred to the supervision of the Revenue Department. The Madras system has the advantage that it leaves highly trained forest officers entirely free to concentrate on what we agree is their main function, that of exploiting the timber forests, and that it marks a definite cleavage with the tradition of rigid administration in the interests of revenue which, in the minds of a very large section of the rural community, has become inseparably associated with the Forest Department. The question whether the new division we propose should continue under the Forest Department or be placed under the Revenue Department is one for decision in the light of local conditions. If the first alternative is adopted, we would stress our conviction that the object of our proposal will be entirely frustrated if the new division is regarded as a source of revenue or if any attempt is made to enforce restrictions which are entirely appropriate when the adequate protection of the forests proper is in question. If the supervision of the management of village forests is entrusted to the Revenue Department, we consider it most desirable that that department should have the advice and assistance of officers who possess a knowledge of forestry, more especially of sylviculture. We would, therefore, suggest that officers of the Forest Department possessed of the tact and enthusiasm which are as essential

as technical knowledge to the success of the schemes we have in view, should be seconded from the regular line of that department to undertake this work.

We are aware that a further burden will be imposed on a small body of officers if the recommendations we make in this paragraph are accepted. For the administration of 108,000 square miles of reserved and protected forests, the State employs some 360 officers in the Indian and some 300 officers in the Provincial Forest Service. The revenue which they have secured for the State has risen in thirty years from Rs. 166 lakhs gross to Rs. 599 lakhs, and from Rs. 75 lakhs net to Rs. 260 lakhs. When we suggest that more attention should be given to the needs of agriculture, we do not fail to appreciate the good work that has been done for the tax-payer; and we recognise that our proposals will require an increase of personnel and of expenditure.

(v) RELATIONS BETWEEN THE FOREST AND AGRICULTURAL DEPARTMENTS.

233. We made a point of asking the directors of agriculture and forest officers who gave evidence before us whether they were satisfied that the relations between the forest and agricultural departments were sufficiently close. We consider that it may be accepted that relations between the two departments are generally satisfactory. The formation of the minor forests divisions, which we have recommended in the preceding paragraph, should lead to still closer relations between the forest and agricultural departments. We consider that further advantages would result if a forest officer on first appointment to the Forest Department underwent a definite course of instruction at an agricultural college. We recommend, in Chapter X, a similar procedure for irrigation officers. There is a close parallel between the respective relationships of the forest and irrigation departments to agriculture. In both cases, it is a matter of adjusting administrative action to meet the requirements and wishes of the cultivator, so far as this is compatible with the public interest. In the control of natural resources, the peasant is prone to take a short-sighted view of even his own interests. A knowledge of agricultural practice and some familiarity with the point of view of the cultivator is of much assistance in enabling an officer to exercise the necessary restraint with the least possible friction. It is true that the forest officer does not in the ordinary course of his duty come into such intimate touch with the main body of cultivators as the irrigation officer, but the interests of a considerable number of cultivators on the margins of the forests and in enclaves in forest lands are very closely affected by forest policy; the development of forest industries will also bring the forest departments into more intimate relations with the agriculturist. If care is taken to select suitable instructors, much could be learnt in a short course modelled on the lines of the rural economy course held at the Lyallpur Agricultural College. This course lasts one month and is designed to give officers of the Indian Civil Service, the Irrigation, Co-operation and other departments an insight into the work of the Punjab Agricultural Department. The knowledge acquired should be tested by an examination.

In addition to this short course of theoretical instruction, we consider that a forest officer, when first posted to the minor forests division, should be attached for a period of not less than three months to the headquarters of the provincial agricultural department, with the object of making himself thoroughly acquainted with the view of the department as to the needs of the cultivators in the vicinity of the forests which he is to administer and in the province generally. Part of this period should be devoted to a special study of co-operative methods of organisation.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

234. The conclusions and recommendations in this chapter may be summarised as follows :—

(1) Grass cutting should be encouraged as an alternative to grazing (paragraph 218).

(2) The grazing of inferior cattle in the forests should be discouraged (paragraph 218).

(3) The intensity of grazing consistent with the proper development of the forest and the preservation of desirable grasses should be determined as soon as possible (paragraph 218).

(4) The question of fodder supplies from forest areas requires careful examination by forest and agricultural officers in consultation (paragraph 219).

(5) Fodder should be transported by the railways at the cheapest possible rates (paragraph 219).

(6) An investigation into the cost and efficiency of wood and charcoal relative to that of coal is urgently required (paragraph 220).

(7) The railway rates for the transport of wood, charcoal and coal should be examined (paragraph 220).

(8) The investigation recommended in (6) should include an enquiry into the economic possibilities of afforestation for fuel supplies (paragraph 221).

(9) Forests cannot furnish any general supply of humus for plant food (paragraph 223).

(10) The initiation of new, and the development of existing, forest industries are matters of great importance to the agricultural population in the vicinity (paragraph 224).

(11) There is a wide field for both experiment and development in regard to these industries (paragraph 224).

(12) Forest lands required for the construction of small irrigation works should be freely disafforested (paragraph 225).

(13) In regions of heavy rainfall, the essential remedy against harmful deforestation is protection against damage by cultivators and their goats and cattle in order to allow of natural regeneration. In tracts of light rainfall, there is no generally satisfactory remedy but, in carefully selected areas, artificial regeneration might be possible though at high cost (paragraph 226).

(14) Temporary afforestation is, under certain conditions, a remedy for restoring the fertility of exhausted soils (paragraph 227).

(15) All " shifting cultivation " should be brought under control with a view to the practice being entirely stopped wherever it is productive of harmful results (paragraph 228).

(16) Forest areas in each province should be classified with a view to determining those areas which are most suitable for the growth of timber or the preservation of which under forests is desirable on climatic or physical grounds, those which are most suitable for development as fodder reserves or grazing grounds and those which should be handed over for ordinary cultivation (paragraph 229).

(17) The most promising method of establishing village forests is to be found in handing over to village management certain more or less wooded areas now under the management of the Forest Department (paragraph 230).

(18) The creation of a special agency is required to manage minor forests, to give advice and technical assistance to forest *panchayats* and co-operative afforestation societies, and generally to develop to their utmost economic capacity the forest resources of the plains (paragraph 231).

(19) The question whether this branch should be part of the Forest Department or should work under the Revenue Department is one to be decided in the light of the local conditions (paragraph 232).

(20) The relations between the forest and agricultural departments are generally satisfactory, but it would be advantageous if short courses were instituted at the agricultural colleges for all newly recruited forest officers and if forest officers were attached to the headquarters of the provincial agricultural department before being posted to the new minor forests division (paragraph 233).

CHAPTER IX

DISEASES OF LIVESTOCK AND THEIR CONTROL

SCOPE OF THE CHAPTER.

235. The scope of this chapter may be briefly indicated. We endeavour to show the harmful effect of cattle diseases on agricultural development; we describe in some detail the character of rinderpest and the methods required to control it; we discuss the meagre provision at present made for veterinary aid; finally, we discuss the provision of superior and subordinate veterinary services and of scientific guidance for those engaged in combating disease.

THE RAVAGES OF DISEASE.

236. The control of livestock diseases presents a very difficult problem. Their character and the ravages they cause call for the services of veterinarians possessed of a thorough training and a high degree of professional skill. On the other hand, the poverty of cultivators and the large cattle population make it essential that, if cultivators' cattle are to get any attention beyond inoculation when epidemics break out, a large number of officers, who have sufficient knowledge to treat cattle intelligently, provided they are directed and guided by qualified veterinary surgeons, must be provided at low cost to the public.

It is, we believe, agreed that the working capital of the cultivator is mainly represented by his livestock. Estimates of the total value of Indian livestock have been attempted but sufficient has been said in Chapter VII to show that little reliance can be placed on them. That the aggregate value of livestock in this country is very great cannot, however, be questioned. It is equally indisputable that the annual losses from disease are very heavy and that these press hardly on the cultivator who may have to pay Rs. 50 to Rs. 150 to replace a good bullock and Rs. 100 to Rs. 200 to replace a good cow or she-buffalo which has been killed by disease. Although efforts are made in all provinces to ascertain the number of deaths due to certain diseases, the statistical information collected, unfortunately, gives little indication of the actual financial losses sustained by cultivators. The recorded deaths from three widespread diseases in the years 1923-24 to 1926-27 were as follows:—

	1923-24	1924-25	1925-26	1926-27
	(in 000's)			
Rinderpest	94·3	155·5	275·9	202·2
Hæmorrhagic septicæmia ..	41·2	32·7	38·8	36·4
Foot-and-mouth disease ..	9·4	12·9	19·9	13·6

These figures in themselves are small in relation to the total cattle population and the most striking point which emerges from them is the rapid increase in the number of deaths from rinderpest in the first three years to which they relate. This is accounted for by the fact that rinderpest is a disease which, though always present in some part of India, has waves of virulence from time to time which take three or four years to reach their crest.

There is, however, reason to believe that the figures in the Table above are very far from revealing the true state of affairs. That this is so is strikingly shown by an examination of the figures for Burma, one of the two provinces in which the notification of deaths from cattle diseases has been made compulsory by legislation. An Agricultural Committee, which examined the point in 1925, concluded that the losses due to epidemics had been very much underestimated. It further stated that the figures supplied by the Civil Veterinary Department clearly showed that the number of deaths of cattle were far in excess of those reported. That these views were not exaggerated is clearly brought out by a comparison between the number of deaths from diseases and natural causes in Burma in the ten years 1915 to 1924 and the number of cattle as returned in the annual cattle censuses. If the number of deaths were correctly reported, the average life of Burmese cattle would work out at 54 years.

Not only is it probable that the deaths from epidemic diseases are several times greater than those actually reported, but the loss by death is only a small part of the loss the cultivator suffers from this cause. Hæmorrhagic septicæmia is a very fatal disease. The percentage of deaths from rinderpest is also very high when it attacks hill cattle or those produced by crossing with European breeds. Rinderpest is not so deadly when it attacks the ordinary cattle of the plains but, though the average mortality, which fluctuates widely, may not be more than thirty per cent of those affected, the remaining seventy per cent are enfeebled by disease. Similarly, in the case of foot-and-mouth disease, for one animal that dies, ninety-nine may be temporarily incapacitated. (If the crude figures given above are weighted by the considerations we have indicated, it will be evident that epidemic diseases cause great direct injury to the cultivator through the death of his cattle and also entail extensive indirect losses through the illness of his working or milking stock.) There must also often be indirect losses from the imperfect cultivation of crops when working animals are stricken by disease.

Some indication of the direct and indirect losses due to cattle disease may be obtained if the subject is approached from another point of view. An examination of the reasons which lead cultivators to borrow from co-operative credit societies shows that there is extensive borrowing for the purchase of cattle. The figures for the four provinces for which returns under this head are available are given in the following Table :—

Loans granted by co-operative credit societies for the purchase of cattle

Province	Sum borrowed, 1924-25 (Rs. lakhs)	Percentage of total advances	Sum borrowed, 1925-26 (Rs. lakhs)	Percentage of total advances
Bihar and Orissa	7·33	13·0	9·25	11·0
Madras	11·91	7·5	11·85	7·0
Punjab	32·95	20·75	37·52	20·5
United Provinces	18·03	37·7	16·49	36·7

On the basis of the Punjab figures, it has been calculated that the cultivators spend four crores a year on the purchase of cattle. The need of loans is, of course, not necessarily due to disease. A cultivator may want to buy additional cattle or to replace bullocks which are worn out, but the experience of credit societies in one province in which the subject has been examined is that borrowing for cattle purchase is mainly due to losses caused by disease. As will be seen in Chapter XIII, co-operative societies provide a relatively small amount of the finance required by cultivators. The more usual source of credit is still the moneylender and there can be little doubt that cattle disease often compels resort to him. What the outbreak of an epidemic amongst their cattle means to cultivators who are struggling to keep free from heavy debt will be realised by a reference to our discussion of indebtedness. (The loss of a pair of bullocks at a critical stage of cultivation, and the partial failure of a single crop in consequence, may place a cultivator wholly in the power of the moneylender and ultimately involve him in ruin.)

(Tuberculosis among cattle is not the scourge in India that it is in so many other countries. If animals are kept in confinement, as they usually are for town milk supply, it may not be uncommon ; but it rarely affects the cultivator's livestock which are freely exposed to sun and air.) There are, however, other wasting diseases which must cause great losses. Chief amongst these are the diseases due to animal parasites, such as round worms, flat worms and protozoa. It has been ascertained that such parasites are extremely common, but little is known of their economic importance. In countries in which this subject has received attention, the losses among livestock because of parasitic infection have been shown to be great. There can be little doubt that the condition of many of the wasted animals to be seen on the common grazing grounds all over India is, in part, due to parasitic infection ; and, although in the absence of any extended enquiry into the damage done by such diseases, no definite statement can be made, it may be surmised that over the drier parts of the country the losses caused may be considerable and that, in the damper regions, they are probably heavy.

There is another form of loss which the country suffers because of the prevalence of livestock diseases. In Chapter VII, we have referred to the lack of private enterprise in improving breeds of cattle. The reasons for this are no doubt manifold but one of them is the uncertainty of

animal life. (In some localities, this is the usual reason given by cultivators for attempting to keep more cattle than they can feed properly; reserves are maintained lest some should be carried off by disease.) The attention of the cultivator is, therefore, directed to increasing numbers when it should be concentrated on improving quality. (Again, the risk of disease must deter those of the larger zamindars who might otherwise be willing to engage in cattle breeding.)

It would have been helpful to the discussion of the subject matter of this chapter if we had been able to frame an estimate of the extent to which the burden of disease impoverishes agriculture. But the setting out of any figure to which the term "estimate" could properly be applied is not possible. It is not merely that the statistics of deaths from contagious diseases are entirely unreliable; there are also losses which occur through illness, through crop failures, through borrowing and subsequent indebtedness, and through the attitude towards questions of stock improvement created in the minds of both large and small landholders. These we are quite unable to value in terms of money. We are, however, satisfied that though the losses caused to agriculturists by disease in livestock cannot be calculated, they are immense.

CONTROL OF CONTAGIOUS DISEASES. (i) GENERAL.

237. The outstanding problem which faces the Civil Veterinary Department in India is thus the control of contagious and infectious diseases. Upon this fact hinge the proposals we make in regard to the organisation of the provincial departments, the training of their staff and the research they should undertake. They will thus be more readily understood if we discuss at this point the measures necessary to combat disease. It would burden our Report unduly if we were to deal in detail with the incidence and control of epidemic diseases in general. (We shall, therefore, refer only to rinderpest, both because it is in itself the most formidable disease of cattle in this country and because the measures necessary to control it are typical of other contagious diseases.)

Rinderpest was formerly the most dreaded of all livestock scourges in western countries. It was the great outbreak of this "cattle plague" in England in 1865 that led to the Cattle Diseases Prevention Act of 1866 and the systematic control of livestock diseases in Britain. In 1920, an outbreak of rinderpest in Belgium, due to Indian cattle which were transhipped at Antwerp for Brazil, caused widespread alarm among the stockowners of adjacent countries; but prompt veterinary police measures were taken and the disease was quickly stamped out. Indeed, scientific methods of dealing with cattle disease had made such progress since it had last appeared in western Europe that the stockowner's estimate of the danger to be apprehended from outbreaks was revised. In some countries, the advance of veterinary medicine has been such that rinderpest is now regarded as a disease that, through resolute action, can be brought under more or less speedy control.

(The success achieved in stamping out rinderpest on the 130 farms which were affected in Belgium raises the question whether it might not

be stamped out in India, for the virus which causes it is both vulnerable and short-lived outside the body of an animal. We sought the opinions of all the expert witnesses who appeared before us in India and in England on possible measures for controlling rinderpest, for a signal benefit would be conferred on the Indian cultivator if his cattle could be protected from it. We have come to the conclusion that measures for stamping it out on the lines adopted in other countries are not possible in India. The disease is wide-spread, effective isolation on a large scale would be so expensive as to be impracticable, and, owing to the sentiment of the Hindu population, the destruction of healthy animals which have been in contact with infected ones could not be contemplated. We have considered the possibility of isolating and safeguarding parts of India by belts of protected country interposed between permanently infected areas and areas from which the disease has been eradicated by the adoption of intensive measures. Within such a belt, all cattle of whatever quality or age would require to be immunised by the serum-simultaneous method of inoculation. This is a method which has proved successful in South Africa and we think that, at a later stage, it might be used with good effect in parts of India; but until the staffs of the veterinary departments in this country have been much strengthened, until the prevalence of the disease has been greatly reduced by other methods and until experience has been gained both by Government and the public of the enforcement of such legislation and administrative orders as would be called for, we do not recommend that this policy should be adopted. There is much preliminary work to be done, the character of which we shall presently explain, before even parts of the country can be freed from rinderpest and kept reasonably safe from re-infection. In the meantime, rinderpest and other contagious diseases must in the main be combated by measures which aim at protecting the individual animal rather than by measures which aim at stamping out the source of infection. A "stamping out" policy can only be successfully applied to diseases which are rare or which have been reduced to small proportions.

(ii) CONTROL OF RINDERPEST.

238. A brief description of the general character of rinderpest and of the methods adopted by veterinarians in combating it appears an essential preliminary to the consideration of the measures we recommend for bringing this and similar epidemic diseases under control.

Rinderpest is caused by a minute organism which gains entrance to the body in food which has been contaminated by the discharges of an infected animal. Urine is the most dangerous of these discharges. The organism survives only a few hours outside the body of an animal. Survival in sunshine is probably limited to about eight hours and in a dark cattle shed to about forty-eight. Cattle begin to exhibit symptoms of febrile disease from two to six days after infection. The violence of the disease varies with the breed and is greatest in European cattle and least in the indigenous breeds of the plains. Cross-bred animals and

Indian hill cattle are intermediate in susceptibility. The virulence of outbreaks varies as does the virulence of the disease in different breeds and hence the great differences in the number of deaths from this cause recorded from year to year. In the worst cases, cattle die about ten days after infection; in milder outbreaks, they may live for three weeks. An animal recovering from rinderpest may continue to be a source of infection until its temperature is normal. The risk of infection is greatest when the fever has reached its height and is beginning to subside. After recovery, an animal is immune from further attack. This immunity, which is believed to be permanent, is due to the fact that when attacked by the disease, the tissues of the animal produce "anti-bodies", that is, structures which destroy the germs of rinderpest. These structures can be identified in the blood. It is by the use of these anti-bodies that protection is conferred on healthy animals. The blood serum of an animal which has recovered from the disease is injected into cattle which it is desired to protect, in doses proportionate to their body weight and their breed. Experience has shown that the following doses of standard Muktesar serum are sufficient to protect animals of the following breeds. The dosage for each breed has been calculated on the basis of a body weight of 600 lbs. The dose for each individual animal is, of course, regulated according to its actual body weight.

Hariana breed	.. 30	cubic centimetres
Sahiwal do.	.. 40	do.
Sindhi do.	.. 60	do.
Delhi buffaloes ..	.. 60	do.
Himalayan hill cattle ..	.. 90	do.
Half-bred Ayrshire do. ..	125-150	do.
Pure-bred Ayrshire do. ..	250-300	do.

As the anti-bodies introduced into the blood in the serum are rapidly excreted from the system, protection lasts only for a brief period. With the doses commonly used, an animal is safe for a period of nine to fifteen days. Animals after protection by serum are allowed to mix freely with infected stock in the hope that they may contract a mild from of rinderpest and thus become permanently immune.

The method of protection described above, which is known as the "serum-alone" or passive method, is now very largely and effectively used in India in checking outbreaks of rinderpest. Serum manufactured at the Imperial Institute of Veterinary Research at Muktesar and its substation at Izatnagar near Bareilly is supplied to provincial governments, Indian States and other authorities in doses of 5 c.c. at three annas per does. Nearly 5·4 million doses, almost all for use in India, were provided in 1926-27, as compared with slightly over 200,000 twenty years earlier.

The "serum-alone" method is, however, subject to the very serious limitation that it confers complete immunity for less than a fortnight whilst infection may persist in a village for a much longer period. Animals are therefore liable to contract disease unless re-inoculated

and when they do so, the process is discredited in the eyes of their owners. Re-inoculation, on the other hand, is not only expensive but, when an outbreak is widespread, is often impossible.

The principle on which protected animals are exposed to infection is sound but it would appear that in practice the chances that the disease will be contracted at the right moment are not good. To ensure infection, therefore, another process known as the "serum-simultaneous," or active, method of conferring immunity has been devised. In this process, a small quantity (from ½ to 1 c.c.) of blood containing the virus of rinderpest is injected into the animal at the same time that serum is used. A mild attack of rinderpest follows, the tissues of the animal prepare their own anti-bodies and an immunity which, in some instances, has been found to be permanent and, in others, to last for about three years is set up.

It is now about thirty years since the serum-simultaneous method was first used. Its efficacy has been proved in countries as far apart as Russia, South Africa and the Philippines where, in all cases, satisfactory results have been secured; but it is Egyptian experience which is of special interest to India. This, at the outset, was disastrous as a heavy mortality followed inoculation, but the causes were detected, the method perfected and the treatment continued with the result that the mortality for some years past has been reduced to negligible proportions. In 1923, for example, when rinderpest appeared in Upper Egypt, some 250,000 cattle were inoculated but the total number of deaths from the disease in that year in the eleven provinces affected was only 2,206. Those of us who visited Egypt were shown the arrangements made for the preparation of serum and were assured by the officer in charge that no administrative difficulties were encountered in applying the method on a large scale. The fellaheen do not offer any opposition to the treatment, which has recently been made compulsory, and the programme of work now mapped out is the immunisation of the cattle in two Egyptian provinces (approximately the equivalent of Indian districts) each year, until the whole country has been covered. As has been pointed out in Chapter VII, the number of cattle kept per 100 acres of cultivated land is very much smaller in Egypt than it is in India. The number of cattle to be inoculated annually in Egypt under the present programme would normally be about 60,000 but if, as in 1923, rinderpest appeared in several localities, a much larger number might be protected. It may be noted that, in Egypt, the cost of producing the material for inoculation appears to be higher than it is in India. We did not ascertain the exact cost but were informed that the upkeep of the laboratories at Abbassia, which are mainly though not exclusively used for rinderpest control, amounted to about £10,000 annually. A substantial item in the cost arises from the need for the importation of the cattle required in the process of serum and virus preparation, whereas in India, suitable cattle, hill bulls and buffaloes, are found within the country. In Egypt, it is held that cattle once inoculated by the simultaneous method are permanently immune and definite evidence of long immunity after treatment has been secured in the large herds belonging to the State Domains Department. It has

recently been found at Muktesar that cattle inoculated as calves were again distinctly susceptible at three years old; but we are informed that, if immunity is found to be disappearing after a short term of years, it could be revived by the very simple process of re-inoculating the animal with a small dose of virulent blood.

Notwithstanding the ample evidence which is available of the excellent results which have followed the adoption of the serum-simultaneous method in other countries, in some of which it is now the standard treatment for rinderpest, there is still much discussion of its value in India. The herds in which it has been tested in this country have for the most part been the property of the Military Farms Department. Those now responsible for the management of the inoculated herds are satisfied with the results and believe in the method. Where failures have occurred, there is no evidence that the blood used to introduce the virus was, in fact, effective. Failures may have been due to the death of the organism, owing to delay in transmission of the virus from Muktesar to the farm where it was used. The special precautions which are now required in testing the virulent blood on receipt were formerly not applied.

(iii) EXPERIENCE IN THE MYSORE STATE OF THE SERUM-SIMULTANEOUS METHOD OF INOCULATION FOR RINDERPEST.

239. Only one experiment on an extensive scale with the serum-simultaneous method has so far been made in India. For an account of the circumstances in which this was carried out, we are indebted to the Director of the Mysore Agricultural Department. Outbreaks of rinderpest occurred at two large cattle fairs in that State in April, 1925. There were over 20,000 cattle at each fair and as there was no legislation enabling the authorities to regulate the movement of animals, rinderpest shortly afterwards broke out in 600 villages in five different districts of the State. The serum-alone method of inoculation was tried, but proved useless because infection remained in the villages and protected cattle soon became re-infected. (The veterinary staff was usually too busy with fresh outbreaks to re-visit villages already treated and, when it was able to do so, it was found almost impossible to get cultivators to agree to a second inoculation as they had lost faith in the value of the method.) In these circumstances, it was decided to discontinue the serum-alone method and to risk the use of the serum-simultaneous method, although the serum in stock was not of the required quality, and although very few members of the staff had had any experience of active immunisation. During the first three months, 6,954 cattle in 49 villages were protected in this way with only five deaths, whilst 1,301 cattle not inoculated contracted the disease of which 516 died. As the serum used was under strength, the reaction after inoculation was severe and the small number of deaths supplied reassuring evidence of the safety of the method. The object lesson was not lost on cultivators, and even cattle owners in unaffected villages began to ask for serum-simultaneous inoculation for their animals.

No charge was made for inoculation and the campaign was prosecuted with great vigour, until by the middle of January, 1926, some 34,800

animals had been successfully protected ; the mortality after inoculation was about 8 per 1000. In view of the high cost of treatment and the great benefit conferred on cultivators, the Mysore Government decided to charge a fee of one rupee per head. The result was remarkable. In spite of the havoc still being caused by disease and the proved value of the treatment, inoculations dropped from nearly 35,000 in the first half of the year to little more than 5,000 in the second.

(*iv*) RISKS INVOLVED IN SERUM-SIMULTANEOUS INOCULATION.

240. Experience in Mysore thus shows—and there is no reason to believe that adjacent parts of British India would furnish grounds for a different view—that the serum-simultaneous inoculation is safe, effective and readily accepted by cultivators whose cattle are dying of rinderpest. It also shows how unwilling the cultivator is to pay for it.

As, however, this method of inoculation is still very commonly regarded in India as a dangerous remedy—as it undoubtedly is when unskilfully applied—the question of the degree of safety attaching to the process requires some further examination. As already mentioned, a high mortality accompanied the first attempts at active immunisation in Egypt : and there was an unfortunate experience in India on a much smaller scale. The cause of death has been satisfactorily accounted for in Egypt and, for some fifteen years, the value of the process has been increasingly recognised. In 1917-18, when 100,000 cattle were inoculated in Nyasaland with the object of providing a protecting belt for South Africa, there were many deaths, the number of which was reported at "not more than 5 per cent." In other countries too, such losses as 1·3 per cent for 10,000 cattle inoculated in South Africa, 1·5 per cent for two million cattle inoculated in Russia and 2 per cent for 7,000 inoculated in the Sudan have been recorded. As even the smallest of these losses would be too large a figure to contemplate in the event of extensive campaigns against rinderpest being undertaken in this country, the nature of the risks involved has to be carefully considered before the adoption of the serum-simultaneous method can be recommended for India.

These risks are of the two kinds which may be described as inevitable and accidental. In a method which introduces living virus into the body of an animal and endeavours to control its action, there is a risk, which, however small, is inevitable. The dose of serum is designed to protect the normal animal and is carefully proportioned to its task. As we have seen, that task requires a very much larger dose of serum for European than for Indian cattle ; but, just as breeds vary widely in the protection required, so may individuals vary within the breed ; and thus the reaction produced by the injection of virus may occasionally be so severe as to cause death. From the experience already gained in India, we regard this risk as very slight, and indeed negligible so far as the breeds of the plains are concerned, provided the control of the operations against disease is in the hands of a competent veterinary surgeon using

standardised materials; but, in the case of European stock imported into India, and debilitated by the change of climate, there is some evidence that the risk may be considerable.

The accidental risks in using the serum-simultaneous method arise from the introduction of diseases other than rinderpest with the virulent blood; or from the stirring into activity of disease germs already present in the animal but incapable of doing harm until the disturbance of the system caused by the virus of rinderpest lowers the vitality of the patient. The first of these accidents, the introduction of another disease, was shown to be the chief cause of the heavy death rate sometimes experienced in South Africa; it was also a complicating factor in Russia. The disease in question which is due to a piroplasm parasite is not likely to harm Indian cattle already "salted" against it, but it is very fatal to European cattle. In some Indian cattle, however, which are already infected with piroplasms, the effect of serum-simultaneous inoculation is to set up a degree of fever which might prove fatal to a debilitated animal. A second parasite of Indian cattle may also be aroused to mischievous activity by this method of inoculation and may produce a disease similar to dysentery. But, though these accidental risks of mortality were formerly considered so serious a danger as to make the value of the serum-simultaneous method of inoculation questionable, they have now been largely eliminated as the result of recent research. (A method of preparing blood infected with rinderpest but free from other parasites dangerous to cattle has been discovered at Muktesar.) Moreover, by microscopic examination of the blood of the cattle used to supply virus, it is possible to determine whether it contains dangerous parasites and so to avoid its use. Should impure blood be used inadvertently, the case can be successfully treated by using certain drugs which are readily available.

Our examination of the evidence available as to the results obtained in India and in other countries from the use of the serum-simultaneous method of inoculation has led us to the conclusion that the introduction of this method is strongly to be recommended and that, indeed, it offers the only hopeful means of combating the ravages of rinderpest. (Provided the materials used for inoculation are properly controlled and the work of inoculation is carried out under the supervision of an experienced veterinary surgeon, careful to guard against such accidents as may occur, the risk involved is so slight that, in view of the great benefits incurred, it should be accepted without hesitation.)

(v) Difficulties likely to be encountered in an inoculation campaign.

241. There are, however, practical difficulties to be overcome in a serum-simultaneous inoculation campaign to which brief allusion must be made. Bullocks after inoculation must be rested for about fifteen days until recovery takes place. Cows temporarily decrease their yield of milk but quickly recover, and we were informed in Egypt that the wide experience there obtained justifies the conclusion that the full milk flow quickly returns. Cows advanced in pregnancy, delicate calves under a month old, and animals weak or debilitated from

any cause are unsuitable subjects for inoculation. In India, the prejudice against handling blood in any form has also to be taken into account. There is finally the risk, real though not very considerable, that rinderpest may be introduced into a district from which it is absent; for inoculated cattle are infectious and must not be allowed to mix with others.) These practical difficulties indicate that some opposition to the use of this method may be anticipated. Objection is often raised to the serum-alone method which does not involve the handling of blood, or the temporary loss of labour and milk, and it is obvious from this that opposition would be much increased if serum-simultaneous inoculation were in question. We have, therefore, considered the desirability of conferring general compulsory powers on officers who engage in inoculation campaigns in accordance with the policy which is being followed in Egypt. We are of opinion that this step would not be desirable in present conditions. It was not until the Egyptian fellaheen had become accustomed to have their cattle immunised on a voluntary basis that compulsion was introduced, and we think that cultivators should be given an opportunity of seeing what inoculation can do to protect their cattle before they are required to accept compulsory measures.

(vi) POLICY TO BE FOLLOWED IN COMBATING RINDERPEST.

242. If no opposition were to be anticipated, we should have recommended that inoculation campaigns should be started in the first instance in the best breeding areas and especially in those districts in which government bulls are being supplied. We hope that co-operative breeding societies and cow-keeping societies, such as the milk unions of Bengal will, by having their cattle immunised, give a lead to the cultivators generally. But the villager is least likely to harden his heart against inoculation when cattle plague is upon him, and we recommend that to begin with, apart from work among societies, the serum-simultaneous method should be adopted in combating actual outbreaks of rinderpest. These are, unfortunately, numerous enough in India to give both veterinary officers and cultivators ample opportunities of studying the results.

The policy we have in view for the control and treatment of livestock diseases in India is one which can only be worked up to gradually; more men, more funds and more experience are all called for. The question, therefore, arises as to the immediate line of action which should be adopted in combating rinderpest. We consider that, whenever outbreaks occur, efforts should be concentrated on protecting all the more valuable animals by the serum-simultaneous method. It would not, in any case, be possible to protect all animals, since cows in advanced pregnancy and very weak animals could not safely be so treated. Valuable pregnant cows should be temporarily protected by the serum-alone method, but as the pressure of work during an outbreak would usually be great, the least valuable stock should be neglected. The extent to which inoculation by serum alone should proceed side by side with simultaneous inoculation can only be decided by the veterinary officer in charge of the operations.

In a widespread outbreak, it is obviously better to protect valuable animals throughout the whole area affected than to spend time in protecting every animal in particular villages. The objection to leaving unprotected animals in a village where the serum-alone method has been used is that dangerous foci of disease remain which may undo the whole of the benefit conferred by temporarily protecting animals; but, when the valuable animals have all been permanently protected, subsequent outbreaks in the village need cause no alarm to those responsible for checking disease. Indeed, in Mysore, such subsequent outbreaks proved distinctly useful as they proved to cultivators whose cattle had been protected that they had been well advised to agree to the operation, and to owners who had refused to have their cattle inoculated that they had acted foolishly.

(viii) Fees for inoculation.

243. Inoculation, not only against rinderpest but against other contagious diseases, is usually done without cost to the cultivator. Sometimes, however, a small charge is made as by some of the district boards in Bengal. In Bombay, where rinderpest serum is provided free, a charge of two annas is made for doses of other vaccines. It is the invariable experience that where charges, however small, are made for such preparations, their use is greatly checked and it was for this reason that the fee of Rs. 2 per head for inoculation by the serum-simultaneous method, which had been levied for some time in the Madras Presidency, was abolished from January 1st, 1926. We recommend that all fees for inoculation not only against rinderpest but also against other contagious diseases should be abolished. The revenue derived from them is very small as compared with the expenditure, and they undoubtedly act as a grave deterrent to an extended use of preventive inoculation. We recognise that the widespread adoption of the serum-simultaneous method must involve an appreciable increase in expenditure if no charge is levied when it is used. For the cattle of the plains, the cost of the doses of serum and virus works out at about one rupee per head; but there is little doubt that, if the work were carried out systematically on a large scale, the cost could be greatly reduced, possibly to not more than half this sum. We shall return to this point in discussing the work of the Imperial Institute of Veterinary Research at Muktesar.

(viii) Compulsory inoculation.

244. Whilst we do not think that, in present conditions, compulsory inoculation is advisable in dealing with the cultivators' cattle, there is one class of cattle owner who should, in our opinion, be required to have his cattle permanently protected; we refer to milk sellers registered by municipalities. Wherever municipalities do not possess the legal power to prescribe the registration of milk sellers or to enforce immunisation, we think that power should be conferred. Recent experience in Madras where a large number of cross-bred European cattle are kept has shown the advisability of the course we have recommended. Milk sellers in that city are licensed and their cattle sheds, milk shops, etc., are inspected by officers of the Health Department, but it does not appear that the maintenance in health of dairy cattle has engaged attention, as no veterinary surgeon is employed permanently

by the Corporation. Outbreaks of rinderpest are not common in Madras city; that which occurred in the latter half of 1926 was the third in twenty years and it is not surprising, in these circumstances, that milkmen should be unwilling to adopt serum-simultaneous inoculation which temporarily arrests the flow of milk. The consequences of this unwillingness may, however, be serious as the following approximate figures for the recent outbreak will show :—

	Indian cows	Cross-bred cows
Number of cattle attacked	9,500	850
Number of deaths	140	121
Percentage of deaths	1·47	14·23

It will be seen that the disease in this case was not of a virulent type; the percentage of deaths among Indian cattle was very small, but that amongst the European cross-breds was ten times as large.

Our reasons for recommending compulsory inoculation for such cities as Madras are two. The city population must be protected from a sudden and serious curtailment of the milk supply and the cultivator must be protected from the spread of disease through the susceptible cross-bred cows kept by licensed milkmen. Licensed milkmen, purchasing a cow in-calf, should be compelled to have it protected shortly after it has calved. They should similarly be compelled to protect cows in milk as soon as bought. It would be necessary for the municipality to provide an isolation hospital for inoculated animals as they would constitute a danger to other animals if they were kept in the ordinary cowsheds.

(*ix*) Conclusion.

245. Rinderpest, although the most important, is only one of the serious infectious diseases to which Indian livestock are liable. In discussing the measures which should be undertaken to deal with it, sufficient has been said to show that the suppression of epidemics must make large demands on the professional skill, the energy and the judgment of the officers in charge of the operations, and that the type of education which such officers should possess is of a different order from that necessary for officers competent to deal with the diseases and injuries that come within ordinary veterinary dispensary practice. It will also be evident that to cope successfully with epidemic diseases, the number of officers employed by provincial governments must be largely increased. Before we formulate our proposals under these heads, it will be convenient if we discuss the question of legislation against disease and describe the present position in regard to veterinary aid.

Legislation against disease.

246. If the policy we outline in this chapter is accepted, we are confident that a great reduction can be effected in the immense losses now caused to cultivators and to the public as a whole by the ravages of disease. No staff, however large and however skilled, can be fully effective unless Government have the power to control the spread of infection by veterinary police

measures. We recognise that such measures present much greater difficulty in India than in the countries in which they are now commonly adopted and it is partly for this reason that we lay such emphasis on the training of officers for the superior veterinary services. Conditions in India call for initiative, judgment, tact and high professional skill in a far greater degree than they do in countries in which rigorous police measures are possible. But it would be fair neither to the veterinary departments nor to the tax-paying public, which is called upon to contribute large sums for the suppression of disease, if no attempts were made to give this work such aid as it is possible to give it by legislation.

More attention to the question of controlling disease appears to have been given in Madras than in any other province. A Cattle Diseases Act was passed in that presidency as early as 1866 and is still in operation. Under the powers conferred by this Act, the notification of certain diseases has been made compulsory; movements within the presidency can be regulated; "standstill" orders, for example, can be made should disease break out during cattle fairs; and the carcases of animals which have died of disease can be destroyed.

But, though the powers conferred by the Act are extensive, their effects are very limited owing to the difficulty of applying them effectively. Some sections of the Act have, however, served a useful purpose. When, for instance, a rinderpest outbreak is being dealt with, inoculation with anti-rinderpest serum is made compulsory and, where cultivators have objected, a few prosecutions have resulted in inoculation being carried out with little difficulty. In Burma, the Cattle Disease Rules of 1914 which apply to all areas in which the Burma Village Act, 1907, is in force enable outbreaks of disease to be dealt with on much the same lines as in Madras, with the important exception that inoculation cannot be made compulsory.

The difficulties which have been encountered in enforcing legislation for the control of cattle disease in Madras have also been encountered in Burma. There are obvious objections to enactments the provisions of which cannot be strictly enforced and we should have hesitated to make any recommendations on this point were we not convinced that the advantages of legislation greatly outweigh these objections.

Under the Devolution Rules, legislation in respect of animal diseases is a central subject to such an extent as may be declared by any Act of the Indian Legislature. We recommend that a Contagious Diseases of Animals Act should be passed for the whole of British India so that a uniform procedure may be possible throughout the country. The Act should empower local governments to apply by administrative order to any tract such of its provisions as may be applicable in the circumstances of the case.

The Act should be sufficiently comprehensive to ensure that all the powers likely to be required in dealing with any disease may be legalised and, following the usual lines of such legislation, should deal with the action required of provincial governments and district boards or other

local authorities and their officers, the reporting of disease, the isolation of infected animals and of animals which have been in contact with them, the disposal of the carcases of diseased animals and of other infective material, disinfection, the closure of markets and fairs, the regulation of movement and the compulsory inoculation of animals which have been in contact with infected animals.

A list of the diseases to which the Act applies should be given in a schedule appended to it and model rules should be drawn up by a committee, on which the veterinary departments should be adequately represented. These rules should be published by the Government of India.

If legislation of this character were enacted, it would be possible for officers dealing with an outbreak to determine which of the powers conferred by it could usefully be applied in a particular case, and to move the provincial governments to take suitable action. The existence of model rules would make it unlikely that there would be any departure from them without good cause, and thus, whilst the elasticity necessary to meet local conditions would exist, the general procedure throughout India would tend to be the same. In the United States, where the position is somewhat similar to that in India, the individual States are responsible for the enforcement, within their own territories, of regulations for the control of livestock diseases, but, in the event of an outbreak of contagious disease, the Federal Government adopts the measures required to prevent it from spreading beyond the boundaries of the States affected. If uniformity of action in dealing with the various contagious diseases is adopted by the provincial veterinary departments, we do not consider it necessary at this stage that the Government of India should follow the example of the Federal Government. The present position in respect of the prevalence of epidemic disease is very different in the two countries. If, as we trust will prove the case, an outbreak of a dangerous disease eventually becomes as rare an occurrence in India as, for example, an outbreak of foot-and-mouth disease is now in the United States, the intervention of the central Government may be essential; but this period is still so distant that the measures likely to be called for when it arrives need not now be discussed.

A more immediate problem is presented by the Indian States. The mutual benefit to be derived from a united effort to check the spread of disease is so great that we are hopeful that Indian States will be prepared to copy the legislation enacted by the Government of India and to adopt the model rules drawn up for use in British India. It is in this hope that we suggest, in paragraph 258, that provision should be made for the training of students from those States at the college selected for the training of candidates for the provincial veterinary services in British India, and, in paragraph 263, that the States should be treated in exactly the same way as provincial governments in regard to the charges made for the products manufactured at Muktesar. Where small States employ veterinary assistant surgeons but are unable to employ fully qualified veterinary surgeons, it should be possible for them to arrange for

the expert guidance necessary, either by obtaining the part-time services of an officer working in an adjoining British district, or by joining with other States to engage a veterinary surgeon who would supervise the work of their dispensaries and organise a staff to combat outbreaks of disease.

THE PRESENT POSITION OF VETERINARY AID.

247. In 1868, Lord Mayo, as Viceroy, appointed a Commission to report on cattle disease in India and the measures necessary for their prevention and cure. The report of the Commission included a recommendation for a Civil Veterinary Establishment. The Famine Commission of 1880 made no recommendations on this subject; it recommended, however, the constitution of an Agricultural Department, and the Secretary of State, in 1882, urged that this should give early and careful attention to the subject of cattle disease. In 1883, a commission recommended the formation of a Civil Veterinary Department, but want of funds prevented anything from being done. In 1886, the Government of India recommended to the Secretary of State the formation of a Civil Veterinary Department but it was not until 1891 that such a department was formed.

Apart from a few practitioners in the large towns, there are no veterinary surgeons in private practice in India. Veterinary aid is thus, except to a negligible extent, provided by officers employed either directly under Government or by local boards and a comparison of the number of these with the total cattle population reveals that there is only one of them to every hundred thousand cattle; but even this single practitioner cannot be regarded as a whole-time officer for cattle, as there are a number of other domestic animals requiring his aid. Moreover, of the officers employed, only one in fifteen can claim to be a qualified veterinary surgeon. The others have been trained only as veterinary assistant surgeons.

For the whole of British India, there are in civil employ about 32 veterinary surgeons in the Indian Veterinary Service and 52 in the provincial veterinary services, whilst the number of veterinary inspectors and veterinary assistant surgeons in 1927 was about 1,400. A number of the superior staff are employed in teaching and other duties. Thus some 33 gazetted officers only are available for the control and treatment of disease, and, of this small corps, fewer than one half are licensed to practise veterinary medicine and surgery through possessing the diploma of the Royal College of Veterinary Surgeons.

These figures sufficiently show the inadequacy of the existing arrangements for controlling contagious diseases and attending to animals suffering from ordinary ailments and from injuries. Many sick and wounded animals do, in fact, receive treatment of some kind from persons who have had no training in veterinary matters. Experience has taught the value of certain remedies and these may at times be used empirically with good effect; but there is much crude quackery and it is unlikely that animals gain as much as they lose from treatment by untrained men. The position, therefore, is that the effective treatment of the

diseases of livestock in India depends upon veterinary assistant surgeons employed, as a rule, under district boards, inspected by a small staff promoted from their ranks, supervised by a very small administrative staff of veterinary surgeons and instructed by a still smaller staff of expert teachers and research workers.

To education and research we shall refer at a later stage. We propose, in the first instance, to examine the provision made for the diagnosis, control and treatment of disease. As was the case in our chapter on Animal Husbandry, our remarks apply mainly to cattle. Except in the hospitals attached to the veterinary colleges, in those northern districts in which horse breeding is still* in their charge, and when cases arise under the Glanders and Farcy Act, officers of the Civil Veterinary Department have little concern with horses. Equine diseases in India are mainly treated by army veterinary surgeons. Sheep suffer to some extent from epidemic diseases; it may also be inferred that they suffer heavily from parasitic diseases, as they do in other countries, but the small value of sheep and goats has resulted in little attention being given to diseases amongst them and almost nothing is known of the extent of the losses caused in flocks by preventible disease. Elephants, though few in number, are very valuable and, in Assam and Burma, their diseases have received some special study. Similarly, because of their local value, attention has been paid to disease in camels in the Punjab and Sind. The diseases of dogs, especially rabies, are of much public interest and dogs are an important class of patient in veterinary hospitals in the towns; but in mofussil practice, they may be left out of account.

All the major provinces employ a very small staff of fully qualified veterinary surgeons but, in other respects, the arrangements made for combating animal disease differ somewhat widely. In the Punjab, and in Burma as a temporary measure, the Veterinary Department is under the administrative control of the Director of Agriculture. Bengal, Bombay, Burma, Madras and the Punjab possess veterinary colleges and Bihar and Orissa will shortly do so, but it is only in Madras and Burma that the college is under the direction of the officer responsible for the supervision of the staff controlling disease. In the other provinces, the principal of the college and the officer in general control of district work, variously designated Veterinary Adviser, Chief Superintendent, Superintendent or Director, are entirely independent. Bombay has two superintendents, one for the presidency proper and one for Sind, who is also in charge of Ajmer-Merwara.

It is, again, only in Madras that the local Government have undertaken full responsibility for veterinary aid and that the district staff is both employed and paid by Government. In other provinces, hospitals and dispensaries are, with few exceptions, provided and maintained by local boards, though Government usually give grants-in-aid.

* When the Civil Veterinary Department was constituted, it was intended that, it should have charge of horse breeding. There was soon afterwards a change of policy: but in about half the Punjab districts, and in Sind, horse, mule and donkey breeding is still in charge of the department.

They are staffed by veterinary assistants whose services are lent by Government. In Bombay, Burma, the Central Provinces and the Punjab, the cost of all veterinary assistants whether they are in charge of hospitals and dispensaries or are itinerating officers, is borne by provincial revenues. In Assam, Bengal, Bihar and Orissa and the United Provinces, veterinary assistants actually receive their pay from the local Government but, in Bengal, the whole and, in the other three provinces, the greater part of it is contributed by the local board concerned.

In all provinces except Madras, the veterinary assistant employed by a local board is thus subject, in varying degrees, to dual control, that of the head of the provincial veterinary department and that of the local body by which he is employed. The control of the district board is, however, strictly limited as it has no power to appoint, punish, transfer or dismiss a veterinary assistant, though it would appear that, in some provinces, due weight is given to its views in this respect. It was held by many witnesses before us that this system of dual control gave rise to considerable administrative difficulties especially where assistants in charge of dispensaries are liable to be called up by the chief veterinary officer of the province to assist in dealing with outbreaks of contagious disease. We shall revert to the question of organisation but, before doing so, we propose to examine the nature of the work which veterinary departments are called upon to undertake.

WORK OF VETERINARY DISPENSARIES.

248. As we have seen, private veterinary practitioners do not exist in India; we were assured that, in present conditions, it would be impossible for a practitioner to make a living in a rural area. Veterinary aid has, in a very few instances, been provided by large landholders and philanthropic bodies, but, were it not for the system described in the preceding paragraphs, relief to sick and wounded animals would be entirely out of reach of all but a minute fraction of the population. The officers in charge of dispensaries and the itinerating veterinary assistants are called upon by livestock owners to treat ordinary non-contagious diseases and to dress wounds; they are also required to share in castration campaigns and to assist provincial officers when outbreaks of contagious disease occur. They thus replace the private practitioners of other countries.

A common and legitimate complaint against many of the existing dispensaries is that they are located in the district headquarters or in other towns, so that while they are useful to the owners of cattle and horses living in or near headquarters and are freely used by them, they are neither accessible to, nor patronised by, ordinary cultivators. The true cause of complaint, however, is not that there have been errors in the selection of sites for dispensaries, but that the dispensaries in most provinces are much too few in number.* In all provinces, the aim

* The numbers of veterinary hospitals and dispensaries in 1926-27 were: Punjab 219, United Provinces 149, Bihar and Orissa 122, Bombay (including Sind) 122, Central Provinces and Berar 94, Madras 87, Bengal 47, Assam 45, North-West Frontier Province 19 and Burma 5.

should be to provide a veterinary hospital with accommodation for in-patients at district headquarters, and in addition a number of dispensaries serving subdivisions of the district. If only two or three dispensaries can be provided within a district, central market towns are obviously the most suitable locations for them. It is clear that, in districts in which cattle alone may number a million, cultivators cannot be greatly aided by the provision of two or three dispensaries only.

To meet the obvious shortcomings of the single dispensary serving a large tract of country, the staff attached to dispensaries should be increased and men sent out to tour in the surrounding villages. They should carry with them a small box of drugs and prescribe such other remedies as can be readily obtained in the bazaars. It is true, as was pointed out to us, that the objections to the system of itinerating veterinary assistants which prevails in most provinces are that the work of these assistants is difficult to supervise and that touring officers are of no use in cases calling for continuous treatment. On the other hand, even a single visit may prove of value in many cases, especially in treating and giving directions for the care of wounds; and it may be remarked that no form of propaganda is likely to be more effective than timely aid given to a cultivator by a trained officer. We think that objections to the system of touring assistants would be very largely met and that the value of most veterinary dispensaries would be more than doubled if they were the headquarters of two or more veterinary assistants, one of whom was in constant attendance at the dispensary and one or more left free for touring.

WORK OF THE PROVINCIAL VETERINARY DEPARTMENTS.

249. The main work of a State veterinary service should be the control of contagious diseases, disastrous to the whole community in their economic effects and in some cases dangerous also to human health. As contrasted with the veterinary assistant of India or the private practitioner of western countries who attends the sick and wounded animals of the stockowner in order to save him loss, the veterinary surgeon in State employ labours in the interests of the whole population. In stopping the onrush of a disease, he is as much a public servant as the engineer who, by the construction of embankments, preserves a district from floods; in eliminating and destroying the sources of infection of anthrax or rabies, he protects human life just as does the medical officer who seeks to detect and destroy the sources of infection of cholera or plague. It is, indeed, recognition of the fact that the veterinary officer is capable of protecting the interests of the whole community and not merely those of the owner of livestock that has led, in recent years, to the employment of State veterinary surgeons, remunerated from public funds, in most civilised countries.

It has been argued by some witnesses that there is no such justification for the appointment by public authorities of veterinary officers whose work relates merely to diseases of a non-infectious kind, or to operations and wounds. In this case, the contention is that the

owner of the affected animal should pay for the services rendered. We agree with this argument in principle, and are of opinion that, in developing the veterinary services in India, the justice of the contention that the stockowner himself should be responsible for the treatment of his sick and wounded animals, where epidemic and public health matters are not involved, should never be lost sight of; but as a practical policy at the present time, we regard it as both unsuitable and undesirable. It has already been stated that, in existing conditions, private veterinary practitioners cannot earn a livelihood in rural areas. Unless, therefore, Government or district boards take the initiative, veterinary aid is beyond the reach of the rural community. Moreover, quite apart from the consideration that it should be repugnant to public opinion to permit preventible suffering in domestic animals, it cannot, we think, be disputed that, where the community consists to so large an extent of cultivators who, individually, are too poor to secure the benefits which modern veterinary medicine can confer, local bodies as trustees of the welfare of the public whom they serve should devote a part of the funds at their disposal to the provision of veterinary assistance.

In India, the need exists for both the types of veterinary officer referred to in the foregoing paragraphs, and both types are now employed. We desire to differentiate clearly between their functions and their training. To the training we shall allude in a later paragraph. The work of controlling operations against epidemic disease is one which calls for the employment of fully qualified veterinary surgeons. The duty of control must rest with the provincial governments and we are of opinion that so far as is practicable, their own staff should consist of fully qualified veterinarians. The duty of providing a local veterinary service for treating diseases not scheduled as contagious and dealing with operations and wounds should, when the necessary arrangements can be made, rest with local bodies. Those local bodies who maintain an approved service of veterinary assistant surgeons should receive grants-in-aid from Government, and the work of these veterinary assistants, whether in dispensaries or as itinerating officers, should be supervised and guided by the qualified veterinarians employed by the province. The legislation which we recommend in paragraph 246 would prescribe the action to be taken on the outbreak of an epidemic by local bodies in receipt of grants. In outline, it may be stated that the services of all veterinary assistant surgeons in the area of the local authority in which disease occurred would be placed under the direction of the provincial veterinary surgeon in charge, and that, under the scheme which we discuss in paragraph 253 below, the services of veterinary assistant surgeons from other districts might be made available. We shall now proceed to explain our proposals in greater detail. It will be evident that they can only be brought into operation gradually, that interim arrangements will be called for, and that what will be necessary, if our recommendations are accepted, is preparation for a change in organisation rather than any immediate change.

STRENGTH OF THE VETERINARY SERVICES.

250. No satisfactory progress can be made in combating contagious diseases of livestock, or even in dealing with the other ailments of cattle, unless the staff of the veterinary departments in all provinces is very greatly expanded. The field for veterinary activity in this country is so vast that the measure of expansion required is a matter on which it is not easy to arrive at a definite decision. Our view is that the aim should be to provide on an average at least one veterinary assistant surgeon for every 25,000 cattle and one qualified veterinary surgeon for each district, who would have, on an average, about 600,000 cattle, in addition to other livestock, in the area under his charge. There are 272 districts in British India, so that, on this basis, the number of Provincial Service officers required would be in the neighbourhood of 300, allowing provision for leave reserve. The number of veterinary assistant surgeons would roughly be increased fourfold, that is, to about 6,000 officers.

Livestock disease in British India could not be effectively handled without the co-operation and assistance of Indian States, a point to which we have referred in paragraph 246. If provisions were made by them on the same scale as we have assumed to be desirable for British India, the total number of qualified veterinary surgeons employed in India, apart from any private veterinary surgeons and a certain number serving under municipalities, would be at least 330 and the total number of veterinary assistant surgeons would exceed 7,500.* To the superior staff must be added the staff of the veterinary colleges, the officers employed in supervising duties, and provision for leave reserves. The total number of qualified veterinary surgeons in the employment of Government and that of Indian States would thus be over 400, as against rather under a hundred at present.

To those accustomed to the standards of western countries, our suggestions for the protection from epidemic diseases and for veterinary treatment of Indian livestock may well appear to be quite inadequate, but they represent a very large increase on the provision now made for veterinary aid and, by the time the increase in staff we have suggested is reached, we have little doubt that another enquiry into the position of agriculture in India will have become due. Our successors will then be able, in the light of experience gained in the interval, to determine what further provision for the control of disease may be called for.

The first need created by an effort to give effect to the proposals we have adumbrated above would be the need for more money; but, even if an unbroken succession of prosperous years and of satisfactory budgets were to overcome financial obstacles, India could not immediately deal successfully with the problems of livestock disease. Experience has still to be gained in the application, in Indian conditions, of such remedies as serum-simultaneous inoculation against rinderpest. The cultivator must be won over to exchange his present dislike and passive,

* The total number of livestock in Indian States is not known. These figures are based on the numbers returned by those States for which statistics are available.

if not active, opposition to such remedies for willingness to take his share in the campaign against disease. Plans are required for the supply of serum in very large quantities; it may be that additional sub-stations to Muktesar will be called for. Again, the whole subject of training qualified veterinary surgeons in India must be examined afresh; for the needs of an expert staff of the dimensions we contemplate could not be met by continuing the practice of sending students to other countries to obtain a full training in veterinary medicine and surgery. There is thus much to be done before anything approaching adequate provision can be made for dealing with the diseases of Indian livestock. But the work is of a kind which can, indeed must, be dealt with in stages, if it is to be handled effectively, and we have already marked out the first stage for action. This is immediate recourse to the serum-simultaneous method of inoculation in combating outbreaks of rinderpest. Experience in Mysore has shown how much can be done with a staff hastily improvised and trained and what is possible in Mysore is not impossible in British India.

ORGANISATION OF THE VETERINARY SERVICES.
(i) THE SUPERIOR SERVICES.

251. We now turn to the consideration of the manner in which the enlarged veterinary services we contemplate should be organised. We would suggest that the chief veterinary officer in a province should be styled Director of Veterinary Services. We would further suggest that the present arrangement under which the Veterinary Department in the Punjab is under the administrative control of the Director of Agriculture should be terminated. We are unable to regard an arrangement under which the head of one technical department is in charge of another as a satisfactory one. The additional work which will be thrown upon directors of agriculture by the recommendations we make elsewhere in our Report furnishes an additional reason for making the Veterinary Department in the Punjab independent of the Agricultural Department. We consider that the principal of the veterinary college should stand in the same relation to the Director of Veterinary Services in his province as does the principal of an agricultural college to the Director of Agriculture. The posts both of Director of Veterinary Services and of principal of a veterinary college should be scheduled as selection posts outside the cadre of the provincial veterinary services. It is most important that the holders of these posts should be officers of ability and strong personality as they will be responsible for carrying out the large expansion of veterinary activities which we propose. If officers of the requisite capacity for these posts are not forthcoming in the veterinary department of a particular province, we think that the local government should, in the first instance, turn to the veterinary department of another province. If suitable officers cannot be spared from any of the provincial departments, the local government should, we consider, be prepared to recruit an officer from outside the country.

Both the present heads of the veterinary departments in the provinces and the principals of the veterinary colleges receive pay on the ordinary

time scale *plus* a personal allowance, unless they are in the selection grade, in which case they receive the pay of that grade only. We consider that the pay of both posts should be reconsidered and that a scale should be fixed commensurate with the responsibilities which will attach to them if our recommendations for the expansion of veterinary activities are accepted.

Under the Director of Veterinary Services, there would be deputy directors in charge of circles. In present conditions, all the major provinces, except Bombay, are divided into such circles, which vary in number from two in Bengal and Bihar and Orissa to six in Madras and the United Provinces. These are in charge either of members of the Indian Veterinary Service, an all-India service, or of the provincial veterinary services, except in Assam, where they are in charge of veterinary inspectors. Recruitment for the Indian Veterinary Service, as for other all-India services working in the transferred departments, has now ceased and the duties of that service will ultimately be taken over by the new superior provincial veterinary services. The main change in the present system involved in our proposals is that they provide for a qualified veterinary surgeon for each district and, in these circumstances, we consider that it will be sufficient if each province is divided into two or three circles only, each of which would be in charge of a deputy director who would be a member of the Indian Veterinary Service, so long as any member of this remains in service, or of the new superior provincial veterinary services. We suggest that an appropriate scale of pay for these services would be the existing scale of the Indian Veterinary Service. We contemplate that vacancies in it will ordinarily be filled by promotion from members of the provincial veterinary services, but direct recruitment should be resorted to whenever an officer with the requisite abilities is not available from this source. The duties of the deputy directors will be responsible, and care should be taken to appoint to these posts men who are in all respects well qualified for the work to be done.

So far as district work is concerned, the Provincial Veterinary Service in each province will consist of the qualified veterinary surgeons we suggest for each district who might be designated "district veterinary surgeons." The primary duty of this service will be the control of epidemic diseases. While we recommend that provincial governments should aim at providing as many veterinary surgeons as there are districts in the province, we think it unlikely that at first these officers could always be stationed in the districts of which they were in charge. The headquarters of the district staff would be settled by the Director of the department, and would depend on local conditions. In the early stages of rinderpest control, while this disease was prevalent, veterinary surgeons would frequently be called upon to leave their districts, but, at a later stage, when epidemics were less prevalent, we hope that they would be able to spend the greater part of their time within their districts where there would be much for them to do. The work of the veterinary assistant surgeons would require inspection and guidance. The veterinary surgeon would

act as a consultant, helping assistant surgeons with difficult cases. The efficiency of the inexpensive service which we propose for enabling cultivators to get treatment for their cattle would depend largely on the qualification of the district veterinary surgeon. Moreover, in most cases he would be the only officer having experience in the treatment of other animals than cattle. For the provincial veterinary services, we consider that the present rate of pay, *viz.*, Rs. 250 to Rs. 750, would be suitable. Complaints have been made of the difficulty of obtaining sufficiently well qualified candidates for these services and higher salaries have been suggested as the remedy. The crux of the matter appears to us to lie in the nature of the training required. It is natural that a student who has to meet the great expense and personal inconvenience involved in proceeding to Europe to qualify himself for employment and who, since the total number of appointments is small, has no certainty, in present conditions, that employment will be forthcoming, should expect a high initial salary when he does receive an appointment. If, however, training were provided in India and a large and expanding service, offering some degree of certainty of employment, were forthcoming, the position would be very different. In these circumstances, we consider that the scale we suggest should be sufficient to attract suitable candidates, provided that a good training, qualifying candidates for admission to the service, is given in this country. Any higher scale would make this service so expensive as to check the rapid expansion which we consider so important. We deal with the question of training in paragraph 257 below. The safeguards which we recommend in our chapter on The Agricultural Services, paragraph 556, in regard to the recruitment, discipline and conditions of service of agricultural officers are equally desirable in the case of veterinary officers.

(*ii*) THE SUBORDINATE VETERINARY SERVICES.

252. The subordinate veterinary services employed in district work ordinarily consist of veterinary assistants who are, for the most part, lent to local bodies and of a smaller number of veterinary inspectors, promoted from the ranks of the assistants, who are directly under the control of the chief veterinary officer of the province. In Madras, there are no veterinary inspectors. We do not contemplate the continuance of this grade under the proposals we have outlined above as their inspection work would, in course of time, be taken over by the veterinary surgeon in charge of each district. Men of ability, who now rise to be inspectors, could, in future, be encouraged to take the full veterinary qualification. Should the prevalence of disease in a province make this course necessary, veterinary assistant surgeons might be employed under district veterinary surgeons as inspectors. The enlarged staff of veterinary assistants would continue to work under local bodies. There is no question in connection with the organisation of the veterinary departments to which we have given more anxious consideration than the relations between the veterinary departments and local bodies in regard to these assistants. We have stated our view that the provision of veterinary aid for diseases not scheduled as contagious and for injuries should be the direct concern of local bodies, whilst the

control of contagious diseases and the maintenance of the efficiency of the local staff should be the concern of the provincial governments. We have pointed out that this distinction is not clearly recognised in present conditions and that the veterinary staff in the employ of local bodies may be called upon to deal with outbreaks of contagious disease outside their own districts. We have mentioned the unsatisfactory character of the arrangement under which local bodies have no control over the veterinary assistants employed by them in regard to appointments, transfers, promotions, punishments and dismissals though, in some provinces, weight is given to their views in this respect. There is a considerable body of opinion which holds that local bodies would take a far greater interest in veterinary matters if they possessed full powers of control over the veterinary assistants working under them, as they would then realise that they were responsible for the success or failure of a veterinary dispensary or of the touring work done by an assistant. On the other hand, it has to be recognised that, if inspection and advice remained with the provincial veterinary services, the absence of any powers of control over the staff in charge of dispensaries or engaged in touring work might lead to a decline in efficiency. The funds at the disposal of local bodies are far from adequate to all the demands on them and, if the subordinate veterinary staff were handed over to their complete control, it is possible that the provision for veterinary aid might figure to an even smaller extent in their budgets than it does at present. Again, it can hardly be doubted that service in a provincial department is ordinarily regarded as offering better prospects and greater security of tenure than employment under local bodies and that this consideration may weigh with those who are contemplating taking up veterinary work and may affect admissions to the veterinary colleges. There is also the risk that local bodies in remote or unhealthy districts might find it difficult to recruit men.

We are not in favour of the complete provincialisation of the veterinary departments as in Madras. In existing conditions, the considerations mentioned above appear to us to show that the disadvantages of an immediate transfer to local boards of complete control over veterinary assistant surgeons would outweigh the advantages. We look forward, however, to the time when local bodies will come to realise to the full their responsibilities for providing veterinary aid and when the control of all veterinary work, apart from that connected with the control and prevention of epidemic disease, can be entrusted to them. When that time comes, the assistance given by all local governments to this branch of veterinary aid would take the form of a conditional grant-in-aid which might be given on a *pro rata* basis. The change in the direction of transfer of greater responsibilities to local bodies in respect of veterinary matters can only be made gradually and the rate of progress will differ in different provinces. Once complete transfer is effected, we have no doubt that it would be made a condition on which a grant-in-aid would be given that local bodies should look to the provincial veterinary services for advice and inspection and should consult the directors of veterinary services in regard to all

appointments. In the meantime, we consider that the system at present adopted in some provinces under which local bodies are consulted in regard to appointments, transfers, promotions, punishments and dismissals should be extended to all provinces. We would suggest that, when an appointment of a veterinary assistant to a dispensary or for touring work under a local board is made, the Director of Veterinary Services should supply the local board with a panel of three or four names from which it might make a selection.

VETERINARY RESERVE CORPS OF ASSISTANT SURGEONS.

253. We contemplate that the provincial staff to be employed to control contagious and infectious diseases should ultimately consist exclusively of qualified veterinary surgeons. It will, however, be obvious that, even if the full number of officers we have postulated were available, they would require more assistance with inoculation work than could be given by veterinary assistant surgeons in the affected districts when operations were being conducted on any large scale. The question therefore arises as to the manner in which this assistance should be provided when the complete control over the staff of veterinary assistant surgeons has been transferred to local boards. We think that the method likely to prove most successful would be to establish in each province a "Veterinary Reserve Corps" of selected veterinary assistants who could be called up for duty in any part of the province when an epidemic occurred. Experienced veterinary assistants would be selected for membership of this corps by arrangement with the local boards under which they were working. Selection for service in it should be regarded as a distinction and provincial governments should grant members of it personal allowances which might take the form of a fixed annual grant or of an addition of, say, ten to fifteen per cent to salaries.

A possible objection which may be raised to this scheme is that district boards would regard it with disfavour inasmuch as their dispensaries might from time to time be left without a veterinary assistant in charge. Where a single officer only is available for a dispensary, it would be undesirable to take him away except in cases of special urgency. We have, however, suggested that the aim should be to provide two or more officers for each dispensary, one or more of whom would be mainly engaged in touring work. Where such provision is made, the surplus officer or officers could be spared temporarily without difficulty for work on contagious disease. If disease actually occurred within the district itself, no question of freeing officers for local work would arise; and, in many cases, it could be claimed that no more useful service could be rendered to the stockowners of a district by its veterinary assistants than they would give by sharing in an attempt to prevent contagious disease from entering their own district from adjacent areas. Our scheme thus is that a veterinary assistant should be wholly under the control of a local board until called up to combat an outbreak of disease; he would not be called up for service outside his district unless, with the consent of the board, his name had previously been entered on the roll of the Veterinary Reserve Corps and he would return to his

dispensary or touring work as soon as the duty for which he had been called up was completed. His pay and allowances during his absence from his district would be borne by the local Government. If discretion is used in selecting the reserve, it may, we think, be anticipated that local boards would regard an invitation to one of their assistants to serve in the Veterinary Reserve Corps as a recognition of their own interest in veterinary matters.

So long as veterinary assistants are few in number, the Veterinary Reserve Corps of a province must be small and the directors of veterinary services would no doubt be careful to carry district boards with them in calling up officers to assist the provincial staff. But if, as we hope, the number of veterinary assistant surgeons increases rapidly, a Veterinary Reserve Corps of from 100 to 150 picked men might be provided for the major provinces and a mobile corps of this size would prove of great assistance to provincial officers engaged in suppressing outbreaks of contagious and infectious diseases.

PRIVATE ASSOCIATIONS AND VETERINARY AID.

254. We have recommended that the existing number of veterinary assistant surgeons should be increased fourfold. If this increase is to be secured within a reasonable period of time, it must be brought about mainly through the action of local boards but, so long as suitable dispensaries are provided to which a veterinary assistant surgeon or one stationary and one touring officer can be attached, we do not think that any advantage is to be gained by adhering to one stereotyped form. It must, however, be recognised that provincial and local authorities cannot be expected to make themselves responsible for a complete veterinary service. We have suggested that one veterinary assistant surgeon on an average should be provided for each 25,000 cattle, but one man cannot be expected to attend to the ailments of so many. The organisation we have recommended can only be regarded as providing a framework round which a more complete service can grow up. Private effort must be encouraged in every possible way to supplement the efforts of Government and of local bodies even if the dispensaries it provides fall short of the standard of those which local boards themselves maintain. That interest in veterinary matters leading to active steps towards self-help can be aroused has been shown by experience in the Rangpur district of Bengal, where the combination of the special interest of the chairman of the district board in veterinary work and the desire of the cultivators to obtain veterinary aid has resulted in funds for seven dispensaries being collected locally. The employment of veterinary assistants of their own by co-operative societies or associations of cultivators might well lead the way to the establishment of the private practitioner whose coming would be such a boon to the cultivator. The founding of dispensaries may be commended to benefactors as an object worthy of support. Under the will of the late Mr. N. M. Wadia, C.I.E., funds were provided through which some twenty dispensaries have already been erected in the Bombay Presidency, the Trustees having contributed Rs. 15,000 annually for the purpose on the condition that fifty per cent of the cost is found from other sources.

In the immediate future, it seems probable that private associations employing veterinary assistants would find it necessary to offer fixed salaries with increments corresponding to those given by local boards to their officers; but when, as the result of the work of the boards, cultivators in increasing numbers demand veterinary aid and follow the example of the Rangpur district, we think that the best method of securing satisfactory service will be for the associations to offer a fixed minimum salary and to encourage the recipient to augment it by private practice. Members of the association would be entitled to his services either free or at a prescribed and reduced rate. The terms would be laid down in the conditions of appointment and might vary in different cases. The aim would be to induce a qualified veterinary assistant to settle in a large village or populous district in which local residents believed there was a reasonable prospect of his eventually finding sufficient private practice, but in which the veterinary assistant himself regarded the risk as too great to accept without some guarantee. Benefactors following the example of the late Mr. Wadia and providing funds for dispensaries, would greatly enhance the value of their gifts by endowing the institution with a sum sufficient to enable a village or small town to secure the services of a veterinary assistant surgeon.

THE TRAINING OF VETERINARY PRACTITIONERS.

255. The first and most important question which demands the attention of the authorities responsible for an enlarged and more efficient veterinary service is the manner in which that service should be trained. We realise that it must take time to bring the strength of the veterinary services up to what, in our opinion, should be regarded as the minimum required to enable them to deal effectively with the diseases of livestock in India, but it is, none the less, necessary that the lines on which the expanded service should be trained should be settled without delay.

The type of training which is required to provide fully qualified veterinary surgeons, and also veterinary assistant surgeons, has been very fully discussed by veterinary officers in India in recent years. General agreement has been reached as to the character of the curriculum required, but there has been some difference of opinion as to the length of time over which veterinary studies should extend. On the one hand, it was pointed out that the salaries of veterinary assistant surgeons were not such as to justify candidates taking the long course of study required to train a well qualified veterinary surgeon and that the aim should therefore be to provide a course of two years' duration for veterinary assistants whose emoluments would usually run from Rs. 60 to Rs. 150 per mensem. On the other hand, it was contended that a course of three years was necessary to give the minimum training required and that, if a course of this length were provided, the better students would qualify themselves for promotion to posts in the provincial services either by taking post-graduate courses or by continuing their studies privately. The latter view is the one that has, until recently, guided the policy of those responsible for veterinary education in this country, and the policy was one well adapted both to the position of veterinary studies and the requirements of the Indian veterinary services a generation ago. At

that time, the work of Pasteur and other great biologists had scarcely influenced the curricula of schools of veterinary medicine. The training in these schools was largely empirical since science was not then in a position to give much assistance to the veterinary practitioner. His art was the result of experience, and training in it consisted largely in imparting to students the lessons which skilful practitioners had learned in treating disease. The subject matter of courses of study in veterinary medicine has undergone a remarkable expansion in recent years and the importance of scientific training for the student has greatly increased. It is now felt that the ordinary four years' course, which students preparing for such a qualification as that of the Royal College of Veterinary Surgeons have to undergo, is the minimum required to train the ordinary practitioner and that all who aspire to become leaders in their profession must give a longer period than this to their college studies. Again, a generation ago, there was no question of providing, in India, a full course of study in veterinary subjects. The aim was to train veterinary assistants only, and a three years' course was then regarded as adequate for this purpose. It was not until 1919 that one veterinary college, that at Lahore, adopted a four years' course.

There was one fundamental point on which there was a difference of opinion amongst those veterinary authorities who, in 1918 and 1923, discussed the future of veterinary training in India. This was in regard to the extent to which, in veterinary medicine, those responsible for providing education can depend upon students, whose early training is admittedly incomplete, making the deficiencies of that training good subsequently, and thus qualifying themselves for more responsible work than that at which the college training aims. In veterinary as in human medicine, skill comes with experience. For this reason it was argued that the courses at present provided, whilst inadequate to the needs of students who might desire to pass such an examination as that of the Royal College of Veterinary Surgeons, were sufficient to enable a really good student, prepared to apply himself to study after leaving college, to become a well qualified practitioner in veterinary medicine and surgery, and so were suited to Indian conditions. The other view taken was that it was impossible, within a period of three years, to combine the scientific and technical training that a qualified veterinary surgeon should possess and that, as provision should exist for giving a full training in India, the better plan, desirable alike in the interests of the majority of the students and of the requirements of the country, would be to distinguish sharply between the courses of study offered.

It appears to us that, however suitable the courses of study offered in India have been to the conditions hitherto existing, they are not adapted to the needs of the two large services of veterinary surgeons and veterinary assistant surgeons which we have in view. We are of opinion that two entirely distinct courses of study should be framed, with different entrance requirements and different classes at each stage. The

requirements of the two services cannot be met by providing one course, the best students passing through which would be appointed to the superior service and the poorer students to the lower service. It might be open to students who failed to qualify for the superior service to seek entrance to the lower; but the only avenue of approach to the latter should be the production of a certificate that the examination qualifying for admission to it has actually been passed.

It will thus be necessary to provide two independent courses of training, one qualifying for admission to the superior and one to the lower veterinary service. Before discussing the arrangements which should be made for these, we propose to examine the nature of the training which should be given.

THE TRAINING OF VETERINARY ASSISTANT SURGEONS.

256. We recommend that the framing of a suitable curriculum for training veterinary assistant surgeons should be referred to a body of experts. An examination of the discussions on education at the veterinary conferences held in 1919 and 1923 suggests no reason to anticipate that there will be any difficulty in deciding upon a suitable curriculum. The differing views on this point which were expressed at the conferences were mainly the result of the absence of a definite objective. If the policy we recommend in this chapter is accepted, that objective will be clearly defined. In some provinces, it should be possible to provide a satisfactory training for veterinary assistant surgeons in two years; in others, a course lasting for three years may be essential. The length of time required for the satisfactory completion of any syllabus of studies that may be agreed upon as suitable must depend both on the preliminary education and capacity of the average student and the skill of the average teacher. We attach importance to the selection of subjects. In veterinary education in India, the anatomy, physiology and diseases of the ox must take the position so largely occupied by the horse in courses of study drawn up for students in western countries. We think that it would be a mistake to attempt to include in a short course any subject the study of which is not essential to the attainment of the purpose for which the student is being trained. The fully qualified veterinary surgeon may be required to treat the diseases of any domestic animal and his course of study must be framed with this object in view. The veterinary assistant surgeon, on the other hand, would usually be called upon to treat the diseases of ruminants and mainly of cattle; throughout his course, this purpose should dominate his studies. It would, for example, be undesirable to make the course in anatomy merely a shorter edition of the existing course given at veterinary colleges. It must be a different course in which special prominence should be given to the anatomy of the ox tribe, and in which the remaining six animal types usually included in the anatomical course should be dealt with either very briefly, or not at all. If the range of the subjects prescribed were restricted in this way, it might be possible to reduce the length of the course and at the same time to improve the quality of the training given in the selected subjects. The

entrance qualification should ordinarily be an examination of the matriculation standard. Study of a new subject in a language other than their own presents a serious difficulty to many of those entering short courses and, in some colleges, it may be possible to overcome this by providing instruction in the vernacular in one or more classes. Where a province has more than one vernacular, English must obviously continue to be the medium of instruction but, in this case, colleges might advantageously employ tutors to assist students, especially first year students, in their private reading.

TRAINING OF THE PROVINCIAL VETERINARY SERVICES.

257. In 1922, a committee consisting of the principals of veterinary colleges and others discussed the curriculum desirable for training veterinary surgeons. A scheme for a course of study lasting for four years was drawn up and the opinion was expressed that the course was of a sufficiently high standard to warrant university recognition and the bestowal of the degree of B.Sc. in veterinary science on students who passed the appropriate examinations at the end of it. The Veterinary Conference which met in 1923 approved the course "as a curriculum representing the present minimum requirements for the training of Indians in India up to the highest standard of veterinary education necessary for the country, as demanded by the Public Services Commission of 1912-14."

The course thus approved corresponds generally to the courses of training offered in British veterinary colleges to students preparing for the diploma of membership of the Royal College of Veterinary Surgeons. Such courses extend over four years and admission to them is gained by passing an entrance examination, or by the presentation of a certificate showing that the applicant has passed a matriculation or other specified examination. With the view of encouraging the study of science among students preparing for the veterinary profession, several British universities now offer degrees in veterinary science. The time taken by students preparing both for the degree and for the qualification of the Royal College of Veterinary Surgeons is usually five years. For veterinary students who desire to enter the employ of some public authority rather than to engage in private practice, the Royal College of Veterinary Surgeons offers a diploma in State veterinary medicine, and certain higher degrees or diplomas are also given by universities.

In view of the general character of the duties which, under our recommendations, would fall to veterinary surgeons in the provincial veterinary services in India, we are of opinion that the educational training provided should extend over a period of not less than five years from matriculation. It would not, in our view, be possible to include in a shorter course the instruction in science which all well-trained veterinary surgeons now require. Indeed, if regard is had only to the subjects which should be included in the course, the period of study might well be six years; for, in addition to the subjects which the student at British colleges has to take to qualify as a practitioner, there are

the subjects required for the diploma in State veterinary medicine, some of which should be included in an Indian curriculum. In the interests of the student, however, it is very desirable that the course qualifying for entry to the provincial veterinary services should not take more than five years. We consider that the course should end in a degree, for which purpose it would be necessary to affiliate colleges giving such a course to a university. By conference between university and veterinary authorities, it should be possible to devise a satisfactory five years' course combining the necessary amount of science to qualify for a degree and the necessary professional training to qualify the student to practise as a veterinary surgeon. In our view, a satisfactory course of training for the provincial veterinary services could easily be provided in India. The subject has received careful attention from veterinary experts; the framework of a suitable course has already been constructed; minor adjustments are no doubt desirable but these can, we think, be settled without difficulty by conference between the university and veterinary authorities concerned.

ESTABLISHMENT OF A CENTRAL VETERINARY COLLEGE.

258. We have recommended that the course of training for the provincial veterinary services should be entirely separated from that for veterinary assistant surgeons. The question, therefore, arises whether higher veterinary education should be given at the existing veterinary colleges or at an all-India institution. Financial considerations will render the enlargement of the provincial veterinary services we have recommended a gradual one but, even when those services reach the strength we have suggested, the number of appointments to be filled in any one province annually will not be large. It will certainly not be sufficient, in our view, to justify the expansion of the colleges in the matter of staff, equipment and possibly also of buildings, which would be necessary if two separate courses of instruction were given at all of them. Nor do we think that the number of candidates who would be in training at any one time requires the establishment of a new central veterinary college. We have examined the possibility of utilising the Imperial Institute of Veterinary Research at Muktesar as an educational centre. Apart from the considerations of interference with research work, and the manufacture of sera and vaccines, that this would involve, the inaccessibility of Muktesar renders it entirely unsuitable for the lengthy course of training required for candidates for the provincial veterinary services. As the primary function of those services will be the control and prevention of contagious disease, this course should either include, or be supplemented by, a short period of work at Muktesar but this is, in our opinion, all that this institution should be expected to provide. In present conditions, we consider that the most satisfactory method of providing a suitable curriculum is to be found in training candidates for the provincial veterinary services in all provinces at one of the existing veterinary colleges. Further enquiry would be necessary before a decision could be arrived at as to which of the colleges should be selected

for this purpose. The additional staff required to enable the college selected to undertake the training of men for the provincial veterinary services, in addition to that of veterinary assistant surgeons for its own province, should be provided by the Government of India. Any expenditure involved in the provision of additional equipment and possibly also of buildings should, we consider, be met by that Government as part of its contribution towards the eradication of epidemic disease in India, which is a matter of Imperial importance.

To the extent that the selected college fulfilled the functions of an all-India veterinary college, it would be a central agency for professional training and no alteration in the Devolution Rules would be necessary to permit expenditure on it from central revenues. The further question arises whether the higher training thus provided should be open to any student desiring to qualify himself for admission to the provincial veterinary services or whether it should be confined to candidates selected by the Government of India, provincial governments and Indian States. We consider it more probable, in present conditions, that an efficient veterinary service will be built up if the second of these alternatives is adopted and, therefore, recommend that the course should be open only to candidates nominated by the Government of India, provincial governments or Indian States who would receive a suitable stipend from the authority nominating them during their period of training.

We recommend that, at the outset, one college only should be selected for this purpose because the first objective should be the provision at the earliest possible moment of an adequately staffed and thoroughly equipped institution which can provide the Indian student in his own country with the training which a fully qualified veterinary surgeon requires. When this object has been attained, it may be found that the demand for training of this character is such as to justify similar arrangements at a second college.

THE STAFF OF THE VETERINARY COLLEGES.

259. The future of veterinary medicine in this country will largely depend upon the attention which is paid in the next few years to the staffing of the veterinary colleges. In general, an effort should be made to secure the best men available from whatever source for all colleges and the observations which we make in our chapter on The Agricultural Services, paragraph 568, apply with equal force to the recruitment of the staff of veterinary colleges. This staff should, we consider, form part of the new superior provincial veterinary services. The scale of pay suggested for these services is the present scale of the Indian Veterinary Service. As the teaching duties will be of great importance and the senior members of the staff will be expected to engage also in research, this scale of pay may not prove sufficient, in all cases, to secure men of the calibre required. Where necessary, therefore, local governments should be prepared to grant, as an addition to the ordinary time scale, special pay personal to the individual officer and based on his qualifications and experience. As a rule, special recruitment will be necessary, but officers in the ordinary line of the Indian Veterinary Service and the new

superior provincial veterinary services should be eligible for appointment. No distinction in respect of quality of staff should be made between the college selected for training the superior staff and the colleges training veterinary assistant surgeons only. The qualifications required in the teachers may differ in kind, but not in importance. The scientific attainments of the staff employed in training candidates for the superior service must range over a wider field; but the successful training of recruits for the subordinate service will make equal, possibly even greater, demands on the skill of the teacher. Wide experience in their profession, as well as high pedagogic qualifications, will be very necessary in the instructors who will be called upon to provide the large number of veterinary assistant surgeons required by district boards and other bodies. The salaries that such bodies are prepared to offer in present conditions are low and no substantial advance in them can be expected, if the number of men we anticipate is to be employed. It follows that the technical training must be short and inexpensive but it does not necessarily follow that the officers provided will be inefficient, or unfitted for the work they will be called upon to undertake, if highly qualified and experienced teachers are secured by the colleges which train them.

It is, we believe, only necessary to point to the very large number of men who would require training under our proposals, to justify the contention that the professors and lecturers at the colleges should be most carefully selected. The duties in which these officers and those engaged in research would be employed would be altogether different from those falling to officers employed in district work; thus, in those provinces in which there are veterinary colleges there would be two groups of veterinary officers, a relatively large group combating disease in the field, and a small group engaged in teaching and research. While, as in agriculture, a change between members of these two groups would at times be desirable, in general, it would be better that those who entered the educational branch and proved good teachers should not be tempted to abandon college duties by the prospects, or fancied prospects, of more rapid promotion in the larger district service. The building up of a good teaching staff would be facilitated if arrangements could be made whereby a lecturer in one provincial college could accept a professorship in another without prejudicing his pension rights or prospects. Local governments might not willingly part with a good young officer, but, if in one case they lost, in another they might gain by a system of free exchange between colleges, and the need for competent teachers is so great that we hope governments may take a broad view, and adopt regulations with respect to exchange of professors and lecturers which would be likely to strengthen the teaching profession.

Six veterinary colleges will be available for the training of veterinary assistant surgeons for nine provinces and for the Indian States. We do not recommend additions to the number for the present. There will be difficulty, in certain cases, in providing an adequate staff for existing colleges. We regard it as important that the standard of training should be approximately the same in all cases.

RESEARCH ON DISEASES OF ANIMALS. (i) INTRODUCTORY REMARKS.

260. In no sphere has scientific research conferred greater benefits on agriculture than by the provision of means of controlling livestock disease and it may be added that India has no reason to be dissatisfied with the contributions which its scientific workers have made to world knowledge during the last thirty years. In view of the record of good work standing to the credit of the civil veterinary departments in this country, we consider it a hopeful sign that almost every expert witness who appeared before us dwelt on the existing lack of knowledge rather than on past achievements, and insisted on the need for greater attention to research. We have no intention of questioning this need; but, in reviewing the position, we have felt that, in some directions, scientific knowledge has already outstripped administrative action and it is for this reason that we have placed in the forefront of our proposals the creation of a large and well-trained executive service of veterinary surgeons qualified to apply laboratory discoveries to the control of disease in the field.

(ii) RESEARCH IN THE PROVINCES.

261. Before we deal in some detail with the work of the Imperial Veterinary Research Institute at Muktesar, we desire to emphasise the importance of research to students undergoing training. In Chapter XV, we discuss the desirability of associating teaching and research in connection with agricultural education and need here, therefore, only state our view that the quality of the veterinary surgeons of the future will depend, in no small degree, on the extent to which research is carried on at the colleges where they are trained. We agree with those witnesses who hold that, in addition to the work at a central research institution, investigation should be fostered in the provinces and, if this view is accepted, we consider that the natural centres for such work should be the veterinary colleges. We found, everywhere, evidence that the officers of the provincial veterinary departments take a keen interest in the work which is proceeding at Muktesar and we desire to see this interest continued among members of the enlarged provincial services. There is much research in which provincial institutions are likely to be called upon to share and it may be found necessary to establish one or more posts to be held by investigators free from teaching duties. A beginning in this direction has already been made in the Punjab where a post of Veterinary Research Officer has recently been created at the Lahore Veterinary College, but we consider that special posts will generally be unnecessary if the senior officers employed in the colleges are men of such calibre as to be well qualified to undertake research, and our view is that they should be expected and encouraged to undertake investigations in their own special spheres.

(iii) THE IMPERIAL INSTITUTE OF VETERINARY RESEARCH.

262. The question of establishing a central research institute for India does not arise. An institute is already in being which has to its credit a record of work which could hardly have been anticipated when, in 1890, the first Imperial Bacteriologist began his researches at Poona. There are certain questions in connection with this institute which we have to discuss.

Their nature will be better understood if we give a brief outline of its history. The work originally assigned by Government to the Imperial Bacteriologist was " to investigate diseases of domesticated animals in all provinces in India and to ascertain, as far as possible, by biological research both in the laboratory and, when necessary, at the place of outbreak, the means of preventing and curing such diseases." Investigations into rinderpest and surra were undertaken at once but Poona proved unsuitable as a centre for the investigation of rinderpest. For effective work on this disease, it was necessary to have at command hill cattle, which are highly susceptible to it, and it was this consideration which led, in 1893, to the removal of the laboratory to Muktesar in the Kumaon hills of the United Provinces at an altitude of 7,500 feet above sea level. In that year, a South African worker discovered that the injection into healthy animals of the blood, or blood serum, of animals recovering after rinderpest conferred protection for a short period. This discovery was followed up at Muktesar and, in 1901, a small quantity of serum was sent out for experimental use. The provincial departments were at first supplied with serum free but, as the work passed beyond the experimental stage and the demands for anti-rinderpest serum and for other products of the Institute became heavy, a charge for rinderpest serum was imposed in 1911 and for other products in 1917. In 1922-23, the charges were raised fifty per cent in order to close the gap between income and expenditure. Early in 1923, the Indian Retrenchment Committee recommended that steps should be taken to place the Institute on a self-supporting basis as it saw no reason why the central Government should produce sera and vaccines for the use of local governments at a financial loss. It was not, however, until 1925-26 that this aim was achieved. The surplus of income over expenditure in that and the following year amounted to about Rs. 4·5 lakhs.

The small laboratory established in 1893 has now grown into an extensive institution. The Muktesar estate is 3,450 acres in extent; the greater part of this is managed as forest land under a working plan drawn up by the Forest Department, but some 730 acres, of which 200 acres are under cultivation, are retained for buildings and the maintenance of livestock. The area of the sub-station at Izatnagar near Bareilly is 800 acres, of which 700 are under cultivation. At this sub-station, sera for combating rinderpest and hæmorrhagic septicæmia are produced in bulk, and, at Muktesar, attention is now concentrated on the more delicate work for which it is specially adapted by its situation, such as the standardisation of products prior to issue, the manufacture of products requiring closer expert supervision, a cooler environment, and special research work.

The total production of sera and vaccines at Muktesar is now very large; in 1926-27, 6·6 million doses were manufactured, of which 6·2 million doses were issued. The bulk of these consisted of rinderpest serum, the figures of manufacture and issue of which were 5·7 and 5·4 million 5 *c.c.* doses respectively. The extensive scale on which sera and vaccines are prepared and the insistence that Muktesar should be self-supporting have given rise to the erroneous impression that this institution,

though established for research work, has developed into a factory. It is true that there is a very large manufacture of products but it is not true that the factory dominates the research institute. The manufacture and despatch of sera on the present scale would not have been possible if it had not been preceded and guided by laboratory work but, and this is the important matter, there would have been no demand in India for sera and vaccines on the present scale if the veterinary departments had been without the guidance of Muktesar. We have been furnished with a list of over eighty papers issued between 1896 and 1919 on rinderpest, surra, anthrax, hæmorrhagic septicæmia, piroplasmosis, and a number of other diseases and, since 1919, the amount of research has shown no signs of decreasing. In framing our recommendations in regard to the control of rinderpest, we have had occasion to examine the experience gained in other countries faced with this problem and our view is that, though other countries have made more use of the serum-simultaneous method of inoculation, no country can claim a better knowledge of the measures required in employing this method with certainty and safety than India, and that for this knowledge this country is primarily indebted to the Muktesar Institute.

Muktesar is some twenty miles from the nearest railway station in the Himalayan foot hills and its inaccessibility, which prevented our visiting it, was frequently referred to in the course of evidence. If a new site for a veterinary research institute were now to be selected, it is possible that a hill district less remote from a railway but offering similar advantages to Muktesar could be found; but, on the whole, we are disposed to the view that too much stress has been laid on the unsuitability of the Muktesar site. In selecting a suitable location for an institution of this kind, considerations of more importance than accessibility to members of a Royal Commission, or even to senior officers of Government, have to be borne in mind. Work is being done on highly dangerous diseases and isolation is, therefore, essential. So important is it that a leading authority, having in view the laboratories of his own country, reported to be among the finest of their kind, recently suggested the establishment of laboratories in a widely different latitude, in which it would be safe to deal with diseases which, if investigated within the territory affected by them, might be a source of danger. Those who selected Muktesar as the site of a research institute showed commendable foresight in providing a station at which diseases of the Indian plains could be studied with safety. Again, as we have seen, Muktesar offers special advantages for investigations on rinderpest, owing to the high susceptibility of hill cattle to this disease, and knowledge of rinderpest would undoubtedly not have been as full as it now is, if a site on the plains had been selected in 1893. A laboratory in the hills is also necessary from another point of view. Many of the technical operations which have to be carried out in the course of investigations require a cool climate. Quite apart, therefore, from the personal convenience of investigators, a high temperature might limit the scope of the research work which an institution like Muktesar, engaged on investigations into a wide range of diseases, might be called upon to

undertake. We understand that the isolation of Muktesar has, at times, given rise to difficulties in recruiting staff, but the genuine explorer in science, as in other domains, is not likely to be very seriously influenced by considerations of a personal kind. On the other hand, in view of the large staff that must be kept together at Muktesar, it appears to us that Government should take all reasonable measures to increase the amenities of life at this isolated station.

Our conclusion thus is that Muktesar is well suited for the prosecution of research into the contagious and infectious diseases of animals and that a second Imperial Institute of Veterinary Research is not required, especially now that the bulk of the manufacturing work can be carried on at the sub-station at Izatnagar. Any extension of central research in the immediate future should be provided for by such additions to the staff and equipment of Muktesar as the nature of the work contemplated may call for.

An account of the investigations which are in progress at Muktesar will be found in the evidence of the Director*. The superior staff consists at present of three gazetted officers, all of whom have the qualifications of the Royal College of Veterinary Surgeons and two of whom are also university graduates. There is a subordinate staff of about ninety officers, approximately half of whom have some veterinary qualifications or have been trained as laboratory assistants. The work of the Institute is organised in divisions, of which the three principal ones are those which deal with administration, the production of sera and vaccines, and research into pathological subjects. Each division is under a responsible head. The research staff is arranged in teams of workers according to the subjects engaging study; thus in recent years, one team has dealt with filterable viruses, including rinderpest, a second with bacterial diseases including hæmorrhagic septicæmia, a third with diseases caused by protozoa, a fourth with surra and a fifth with tuberculosis.

The importance of the subjects dealt with at Muktesar is so great that we consider the scientific staff should always be maintained at full strength. We observe that the posts of First Research Officer and of two other scientific officers are vacant, and recommend that these should be filled as soon as suitably qualified candidates are available. From the descriptions we received of the work at Muktesar, we think it probable that an immediate increase in the scientific staff could be justified; but as we did not visit the Institute and examine the position there in detail, we make no specific recommendation on this point.

All three members of the superior staff are members of the Indian Veterinary Service and receive pay on the scale in force for that service; the Director of the Institute receives pay in the selection grade and the remaining two are on the ordinary time scale. They are all in receipt of a Muktesar allowance of Rs. 100 per mensem. The position of Muktesar is different from that of Pusa, the future position of which in

* Evidence Volume I, Part III, page 13.

regard to staff we deal with in our chapter on The Agricultural Services. It is hoped that Pusa, in addition to occupying a premier position in agricultural research, will become a post-graduate teaching centre for all India. Muktesar will continue to be mainly a research station except for the short course there which we have suggested should be included in, or should supplement, the course of training for the provincial veterinary services. As recruitment to the Indian Veterinary Service has ceased, some other arrangements will have to be made for regulating the conditions of service of those who may be appointed in the future. We are inclined to think that, as the number of superior posts at Muktesar is so small, no advantage would be gained, in present conditions, by the formation of a central veterinary service and that, when an appointment, including that of the Director, falls vacant, the officer recruited to fill it should be given a scale of pay in accordance with his special qualifications and experience.

In addition to the staff details of which are given above, a menial staff, which numbers about a hundred, is employed as laboratory attendants, peons, watchmen, etc., and there are nearly 800 cattlemen and outdoor workers. The administrative work which falls upon the Director is therefore heavy and must seriously hamper his research work. Various suggestions have been made for dealing with this difficulty. It has been proposed that the direction of the Muktesar Institute should be entrusted to a senior veterinary officer whose work would be of an administrative character, and that research should be conducted under his supervision by a specially qualified staff. We are opposed to this proposal. For work at Muktesar, a very special training is necessary; the work is scientific rather than professional, and a veterinary or medical qualification, in itself, affords no guarantee that an officer has the training required to undertake, much less to direct, research. In the past, distinguished members of both the veterinary and medical professions have directed the work at Muktesar but their success was due quite as much to personal as to professional qualifications. Seniority is, in itself, a disqualification rather than a qualification for directing research. In his evidence before us, Sir John Russell, Director of the Rothamsted Experimental Station, expressed the view that "few men are able to evolve new ideas after the age of about 45 or to adapt themselves to new conceptions in science after the age of 50." We agree as to the advantages of youth in all forms of pioneer work; and we strongly deprecate the idea that the directorship of a research institute should be the reward of seniority in service.

It does not appear feasible to separate the research work at Muktesar from the administrative, including the manufacturing, side. An arrangement of this character would almost certainly give rise to friction between the officers responsible for the two branches of work. The Director of the Institute must, in our view, control all its activities and we consider that he should, in future, as at present, be selected for his scientific qualifications and on the ground that he is, in the words in which the appointment was last advertised, "a first class veterinary pathologist."

The best solution of the difficulty arising from the heavy administrative work involved in controlling a large estate such as that at Muktesar, and in the manufacture and issue of sera and vaccine on the scale that this has now reached, appears to us to lie in attaching to the staff of the Institute an officer with administrative experience,such as is to be found in the ranks of the Indian Civil Service or of the Provincial Civil Service. This officer, who should be an officer of some standing in his service, would take over the whole of the administrative side of the Institute, but would work under the general control of the Director. In this connection, we would stress the importance we attach to providing scientific institutions with a thoroughly competent staff for estate management and secretarial work. So far as is possible, the time of highly qualified research workers should be used in investigation, and not in duties for which competent officers can be found without difficulty.

(iv) THE FINANCIAL POSITION OF MUKTESAR.

263. We have mentioned the recommendation of the Indian Retrenchment Committee of 1922 that Muktesar should be run on a self-supporting basis. This may have been a desirable policy at a time of great financial stringency; but we do not regard it as suitable for permanent adoption. We consider that an effort should be made to distinguish as fully as possible between the expenditure on research and that on manufacturing operations. Muktesar, on its factory side,should be regarded as an all-India institution maintained to supply provincial governments and Indian States with sera and vaccines at cost price. Centralised manufacture means cheap production and, in our view, the right course would be to return to each province or State any profits which may accrue from the sale of sera and vaccines. This return might be made in the form of a bonus in proportion to the purchases and declared at intervals of three to five years so as to cover the fluctuations in the cost of production. The cost of research should be met by definite grants for this purpose and should depend on the expenditure which the work in progress may call for, and not on the profits realised from manufacturing operations. If it were found impracticable completely to dissociate the cost of research from that of production, the difficulty might be met by an arrangement under which, before a bonus was declared on the profits of manufacture, a portion, say, ten to fifteen per cent, was credited in the research budget.

THE RELATIONS OF THE GOVERNMENT OF INDIA TO THE PROVINCES IN VETERINARY MATTERS.

264. It was strongly urged upon us by several expert veterinary witnesses that the Government of India should revive the appointment of Inspector General, Civil Veterinary Department, which was abolished in 1912, or that, at least, a Veterinary Adviser comparable in status with the Agricultural Adviser should be appointed. We are unable to support this suggestion. We have throughout assumed that the responsibility for controlling contagious diseases must rest with local governments. These diseases are so widespread as to be beyond the scope of " stamping out " measures and it is at the " stamping out " stage that central control becomes highly valuable and indeed, it may be, essential. We have considered whether the duties of Adviser to the Government of India on veterinary matters might not be

combined with those of the Director of the Muktesar Institute, as the duties of Agricultural Adviser have been combined with the directorship of the Pusa Institute. We are not in favour of this course. We have pointed out that the Director of Muktesar requires very special qualifications, but these do not include that knowledge of local conditions which would make him a suitable Adviser to the Government of India.

We are of opinion that the necessities of the case can be adequately met under the proposals we make for the organisation of agricultural research in Chapter III. In that chapter and in Chapter VII, we have recommended that one whole-time member of the Council of Agricultural Research should represent animal husbandry. Should the officer holding this post have a veterinary qualification, he would be available to advise Government on veterinary matters; but whether he were a veterinary surgeon or not, we consider it necessary that there should be a small Standing Committee of the Research Council to deal with veterinary subjects, with the representative of animal husbandry in the chair. One main duty of this Standing Committee would be to secure co-operation between the provinces in controlling contagious diseases. The form of legislation we have recommended is permissive and the measures required to deal with diseases in different conditions may vary. Legitimate differences of opinion may therefore exist between technical officers as to the measures best suited to meet particular emergencies. The whole position points to the need for conference and agreement, not to the carrying out by officers of orders, merely because they are orders.

The Standing Committee on Veterinary Subjects which we contemplate would function as a nucleus committee. It should be free to co-opt members for special subjects, and the usual course would be to form committees after a conference had been held on the subject for which a special committee was required. There are two subjects mentioned in this chapter for which special committees would no doubt be set up without delay. One is the serum-simultaneous campaign we have recommended; the progress of field operations would require very careful study by veterinary experts. The other is veterinary education. A committee on this subject would be required to consider such matters as syllabuses, and negotiations with university authorities in regard to entrance requirements and degrees, and with the Royal College of Veterinary Surgeons and similar bodies in regard to professional qualifications.

We recommend that the administrative control of the Muktesar Institute at present vested in the Agricultural Adviser to the Government of India should pass to the Director of the Institute, whose position, *vis-à-vis* the Muktesar Institute on the one hand and on the other the Council of Agricultural Research, would be precisely that of the Director of Pusa to his own institution and to the Council.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

265. The conclusions and recommendations in this chapter may be summarised as follows:—

(1) It is impossible to frame any estimate of the losses to agriculture caused by contagious diseases but they are undoubtedly immense (paragraph 236).

(2) Rinderpest is the most formidable disease of cattle in India (paragraph 237).

(3) Measures for stamping out rinderpest on the lines possible in European countries are not practicable in India (paragraph 237).

(4) Similarly, the time is not yet ripe for the establishment of protective belts on the South African model (paragraph 237).

(5) In present conditions in India, rinderpest and other contagious diseases must be combated by measures aiming at the protection of the individual animal rather than by measures which aim at stamping out the source of infection (paragraph 237).

(6) The serum-simultaneous method of inoculation offers the only hopeful method of combating the ravages of rinderpest and its employment on a large scale is, therefore, strongly recommended (paragraph 240).

(7) With proper safeguards, this method involves a risk so slight, that, in view of the benefits conferred, it should be accepted (paragraph 240).

(8) There are, however, practical difficulties which indicate that some opposition from cultivators to the employment of this method may be anticipated. General resort to compulsory inoculation would, however, be undesirable at present (paragraph 241).

(9) It may be hoped that co-operative breeding societies and milk unions, by agreeing to the immunisation of their cattle, will give a lead to cultivators generally (paragraph 242).

(10) Apart from work amongst such societies, the serum-simultaneous method should be adopted, at the outset, when combating actual outbreaks of rinderpest (paragraph 242).

(11) As the inoculation of all cattle by the serum-simultaneous method is not possible during a widespread outbreak, efforts should be concentrated on protecting the more valuable cattle. The extent to which the serum-alone method should be used concurrently with the serum-simultaneous method must be decided by the veterinary officer in charge of the operations (paragraph 242).

(12) All inoculation against disease should be done free of charge (paragraph 243).

(13) Although compulsory inoculation against rinderpest is not recommended generally, it should be enforced for all animals kept by milksellers in large cities (paragraph 244).

(14) An All-India Contagious Diseases of Animals Act should be passed with a view to ensuring a uniform procedure in dealing with contagious diseases (paragraph 246).

(15) In all provinces, the aim should be to provide a veterinary hospital with accommodation for in-patients at district headquarters, and, in addition, a number of dispensaries serving subdivisions of the district. The value of dispensaries would be greatly enhanced if

two or more veterinary assistants were attached to them, one or more of whom would be free for touring duties (paragraph 248).

(16) The principle that the stockowner should be responsible for obtaining treatment for sick and wounded animals, where epidemic and public health matters are not involved, is sound but its enforcement is not practicable or desirable in present conditions (paragraph 249).

(17) The control of measures for treating and preventing the spread of contagious diseases should be regarded as the concern of the provincial governments; the duty of providing a local veterinary service for treating diseases not scheduled as contagious and for dealing with operations and wounds should, when the necessary arrangements can be made, rest with local bodies (paragraph 249).

(18) The present aim should be to provide, on an average, one qualified veterinary surgeon for every district in British India and one veterinary assistant surgeon for each 25,000 cattle (paragraph 250).

(19) The total number of veterinary surgeons required, including provision for Indian States, would be over 400 and of veterinary assistant surgeons over 7,500 (paragraph 250).

(20) The chief veterinary officer in each province should be styled Director of Veterinary Services (paragraph 251).

(21) The Veterinary Department in the Punjab should be independent of the Agricultural Department (paragraph 251).

(22) The Principal of a provincial veterinary college should stand in the same relation to the Director of Veterinary Services as the Principal of an agricultural college to the Director of Agriculture (paragraph 251).

(23) The posts of Director of Veterinary Services, and Principal of a veterinary college, should be scheduled as selection posts outside the cadre (paragraph 251).

(24) The pay of both posts should be re-examined and a scale fixed commensurate with the responsibilities which will attach to them, if the recommendation made for the extension of veterinary activities are accepted (paragraph 251).

(25) Each province should be divided, for veterinary purposes, into two or three circles, each of which should be in charge of a deputy director who would be a member of the Indian Veterinary Service, so long as any members of this remain in service, or of the new superior provincial veterinary services (paragraph 251).

(26) An appropriate scale of pay for the new superior provincial veterinary services would be the existing scale for the Indian Veterinary Service (paragraph 251).

(27) The qualified veterinary surgeons provided for the districts would constitute the Provincial Veterinary Service (paragraph 251).

(28) The primary duty of this service would be the control of epidemic disease, but it would also be entrusted with the supervision of dispensaries and of touring veterinary assistants (paragraph 251).

(29) The present rate of pay of the provincial veterinary services is suitable for the enlarged service recommended (paragraph 251).

(30) The safeguards recommended in Chapter XIX in regard to the recruitment, discipline and conditions of service of agricultural officers are equally desirable in the case of veterinary officers (paragraph 251).

(31) The grade of veterinary inspectors where it exists should be abolished when a sufficient number of fully qualified veterinary surgeons is available. Should the prevalence of disease in a province make this course necessary, veterinary assistant surgeons might be employed under district veterinary surgeons as inspectors (paragraph 252).

(32) The complete provincialisation of the veterinary departments is not recommended (paragraph 252).

(33) The subordinate veterinary services will continue as at present to be mainly employed by local boards (paragraph 252).

(34) The immediate transfer to local boards of complete control over veterinary assistant surgeons employed by them is not recommended. Progress in the direction of transferring greater responsibility to local bodies in veterinary matters can only be made gradually (paragraph 252).

(35) When complete transfer is made, government assistance should take the form of a grant-in-aid, preferably on a *pro rata* basis, which would be made on condition that local bodies should look to the provincial veterinary services for advice and inspection and should consult the Director of Veterinary Services in regard to all appointments (paragraph 252).

(36) In the meantime, local bodies should be consulted in regard to appointments, transfers, promotions, punishments and dismissals of veterinary assistant surgeons (paragraph 252).

(37) When complete control over veterinary assistant surgeons has been transferred to local boards, a Veterinary Reserve Corps of selected veterinary assistants should be formed (paragraph 253).

(38) Private effort should be encouraged in every possible way to supplement the efforts of Government and of local bodies to provide veterinary aid (paragraph 254).

(39) For the training of veterinary surgeons and assistant surgeons respectively, two entirely distinct courses of study are required with different entrance requirements and different classes at all stages (paragraph 255).

(40) The framing of a suitable curriculum for training veterinary assistant surgeons should be referred to a body of experts (paragraph 256).

(41) The course for veterinary assistant surgeons should extend over two or three years. Special prominence should be given in the course to the anatomy, physiology, and diseases of cattle (paragraph 256).

(42) The course of study for veterinary surgeons, which should extend over a period of five years from matriculation and should end in a degree, should be settled by conference between the university and veterinary authorities (paragraph 257).

(43) The establishment of an all-India veterinary college is not recommended nor is the expansion of Muktesar as an educational centre (paragraph 258).

(44) At the outset, one of the existing veterinary colleges should be selected for the training of veterinary surgeons but the training should include or be supplemented by a short period of work at Muktesar (paragraph 258).

(45) The course should be open only to candidates nominated by the Government of India, provincial governments or Indian States (paragraph 258).

(46) The additional expenditure involved in adapting the selected college to undertake higher veterinary education should be met by the Government of India (paragraph 258).

(47) Officers recruited for veterinary education and research should be members of the new superior provincial veterinary services. Where necessary, local governments should be prepared to grant special pay as an addition to the pay on the ordinary time scale. The special pay should be personal to the individual officer and should be based on his qualifications and experience (paragraph 259).

(48) The provincial veterinary college should be the natural centre for research work in the provinces. All senior officers employed in the colleges should be expected and encouraged to undertake investigations in their own special spheres (paragraph 261).

(49) Muktesar is well suited for the prosecution of research into animal disease and a second Imperial Institute of Veterinary Research is not required. In view of its isolation, Government should, however, take all reasonable measures to increase the amenities of life at Muktesar (paragraph 262).

(50) The scientific staff at Muktesar should always be maintained at full strength and the appointments at present vacant should be filled as soon as suitably qualified candidates are available (paragraph 262).

(51) When an appointment at Muktesar, including that of the Director, falls vacant, the officer recruited to fill it should be given a scale of pay commensurate with his special qualifications and experience (paragraph 262).

(52) The Director of the Muktesar Institute should be selected on the ground of scientific qualifications (paragraph 262).

(53) An officer with administrative experience should be attached to the staff of the Muktesar Institute to relieve the Director of administrative work (paragraph 262).

(54) Scientific institutions such as Muktesar should be provided with a thoroughly competent staff for secretarial work and estate management (paragraph 262).

(55) The expenditure on research work at Muktesar should be separated as fully as possible from that on manufacturing operations. Provinces and States should share in any profits from the manufacture of sera and vaccines in proportion to their purchases (paragraph 263).

(56) The revival of the appointment of Inspector General, Civil Veterinary Department, or the creation of a post of Veterinary Adviser to the Government of India is not recommended (paragraph 264).

(57) A small Standing Committee of the Council of Agricultural Research to deal with veterinary matters should be constituted. The chairman of the Committee should be the whole-time member representing animal husbandry on the Council of Agricultural Research (paragraph 264).

(58) This Standing Committee should have the power of co-opting members and of constituting special committees for particular subjects (paragraph 264).

(59) The administrative control of the Muktesar Institute should pass to the Director of the Institute (paragraph 264).

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CHAPTER X

IRRIGATION

INTRODUCTORY.

266. Irrigation plays so large a part in agriculture in India that no investigation into rural conditions in this country would be complete which failed to examine its present position and future possibilities from the agricultural point of view. The problems which the irrigation engineer is called upon to solve necessarily differ widely in different parts of India, but it may be said that, in general, these problems fall into three main classes.

In the first class, the problem is how best to utilise the waters of rivers without recourse to the construction of storage works. In some cases, this is possible without raising the natural level of the river. In others, it entails the construction of weirs. The problem is in general solved by conducting the water drawn off from the rivers along contour levels sufficiently high above the general level of the fields to be irrigated to permit the water to flow on to them by gravity. The irrigation canals of the Punjab supply notable examples of overcoming the difficulties of crossing secondary lines of drainage, and of so aligning the main courses and subsidiary channels that the maximum area of the country is benefited.

The second main division consists of the problems arising out of the management of the deltas of rivers in such a way as to combine the protection of cultivation from wandering rivers with the regular supply of water necessary to the full development of cultivation in these fertile areas. The chief examples of the successful solution of these problems are to be found in the management of the deltas of the Godavari, the Kistna and the Cauvery in the Madras Presidency. We shall have occasion to notice, later on in this chapter, the need for examining what can be done in the case of the far more difficult problems presented by the Ganges delta in Bengal.

The third class of works are those in which the surplus water, whether the result of monsoon rains or melting snows, is stored by means of dams across the line of flow and released gradually as required for the purposes of cultivation. Some notable works of this character have already been constructed and, when the great projects now in progress for utilising the waters of the rivers are completed, it will be, in the main, only from works of this class that any large extension of irrigation may be anticipated.

The reasons which have led to the construction of irrigation works vary as greatly as do the types of those works. In some cases, for example, in Sind and over large areas of the Punjab, where the rainfall is normally insufficient to ripen the crop, no cultivation is possible until schemes of irrigation carry the essential water to the land. In other cases,

as in parts of the Deccan, the rainfall, though normally sufficient to ripen the crop, is yet so precarious that without irrigation there can be no assurance to the cultivator that his crops will mature. Yet again there are cases where irrigation is needed more as a precaution against famine than as a requirement of the normal year. The canals in the United Provinces, Bihar and Orissa and the Central Provinces provide examples of this type.)

The last general examination of the position in regard to irrigation in India was carried out by the Indian Irrigation Commission which was appointed in 1901. The Report of that Commission which appeared in 1903 was so comprehensive and its recommendations so exhaustive that no further enquiry of a similar character has been considered necessary. The great development of irrigation which has since taken place has been, in the main, on the lines laid down by the Commission.

STATISTICAL.

267. In Chapter I, we have mentioned the obstacles to agricultural development consequent on the unequal distribution of the rainfall of India over the country, its frequently irregular distribution throughout the season and its liability to failure or serious deficiency. Except in the submontane tracts of the Himalayas, East Bengal, Assam, Lower Burma and the narrow strip between the Western Ghats and the Arabian Sea, the absolute security of the harvest throughout India depends on the existence of some form of irrigation. From time immemorial, therefore, the cultivators have sought to supplement and conserve the rainfall by the construction of wells and storage reservoirs, and by *bunding* streams. In some parts of India, considerable capacity for organisation was developed for this purpose as the *phad* system of irrigation which still exists in the Nasik and Khandesh districts of the Bombay Presidency and the innumerable tanks in the Madras Presidency, many of which are undoubtedly of great antiquity, bear witness. There are some notable instances of large irrigation works carried out in ancient days in India. The oldest and most famous of these is the Grand Anicut across the Cauvery in Madras which dates back some 1600 years and, even before the improvements effected in the nineteenth century, irrigated over 600,000 acres. In the north, two canals were constructed from the Jumna; that now represented by the Western Jumna Canal is attributed to Firoz Shah in the fourteenth century and was renovated by Akbar in 1568 and remodelled by Ali Mardan Khan in 1628, while work on the second, which developed into the existing Eastern Jumna Canal, was started by Shah Jehan in the seventeenth century. The original Upper Bari Doab Canal was built by early rulers and brought water to Lahore and to the sacred tank of Amritsar. Some of the inundation canals taking off from the Indus are also of ancient date. These examples suggested the construction of those large perennial irrigation works which have been such a notable feature of British administration.

The Table below shows the development of irrigation in British India since the year 1908-09, the first year in which figures for irrigation

were recorded in the "Agricultural Statistics of India" in a fairly complete form :—

Year	Gross area sown*	Percentage increase or decrease over 1908-09	Gross area irrigated†	Percentage increase over 1908-09	Percentage of area irrigated to area sown
	Acres (in 000's)		Acres (in 000's)		
1908-09 ..	246,189	..	45,681	..	18·6
1914-15 ..	260,641	5·9	50,644	10·9	19·4
1920-21 ..	239,202	—2·8	52,519	15·0	22·0
1924-25 ..	259,784	5·5	48,429	6·0	18·6
1925-26 ..	256,991	4·4	50,813	11·2	19·8

The area irrigated in 1920-21 was the largest which has yet been recorded. The fall in subsequent years was due to the fact that timely rains, and especially timely winter rains, considerably reduce the demand for water everywhere, more especially in the United Provinces and the Central Provinces.

The part which irrigation plays in the rural economy of the different provinces varies greatly from province to province as will be seen from the Table given below which brings out clearly its importance in Sind, the Punjab, the North-West Frontier Province, Madras, the United Provinces and Bihar and Orissa. The figures are averages of the five years 1921-22 to 1925-26 :—

Province	Gross area sown*	Gross area of crops irrigated† (from government and private sources)	Percentage of area irrigated to area sown
	Acres (in 000's)	Acres (in 000's)	
Assam	6,379	364	5·7
Bengal	27,777	1,710	6·2
Bihar and Orissa	31,021	5,386	17·4
Bombay .. { Proper	27,764	1,092	3·9
Bombay .. { Sind	4,451	3,281	73·7
Burma	17,172	1,436	8·4
Central Provinces and Berar ..	26,726	1,110	4·2
Madras	37,691	11,208	29·7
N. W. F. Province	2,673	919	34·4
Punjab	30,970	13,644	44·1
United Provinces	43,739	9,630	22·0
Minor Administrations	807	156	19·3
Total ..	257,170	49,936	19·4

*Areas sown twice are counted twice.

†Areas sown twice under irrigation are counted twice.

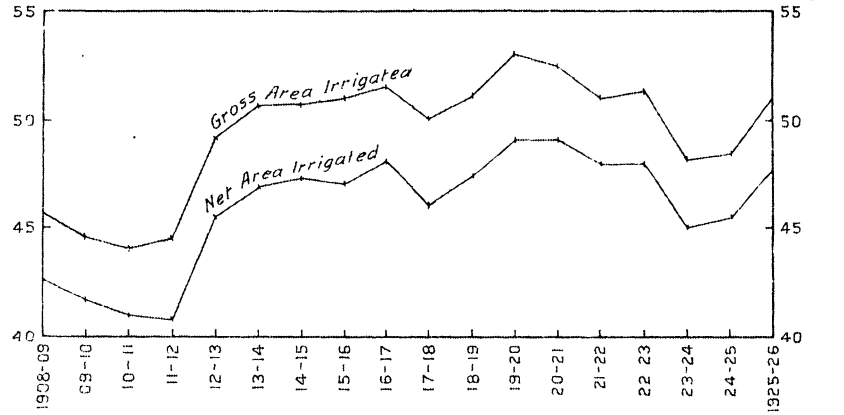
AREA IRRIGATED IN BRITISH INDIA

Note:- *The figures for this graph have been taken from the annual Volumes of Agricultural Statistics of British India.*

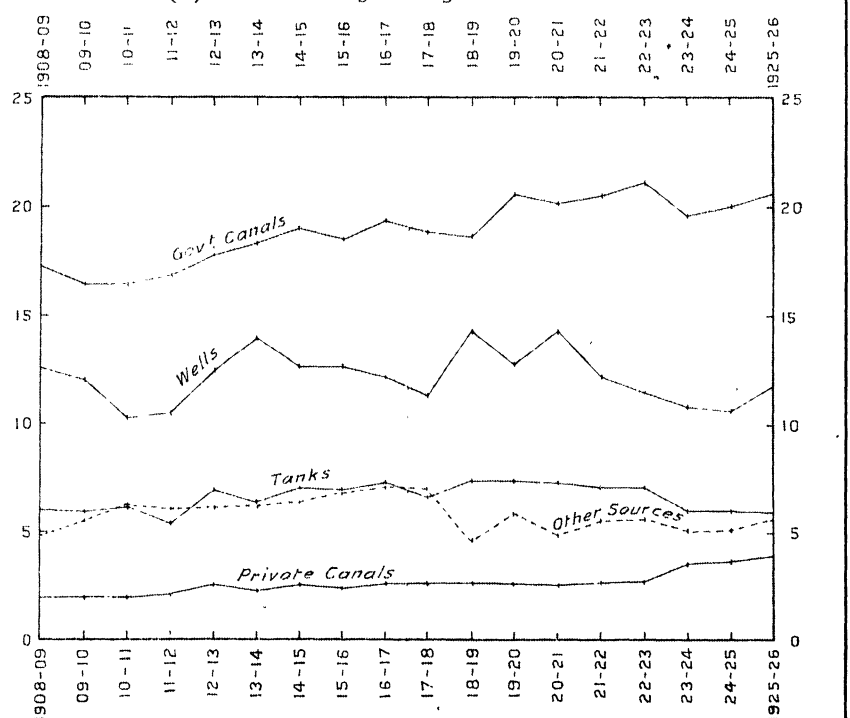
Area in Millions of Acres

(i) Total Gross Area and Total Net Area irrigated.

Area in Millions of Acres



(ii) Net Area irrigated by various sources.



In the Gross Area irrigated, areas sown twice under irrigation are counted twice.

The figures in the above Table have been extracted from the latest issue of the "Agricultural Statistics of India." Figures for government irrigation systems, that is for irrigation under works which have been constructed or which are maintained, wholly or partially, by the State are given in the Table below, the figures in which are taken from the "Annual Review of Irrigation in India":—

Province	Net area sown (average for 5 years 1921-22 to 1925-26)	Area irrigated by government irrigation works (average for 5 years 1921-22 to 1925-26)	Percentage of area irrigated to total net area sown	Capital cost of government irrigation works to end of 1925-26	Percentage net return on capital cost of irrigation works (average for 5 years 1921-22 to 1925-26)	Estimated value of crops raised on areas receiving State irrigation (average for 5 years 1921-22 to 1925-26)
	Acres (in 000's)	Acres (in 000's)		Rs. Lakhs		Rs. Lakhs
Ajmer Merwara ..	269	20	7·4	35	..	7½
Assam	5,842	..	..	..	..	..
Baluchistan ..	240	23	9·6	32	0·3	5½
Bengal	23,504	100	0·4	4,20	— 0·4	84
Bihar and Orissa ..	25,222	922	3·6	6,27	2·6	6,54
Bombay { Proper ..	27,072	433	1·6	9,50	1·6	5,01
Bombay { Sind ..	4,069	3,466	85·2	8,26	6·2	10,77
Burma	16,580	738	4·4	3,85	6·1	7,98
Central Provinces and Berar ..	24,395	438	1·8	5,41	— 0·3	2,68
Madras	33,099	7,196	21·7	12,47	7·6	38,62*
N. W. F. Province ..	2,340	389	16·6	2,87	3·2	2,90
Punjab	26,491	10,383	39·2	28,04	15·8	56,76
United Provinces ..	35,399	2,473	7·0	18,30	5·2	18,06
Total ..	224,522	26,581	11·8	99,84	7·4	1,50,29

* Exclusive of the value of crops raised on some three million acres irrigated by non-capital works.

It will be seen that, on the average of the five years ending with 1925-26, 11·8 per cent of the entire cropped area of the country was irrigated by government irrigation works and that the collective value of the crops so irrigated amounted to one-and-a-half times the total capital expended on the works.

GENERAL DESCRIPTION OF IRRIGATION WORKS.

268. The works which, between them, irrigate approximately fifty million acres of land are classified in the statistics published by the Government of India under four heads: canals, tanks, wells and "other sources." As explained by the Irrigation Commission, under "canals" come all works of any considerable size for diverting the water of streams or rivers, and carrying them on to the land; under "tanks," all works for the storage of water, and all natural depressions of which the water is used for irrigation; and under "wells," works for giving access to the subterranean supply, or to the waters of rivers which, running deep below the level of the ground, have to be lifted vertically before they can be used for flow irrigation. "Other sources" have never been clearly defined but consist for the most part of temporary *bunds* for the storage of rainfall, of lift irrigation from rivers, and of channels from rivers and streams which are too small to be classed as canals. The areas irrigated from the different

classes of works are given in the following Table. The figures are averages of the five years 1921-22 to 1925-26 :—

Province	Canals	Wells	Tanks	Other sources	Total
	Acres (in 000's)	Acres (in 000's)	Acres (in 000's)	Acres (in 000's)	Acres (in 000's)
Assam ..	191	..	1	172	364
Bengal ..	289	32	615	557	1,493
Bihar and Orissa ..	1,812	628	1,709	1,205	5,354
Bombay { Proper ..	290	531	109	38	968
Bombay { Sind ..	2,930	43	1	127	3,101
Burma ..	889	18	195	299	1,401
Central Provinces and Berar.	946	117	(a)	46	1,109
Madras ..	3,803	1,654	3,362	467	9,286
N. W. F. Province.	769	89	....	57	915
Punjab ..	9,836	3,385	15	120	13,356
United Provinces.	2,080	4,737	65	2,317	9,199
Minor Administrations.	28	88	28	..	144
Total ..	23,863	11,322	6,100	5,405	46,690*

Canals are thus of greater importance than the other three classes together. Irrigation under tanks is most extensive in the Madras Presidency where there are over 35,000 of them, of which about 28,000 are in the *ryotwari* area of the province ; of the latter about 25,000 are in charge of the Revenue Department and the remainder in charge of the Public Works Department. The total area irrigated by tanks in that province is nearly as large as that irrigated by canals. Well irrigation is most important in the United Provinces where it accounts for more than half the total irrigated area. Even in the Punjab, where the irrigation under tanks and "other sources" is negligible, the area irrigated by wells amounts to a quarter of the total irrigated area. The greater part of the area under "other sources" is contributed by the United Provinces (2·3 million acres) and by Bihar and Orissa (1·2 million acres).

269. We do not propose to describe in detail the existing canal systems of India or the projects for their extension which are now in process of construction or are contemplated. The importance of irrigation to Indian agriculture is, however, so profound and, notwithstanding recent developments, the possibilities of its extension are still so great that some mention of these projects is inevitable. The very brief description of the most important of them which is all that can here be given must not be regarded as in any way indicating a preference on our part for a particular scheme.

POSSIBLE DEVELOPMENTS OF IRRIGATION UNDER CANALS—
(i) THE PUNJAB.

Although, by the skilful utilisation of the waters of the Indus and of its tributaries as well as of those of the Jumna, the area under irrigation from government works in the Punjab has steadily increased

(a) Included under "Canals."

* The difference between this figure and that of 49,936,000 acres in the second Table on page 326 is due to the fact that the latter figure includes areas sown twice under irrigation.

from 2·3 million acres in 1887-88 to an average of 10·4 million acres from 1921-22 to 1925-26 and vast tracts of precarious cultivation and even of actual desert have been converted into most fertile agricultural land, the possibilities of further expansion are far from exhausted. The Sutlej Valley project will, when completed in 1933-34, provide perennial irrigation for two million acres. It will also greatly improve the irrigation of another three million acres which are at present dependent on inundation canals, that is, on canals which have no weirs at their head and the supplies in which consequently fluctuate with the natural water level in the river. Of the area under perennial irrigation, over a million-and-a-half acres will be in the Bahawalpur and Bikanir States. This is the only large project at present under construction in the Punjab but other great schemes are under consideration. The Thal project, if carried out even on a much smaller scale than was at first contemplated, will command an area of nearly a million-and-a-half acres in the Sind Sagar Doab in the desert districts of Mianwali and Muzaffargarh. The Haveli project will bring perennial irrigation to an area of about 700,000 acres in tracts in the Jhang and Muzaffargarh districts. All these projects comprise weirs or barrages to raise the level of the water in the river bed.

The next stage in the exploitation of the Punjab river system will involve the construction of storage works. The Irrigation Commission pointed out that only six per cent of the rainfall is utilised in artificial irrigation, and that the rivers carry off uselessly to the sea a volume of water six times greater: on the other hand, they concluded that "storage is so costly even in the most favourable circumstances that very few irrigation works which depend on it are remunerative."

The Sutlej Dam project proposes the construction of four storage reservoirs: of which the first, the Bhakra Dam—400 feet high—would impound 112,385 million cubic feet, and add two million acres of *rabi* cultivation between the Sutlej and the Jumna rivers. A project for the utilisation of the Woollar Lake in Kashmir as a storage reservoir from which to supplement the supplies in the three linked canals at the commencement of the *rabi* season was prepared in 1915 but is at present in abeyance as it has not yet been possible to reach an agreement with the Kashmir Darbar.

It should here be mentioned that progress with the Thal project has been indefinitely postponed pending the settlement of the dispute which has arisen between the governments of Bombay and the Punjab in regard to the further utilisation of the waters of the Indus. We have no comments to offer on the merits of the question but, in a subsequent paragraph, we discuss the question of machinery for the settlement of disputes of this character.

(ii) Sind.

270. As the agricultural problems of Sind are entirely different from those of the remainder of the Bombay Presidency, to which it is attached for administrative purposes, it is convenient to deal with it as a separate entity. The existing canals in Sind are entirely of the inundation type. It is only from May to September, when the Indus is in flood, that they provide water,

and then only in fluctuating quantities. The Sukkur Barrage which is being constructed across the Indus just below Sukkur and which, when completed, will be the greatest work of its kind in the world, will completely change this. It is anticipated that it will irrigate over five million acres, of which two million acres are at present very unsatisfactorily irrigated from the existing inundation canals. We deal in detail with the problems presented by this great project in paragraphs 290 and 291 below.

(iii) The United Provinces.

271. The only project of importance which is under construction or in contemplation in the United Provinces is the Sarda Canal which is designed primarily to irrigate the Sarda-Ganges Doab. It is estimated that the canal will irrigate annually an area of about 1·7 million acres. The area irrigated annually by the existing canals in the province in a year of keen demand reaches nearly three million acres. The Sarda Canal, when fully developed, will add over fifty per cent to that area and will raise the total maximum area irrigated annually to close upon four-and-a-half million acres.

The completion of the Sarda Canal will for all practical purposes mark the completion of the present projects of canal irrigation in the United Provinces. All the principal available resources for perennial irrigation will then have been tapped. It may, at some future date, be found feasible to construct a Lower Sarda Canal, but, in the immediate future, the only openings for expansion lie in carrying out certain protective works such as supplementary storage reservoirs on some of the existing canals. Works of this character can at most add not more than two or three hundred thousand acres to the total canal irrigation for the province.

(iv) Madras.

272. The great irrigation systems of the Madras Presidency, the Godavari, the Kistna and the Cauvery, differ completely in character from those already described. They are, in the main, deltaic and the problem has been to regulate the supply rather than to extend it to new areas. So successfully has this been done that river conservancy has been achieved at the same time and no problems have arisen in the deltas of the Madras rivers analogous to those which perplex the engineers of Bengal, Burma and Orissa. Credit for this cannot, however, be entirely taken by the irrigation engineers; for, as they would be the first to admit, the character of the soil which derives from the uplands of the peninsula has made their task much easier than that which has been presented to the engineers who deal with the soils of northern India. The works consist of weirs by which a sufficient head of water is obtained to irrigate the lands of the deltas and of sluices and regulators by means of which the water is conducted over these lands. By works of this character on the Godavari, the Kistna and the Cauvery rivers, some 2·4 million acres of fertile deltaic lands have been afforded the benefits of an assured supply of water. There has been no great expansion of irrigation in these tracts since the Irrigation Commission reported, but there is undoubtedly scope for development, though on entirely different lines

from those which have hitherto been followed. The only example of a great storage reservoir in the Madras Presidency at present is the Periyar system. The main feature of this system is the impounding, by the construction of a large dam, 3,000 feet above sea level, of the waters of a river which would otherwise have flowed into the Arabian Sea and their diversion to the other side of the peninsula through a tunnel bored through the main watershed of the country. The new works under construction or consideration would also be storage reservoirs which would impound the waters of the great rivers of the province, their tributaries and other streams. They would not only supplement existing supplies which, even now, are not always sufficient for the whole of the area normally irrigated in the first crop season but would also make possible the cultivation of second crops which, if grown at all, are now grown as "dry" crops. Such storage works are in reality a combination of tank and canal irrigation and, as they are expensive to construct, it will be necessary to levy a comparatively high rate for the water supplied to the cultivator. It is estimated that the Cauvery-Mettur project, which is at present under construction, will improve the supply of an area of 1·04 million acres already under irrigation and will bring under irrigation a new area of 221,000 acres of first crop and 90,000 acres of second crop. It will also supplement the supply to an existing wet area of 80,000 acres now irrigated by inferior and unreliable sources of supply. The construction of the Cauvery-Mettur project was only rendered possible by an agreement with the Mysore Darbar which was reached as recently as 1924. Of the same type, but of larger scope, are two projects, which have long been under consideration, the Kistna and the Tungabhadra projects. Hitherto, technical and financial considerations and the fact that an agreement with an Indian State, that of Hyderabad, in regard to the use of water was involved have stood in the way of their execution. Attention is now being concentrated on a revised scheme for impounding the waters of the Tungabhadra by the construction of a reservoir at Timmalapuram in the Bellary district. This would provide water for a wide extension of irrigation, mainly in the districts of Bellary, Anantapur and Kistna; and would protect a large area of dry cultivation in a tract liable to scarcity. As in the case of the irrigation projects under consideration in the Punjab, we have mentioned these projects here merely as an indication of the opportunities which still exist for an extension of irrigation on a large scale in the Madras Presidency, with all the advantages that would thereby accrue to the agricultural population. We are not in a position to express any opinion as to the feasibility of the Kistna or the Tungabhadra projects either from the financial or the technical point of view, but we cannot refrain from pointing out the transformation which would be effected by the construction of the latter project in that part of the Madras Presidency which is at present least immune from famine and scarcity. In our opinion, however, the project should in no case be proceeded with until a thorough investigation has been made and a definite decision reached as to the suitability of the black cotton soil of that area for irrigation, a question on which the

evidence before us showed that there was considerable difference of opinion.

A much smaller project for utilising part of the supplies available from the Tungabhadra river is at present under consideration. This is the Bellary West project which would bring under irrigation an area of 57,600 acres in the Bellary district. A larger project, the Upper Bhavani project, which provides for the irrigation of 110,000 acres of first crop and 60,000 acres of second crop in the Coimbatore district, a tract which needs protection, deserves mention here as it marks a new departure in irrigation in Madras. It is primarily designed for the irrigation of dry crops, instead of rice which is much the most important crop grown under irrigation in Madras.

(v) The Bombay Presidency Proper.

273. In the Bombay Presidency proper, irrigation by canals is confined to the Deccan and (on a very small scale) to Gujarat. The most important works are of the reservoir type in which Bombay led the way. The Khadak Wasla Dam across the Mutha river, ten miles above Poona, was completed in 1879 and was the first of its kind in India. The total area irrigated from government works in the Bombay Presidency proper is only about 450,000 acres and as the works were, in the main, designed for protective purposes, there is, with very few exceptions, a heavy annual loss on their working. Financial considerations, therefore, seriously limit the possibilities of extending works of this class. This is the more unfortunate as the rainfall of the Western Ghats which they utilise is unfailing. Such opportunities of extension as present themselves are, however, receiving due attention. A new dam, the Lloyd Dam at Bhatgar, which we visited in the autumn of 1926, and the subsidiary canals are designed to protect three talukas in the Sholapur district, which are specially liable to famine, and also to improve existing irrigation.

Wells and tanks.

274. The figures we have given in paragraph 268 show that, after canals, wells are the most important source of irrigation. These vary greatly in construction and capacity. They may be mere holes in the ground, elaborate masonry structures of great width and considerable depth, or tubes of small bore, from which, by power pumping, large supplies of water can be obtained continuously throughout the year. Wells of the first of these types may irrigate an acre or two in their immediate vicinity, wells of the last may have a capacity of 35,000 gallons an hour and may irrigate as much as 150 acres in addition to affording protection to another 100 acres. Between the two extremes come masonry wells in the floor of which perforated pipes have been sunk which tap largely increased supplies, often at no great depth. Wells of this type have been most successful in the United Provinces. In Madras, small wells, sunk for the purpose of supplementing irrigation from tanks the supply of which is precarious, are very common.

The type of well used is largely determined by the geological formation and the conditions for successful well-sinking are generally far more favourable in northern than in peninsular India. This is specially

true of tube wells. Notwithstanding the differences in the local conditions, there is no province in India in which well irrigation might not be largely extended with advantage.

Tanks, like wells, comprise a great diversity of works, varying from storage reservoirs the distributary channels from which irrigate several thousand acres to works which irrigate a few acres only. Occasionally they act as regulators and storage reserves for canals, and sometimes their purpose is to maintain the water level in the wells in their immediate neighbourhood. The larger tanks are, with very few exceptions, government works as are the numerous small tanks in the *ryotwari* areas of Madras and in Bombay. Elsewhere, the smaller tanks are, for the most part, owned by village communities and by private individuals.

NEW IRRIGATION SCHEMES.

275. In our questionnaire, we specially invited suggestions for new irrigation schemes and for the extension or improvement of existing schemes. We also asked for mention of any local obstacles to the promotion of irrigation by canals, tanks and wells and for opinions as to whether the existing methods of distributing canal water to cultivators gave satisfaction. The views expressed by witnesses were not confined to these subjects and, as our enquiry progressed, other matters assumed importance.

We have already explained the circumstances in which we refrain from comment on the suggestions we received in regard to new irrigation schemes and the improvement of existing schemes. The technical advisers of the provincial governments are in a far better position than we are to pronounce on the feasibility of these suggestions and we trust that they will receive due consideration. In these circumstances, we have only one recommendation to make under this head. It appears to us that no sufficient provision has anywhere been made for a systematic review of the position in regard to outstanding irrigation projects. For financial or other adequate reasons, it may be impossible to proceed with a scheme, however promising, when it is first worked out. We consider that, until a definite decision to take no further action has been reached, the scheme should be periodically reviewed by the provincial Government. If this is done, any change in circumstances which makes it feasible to proceed with it will be brought to notice. If a definite decision is reached to take no further action by the State, a public announcement should be made of the reasons which have led Government not to proceed with the scheme.

EXTENSION OF PROTECTIVE IRRIGATION

276. As the result of the constitutional changes which followed on the passing of the Government of India Act of 1919, irrigation, with certain limitations which will be mentioned later, became a provincial subject administered by the reserved side of the local government. This alteration in the constitutional position removed the previously existing restrictions on the powers of the provincial governments to undertake protective schemes of irrigation. Prior to 1919, irrigation works were, from the point of view of their financial

results, divided into three classes; "productive works," the capital outlay on which had been sanctioned against loan funds in the expectation that the works would prove directly remunerative; "protective works" which were not considered likely to fulfil the conditions of a productive work but which were sanctioned against the Famine Fund on the ground of their protective value; and "minor works," outlay on which was met from general revenues and which included all works which were not classed as productive or protective. Protective works were thus financed from the general revenues of the country. (After the great famine of 1877-78, it was decided to set apart every year a sum of Rs. 150 lakhs, known as the Famine Relief and Insurance Fund, for famine relief, the construction of protective works, and the avoidance and reduction of debt. Of this amount, one-half, or Rs. 75 lakhs, was to be allotted to protective railways and canals; the charge on the Fund on account of protective railways, however, ceased to be imposed and the whole of the Rs. 75 lakhs became available for irrigation works. In 1910, the allotment was found to be insufficient for the programme of construction then contemplated and the Secretary of State sanctioned the provision of an annual subsidy not exceeding Rs. 25 lakhs for the purpose. The full allotment of Rs. 100 lakhs was, however, never worked up to; Rs. 86 lakhs were spent in 1913-14 and Rs. 84 lakhs in 1914-15, after which expenditure was restricted owing to circumstances arising out of the war. The expenditure of this amount was governed by the principles laid down by the Irrigation Commission. The Commission considered that, in general, it would be permissible to spend up to three times its direct "protective" value for each acre irrigated, worked out by a formula* which they suggested, to which might be added the capitalised value of the net revenue anticipated from each such acre, in payment of the water provided. The sum of these items was the so-called "permissible capital outlay per acre" and, in the case of every protective work submitted for sanction, it had to be shown that the permissible outlay would not be exceeded. The restrictions thus imposed were removed on the introduction of the Reforms. In cases in which local governments are unable to finance protective schemes of irrigation from current revenues or from the Famine

* The formula suggested was :—

$$X = \frac{F}{Pn - a}$$

Where X = The direct protective value of an irrigated acre, or the capitalised value, at 25 years' purchase, of the saving in average annual cost of famine which will be effected by every acre brought under irrigation.

F = Estimated total cost of famine in the given tract for a period of 25 years, or quarter of a century.

P = Population of the tract, with necessary addition for prospective increase.

n = Area in acres which should be protected by irrigation for each head of the population.

a = Area in acres already protected.

The co-efficient 'n' was a variable one in each tract, but the Commission held that in insecure tracts, it would probably never be less than 0·3 or more than 0·5 and that other things being equal such as the character of the cultivation and the nature of the staple crops, the value of 'n' should diminish as the area normally cropped per head of population increased.

Insurance Fund which, under the Devolution Rules, they are bound to maintain, it is open to them to raise the funds required by loan provided that, if the project appears to the Governor General in Council to be one which is unlikely to yield a return of not less than such percentage as he may from time to time prescribe, arrangements are made for the amortisation of the debt. We trust that the recent relaxation of the rules on this point will encourage, so far as the financial situation may allow, the construction of further protective works.

DISTRIBUTION OF WATER.

277. The evidence we received did not establish the existence of serious dissatisfaction amongst cultivators with the present method of distributing water. It is true that we received complaints in regard to short supplies, arbitrary withdrawal of supplies and the like, but, in a business so extensive as the distribution of water in India has become, isolated complaints of this character are to be expected and are not in themselves sufficient to show that the system of distribution generally is at fault. We have, however, examined the question in some detail as it has an important bearing on the subject matter of our enquiries.

That there is an enormous waste of water by the cultivator in the canal-irrigated tracts of India is universally admitted. It has been estimated that the amount of excess water applied to crops such as wheat in northern India is from thirty to fifty per cent. The contrast in this respect between land irrigated by canals and land irrigated by wells is very striking. The waste of canal water is usually attributed to the fact that, when the cultivator lifts water from a well, he realises that he is paying in time and labour for every gallon he uses; when he irrigates his land from a canal, the water is provided for him and he pays not by the amount he uses but by the area he irrigates or, in the Punjab, by the area of the crop matured. He has, therefore, little incentive to economise water and to see that it is not wasted between the government channel and his fields. This is not, however, the whole explanation. No small proportion of the wastage is due to uncertainty of supply. With a well, the cultivator has the source of supply entirely at his disposal and can, without risk, give a light watering if he considers that is all that is required; with canal irrigation, he often does not know definitely when the next watering will be possible; he, therefore, applies water in large quantities, in the hope that this will tide him over the period of unknown length during which it is not obtainable. Unfortunately, the evil effects of this uneconomic use of water are not confined to the wastage of water which could be used more profitably elsewhere; they often extend to definite damage to the soil. The marked deterioration of some ten per cent of the total area commanded by the Deccan canals in the Bombay Presidency must largely be attributed to this cause.

The problem of preventing this waste of water, of securing greater certainty to the cultivator as to the supply he will receive and of relieving him from any harassment and interference from the staff which records his irrigation has long engaged the attention of irrigation experts in India. The view taken by the Indian Irrigation Commission was that it

would be a great advantage both to the Government and the cultivators, if the latter could be induced to take over their supplies at the outlets, to arrange all details of internal distribution between themselves and to relieve the canal administration of all further responsibility and of the great expense of recording the details of the irrigation and of making the final measurements and assessments. Their general conclusion was, however, that the system of charging by volume could not, in spite of all its advantages, be safely introduced in India until a system of distribution by modules of the type which it might be proposed to use had been in force for a time sufficiently long to enable the people to understand what was proposed. They held that, even then, the change in the system of assessment should not be forced but should be introduced gradually, as the people learned to appreciate its advantages. They added that it was an end to be aimed at and that irrigation officers should be encouraged to design and experiment on modules which would be suited to the conditions to be met with in practice, until the work of distribution could be carried out with all the regularity and certainty which were essential to the success of any scheme of charging by volume.

We have quoted the views of the Irrigation Commission on this point at length as they mark the starting point of investigations into the possibility of more scientific and equitable distribution of water which appear, in the Punjab and Bombay, to have crystallised into scepticism on the part of the engineers as to the possibility of the sale of water by volume. It was represented to us that assessment at volumetric rates instead of by areas irrigated, though advantageous to the big cultivator, is quite unsuited to the interests of the smaller men; that no reduction in staff or in working expenses would be secured by its adoption; that no meter is yet obtainable at reasonable cost which will give measurements as accurate as measurements by area; that there is no meter which cannot be tampered with, so that, with quantity measurements, the temptation to dishonesty would be enormously greater than with area measurements; that the charges for water would not be in proportion to the profits of the cultivators which have hitherto been considered the fair basis for assessment; and, finally, that the staff would lose touch with the conditions of the cultivators and their difficulties and that irregular practices due to laziness and dishonesty would arise which would reduce the general efficiency and cause damage in adjoining areas.

We fully admit the force of these objections but, none the less, we feel that it is impossible to hold that the system of sale of water by volume has yet received the fair trial which alone can determine whether it is worthy of adoption on its merits. The suggestion was made to us that, if the cultivators could be induced to experiment roughly for themselves, progress in the solution of what is unquestionably a most complicated problem would be more rapid. Suitable meters might be installed on each outlet of one or more channels and water charged for on one outlet by volume and on the next by area. The figures obtained should prove very useful and worth the expense involved,

especially as the cultivator who paid by volume should speedily develop economical methods, and a comparison of his crops with those of his neighbours should indicate whether excessive irrigation not only means loss of water but also actual damage to the growing crop. We consider that this view has much to commend it and that further investigation and experiment are eminently desirable, both in the Punjab and elsewhere, before a final decision against the sale of water by volume is reached.

The scepticism of irrigation engineers in regard to the sale of water by volume does not mean that no progress has been made in recent years in the improvement of the system of distribution. This is far from the case. Every distributary in the Punjab has been, or is being, fitted with a meter so that the exact amount of water passed into the distributary is known. The meter functions with a module, which is an apparatus designed to fix the proportion of water taken from the canal and to give as even a distribution as possible from the head to the tail, independently of any rise or fall in the level of the water in the canal. By this means, considerable economy of supply has been effected, enabling irrigation to be extended to areas for which water was not previously available, and the opportunities for harassment and interference by the subordinate staff have been greatly reduced. It is held that the new system inspires confidence in the cultivator, especially in the small man, but there is one respect in which there appears reason to doubt this. Even under the area system of distribution, there are some cultivators who make their water go much further than others. It was represented to us that the good cultivator who utilises his water in the irrigation of a larger area than his neighbour is promptly penalised by a reduction in the capacity of his outlet. It would appear obvious that, once the cultivator is aware that he will not be permitted to retain the benefit of an economical use of water, he ceases to have any incentive to economy. It was stated in evidence that the saving of water thus effected might enable the cultivators at the tail end of a distributary to receive water of which they would otherwise be deprived and that the Irrigation Department has an obligation to fulfil its responsibilities to these cultivators by every means possible. We agree that this is a strong argument for the economical use of water in general, but we are [illegible] accept it as justification for reduction of supply to a specially [illegible] cultivator. If savings are to be effected, it is the careless and wasteful user of water who should first be penalised. We are of opinion, therefore, that the cultivator should be regarded as having a right to an outlet of a definite and uniform capacity in proportion to his area and that no reduction in this capacity should be made in any individual case solely because it is found that a larger area is irrigated than that for which the outlet was designed.

AGENCY OF DISTRIBUTION.

278. As regards the agency of distribution, we can see no advantage in the proposal made to us by several witnesses that this should be transferred from the irrigation to the agricultural departments. Closer co-operation [illegible] the two departments in this and other matters is no doubt very desirable and we recur to this point later, but the acceptance of this

suggestion would involve the diversion of the agricultural departments from their legitimate functions to work for which they are wholly unfitted. As between government and private agency, we are of opinion that there is at present no practical alternative to the system of government control over distribution down to the field distributaries. The question of agency is closely linked with that of methods of distribution and, as we have already indicated, there can be little doubt that the general introduction of the sale of water by volume would greatly facilitate the substitution of private for official management of the minor distributaries. Co-operative action in this respect has so far made little headway. One instance in which the co-operative distribution of water on an acreage basis—on the Nira Canal in the Bombay Deccan by cultivators in the village of Malegaon—has proved successful was brought to our notice in the Bombay Presidency. Irrigation *panchayats* for the management of minor irrigation works and of branch channels have in some instances worked with fair success in Madras and the possibilities of the *panchayat* system for the control of field distributaries were hopefully spoken of, on the basis of recent experience, by a Chief Engineer for Irrigation in the Punjab. It is important that the real obstacle to entrusting the distribution of water to private agency should be clearly grasped. It is not the lack of facilities to measure water accurately and to control supplies to distributaries from canals and their main branches. Meters and modules have been devised which are held to measure and control water in a satisfactory manner. The fundamental obstacle is the attitude of the cultivator himself. Water is so vital a need to him that he is not at present prepared to entrust his interests in this matter to the decision of his fellows. The formation of irrigation *panchayats* for the management of field distributaries points the way and it is collective action in this limited sphere which will best develop the mutual confidence necessary for the successful management of the larger distributaries. The progress of education, and the experience gained in other directions, such as the communal management of forests and the co-operative supply of credit, should also play their part in rendering the distribution of water by private agency possible.

MINOR WORKS.

129. The figures we have given in this chapter have shown the importance to the cultivator of the smaller storage works and of "other sources" of irrigation. We do not consider that the construction, preservation and improvement of these minor works have, in the past, received the attention from Government which that importance justifies. To mention only one instance, we were informed by the Secretary for Irrigation to the Government of the United Provinces, that there was endless scope for small tank schemes in that province. In Madras, the fact that over wide areas the only source of irrigation is the conservation of the annual rainfall has ensured that due attention is paid by Government to works of this character. Up to date, nearly a crore-and-a-half of rupees have been spent on the restoration of tanks. In that province, all government works irrigating less than 200 acres, except such as for special reasons

have been transferred to the charge of the Public Works Department, are in charge of a "Minor Irrigation Department" which works under the Collector of the district and is, in effect, a subordinate branch of the Revenue Department. The maintenance of minor irrigation works by the Revenue Department is, as a rule, limited to the repair of masonry and earth work and the reconstruction of damaged works. If anything beyond this is required, the assistance of the Public Works Department is invoked. In Bombay, special attention has recently been paid to this subject and, in 1925, a superintending engineer was placed on special duty "to investigate natural resources for the protection of lands from famine" for which purpose he was given a staff of three assistant engineers and eight survey parties. His operations are, however, confined to the insecure tracts of the Bombay Presidency, except that two subordinates have been placed under his orders to give advice to cultivators outside those tracts. In the Punjab, a Rural Sanitary Board which was first started in 1920 as a Drainage Board, has been responsible for various minor irrigation works in the course of its work of supervising or co-ordinating operations for the prevention or cure of waterlogging.

We are of opinion that much could be done to promote the development of minor works, if the example of the Bombay Government were followed in other provinces, and we would also suggest that the operations in Bombay should be extended to districts outside the insecure tracts. In our view, an agency is wanted, to which the cultivator who wishes to improve his land by utilising the natural sources of water supply can turn for technical advice and assistance. This agency should not wait for the cultivator to consult it, but should go to him and urge him to adopt the scheme best calculated to utilise his available water supply to the fullest advantage. The personnel should regard its function as educative rather than purely advisory. The Madras system does not provide such a staff, but there is probably less scope for the construction of small private irrigation works in the *ryotwari* tracts of that province than there is elsewhere. Had such advice and assistance been available in the past, it is probable, to say the least, that many *taccavi* loans to cultivators for land improvement would have been utilised to better purpose than they have been.

We refrain from proposing detailed arrangements for giving effect to our recommendations under this head as we apprehend that a suggestion for the formation of a separate Minor Irrigation Department might give rise to administrative difficulties. The object we have in view would be achieved if, in each province, one or more officers with suitable subordinate staff were made directly responsible for the investigation of the possibilities of small irrigation works and for advising and assisting the cultivators in regard to all questions connected with such works. Special attention should be devoted to the formation and assistance of co-operative irrigation societies for the construction of small works and for keeping existing works in proper order by the removal of silt and the repairs of embankments. The officer or officers entrusted with these duties would ordinarily be selected from the Irrigation Branch of the Indian Service

of Engineers. It is essential that the work should be done in the closest association with both the revenue and agricultural departments. In thus recommending the formation of a special agency within the provincial irrigation departments to deal with the investigation and construction of minor works, it is far from our intention in any way to criticise those departments for any failure in this respect in the past. Where small schemes possessing no engineering features of interest have to compete for attention with important projects presenting problems which demand the highest professional qualities for their solution, it is both natural and proper that they should take the second place. In these circumstances, we are persuaded that it is only by making minor works the definite responsibility of a special agency that they will receive the attention to which their value to the cultivator, especially to the smaller man, entitles them.

TUBE WELLS.

280. Irrigation from tube wells is a comparatively recent development in India. There were few such wells in existence when the Indian Irrigation Commission reported. Wells of this type are almost entirely in private ownership and, except in the United Provinces, are privately financed, though a loan under the Land Improvement Loans Act may be given for their construction. Technical advice and assistance are, however, freely given by the government department concerned and the well is, in fact, usually installed by that department subject to the payment of moderate fees for the services it renders. In Madras, pumping and boring operations have been entrusted to the Department of Industries and, in the Central Provinces, to the Public Works Department; in other provinces they are in the charge of the Agricultural Department.

The assistance given in the United Provinces in the construction of tube wells goes much further than that described above. In that province, the landholder pays the cost price of the actual material left in his possession on the completion of the work, that is, for the tube, the engine and pumping plant, all overhead charges and depreciation and interest on the capital invested in the boring equipment being borne by Government. The following figures have been supplied to us by the Director of Agriculture, United Provinces, as giving "a reasonably accurate estimate of the 'all in cost' of a 15 inch strainer tube well and pumping plant giving 35,000 gallons of water per hour":—

	Rs.
(*i*) Paid by landholder	8,000
(*ii*) Overhead charges borne by Government (1926) ..	4,987
(*iii*) Depreciation (ten per cent) and interest (six per cent) on capital invested in boring equipment ..	960

Thus, towards the expenditure of a well costing in round figures Rs. 14,000, Government contribute about Rs. 6,000. In addition to the assistance thus given, zamindars, who undertake to multiply seed for Government or to lease land to Government for demonstration purposes, may receive, in special cases, grants-in-aid up to a maximum of Rs. 3,000. We understand that, in practice, such

grants are invariably applied for and are given at the maximum rate.

The main points for examination in connection with tube wells are three in number, the conditions under which they can be regarded as a paying proposition, the degree of responsibility which Government should assume for their construction and the department of Government which should be charged with that responsibility.

The point at which the cost of sinking and operating a tube well becomes such that the undertaking ceases to be profitable is obviously not a fixed one, but must vary, not only with the first cost of sinking the well, but also with the flow of water per hour, the character and extent of ground irrigable, the nature of the crops grown and the marketing facilities which are available. All that can be said with confidence, in present conditions, is that irrigation from tube wells is never cheap as compared with canal irrigation. The Director of Agriculture in the United Provinces informed us that it does not pay unless intensive cultivation is adopted and unless a valuable crop such as sugarcane, potatoes or tobacco is grown. He added that it is not a business proposition to irrigate only wheat or other *rabi* crops grown on the indigenous system, with yields of fifteen *maunds* per acre, except in cases in which the discharge is high and the lift low. We consider that a landholder is entitled to obtain from the Agricultural Department sufficiently definite information to enable him to decide whether, if water is found at a certain depth and with a certain minimum discharge at the surface, it will pay him, in the local conditions of soil and of marketing facilities, to install such a well. The department entrusted with the charge of pumping and boring operations should make detailed investigations with a view to the collection of this information. These investigations should include a systematic survey of the subsoil water supplies.

The degree of responsibility which should be assumed by Government for the development of tube well irrigation should be limited to the supply of the economic data just mentioned and of expert advice, to the provision of finance, where required, on the *taccavi* system and to placing at the disposal of the landholder, on payment of a reasonable fee, the boring equipment and skilled labour required. We can see no justification for the system of subsidies which has been adopted in the United Provinces and recommend that it should be terminated. In so far as the subsidy may have served to popularise tube wells, we are of opinion that more satisfactory results would have been obtained if the work had been undertaken directly by the Agricultural Department. If the wells had been sunk in typical areas and utilised for intensive cultivation under the close supervision of the department, it would now be in a position to supply the data on the absence of which we have commented. The benefits of the subsidy have so far been entirely confined to the large landholder. If the wells had been operated as we have suggested, under the supervision of officers whose business it would have been to supply information to all enquirers, this might have led to developments in the direction of co-operative action which would have assisted the small cultivator. We would mention that the Punjab Government have

recently approved a scheme for the installation of an experimental battery of sixteen tube wells, operated by one prime mover, which will irrigate an area of 6,400 acres. This scheme, when it comes into operation, should throw much valuable light on the economics of tube well irrigation.

The equipment required for pumping and boring operations is at present provided by Government and in tracts in which the scope of tube wells is limited or in which they are still a novelty, this must, we think, continue to be the case for some time to come. But in areas such as those in the United Provinces in which wells are being sunk in increasing numbers, private enterprise should not be discouraged by government competition in the manufacture of the plant, in hiring it out and in the provision of the skilled staff required to operate it and to effect repairs when necessary. Government cannot undertake responsibilities of this kind for an indefinite period and on an ever increasing scale. The limits of justifiable pioneering enterprise in this respect appear to us to have been already exceeded in the United Provinces. Even in areas in which tube wells are not at present in great demand, the longer the transfer to private enterprise is postponed, the more difficult it will eventually prove.

Except in Madras and the Central Provinces, the Agricultural Department is the department which is responsible for pumping and boring operations. Apart from the fact that the agricultural engineers in the United Provinces and the Punjab have given special attention to the design and the technique of sinking tube wells and to the manufacture of the plant required, we consider that it is the department which is best fitted to undertake the work. The greatest incentive to private enterprise in sinking tube wells obviously exists in areas which have not the benefit of canal irrigation, that is, in tracts outside the normal operations of the Irrigation Department which would not, therefore, be in a position satisfactorily to supervise their construction and working. At the same time, it should be mentioned that the sinking of tube wells in waterlogged areas is often the most appropriate method of lowering the subsoil water. Again, the question whether, in any locality, a tube well is likely to prove a paying proposition depends, in part, on the depth from which the subsoil water has to be lifted and, in part, on the agricultural possibilities of the land to be irrigated and the marketing facilities available in the neighbourhood. These are matters in regard to which the Agricultural Department and its agricultural engineers are in the best position to advise. We would here reiterate the view already expressed in paragraph 106, Chapter IV, that, where pumping and boring operations are in progress in any province on a considerable scale, a separate branch of the engineering section of the Agricultural Department should be constituted which would concentrate on them alone.

ORDINARY WELLS.

281. There has, on the whole, been little or no expansion in the area under well irrigation since the Irrigation Commission reported, as the figures in Appendix VII show. The area irrigated by wells in British India in 1902-03 was

11·6 million acres; in 1925-26, it was 11·7 million acres. There were great fluctuations in the intervening period and the immense value of wells in years of drought is shown by the figures for the bad years, 1907-08, 1918-19 and 1920-21, in each of which the area irrigated by wells was over 14 million acres. The figures include those for tube wells, but the area under these is too small to affect them appreciably. The figures hardly give a true impression. Where there has been extensive construction of canals, these have superseded wells in several areas, the cost of irrigation from canals* being but a fraction of that from wells.† This is specially true of the Punjab.‡ Even when the expansion of canal irrigation, which has rendered wells unnecessary in large areas, is taken into consideration, it is disappointing that so little progress in sinking ordinary wells should have been made since the beginning of this century. Difficulties and cost of construction, the tenure on which land is held, the fragmentation of holdings, disputes amongst co-sharers, the uncertain return on the money invested and the power available for lifting water have all, either singly or in combination, proved limiting factors in this respect. Lack of water is rarely an obstacle in the alluvial tracts of the north; in peninsular India, it is often a difficulty.

The construction of wells is essentially a matter for private enterprise, but there are many ways in which the agricultural and irrigation departments can help the landholder. The agency for minor irrigation works which we have recommended in paragraph 279, the agency for research into irrigation problems which we propose in paragraph 287 and the branch of the engineering section of the Agricultural Department which, under our suggestions in paragraph 106, Chapter IV, would deal with water-lifts should all be able to give the cultivator substantial assistance in the appropriate direction. Much useful work can be done in investigating the methods of constructing and of lining wells most suitable to his conditions. The systematic surveys of subsoil water supplies, which we have recommended in the preceding paragraph, will enable advice to be given him in regard to the probabilities of finding water. The agricultural engineer should be able to work out for him the cheapest and most efficient method of raising water when it has been found. If assistance is given in these ways, any reluctance to sink wells which arises from uncertainties as to whether they will pay or from lack of skill in constructing them should be overcome. Difficulties will still remain. Where holdings are very small, the cost of construction of a well may prove out of all proportion to the benefits to be derived from it by the individual cultivator. The only remedy in such circumstances lies in sharing the cost of construction amongst a number of small holders, but the risk of

*About Rs. 3-8 per acre.

†About Rs. 22 per acre.

‡ Area irrigated from wells in the Punjab :—

	Acres.
1868-69	4,612,000
1918-19	3,829,000
1926-27	3,484,000

The decline is due to the extension of canal irrigation to tracts formerly dependent on wells.

disputes is likely to prove a deterrent to joint action. The difficulty might be overcome by the formation of a small co-operative society for the sinking and working of the well. An increase in the number of ordinary wells is so desirable that we consider that every effort should be made to encourage the formation of such societies. It is a matter for regret that, in some parts of India, the number of abandoned wells is large. In tracts such as the Bombay Deccan, this is doubtless due to a fall in the subsoil water level which has made the working of wells unprofitable; but, in general, the abandonment of wells would seem to be due to fragmentation of holdings and disputes in regard to the division of the supply. We would suggest that, in tracts where the number of abandoned wells is at all numerous, a special enquiry should be made by the Revenue Department into the reasons why the wells have fallen into disuse with a view to ascertaining whether the difficulties can be removed.

OTHER SOURCES.

282. As has already been explained in paragraph 268, the other sources of irrigation are of very various kinds. Although, in the aggregate, over ten per cent of the total irrigated area is irrigated from these sources and they are thus of great importance to cultivation, each individual work is usually quite small. There is great scope, we consider, for extending works of this character and also for increasing the efficiency of those already constructed. We trust that this development will be assisted by the suggestions made in paragraph 279 for the extension of minor works generally, of which these "other sources" form an important part.

We desire, in particular, to draw attention in this connection to the possibilities of extending irrigation from small streams by means of power-driven pumps placed on the banks, or on temporary stages or floats where the permanent bank is at some distance from the water. We consider that this source of irrigation provides opportunities for fully protecting the harvest over many thousands of acres. Failure to turn these opportunities to account in the past has probably been due to several causes, amongst others, to the difficulties of securing suitable pumps, especially pumps combining a low lift with a high discharging capacity, the general lack of knowledge how to manage them and of facilities for effecting repairs, the cost of installation which places them beyond the reach of the small cultivator, unless he is able to combine with his neighbours, and the obvious difficulties of such combination. The difficulty of combination is probably the most serious and can, we think, be best overcome by the formation of co-operative societies, the encouragement of which we have urged in the preceding paragraph in the case of ordinary wells. But there is also a wide field of opportunity for the branch of the agricultural engineering section, which will be responsible for pumping operations under the suggestions made by us in Chapter IV, to devise cheap and efficient pumps with suitable staging or floating platforms, where these are required to mount them, and to induce private enterprise to undertake their multiplication and the establishment of a repairing service for them.

283. In its administrative aspect, irrigation presents in a marked degree the problem of co-ordinating satisfactorily the relations between two highly skilled services of technical officers. The *raison d'être* of the Irrigation Department is to assist the agriculturist by providing an assured supply of water. Each scheme of irrigation presents its own special agricultural problems. It might be thought, therefore, that no new project would be initiated by the Irrigation Department without the fullest consultation with the Agricultural Department both in regard to the suitability of the soil for irrigation, including the conformation of the subsoil, the nature of the crops that would be grown and the character of the supply that would be required for them. Such preliminary consultations do not, however, appear to be the universal practice. We were informed by the Director of Agriculture, Madras, that he and his department had no contact whatever with the Irrigation Department. Dr. Mann, the late Director of Agriculture, Bombay, expressed a desire for closer relations between the two departments. On the other hand, the directors of agriculture in the Punjab, the United Provinces and the Central Provinces declared themselves satisfied with the degree of contact maintained between the two departments which, however, is of a personal character and owes little or nothing to official organisation directed to that end. Yet it is from the Punjab that there comes a striking illustration of the need for consultation of the kind here contemplated. Two years after the colonisation of the Lower Bari Doab canal area was commenced, a soil survey revealed the fact that the area of culturable land was very considerably less than that which had been originally anticipated. Whilst we agree with the view that successful co-operation between any two departments must depend in very large measure on the personality of the heads of those departments, we are of opinion that the existence of formal official orders stressing the necessity of such co-operation would be salutary. Orders directing that the views of the Director of Agriculture must be obtained at an early stage on the agricultural aspect of all new irrigation schemes would serve as a reminder to both departments of the need for that close co-operation between them which alone can secure the adequate discharge of their responsibilities to the agricultural community.

RELATIONS BETWEEN THE AGRICULTURAL AND THE IRRIGATION DEPARTMENTS.

We are further of opinion that, when there is occasion for consultation between the heads of the agricultural and irrigation departments, their views should be placed formally on record. Conditions of service in India make frequent changes of officers inevitable and it is, therefore, all the more important that a permanent record should be kept of the views of those responsible for important decisions, together with any relevant data. Our object is to secure that the documents which are really material to the decisions reached by heads of departments should be readily available.

We have little doubt that co-operation between the agricultural and irrigation departments would be rendered easier if the officers of the one department possessed a more intimate knowledge of the working of

the other than they do at present. We would suggest, therefore, that the possibility of instituting a short course in agriculture for irrigation officers and in irrigation for agricultural officers should be carefully examined. Such instruction could, we think, best be given at the agricultural colleges.

In regard to the curriculum at these colleges, we are aware that little, if any, scope is left for the inclusion of new subjects and it may be found undesirable to add to it even a short course of lectures in irrigation especially if any effort is made, as it should be, to give the student a practical insight into the workings of the irrigation system of the province. The institution of a short post-graduate or post-certificate course in irrigation will, therefore, in all probability be found preferable. This course would be open to all students but would be compulsory for junior officers of the agricultural departments. It would be confined to an exposition of the salient features of the irrigation systems of the province, their problems and potentialities, the methods of distribution of water and the ways in which the agricultural officer can assist the irrigation engineer. The irrigation engineer, on the other hand, would be expected to acquaint himself with the agricultural aspect of the soils of the province, the nature and requirements of the crops grown under irrigation and the agricultural practices of the cultivators in the irrigated tracts. If care is taken to select suitable instructors, much could be learnt in a short course modelled on the lines of the rural economy course held at the Lyallpur Agricultural College to which we have already referred in paragraph 233, Chapter VIII. This course lasts one month and is designed to give officers of the Irrigation and other departments an insight into the work of the Punjab Agricultural Department. The knowledge acquired should, if possible, be tested by an examination.

THE IRRIGATION DEPARTMENTS AND THE CULTIVATOR.

284. We consider that the time has come to devise means whereby the cultivators, for the furtherance of whose interests the irrigation departments exist, should have a more direct avenue of approach to the responsible officers of the department and to Government At present, though full advantage is taken of the opportunities afforded by visits of inspection from the superior officers of the irrigation and revenue departments and by the right of interpellation possessed by members of the provincial legislatures, the representation of their needs is, in the main, effected through the subordinate officials of the irrigation and revenue departments. We do not wish to minimise the value of any of these channels of communication, in particular that provided by the provincial legislatures, which should certainly constitute the cultivator's ultimate protection. But something further is required to prevent questions arising out of the distribution of water from reaching a stage at which any section of the rural community regards itself as aggrieved. We would therefore suggest the creation, in those provinces in which irrigation is of mportance, of an organisation on the analogy of the local railway advisory committees which would be composed of representatives of

the irrigation, revenue and agricultural departments, with a majority of non-official members who should, if possible, be cultivators. The functions of this organisation would be to examine representations made to it by individual cultivators and by associations of cultivators, and to arrange that such of them as contained points of substance should receive careful attention at the hands of Government. Whether an organisation of this character should be constituted for a province as a whole or for particular irrigation systems is a matter we would leave to the discretion of the provincial governments, but we consider it essential that the non-official members of it should themselves be landholders or cultivators in the irrigated tracts for which it is formed. Advisory committees for irrigation already exist in the Godavari, Kistna and Cauvery deltas in Madras and appear to be working effectively. In the Central Provinces, there is a Standing Committee for Irrigation composed mainly of members of the Legislative Council, but its duties appear to be the consideration of important new proposals rather than the examination of grievances. The more thoroughly such grievances are aired and the sooner they receive a preliminary investigation and sifting at the hands of the district officers and of local agricultural associations and kindred bodies the better for all concerned, but there should remain a definite right of access to some central organisation constituted as we have suggested.*

CENTRAL ORGANISATION.

285. Before the constitutional changes which followed the passing of the Government of India Act of 1919, the Government of India were the real owners of every major irrigation work in India, the position of the provincial governments being very much akin to that of managing agents. The capital required for the works was found by the central Government and no original estimate could be sanctioned by any lower authority. After the Secretary of State or the Government of India had accorded sanction to a new major work, a term which included all productive and protective works, some of them costing even less than a lakh of rupees, the project was constructed by the local governments as agents of the Government of India, whose control was exercised through the medium of the Inspector General of Irrigation. The position was completely changed by the Reforms as the result of which, as already mentioned, irrigation became a provincial subject, administered by the reserved side of the local governments. Although, under the new Constitution, the funds for all new works have to be provided by the local governments, a specific limitation has been placed on their powers. It is laid down that the sanction of the Secretary of State is necessary to capital expenditure on irrigation

*Mr. Calvert dissents from this recommendation. He considers that where the Northern India Canal and Drainage Act is in force and where suitable rules have been framed thereunder, ample provision exists for full consideration of cultivators' grievances and opportunity is provided for appeal to Superintending Engineers and Commissioners. Elsewhere in temporarily settled provinces, he considers that the Collector is the most suitable authority to deal with such grievances. Organisations of the kind recommended would, he considers, be of little use to the cultivators while they would provide yet further opportunity for misrepresentation.

and similar works, if the project concerned materially affects the interests of more than one local government, if the original estimate exceeds Rs. 50 lakhs, if a revised estimate exceeds by fifteen per cent an original estimate sanctioned by the Secretary of State or if a further revised estimate has been proposed after one revised estimate has been sanctioned by the Secretary of State. The effect of this limitation is to give the Government of India a greater measure of control over irrigation matters than they possess in regard to other reserved subjects. For the exercise of this control they rely upon the advice of their Consulting Engineer who has replaced the Inspector General of Irrigation. The position thus created has given rise to difficulties and we were informed by Mr. Harris, who, at the time he gave evidence before us, was performing the duties of Consulting Engineer to the Government of India, that it had been ascertained that whilst provincial governments were agreed that it was very desirable that they should be able to obtain a second opinion on their irrigation projects, they strongly objected to interference once a project had been sanctioned.

Rivers and drainage lines do not respect provincial boundaries, and the evidence we received in the course of our enquiry convinced us of the urgent need for the creation of an organisation which would not only enable provincial governments to obtain a second opinion in regard to their irrigation projects but would also be in a position to give the Government of India authoritative advice in regard to the settlement of disputes between provinces arising out of claims to the same source of supply. In these circumstances, we welcome the recent constitution by the Government of India of a Central Irrigation Board, of which the Consulting Engineer to the Government of India and all the chief engineers for irrigation in the provinces are members. The Board will work through sub-committees consisting of those engineers with recent experience of works akin to those to be discussed. These sub-committees will be convened by the Government of India at the instance of the local government concerned when a new project is about to be sanctioned or when a province finds itself in difficulties in any technical matter. We understand that three such sub-committees have already been convened. This arrangement has many advantages, not the least of which is that, as the Government of India have the right to convene sub-committees for their own purposes, they have now a ready means of obtaining competent advice on such central questions as irrigation schemes affecting two provinces, or a province and an Indian State, and on irrigation schemes which they are required to submit for the sanction of the Secretary of State in Council. The Consulting Engineer to the Government of India is not necessarily a member of all sub-committees and the incumbent of the post has, therefore, been required to take up, in addition to his technical work, the duties which formerly devolved on the Deputy Secretary to the Government of India in the Department of Industries and Labour.

Whilst the constitution of the Central Irrigation Board and the manner in which it will function will result in the benefit of experience gained in one province being placed at the disposal of other provinces, we are of opinion that something more than this is required. We do not consider that it is, in itself, sufficient to secure that general dissemination of technical information throughout the provincial irrigation departments which we regard as desirable. We have been impressed in this, as in so many other directions, with the ignorance in one province of what is going on in others. Unless steps are taken to remedy this defect, that ignorance will become even more marked with the establishment of the provincial stations for research into irrigation matters which we recommend in the following paragraph. We, therefore, propose the establishment of a Central Bureau of Information for Irrigation, the headquarters of which would be at Delhi and which might suitably be placed in charge of the Consulting Engineer to the Government of India. The main functions of the Bureau would be to establish and maintain a comprehensive library of irrigation publications, both Indian and foreign, which could be consulted by irrigation engineers and to act as a clearing house of information needed by provincial officers. It should, however, be something more than a mere repository of information and a centre for answering enquiries. It should endeavour to reach a wider public than the irrigation departments and to keep agricultural officers, and the public generally, in touch with irrigation developments in India and abroad.

An additional means of bringing the irrigation engineers in the provinces into closer touch with each other would be provided by annual or biennial meetings and we consider it very desirable that such meetings should be arranged. They should be held in rotation in the different provinces and in localities which possess features of special interest to the irrigation engineer.

THE NEED FOR IRRIGATION RESEARCH.

286. The Irrigation Commission expressed itself as struck by the small amount of attention which appeared to have been given by the departments of agriculture and public works to matters connected with the application of water to cultivated crops and recommended that systematic experiments should be made and carried on continuously for a series of years, with the object of solving the numerous problems which arise in connection with the distribution and application of water to the land. The waterlogging of land as a result of defective irrigation was forced on the attention of Government so long ago as 1832, and the long history of the Western Jumna Canal, one of the oldest in India, has afforded ample lessons in hydraulic engineering. The experience thereby gained, however, was not sufficient to prevent the recurrence of the evil in the new canal colonies of the Punjab. The problem has received continuous attention from the Government and its engineers, but the difficulty is to discover a measure that would not be too costly. Experiments in drainage, in lining the canals, in limiting irrigation, and so on, have been tried and, in 1925, a special committee of enquiry was appointed.

The reverse problem of desiccation or sinking of the water table is presented in the Jullundur Doab and is ascribed to the great increase of well irrigation. A detailed investigation confirmed popular opinion on the subject but led to no other recommendation than a restriction on the construction of new wells.

The treatment of alkaline lands has received more prolonged attention, but the investigation has suffered from interruptions and more systematic and continuous research is required to discover measures to deal with this widespread evil.

The water requirements of crops have been studied on empirical lines by irrigation engineers who keep a careful record of the depth of water supplied per acre irrigated, and they incline to the opinion that nothing further of practical value is likely to accrue from research. The scientific study of the problems was begun at Pusa some years ago but was not continued; the Bombay Irrigation Department is carrying out an investigation of considerable interest at Hadapsar, but elsewhere little is being done. Even in the Punjab, where the importance of irrigation is almost supreme, it is only recently that a scientific research officer has been appointed for irrigation research and the question of a farm where problems could be studied under field conditions has not gone further than the earmarking of an area of land. No scheme for its working has so far matured and no staff has yet been appointed. It is hardly necessary to add that, when the era of construction of large irrigation works draws to a close, as there is every reason to believe that it soon will, economy in the use of water will be the determining factor in the extension of cultivation.

ORGANISATION OF IRRIGATION RESEARCH.

287. We are strongly of opinion, therefore, that more attention should be paid in all provinces in which irrigation is of importance to research on the problems to which it gives rise. The value of irrigation research has, as we have noted, been recognised of late in Bombay, where a special irrigation division was formed in 1916 to enquire into problems which the agricultural and irrigation departments had till then been investigating from different points of view; and in the Punjab, where the scientific research officer mentioned above, who will shortly have a permanent and suitably equipped hydrological laboratory, was appointed in 1924. In both these provinces, there are now officers engaged on the investigation of a wide range of irrigation problems such as the study of movements of the water table and their effect in producing waterlogging on the one hand or desiccation on the other, the water requirements of crops under field conditions, improved methods of irrigation both as regards the distribution of water by modules and the lay out of land for irrigation and hydrodynamical problems connected with such questions as the design of irrigation works and water-borne silt. Whilst we consider that the example set by the Punjab and Bombay should be followed in other provinces, we have no desire to lay down any hard and fast lines on which such research should be conducted and would leave it to each province to decide upon the organisation it requires. In

some provinces, a single officer assisted by a subordinate staff may prove sufficient; in others, a special research division of the provincial irrigation department may be required. Much depends on the nature of the problems to be investigated. Waterlogging, for example, primarily requires investigation by an engineer, but he will need to learn from the agriculturist the minimum depth below the soil surface to which the water table must be kept in order to ensure successful cropping in the locality. Agricultural experience is also wanted to determine the amount of water which a crop requires and its distribution through the period of its development in order to produce its maximum yield. Yet again, in attacking the problem of alkali formation, the services of the chemist as well as of the agriculturist and the engineer have to be requisitioned. Whilst we do not advocate any rigid type of organisation for irrigation research, we would insist most strongly on the closest association between the irrigation and agricultural departments in regard to it. In the Bombay Presidency, we found that the irrigation research station at Hadapsar and the neighbouring agricultural farm at Manjri were not agreed on the aim to be pursued in studying the water requirements of crops. At the Hadapsar station, the aim was to discover the minimum amount of water which would mature an average crop so that the water available might be spread over the maximum area; at Manjri farm, it was to ascertain the amount of water which should be given in order to secure the greatest yield. Such disagreement not only involves waste of energy but also if, as it obviously must, it results in conflicting advice to the cultivator, it gravely militates against the usefulness of both stations. It is, therefore, in our view, essential that the heads of the two departments should collaborate in the presentation to the local government of an agreed list of the irrigation problems to be investigated in the order of urgency and importance. Where the nature of the problem requires the establishment of a research station, it may also be desirable that they should submit a scheme for staffing it jointly with irrigation and agricultural officers. We cannot stress too strongly the necessity for continuity in this, as in other branches of research, if any results of value are to be obtained.

It should, we think, be made clear to both irrigation and agricultural officers that the institution by Government of a special research organisation is not intended in any way to indicate discouragement of research by officers who have not been specially detailed for such work. Individual irrigation engineers in the Punjab at various times during the past thirty years have, for instance, done valuable research work on the evolution of modules and on materials for waterproofing canals and distributaries. It should, therefore, be one of the most important duties of the officers in charge of the special research stations to watch for useful suggestions from all quarters and to encourage the efforts of those who make them by placing apparatus and information at their disposal so far as this can be done without detriment to the regular work of the stations.

In this connection, we would draw attention to the part which could be played by the scientific staff of the Indian universities in the solution

of irrigation problems for which geological, chemical or mechanical knowledge is required. It has, for example, been suggested that a sunken range of rocks is a factor which influences the water table of the Punjab plains: the verification of the existence of such a range and the determination of its features is work for the geologist but it might prove of the greatest value to the irrigation engineer. The discovery of a suitable material for lining canals which would bring the cost of that method of preventing waterlogging within the sphere of practical politics might well prove the decisive factor in restoring waterlogged areas to cultivation. In these and other directions, the scientific staff of the Indian universities could render material help to the irrigation engineer.

The investigation of the problems of irrigation in the Empire generally will doubtless receive an impetus from the prominence given to the subject in the Imperial Agricultural Conference held in London in the autumn of 1927. We have no doubt that irrigation engineers in India will be able to make a valuable contribution to the solution of these problems. The precise way in which this contribution can best be made will need careful consideration. We are confident that Indian opinion would warmly welcome a decision to establish an all-Empire research station in India. The new experience thus made mutually available between the staff of the station and the officers of the irrigation and agricultural departments should contribute much towards the advancement of research in irrigation both in India and throughout the Empire. The authorities responsible for the decision on this point may be assured that Indian opinion will welcome an arrangement by which the personnel of an all-Empire station in India whould be controlled, and the administration conducted, in precisely the same manner as in the case of the other stations in the chain.

NECESSITY FOR A CENTRAL STATION FOR IRRIGATION RESEARCH.

288. If, as we hold, the necessity for research into irrigation problems in all provinces in which irrigation is of importance has been established, the question arises whether much of the work could not be carried out at a central station with consequent saving in staff and expense. The number of officers qualified to undertake research of this character is limited and the establishment of a central station might enable their services to be utilised to greater advantage. But, apart entirely from the administrative problems which are presented by the fact that irrigation is now a provincial subject, we are doubtful whether the problems arising out of irrigation are sufficiently common to all provinces to make the establishment of a central research station either necessary or desirable. Of these problems, that presented by alkali formations is undoubtedly the one which is most common to the irrigated tracts of India but such little work as has been done on it goes to show that these formations are by no means universally due to the same causes. Again, the problem presented by waterlogging in the alluvial tracts of the north is entirely different from

that in the trap and crystalline formations of the south, whilst the water requirements of the crops grown in sub-tropical India differ greatly from those of the crops grown in the peninsula. In such circumstances, we are inclined to doubt whether any provincial irrigation department would be willing to accept and work on the results obtained at a research station situated in another province without further independent enquiry. The object we have in view, that of making the experience of one province available to others, can, we think, best be secured by the Central Bureau of Information, the establishment of which we have recommended in paragraph 285 above. The work carried on at each provincial research station should be reviewed from time to time by a committee appointed by the local government in consultation with the Central Board of Irrigation and the Council of Agricultural Research. Whilst we do not recommend the establishment of a central research station, it will be obvious that an officer who has made a special study of a problem in one province would be in a position to render substantial help to another province even though the local conditions in that province might be different from those in his own. We consider, therefore, that the interchange between provinces of specialist officers—the number of which is, in the nature of the case, bound to be very limited—should be encouraged.

DRAINAGE SURVEYS.

289. It would appear that many of the troubles which have arisen in the irrigated tracts of India in regard to water-logging and the formation of alkali lands have been due to failure properly to correlate a new irrigation system with the natural drainage of the tract. We have little doubt that the lesson has been learnt and that, where this is not already the practice, a careful drainage survey which should include estimates for drainage construction will, in future, form an integral part of all new irrigation projects. The importance of the control of surface drainage is not, however, confined to canal-irrigated areas. We have drawn attention to one aspect of it in connection with soil erosion. In paragraph 292 below, we draw attention to yet another aspect of it in Bengal. The Indian Sugar Committee pointed out the importance of proper drainage as a factor in the successful cultivation of sugarcane and drew special attention to the system of drainage which is practised in Java. The Committee recommended that a drainage survey should be carried out in the submontane tracts of the United Provinces in which, from Saharanpur to Gorakhpur, with the exception of Bahraich, the area under sugarcane is large. The necessity for a complete drainage scheme was also brought prominently to our notice in the North-West Frontier Province. In these circumstances, we support the suggestion made by Mr. Howard in his book on "Crop Production in India" that drainage maps should be drawn up by competent engineers who possess the necessary agricultural insight. As he points out, once such maps have been constructed, it will be easy to control all such undertakings as the construction of roads, railways, canals and embankments and to see that nothing interferes with crop production. From the drainage maps it will be

a short step to the preparation of a series of monographs on the river systems of India such as already exists in European countries like Italy. Those of our members who have visited Egypt have been impressed with the attention there given to the systematic drainage of irrigated land. We understand, too, that in the United States of America, where large irrigation schemes have been carried out, drainage questions have now assumed first place in importance among subjects receiving the attention of research workers; since it is found that, if the free downward percolation of water is arrested, alkali troubles almost invariably follow.

IRRIGATION IN SIND. (i) PROBLEMS AND POSSIBILITIES.

290. Whilst we have not been in a position to present an exhaustive review of the irrigation problems of the different provinces, there are four questions to the importance of which we desire to draw special attention. These are the problems and opportunities which arise from the prospective wide extension of irrigation in Sind and the irrigation problems in Bengal, the North-West Frontier Province and Baluchistan.

We have mentioned that the great Sukkur Barrage which is now being constructed across the Indus below Sukkur, the work on which we inspected in March, 1927, will provide perennial irrigation for some five million acres of land, of which two million acres now receive an unsatisfactory supply from inundation canals and three million acres are uncultivated for lack of irrigation. It is anticipated that water will be available in 1931 and that, although it may take forty years before irrigation is developed to the final stage, the most rapid progress will take place from 1935 to 1938. There can be no doubt that this vast project provides a unique opportunity for putting into practice the lessons to be drawn from irrigation experience elsewhere in India. There is every reason to believe that the greatness of the opportunity thus presented is fully realised but there are a few points we wish to emphasise. We have carefully examined the project from the point of view of its effect on cultivation and on the welfare of the rural population. There is at present considerable difference in the agricultural conditions on the right and left banks of the Indus. The area on the left bank is mainly a cotton area, the agricultural organisation of which is based on one irrigated crop in three years. Wheat and rice are the principal crops on the right bank and a crop is taken every year. The first question for special investigation is the kind of crops the cultivation of which can confidently be recommended to the cultivator in all the tracts to be brought under perennial irrigation. It should be ascertained whether the distinction between the crops which are grown on the right and left banks is based on a real difference in conditions of soil, water supply or climate, in fact, on anything more definite than a preference on the part of the cultivator. It should further be decided how far it is prudent, in the left bank area, to rely on cotton only as the main crop or whether efforts should be made to find alternative money crops which can be grown successfully in this tract. We note that *berseem* has been grown with success. The Agricultural Department

should examine the possibility of encouraging the development of a dairy industry based on fodder crops grown on irrigated land. A system of mixed farming might well prove of much value both from the point of view of direct financial return and in its effect in promoting and maintaining soil fertility; but this last advantage will depend upon the adoption by the cultivator of sound practice in conserving and using natural manure. We need hardly emphasise the desirability that the water requirements of the crops which will be grown when perennial irrigation is assured should be determined as soon as possible and that from the outset, investigations should be carried out with a view to ensuring that the problems which have arisen in other irrigated tracts from waterlogging and alkaline formations do not appear in this tract. We attach great importance to obtaining timely and authoritative information in regard to these and kindred matters which affect the welfare of the cultivator. The tract appears to us to be one in which the establishment of a joint irrigation and agricultural station for research into irrigation problems at the earliest possible moment is eminently desirable. In 1924, the Government of Bombay appointed a committee to consider the administrative developments that were necessary for the provision of agricultural advice to zamindars confronted with an entirely novel system of irrigation; and the opening of the research and experiment station at Sakrand in 1925 has been the first step in a programme of vast importance.

No decision appears to have yet been taken on the point whether the Agricultural Department in Sind should be separated from the department in the Presidency proper and placed under a separate Director. The urgency of the closest collaboration between agricultural, revenue and irrigational officers has been already set forth, and we deem it our duty to advise the Government that the chief revenue and irrigational officers should have ready access to agricultural advice at the headquarters of the Province of Sind. The agricultural problems of Sind will, in our opinion, assume such importance as a result of the construction of the Barrage that we consider the province should have its own Director of Agriculture with headquarters at Karachi. The work at the Sakrand farm and its sub-stations will fully occupy the time of a deputy director of agriculture.

We recognise that Sind under Barrage irrigation will contain as important and comprehensive a system of agriculture as Egypt has to-day and we consider that the welfare of the people demands a chain of experimental stations subsidiary to Sakrand, and a full staff of competent officers. We are convinced that the financial returns to the State from expenditure on a far-sighted policy will be on the most generous scale.

The training of the staff for Sind is a matter of considerable difficulty. We are informed that the arrangement with the Punjab Government, whereby Sindhi candidates attended the college at Lyallpur, was given up owing to a financial disagreement;

and we would suggest that this matter should be adjusted at the earliest possible date.

We trust that, in the very natural preoccupation due to the construction of the Sukkur Barrage, the possibilities of irrigation development in other parts of Sind will not be entirely lost sight of. The evidence we recorded at Karachi showed that there are certain areas outside the area commanded by the Sukkur Barrage project in which there are considerable possibilities for schemes for pumping water from rivers, canals and other sources, as the water requires to be lifted a few feet only. The problem which is thus one of evolving a suitable pump combining a low lift with a high discharging capacity should be investigated by the engineering section of the Agricultural Department.

291. The principles which should be adopted in disposing of such of the areas which will come under irrigation as are still at the disposal of Government require to be settled without delay. We conceive that these fall into three main divisions. In the first place, the claims of the indigenous population in the face of the general immigration from outside which will be essential to the proper development of the tract will require careful consideration. We trust that some equitable solution will be found which will ensure to the labourer (*hari*) as well as to the landholder in Sind a first claim to those lands in the newly irrigated tracts which are at the disposal of Government. We consider, however, that the immigration of a certain number of progressive cultivators, including those familiar with the possibilities of irrigation elsewhere, should have a beneficial effect on the local standards of cultivation, and we, therefore, recommend that provision for them should be included in the allocation of such lands.

(*ii*) THE PRINCIPLES TO BE ADOPTED IN DISPOSING OF GOVERNMENT LAND.

In the second place, it is important that the manner in which the areas at the disposal of Government should be allocated should be determined as soon as possible. In such schemes, the small holder must form the backbone of any intensive system of cultivation and should be encouraged in every possible way. But it will probably be as important here, as in the Punjab colonies, to insist that the small holder shall himself cultivate his grant and shall not be allowed to grow into a petty absentee landlord. In the Punjab, it is a condition of all peasant grants that the grantee shall settle permanently on the estate and build himself a house there. These conditions must be fulfilled before occupancy rights can be acquired, and even when, later, the grantee is permitted to acquire proprietary rights, the sale is conditional on the continued observance of this condition. The value of the small holder is so linked up with his residence on the estate that we think that the attempt should be made in Sind to ensure observance of this condition on lines conformable to the prevailing systems of tenure.

If any applicants for larger grants are forthcoming who can be trusted to carry on agriculture by progressive methods and who possess such public spirit as would lead them to contribute substantially to the social advancement of their smaller neighbours, then we

consider that an improvement in social and economic conditions will be likely to result from interspersing a suitable proportion of these amongst the population. We are also of opinion that provision should be made for a few large grants of land of some 2,000 to 4,000 acres on terminable leases to individuals or groups of individuals. The actual cultivation would, no doubt, be carried on by tenants, but these would have skilled guidance and the grant as a whole would derive all the benefit that follows from a single control. In this way, as the Indian Cotton Committee pointed out, the agricultural development of the tract would be greatly facilitated. Further, the large scale production, which these grants would mean, would assist the surrounding small holders in marketing their produce, and should go far to solve the difficult problem of securing a proper price for it.

In this connection, we are impressed by the many advantages attaching to the planting of extensive and homogeneous areas with a single variety of cotton well suited to local conditions. Where this can be achieved, the risk of deterioration by cross-fertilisation between the improved variety and inferior cottons is removed. Furthermore, the fact that local ginneries handle no cotton other than the approved variety insures to the cultivators a supply of pure seed at the lowest possible cost. Again, marketing arrangements are greatly facilitated by the existence in the tract of a large volume of one variety of high class cotton. Purchasers soon discover that cotton from such a tract can be relied upon both for purity and quality. The reputation of the district for cotton is established and soon becomes widely known, and, if marketing arrangements are satisfactory, the cultivator is thus assured of the maximum premium for the high quality of his produce. The information at our disposal goes to show that, in the Indian State of Rajpipla, where regulations have been enforced over a period of four years compelling the cultivator to grow cotton of an approved variety, highly encouraging results have already been obtained. Again, Government in the Sudan have taken power to enforce the creation and maintenance of areas in which one variety of cotton only is grown. Here also results have, we are told, entirely justified the wisdom of this provision. With these facts in mind, we would suggest to the Government of Bombay that they should very carefully examine the possibilities of attaching to occupancy rights in Crown lands to be newly colonised as part of the Sukkur Barrage scheme, the obligation to sow only such cotton as may be provided or approved by the Department of Agriculture. The cotton of the entire tract could then be kept pure by the application of the Cotton Transport Act. We are well aware that such a suggestion involves a departure from existing practice, but we are of opinion that the benefits in terms of financial advantage to the cultivator and to the community are likely to be so considerable as fully to justify a bold experiment in the direction indicated.

The third problem to be considered is that of securing adequate fuel supplies to the irrigated area. It is clear from the Punjab experience that no private person is likely to undertake the formation of plantations

in irrigated areas owing to the length of time which must elapse before they yield a return in any way comparable with that from ordinary cultivation. The evidence we took in the Punjab showed that such plantations do not come into full bearing for fifteen years, after which they may yield a net profit of as much as Rs. 25, or, allowing for the water rate paid per acre, Rs. 28. It is estimated that the interim revenue received from the plantation during the first fifteen years should meet, and, perhaps, slightly exceed, the cost (including interest on capital outlay) of its formation and maintenance. It is possible that Government would obtain a larger return from land placed under plantations than would be received if the land were disposed of in the ordinary way. For the reasons given in our chapter on Forests, the establishment of such plantations is most desirable if they can be shown to be profitable. We recommend that the financial considerations involved should be carefully examined and that, if the result is satisfactory, the Forest and Irrigation departments should, in consultation, decide what percentage of the area at the disposal of Government can suitably be allotted to the establishment of such plantations and how far the provision of a wider belt of land along the canal banks than it is customary to devote to the growth of trees would meet the case. The two departments should then work out a definite scheme for the formation of plantations, either along canal banks or in isolated blocks elsewhere.

THE POSITION IN BENGAL.

292. The problem in Bengal differs from that in most other parts of India in that it arises from the presence of too much rather than of too little water. Even in the west of the province, which has a comparatively short rainy season and, therefore, offers considerable scope for the extension of irrigation, the liability of low lying lands to inundation by river flood is a serious obstacle to the extension of cultivation of such a profitable crop as sugarcane. The intimate relation between the drainage system of the province and the prevalence of malaria and water-borne diseases and the bearing this has on the well-being of the population are fully realised. The improvement of the drainage system has accordingly long been regarded as the most potent weapon which can be forged in the fight against disease. It is essential to the transport of jute and other agricultural produce in a province which depends so largely on its waterways as a means of communication that they should be kept open to navigation, but, in their upper reaches, the rapid extension of the water hyacinth makes this a task of ever increasing difficulty and they are throughout liable to silting and deterioration owing to changes in the general drainage system. The Irrigation Department, which has thus to fulfil a multiplicity of functions which do not fall to the lot of similar departments elsewhere, only became a separate department in 1921, when it was formed out of the Public Works Department. It is a small department which consists, in its superior ranks, of the Chief Engineer and Secretary to Government and four superintending engineers. The relative importance of the activities of this department in regard to irrigation, navigation and embankments

and drainage can be gauged from the following figures taken from its report for 1925-26 :—

		Area irrigated. Acres		Length of main and branch channels. Miles	
I.	Irrigation—				
	Midnapur Canal ..	75,698	99,534	70	97
	Eden Canal ..	23,836		27	
II.	Navigable canals ..	..	..		1,886
III.	Embankments and drainage—total length of embankments.				1,298

Thus the Irrigation Department in Bengal has to deal more with the improvement of navigation and sanitary conditions and the control of flood water than with irrigation proper.

As we have mentioned, there are areas in Bengal, especially in the west of the province, which are suited for an extension of canal irrigation and of minor works of all kinds. We would refer in passing to the excellent work which is being done in the Bankura and, to a lesser extent, in the Birbhum districts by co-operative irrigation societies. We are glad to note the assistance which is given by the Irrigation Department to these societies.

It is not, however, the problems connected with irrigation proper that have caused us concern so much as those which arise in regard to drainage and the preservation of existing river channels from deterioration. These problems are singularly complex and difficult.

No single department can be expected adequately to deal with all the water problems of Bengal and the first step which should be taken towards their solution is the complete separation of the irrigation branch from the navigation and embankments and drainage branches and the formation of two entirely separate departments.

No general survey of the irrigation possibilities of Bengal has yet been made. The first duty of the new Irrigation Department would, therefore, be to formulate a general scheme for irrigation development based on a survey in such detail as would ensure ordered progress. This is a point of special importance in tracts which, in the nature of things, do not lend themselves to large projects and where facilities for the construction of a number of small schemes exist in the same drainage area.

We would next draw attention to the critical importance of the work which awaits the new department which would deal with navigation, embankments and drainage and which might be re-named the Waterways and Navigation Department.

The problems of the Gangetic delta and the Damodar river are typical of those associated throughout the world with rivers whose courses lie through broad alluvial plains and at whose mouths extensive deltas have developed. Such rivers, in their natural state and when uncontrolled by the hand of man, tend in seasons of flood to overflow their banks and to spill their water over large areas of alluvial land. By the action

of the swollen current upon the soft soil of which their banks and beds are composed, they tend also to change their course, sometimes by many miles from season to season. Thus, both the raising of the land level and the creation of new deltaic land take place more or less evenly over the whole lateral area of the tract. It is these two processes in combined action that have built up the alluvial deposits of the sub-continent and also the deltaic lands lying at the mouths of the great rivers. They are continuous in their operation and to-day, as in past centuries, it is by them that the rock masses of the Himalayas are compelled to pay constant tribute alike to the rich plains of the interior and the extending mud banks of the Sunderbunds.

Favourable agricultural conditions and convenience of communication and transport, combined often with considerations of military advantage, lead man to build his habitations and to prosecute his commercial activities on the banks of great rivers. In order to protect himself and his property against risk of floods, he heightens the river banks by building embankments, *bunds* or, as they are known in America, levees ; and so contrives, even during periods of flood, to confine the stream within its normal channels. But the waters of the river continue to carry their burden of silt and, at seasons when the stream is slack, large quantities of this are deposited in the bed of the river. The force of the current tends in flood season to scour, and so to lower, the river bed. But in the flat reaches of a river where the stream is broad and the current slow, the tendency often is for deposit to outweigh denudation and thus, over a series of years, to raise the bed of the river and with it the flood level. This, in turn brings about the necessity for the construction of still higher embankments, until finally a stage is reached at which the surface of the river, flowing high above the level of the adjacent lands, has ceased altogether to relieve the riparian tracts of their superfluous water : the river can no longer drain the lands through which it flows.

Where no *bunds* prevent the river from overflowing its banks, the floods of each succeeding season bring a further deposit of fertile silt to wide areas of territory ; while, at the same time, the flood waters cleanse and purify the surface of the land, sweeping away decaying vegetable and animal matter and purging the streams, ditches and ponds of insects and impurities, many of them harmful to man and beast. Inevitably the *bunding* of such rivers must, to some extent, incline both to arrest this natural regeneration of fertility and to give rise to a deterioration in the health of the population in the riverain tracts. There can be little doubt that certain districts have tended, as a consequence of the interference by man with the forces of Nature, to decline in natural fertility and to become the breeding ground of malaria and other diseases. This process is occasionally, and sometimes seriously, aggravated by the construction of railway and road embankments across the lines of natural drainage.

This group of problems is by no means confined to north and north-eastern India. It has presented itself with tragic emphasis in the United States by the devastating floods of 1927 in the Mississippi Valley. It is known to exist in many other parts of the world.

The problems that await solution in Bengal, if, indeed, all the problems presented can be completely solved, are thus complex in the extreme. The order in which they should be attacked, the nature of the measures to be adopted, and the amount which can properly be spent on them, having regard to other urgent calls on the public purse, will all require most careful investigation and the provincial legislature will rightly require an authoritative opinion on these questions as a preliminary to granting its approval to any scheme which may be put before it. We accordingly recommend to the earnest consideration of the Bengal Government the desirability of appointing a committee of experts which should include among its members at least one who is familiar with the management of the deltas of large rivers in other countries, such as, for example, that of the Mississippi and we would suggest that one of the specific directions to such a committee should be to consider and report upon the advisability of setting up a Provincial Waterways Board.

IRRIGATION IN THE NORTH-WEST FRONTIER PROVINCE.

293. The irrigation problems of the North-West Frontier Province must be considered not in respect of the magnitude of the irrigation systems of that small province but in relation to their importance to the well-being of the agricultural community. The province possesses three government canal systems which, between them, irrigate 370,000 acres or sixteen per cent of the total cropped area, a percentage which is only exceeded in Sind, the Punjab and Madras. More important in the aggregate, however, are the district and private canals which, between them, irrigate another 100,000 acres. By far the greater part of this is under the district canals which, with the exception of the Paharpur Canal in the Dera Ismail Khan district which was constructed by the Punjab irrigation engineers, were constructed by the people themselves with or without the help of Government and are in the charge of the deputy commissioner of the district. They were constructed without competent, or, indeed, any, technical supervision and it is not surprising, therefore, that they are badly aligned, scantily provided with drainage crossings, ill regulated and altogether badly equipped. We were informed that the canals in the Dera Ismail Khan district, which at the time of our inquiry had no engineering staff in charge of them, are in a specially unsatisfactory condition, which arises, in the main, from the fact that there is no direct outlet to the Indus for the waters of the many torrents which come down from the surrounding hills in violent spate during the monsoon months and which, in consequence, wipe out *bunds*, breach canals and turn valuable lands into a network of ravines. The result is that considerable areas are going out of cultivation and many villages are being forsaken.

We would suggest that the possibility of transferring the most important district canals, if not all of them, to the charge of the Irrigation Department should be examined. We were informed that such a transfer was effected in the case of the Kabul River Canal in 1903-04 and that the area under irrigation on that canal increased by forty-five per cent in seven years from that date. If, for reasons of the existence of which we are not aware, there are objections to the transfer of the canals to the

Irrigation Department, we are of opinion that steps should be taken to ensure that the deputy commissioners have the assistance of a competent staff in dealing with them.

IRRIGATION IN BALUCHISTAN.

294. We have heard two witnesses in regard to the agricultural position in Baluchistan and we are impressed by the testimony which they both gave as to the extent to which agricultural progress in that area must be dependent upon enhanced supplies of water. Since we heard this evidence, we have been informed that the officer who is investigating water control in Waziristan will also examine the possibilities of extending irrigation in Baluchistan. We consider that it is impossible for one officer to carry out, adequately, investigations in areas so extensive and so widely separated as Waziristan and Baluchistan. We, therefore, recommend that an examination of the possibilities of extending irrigation in Baluchistan should be forthwith undertaken by an officer specially selected for that purpose and that he should be assisted by a suitable subordinate staff.

HYDRO-ELECTRIC DEVELOPMENT.

295. The natural reserves of water power available in certain parts of India, notably in the submontane districts of the Himalayas and in the Western Ghats, including the Nilgiris, are considerable. It is also probable that opportunities exist for obtaining power by utilising falls of a few feet on rivers in the plains, and by the construction of similar falls on canals by a suitable alignment of the canal gradients. As regards canals, we understand that attention is now being paid in new irrigation projects to this source of power, which should certainly not be neglected in view of possible future demands for power both for industrial and agricultural purposes. The possibilities of this source of power have been strikingly illustrated by the success of the hydro-electric scheme carried out by our late colleague, Sir Ganga Ram, at Renala in the Lower Bari Doab Canal Colony of the Punjab, which we visited in February, 1927, where 80,000 acres are irrigated by a six feet fall.

From the agricultural standpoint, electric power has at present two main uses, as a motive power for machinery including pumps, and as a means of obtaining supplies of synthetic nitrogen from the air. Experiments are being conducted with a view to applying electricity on a commercial scale as a stimulus to plant growth. This is a possibility which need hardly be seriously considered at present and, in any event, the power required would probably be insufficient to make generation for this purpose alone economic. The desiderata in all these cases are cheapness and wide diffusion. The circumstances of the Indian cultivator make it improbable that, for a long time to come, if ever, there will be an appreciable demand for electric power for agricultural machinery or that there will be much scope for the use of electricity as a stimulus to plant growth. In paragraph 89, Chapter IV, we have given reasons for doubting whether the manufacture, in this country, of synthetic nitrogen from the air is likely to prove a commercial proposition. In existing conditions, therefore, the immediate openings for electric

power for agricultural purposes are confined to pumping schemes. The experience of other countries suggests that, in the present state of electrical development, power can only be profitably developed for urban and industrial purposes and that its economic use in agriculture must depend upon the availability of a surplus which is not required for these purposes and which would otherwise go to waste. We recognise, however, that the possibility of utilising electricity for the purpose of raising water from wells may make its use profitable in India, otherwise than as a mere surplus of power required for urban and industrial purposes. We have been informed that a considerable development of the industrial use of electric power may be expected in Lahore and Amritsar and their immediate neighbourhood. Such an area as this, we consider, offers the best prospects for testing the agricultural uses to which electric power, surplus to industrial requirements, can be put and we have no doubt that the Government of the Punjab will see that full advantage is taken of this and of any other opportunity which may present itself.

Whilst the development of its hydro-electric schemes is now a matter for which each province is entirely responsible, we consider that, as in the case of irrigation problems, it would be of great value to the provinces if some central organisation existed from which information in regard to hydro-electric developments in India as well as in other countries could be obtained. We recommend, therefore, that the Central Information Bureau, the formation of which we have proposed in paragraph 285 above, should also act as a clearing house of information on hydro-electric matters and that a section of its library should be devoted to literature on the subject. Expert advice in regard to any particular scheme of development can, we think, be best obtained from a firm of consulting engineers of which there are many of recognised eminence. This is a course which, to mention two instances, has been followed in regard to the Yunzalin hydro-electric project for the water supply of Rangoon and the Pykara hydro-electric project in Madras. It should prove less expensive than that of retaining the services of an expert permanently at the headquarters of the Government of India and has the further advantage that it in no way involves any interference with provincial independence in the matter.

As regards the orderly development of hydro-electric schemes throughout India, it is, perhaps, fortunate that the natural centres of hydro-electric development are widely separated and it does not seem probable that problems similar to those which have arisen from the conflicting claims of more than one province to irrigation supplies will here occur. The contingency that when the development of natural sites has made greater progress, questions affecting more than one province may arise cannot, however, be entirely overlooked. If such a situation should occur, the best method of dealing with it would probably be the appointment of an *ad hoc* committee of experts.

Another contingency which has to be provided against is the premature development of easily accessible sites in the lower reaches of rivers where they debouch from the hills on to the plains. The effect of such

development would be to create vested interests which might ultimately impede the development of sites which may exist further upstream in the recesses of the hills but which have yet to be surveyed. These remote sites may represent sources of power of the greatest importance and no action should be taken which would hinder their ultimate utilisation. We commend this point to the special attention of local governments.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

296. The conclusions and recommendations in this chapter may be summarised as follows :—

(1) There should be a periodic revision of the position in regard to all outstanding irrigation projects (paragraph 275).

(2) The relaxation of the financial rules which formerly governed the construction of protective works should furnish a stimulus to the construction of this class of works (paragraph 276).

(3) Further investigation and experiment should be undertaken before a final decision against the sale of water by volume is reached (paragraph 277).

(4) No reduction in the capacity of an outlet should be made in individual cases if it is found that irrigation is done over a larger area than that for which the outlet was designed (paragraph 277).

(5) No change should be made in the agency charged with the distribution of water but the formation of irrigation *panchayats* should be encouraged (paragraph 278).

(6) The construction and maintenance of minor irrigation works should be entrusted to a special agency (paragraph 279).

(7) The department entrusted with the charge of pumping and boring operations should make detailed investigations into the economics of tube well irrigation and should also carry out a systematic survey of subsoil water supplies (paragraph 280).

(8) Government assistance in regard to the construction of tube wells should be limited to the provision of information, of technical advice and of finance, where required, on the *taccavi* system and to placing boring equipment and skilled labour at the disposal of the landholder on payment of a moderate fee (paragraph 280).

(9) The system of subsidising tube wells at present in force in the United Provinces should be discontinued (paragraph 280).

(10) Private enterprise in the construction and maintenance of tube wells should not be discouraged by Government competition (paragraph 280).

(11) Pumping and boring operations should be entrusted to the agricultural departments (paragraph 280).

(12) The construction of ordinary wells is essentially a matter for private enterprise, but there are many ways in which the agricultural and irrigation departments can help the landholder (paragraph 281).

(13) In districts where holdings are very small, every effort should be made to encourage the co-operative sinking and working of wells (paragraph 281).

(14) In tracts in which the number of abandoned wells is at all numerous, a special enquiry should be made into the cause of abandonment (paragraph 281).

(15) The extension of irrigation from small streams by means of power driven pumps should be encouraged (paragraph 282).

(16) Closer relations should be established between the agricultural and the irrigation departments (paragraph 283).

(17) Short courses in agriculture for irrigation officers and in irrigation for agricultural officers should be instituted (paragraph 283).

(18) An organisation on the analogy of local railway advisory committees should be established to deal with complaints in regard to irrigation matters (paragraph 284).

(19) A Central Bureau of Information on irrigation matters should be established (paragraph 285).

(20) Frequent conferences of irrigation engineers should be held (paragraph 285).

(21) More attention should be paid to research on irrigation problems in all provinces in which irrigation is of importance (paragraph 287).

(22) There should be the fullest collaboration in such research between the agricultural and irrigation departments (paragraph 287).

(23) The assistance of the Indian universities in irrigation research should be enlisted (paragraph 287).

(24) The necessity for a central station for irrigation research has not been established but the work of each provincial station should be reviewed from time to time by a committee appointed by the local government in consultation with the Central Board of Irrigation and the Council of Agricultural Research (paragraph 288).

(25) The interchange between provinces of officers engaged in research on irrigation is desirable (paragraph 288).

(26) Drainage maps should be prepared (paragraph 289).

(27) In view of the importance of the Sukkur Barrage project, the chief revenue and irrigational officers should have ready access to agricultural advice at the headquarters of the Province of Sind. The appointment of a Director of Agriculture with headquarters at Karachi is, therefore, recommended (paragraph 290).

(28) In addition to the station at Sakrand, a chain of subsidiary research stations should be established and there should be a full staff of competent officers for all the stations (paragraph 290).

(29) The question of training agricultural students from Sind at the Lyallpur Agricultural College should be re-examined (paragraph 290).

(30) The possibility of developing irrigation in parts of Sind not commanded by the Sukkur Barrage project should not be lost sight of (paragraph 290).

(31) The principles which should be adopted in disposing of the areas which will come under irrigation under the Sukkur Barrage project and which are still at the disposal of Government should be determined without delay more especially in regard to the claims of the indigenous cultivators, the manner of allocating the areas and the provision of fuel supplies (paragraph 291).

(32) The Irrigation Department in Bengal should be divided into two entirely separate departments, one to deal with irrigation proper and the other with navigation, embankments and drainage (paragraph 292).

(33) The first duty of the new Irrigation Department should be to formulate a general scheme of irrigation development (paragraph 292).

(34) The problems presented by the river systems of Bengal require investigation by a committee of experts (paragraph 292).

(35) The possibility of transferring the district canals in the North-West Frontier Province to the charge of the Irrigation Department should be examined (paragraph 293).

(36) An examination of the possibilities of extending irrigation in Baluchistan should be forthwith undertaken (paragraph 294).

(37) The Central Bureau of Information for Irrigation should also deal with matters arising out of hydro-electric development (paragraph 295).

(38) Advice in regard to provincial hydro-electric schemes should be obtained from firms of consulting engineers (paragraph 295).

(39) Should disputes between provinces in any matters arising out of hydro-electric development occur, these should be referred to committees appointed *ad hoc* (paragraph 295).

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CHAPTER XI

COMMUNICATIONS AND MARKETING

SCOPE OF THE CHAPTER.

297. The prosperity of the agriculturist and the success of any policy of general agricultural improvement depend to a very large degree on the facilities which the agricultural community has at its disposal for marketing to the best advantage such of its produce as is surplus to its own requirements. Transportation is an integral part of marketing, and modern commercial development tends everywhere to enhance the value and importance of good communications. The building of railways in India has made commercially possible the movement of produce from areas of surplus production to other parts of the sub-continent, while railways, together with the steamship, have linked the cultivators of India with markets throughout the world. Local distribution of commodities has been facilitated by the construction of a road system of which the more important roads are, for the most part, metalled and bridged. But other roads and lanes in India are usually in a bad condition and good markets are of little help to the cultivator unless he can transport his produce to them cheaply and promptly. The handicap imposed on the cultivator in selling his produce by the lack of a passable route between his holding and the local market town may bar to him the markets of Europe or America. We propose, first, to discuss the present state of communications in India as an essential preliminary to the consideration, in the second part of this chapter, of the marketing and distribution of agricultural produce.

Communications

THE IMPORTANCE OF GOOD COMMUNICATIONS.

298. As a factor in rural progress, we consider improvement of communications of the utmost importance. Improvement in communications and the spread of literacy are intimately related, for the closer connection between town and country which an improvement in the communications between them brings about must inevitably stimulate the more backward rural community to demand a higher standard of education as part of a higher general standard of living. Isolation perpetuates ignorance. Good roads promote the free exchange of ideas no less than that of merchandise. Here, however, we are concerned mainly with the material aspect of the question, that is, with communications as they affect the prosperity of the cultivator. Good communications, in combination with efficient marketing arrangements, enable produce to be moved cheaply and quickly to places where the demand for it is active and secure the equalisation of prices for particular classes of produce throughout the country, and both these factors react favourably on the price which the average cultivator receives. They frequently open out to him alternative markets and the element of competition between market and market that follows usually operates greatly to the advantage of the producer. Defective communications between the point of production

and the local market hinder the movement of goods and make primary marketing costly, the additional charge ordinarily falling upon the shoulders of the cultivator. In extreme cases, difficulty of communications may leave the cultivator entirely at the mercy of the local dealer who alone has at his command enough pack or cart bullocks to undertake the transport of produce to the nearest market. In the case of produce exported from the area of production to meet a distant demand, the addition to the cost of primary marketing resulting from defective communications may appear trivial when viewed from the angle of the consumer in relation to the prices paid by him. But from the point of view of the cultivator, such charges may, when measured over the whole volume of his produce marketed in any season, represent a substantial diminution of the return which he may receive on his industry. The cost of transportation does not depend on distance alone, nor does it always vary directly with distance; the difficulties arising from the distances between the points of supply and demand may be offset by improvements in communications and cheapening of transport. Efficient communications exercise an immediate effect on the factor of time which is an essential element in the price factor. Time assumes a special importance where the disparity in prices tending to induce movement is one that fluctuates so rapidly that the margin may be narrowed and the transaction rendered unprofitable after the goods have been consigned; or where the extreme perishability of produce renders rapid transport essential or imposes prohibitive charges for refrigeration and other special treatment. The provision of good communications in any area will often bring within the range of profitable cultivation several crops, not one of which could be grown on a commercial basis until its extraction from the area of production was made commercially possible by the cheapening of transportation. It has been the improvement in communications since the middle of the last century that, more than any other factor, has brought about the change from subsistence farming to the growing of money crops, such as cotton, jute, groundnut and tobacco, and this tendency is active at the present time. Again, defective communications, by increasing the cost of importing goods into any area, raise the price of such goods to the villager. (In short, the true income of the cultivator is largely dependent on the efficiency of communications.)

A consideration which is often overlooked in this connection is that bad communications tend to increase the amount of absentee landlordism with its consequent evils. The large landholder has little inducement to live on his estate and to do his best to develop it, if, by so doing, he is cut off from the society of his fellows and from other amenities to which he has become accustomed.

Again, bad communications, by imposing a constant strain on the health and stamina of the draught animals, seriously reduce their efficiency for the all important work of cultivation. In areas in which the marketing of *kharif* produce coincides with the preparation of the ground for, and the sowing of, *rabi* crops, bad communications seriously aggravate the strain which must in any event fall on the bullock power of the tract at this period of the year.

A COMPARISON WITH OTHER COUNTRIES.

299. We have dwelt at some length, in Chapter I, on the benefits which improved communications in India have already conferred upon the rural community. It must not, however, be inferred from this that we regard the present state of communications as satisfactory. In spite of the developments of the last half century, this is very far from being the case and India must still be regarded as a backward country in respect both of railways and roads. The Indian Railway Committee of 1921 pointed out the "humble position" that India occupies if a comparison is made between the milage of railway per head of population in this and other countries. The position occupied by India in this respect will be clear from the following Table. The figures, have been taken from the "Railway Statistics of the United States of America for the year ending December 31st, 1926," published by the Slason Thompson Bureau of Railway News and Statistics of Chicago. The countries included in this Table have been selected because their extent, or the predominantly agricultural character of their population, or both, make a comparison with India of special relevance.

Countries	Milage		Miles of line per 100 square miles	Inhabitants per mile of line
	State railways	Total railways		
United States of America	..	249,398	8·42	469
Canada	20,596	40,351	1·0	222
India	27,264	38,579	2·2	7,894
Russia in Europe	24,509	35,528	1·5	3,709
Australia and New Zealand.. ..	28,277	28,748	0·9	238
Argentine	3,985	23,429	2·0	376
Union of South Africa	11,478	12,481	2·4	605

The comparison, in the Table below, between the milage of roads in the nine major provinces of India and the United States of America is of interest.

	Nine major provinces of India		United States of America	
Density of population per square mile..	240		31·5	
	Per 100 sq. miles of area	Per 100,000 of population	Per 100 sq. miles of area	Per 100,000 of population
Milage of all roads	20·18	84	80·00	2,550
Surfaced roads	5·38	22	12·05	383
Percentage of roads surfaced ..	26·5		15·0	

With these preliminary observations, we pass, first, to a consideration of the roads.

HISTORICAL.

300. Until 1854-55, such main roads as existed in India were in charge of military boards, one for each presidency. One historic highway deserves special mention. In the middle of the sixteenth century, the Emperor Sher Shah built a highway from the Punjab to the city of Sunargaon (Calcutta). During the Governor Generalship of Lord William Bentinck (1828-1835), the idea of a highway connecting the north of India with Bengal was revived and resulted in the famous Grand Trunk Road linking Peshawar with Delhi and Calcutta. In 1855, the boards were abolished, and their duties taken over by the newly organised Public Works Department. With this step the era of road making in the modern sense may be said to have commenced though, even before that date, considerable progress had been made in the construction of metalled roads between the large cities of what are now the United Provinces. It was about this time that the influence of railways upon the construction of roads began to make itself felt. As the railway system extended, it became increasingly necessary to build roads to feed the railways rather than to compete with them and this in turn led to a demand, which remains to-day far from being completely satisfied, for bridged and metalled roads which would give access to the railways at all times of the year. Another stimulus to road construction came later with the adoption of the policy of local control over local affairs initiated by Lord Mayo and developed by Lord Ripon. Criticisms of the condition of the roads maintained by local authorities were frequently made in the evidence before us and it is, therefore, worthy of mention that the extension of local control was, at the outset and for long, accompanied by considerable improvement in local communications.

THE PRESENT POSITION.

301. "Roads, bridges, ferries, tunnels, ropeways, causeways and other means of communication", except such as have been declared by the Governor General in Council to be of military importance, are a transferred subject in all the major provinces. The extent to which local governments have delegated to local authorities the responsibility for the construction and maintenance of roads varies greatly from province to province, as does the measure of financial assistance given by the Government. Decentralisation has been carried to its furthest point in Bengal. In that province, the total road milage maintained by the district boards is 35,200 as compared with 1,615 miles maintained by the Public Works Department outside Calcutta. The entire cost of construction and repair of the district board roads is met from the roads and public works cesses and the Government give no direct subsidy towards it. With the exception of a few hill roads and of roads in the Agency tracts of Madras, the roads in that province are also entirely in charge of the local authorities but they receive very substantial financial assistance from provincial revenues. The whole cost of the maintenance of trunk roads within certain limits, as well as that of constructing bridges and causeways on them, is borne by the Government, provided the condition of these works is satisfactorily reported on by the Public Works Department. The Government also contribute half the cost of maintenance of second class

roads and of the construction of bridges and causeways on them, subject to a maximum which is fixed for each district. Other roads are a charge on local funds. In other provinces, except the Punjab, roads fall into two main classes, those of provincial importance which are maintained by the Public Works Department and local roads which are maintained by local bodies. Except in the United Provinces, where grants are given only in special cases, the expenditure incurred by local bodies on local roads is met in part by subsidies from provincial revenues. Some provincial roads in the Central Provinces have been handed over to district boards and the whole estimated cost of construction and maintenance of these roads is met by a grant from provincial revenues. In all provinces, except the Punjab and the United Provinces, the sanction of the local Government, the Commissioner of the division or of an officer of the Public Works Department is required to the plans and estimates of original works when the estimates exceed certain prescribed limits. Such sanction is only required in the United Provinces when the district board does not possess a qualified engineer. Works costing more than Rs. 5,000 have then to be carried out by the Public Works Department, and the same agency is also employed for works in Assam which are beyond the capacity of the district staff.

Roads in the Punjab have been classified very systematically. Class I roads consist of the arteries of the road system. These radiate mostly from Lahore and are so arranged that every district headquarters is on one of the roads of the system, as are also towns with a population of over 20,000. Class II roads are those second in provincial importance to class I. They include roads passing through more than one district, those connecting towns with a population of 5,000 and over, important trading centres and markets and places of pilgrimage with each other, with the railway and with the arterial road system ; they also connect all tahsil headquarters with the headquarters of the district. Other roads fall in class III. All class I roads have been taken over by the Public Works Department and are a charge on provincial revenues. Roads in class II are in charge of district boards but the cost both of maintaining and developing them is shared between government revenues and local funds. The proportion of the cost which is borne by provincial revenues varies from district to district. The provincial contribution takes the form of a grant-in-aid which is made by the Communications Board which has recently been constituted for the province, on consideration of the circumstances of the district.

It should be added that the roads, or rather lanes, connecting villages, which are not on any through line of communications, with the road system of the district do not ordinarily come within the purview either of the Public Works Department or of the local boards, though in some provinces, such as Bombay, small amounts are occasionally spent on them by the local boards concerned. Such roads, which are often mere tracks that can only be used during dry weather, are a matter for the villagers themselves. In Madras, the Government have, however, since 1925-26, given an annual grant of several lakhs of rupees for their

construction subject to the condition that an equal amount is provided by the district board concerned.

THE DEVELOPMENT OF MOTOR TRANSPORT.

302. We received a large volume of evidence to the effect that the condition of the roads in India has deteriorated in recent years and that deterioration has been most marked where the roads are maintained by local bodies. The rising cost of labour and material and the increasing strain this has involved on the resources of local boards, which have never been adequate to all the demands on them, are in themselves sufficient to account for the condition of many roads. The appearance of a new factor, the development of motor traffic, has in every district seriously aggravated these difficulties. The private motor car and the public motor omnibus have brought into existence an entirely new range of problems of road construction and maintenance, but it is the motor passenger services which have sprung up with astonishing rapidity all over India and Burma which have done most to increase the complexity of these problems. There are, as yet, few instances in which, for the transport of agricultural produce, the motor lorry has displaced the bullock cart even in the large industrial centres. It is doubtful whether it will ever supersede the bullock cart for short distance traffic in rural areas, as the cultivator is hardly likely to find it a cheaper method of transporting his produce to the nearest market than by his own bullocks. For longer distances, its use is severely limited by the condition of the roads and by the obstacles presented by the many unbridged rivers which still exist even on main routes of communication.

ROAD BOARDS IN THE PROVINCES.

303. The rapid expansion of motor traffic has compelled both the Imperial and provincial governments to face the fact that the roads of India can no longer be regarded as a matter of purely local concern to the extent they have been in the past. Road boards have been established in Bombay, Burma, Madras, the Punjab and the United Provinces. Their functions are in the main advisory and it is only in the Punjab and Burma that the Communications Board, as it is termed in those provinces, has wider functions and has embarked upon an ordered programme of road development. The Punjab Communications Board consists of twelve official and seven non-official members, the officials representing those departments which are interested in the development of rural communications. It not only advises on the classification of roads, as do the road boards in other provinces, but it distributes the grants-in-aid from provincial funds which are given for their construction and maintenance. The grant-in-aid for the latter object is made conditional upon satisfactory maintenance. The Burma Communications Board has somewhat similar powers and its Road Committee has, since 1924, considered 241 projects and approved of work estimated to cost Rs. 467 lakhs.

THE ROAD DEVELOPMENT COMMITTEE.

304. Even more significant of the importance which the problems of road transport in India have recently assumed has been the appointment by the Government of India, under a Resolution issued by the

Commerce Department on November 3rd, 1927, of a Committee consisting of fourteen members of the central legislatures to investigate them. The Committee has been requested to examine the desirability of developing the road system of India and, in particular, the means by which such development can most suitably be financed. It has further been asked to consider, with due regard to the distribution of central and provincial functions, whether it is desirable that steps should be taken for the co-ordination of road development and research in road construction by the formation of a Central Road Board or otherwise.

NECESSITY FOR THE DEVELOPMENT OF ROADS OTHER THAN MAIN ROADS.

305. The appointment of a special committee to investigate the whole question of road development in India renders it unnecessary for us to discuss the problems which will come under its consideration as exhaustively as we should otherwise have done in view of their intimate bearing on our own enquiries. We have little doubt that the Committee's recommendations will result in the constitution of road boards for all provinces and trust that such boards will have not merely advisory functions but will be entrusted with functions similar to those which have been given to the Communications Boards in the Punjab and Burma. The constitution of such boards, especially if a Central Road Board for India is concurrently established, will furnish a much needed stimulus to an active policy of road development in all provinces. In our opinion, the cultivating classes cannot fail ultimately to derive great benefit from the adoption of such a policy. It should also benefit the railway systems, for all improvements in communications create traffic. It would, however, appear from the terms of reference to the Committee and from the questionnaire which it has issued to local governments that its main concern is with the arterial roads of India with special reference to the needs of motor transport. In these circumstances, we would stress the importance of including roads which, under the Punjab system of classification, would fall in class III, and of village roads, in any ordered programme of road development. The provision of excellent main roads adequate in all respects for every form of transport is of little benefit to the cultivator if his access to them is hampered by the condition of the road which connects his village with them. What matters most to him is the state of the road between his village and the main road and his market. We agree with the view expressed by the Indian Taxation Enquiry Committee, and implicit in the appointment of the Road Development Committee, that it is difficult to exaggerate the political and economic advantages of the development of rapid means of transport in India and that it is desirable that the development of motor transport services should be encouraged. We should, however, consider it unfortunate if the growing sense of the need for improving main roads were to divert attention from the need for improving the subsidiary communications which are of even greater importance to the cultivator. We, therefore, hold that along with the policy of developing main roads should go that of developing communications between them and the villages which are not situated immediately on them. We are glad to

observe that the danger that increased attention to main roads may lead to the neglect of roads at present classified under class III has been recognised in the Punjab and that it is the intention eventually to remove the distinction between them and class II roads

THE FINANCE OF ROAD DEVELOPMENT.

306. In view of the appointment of the Road Development Committee, we make no suggestions as to the manner in which the development of the arterial roads should be financed. We have little doubt that one result of the Committee's labours will be the complete reclassification of the road systems of all provinces and that many more roads will be included in the arterial system than is at present the case. We hope, in any case, that local bodies will be relieved of a large part of their financial obligations in respect of such roads. We would express the earnest hope that any funds thus set free will be devoted to the construction and maintenance of roads which do not fall within the arterial road system. Such roads must continue to be, in the main, the concern of local bodies but we are strongly of opinion that, as will be the case in the Punjab when these roads are transferred from class III to class II, the local governments should give liberal financial assistance to local boards in the discharge of their duties towards them. Grants-in-aid in the Punjab are made in consideration, *inter alia*, of the financial circumstances of the local boards. We entirely approve this policy as it can hardly be regarded as equitable that the cultivator in a particular district should be handicapped as compared with the cultivator in another part of the province by the fact that his district board is too poor to construct new roads or to maintain in tolerable order those already in its charge. The development of all roads would undoubtedly be much more rapid if the policy of financing a road programme from loans rather than from current revenues were accepted and if the rules governing provincial loans made provision for such a policy. The annual amount required for the amortisation of provincial loans raised for this purpose should not be a heavy charge on the resources of a province, as roads and works connected with them are works of a quasi-permanent character.

One of the most important considerations in framing any programme of road development is the cost of maintenance. (It is obviously of little use constructing new roads unless there is a reasonable certainty that funds will be forthcoming to keep them in proper order.) The cost of maintenance must often be the determining factor in a decision whether a road should be metalled or not.

In areas which are newly brought under irrigation such as those which will come under the Sukkur Barrage project, the provision of an adequate road system is obviously the duty of the State. Part of the sale proceeds of land at its disposal may well be utilised for this purpose. The cost of such road construction should be largely set off by the increased price realised for land situated on the roads.

THE DEVELOPMENT OF VILLAGE ROADS.

307. We have mentioned that, in Madras, the local Government have, since 1925-26, given an annual grant of several lakhs of rupees for the construction of village roads,

subject to the condition that an equal amount is provided by the district board. No grant is, however, paid for the maintenance of such roads. Burma is the only other province in which specific provision has been made for these roads. The provision made in 1927-28 amounted to approximately one lakh of rupees. In the Punjab, the Communications Board has offered a two-thirds grant-in-aid to any district board which submits a programme for improving village roads in a group of villages.

It must, we think, be recognised that, even if local bodies are relieved to a substantial extent of their financial responsibilities in respect of arterial roads, their staff and funds will still be hardly adequate to the work which lies before them in developing class III roads. Most of them will not be in a position to do much, if anything, for village roads. The policy followed in the three provinces mentioned above, which we cordially approve, is evidence that something can be done to advance matters in this respect. But for some time to come and until the more urgent needs of the roads which fall definitely within the district road system have been satisfied, any improvement in the condition of village roads must depend largely, if not entirely, on the efforts of the villagers themselves. Some improvements could, we think, be effected if the villagers could be induced to realise their joint interest in the matter. The construction of new roads, in all but very few instances, will be beyond their resources and assistance from provincial or local board funds will be required. The maintenance of the roads is, however, on a different footing. Here, labour is the most important factor and it should be forthcoming if the tradition of corporate labour which still exists in many parts of India, notably in respect of repairs to minor irrigation works in Madras, could be translated into action. We point out in our chapter on Rural Industries and Labour that, in most parts of India, there are long periods of the year when the villager has much spare time on his hands and the utilisation of some of this on the improvement of his roads, whether they are within the village itself or connect it with an arterial or local board road, should not be entirely outside the sphere of practical politics. The village *panchayats* which have been established in some provinces should prove useful agents for this purpose. The co-operative movement, especially in the Punjab, has shown what can be done to improve village amenities in other respects and could well be brought into play here also. Any efforts at self-help should be encouraged in every possible way and such financial assistance as can be made available should first be given to villages which are willing to tax themselves either in the form of money or of the provision of labour.

NECESSITY FOR A QUALIFIED DISTRICT BOARD ENGINEERING STAFF.

308. We consider that all district boards should have the services of a qualified engineer. We cannot regard it as satisfactory that district board roads should be in charge of a subordinate of the supervisor or overseer class, as they are, for example, in some districts of the United Provinces, even if the agency of the Public Works Department has to be

called in for original works and repairs costing more than a certain amount. We are aware that the efficiency of the district board engineering staff must depend to a very large extent on the resources of the local board, but, however straitened may be the finances of the board, we cannot but think that the employment of a competent engineer must in the end prove a wise economy. We, therefore, recommend that it should be insisted on in all cases.

INTERFERENCE OF ROADS WITH DRAINAGE LINES.

309. In dealing with the irrigation problems of Bengal in Chapter X, we have mentioned the serious effects on the health of a district which may ensue from the interference with natural drainage lines by the construction of road embankments. The problem is one which is by no means confined to Bengal and we consider that special attention should be paid to the point in all schemes of road development, whether undertaken by the Public Works Department or by local bodies. We consider that no local body should be permitted to embark upon any scheme which involves the raising of a road above the level of the surrounding country unless the approval of the provincial Road Board or, where no such board has been constituted, that of the provincial Government has been obtained.

ROAD BRIDGES.

310. Road bridges over *nullahs* and other natural obstacles are still too generally lacking. In addition to the inconvenience thereby occasioned to traffic, material damage to the cultivators' cattle frequently results from the strain of dragging heavy loads up precipitous slopes. We think that local authorities may not in all cases be aware of the concessions allowed by the railway authorities for the building of road bridges alongside of railway bridges. Details of these concessions are given in Chapter IV of the Rules for the preparation of railway projects (revised edition 1926) and we would suggest that the special attention of all local authorities should be drawn to them.

RAILWAY DEVELOPMENT.

311. The active policy of railway development in every direction, which is being pursued both by the Railway Board and by the railway systems of India and which has been greatly facilitated by the separation of the railway budget from the general budget, cannot fail to exercise a profound influence upon rural development generally. The programme of expansion which has been undertaken will, during the next five years, add another 6,000 miles of open lines to the 38,579 miles of railway already in existence, of which 27,264 are owned by the State, 13,169 being worked direct by State agency and the remainder by companies on its behalf. Another 3,000 miles will be under construction at the end of that period. We welcome this progressive policy and we have no doubt that the optimism underlying it is well-founded. We are confident that the construction of feeder lines in tracts where the indications are reasonably promising will be justified by the volume of traffic forthcoming. We note, for instance, that in the case of the Shahdara-Narowal Railway, which was opened in December 1926, the actual gross earnings for the first six months of working have

exceeded the estimates by no less than twenty-five per cent. Experience in India since the earliest days of railway construction goes to show that the rural population is very ready to take full advantage of opportunities for transport by rail, whether of passengers or of goods.

ROADS AND RAILWAYS: A POLICY OF CO-ORDINATION.

312. In the development of communications generally, railways and roads should be regarded as complementary each to the other. The road system links up the cultivator's holding with the local markets and the nearest railway station, while the railway provides the connecting links between the area of production and consumers at a distance, and between the manufacturer in the town and the cultivator who purchases his ploughs, his fertilisers, or his cloth. Without good and sufficient roads, no railway can collect for transport enough produce to render its operations profitable, while the best of roads cannot place the producer of crops destined for markets overseas or in distant parts of the sub-continent in touch with the consumer. We trust that it may be found possible in the future to avoid in India the senseless and wasteful competition between rail and motor traffic that is to-day taking place in many European countries. We apprehend that, where roads exist parallel to railways, it may be difficult to arrange for a policy of co-operation between the two forms of transport. But, in planning new programmes of road and railway extensions, we hope that roads may be designed to serve rather as feeders of the railways than as competitors for such traffic as the railway is capable of carrying efficiently and economically. We think it probable that conditions of weather in India, which combine extreme dryness for many months of the year with continuous and heavy rainfall concentrated in a shorter period, may be found to render the maintenance of roads capable of carrying heavy motor traffic extremely expensive. In many parts of the country, the dearth of good road-making material is likely seriously to aggravate these difficulties. For these reasons, we hold that every attempt should be made to avoid the transport over long distances, by road, of passenger and goods traffic which could be carried by rail more cheaply and with equal convenience. It may be held that road transport will not attract traffic unless this can be carried as cheaply as on the railways. The fact is, however, that, whereas the railways have to pay for the whole cost and upkeep of their permanent way, the motor car, in too many instances, depends to a great extent for the financing of its "permanent way" upon the pockets of the tax-payers. From the national point of view, needlessly expensive transportation is to be deprecated as involving avoidable destruction of wealth, and this is true whether the cost is defrayed from private or public sources.

FREIGHT RATES.

313. The question of freight rates was raised by several witnesses. There has been practically no increase in the rates on agricultural produce since 1913, in spite of the great rise in its value during the last fourteen years, more especially at the end of the war period, and the fact that the prices of all forms of produce, with the exception of raw jute, are still markedly above the pre-war level. Freight rates are ordinarily the heaviest single addition to the prime cost of produce exported by rail

from the area of production. In a competitive market, they amount to a heavy charge on the gross price ultimately paid for the produce and, to the cultivator who is selling his commodity at a distance, they amount to a substantial proportion of the price he receives at the place of sale. A comparatively small difference in rates may mean the closing of important markets to a crop grower in any particular area and a consequent loss to the cultivators and the railways. (We are not inclined to accept the view that rates are generally too high, but we recommend a periodical revision of rates with a view to the adjustment of their incidence as between various sorts of produce according to their relative ability to bear and that arrangements should be made by the Railway Board for this purpose.)

We have dealt with freight rates, in so far as they affect the cost to the agriculturist of his fertilisers and implements, in Chapter IV. We have there suggested that the railway authorities should consider whether further concessions might not be given in respect of these as any considerable increase in crop yields, resulting from their use, must eventually lead to an increase in traffic and thus benefit the railways concerned. An anomaly in regard to the rates on agricultural implements, which was brought to our notice and appears deserving of examination is the classification of sugarcane mills, which are not at present included under agricultural implements. A point raised by the Imperial Dairy Expert was that the railways charged the same amount for the carriage of a newly born calf by passenger train as is charged for a full grown cow and that this constituted a hardship to the Indian cattle trade as Indian cows are useless as milkers unless accompanied by their calves. Newly born calves can take up but little space and we consider that a calf aged one month or under should not be charged for when travelling with its dam.

THE DEVELOPMENT OF FRUIT AND MILK TRAFFIC.

314. It was further suggested that the railway authorities should take active steps to encourage the development of traffic in certain kinds of agricultural produce. Fruit and milk were the two products most prominently mentioned in this connection. It does not appear to us that the railways can justly be accused of any lack of enterprise in respect of either of these or of any unwillingness to meet their special transport requirements. Ice-cooled vans for the carriage of the more delicate kinds of fruits have already been brought into use, chiefly on the North-Western Railway. The extensive employment of refrigerator or cold-storage vans for this form of traffic must depend on the extent to which it develops and on the establishment of cold-storage depôts at suitable centres. We trust that railway administrations will continue to pursue a liberal and progressive policy in providing the facilities required. In the initial stages of the development of an industry such as fruit growing, the agricultural departments should interpret to the railway authorities the requirements of the growers in the matter of facilities on the railways, such as special vans, rapid transit, and accommodation at terminal points. When this is done, and provided it is clear that the

venture offers firm prospects of profitable traffic within a reasonable period of time, we have no doubt that the railway authorities will do their best to meet the needs of the industry.

THE TRANSPORT OF CATTLE.

315. There is, however, one point in connection with railway transport which, in our view, calls for immediate examination by the railway authorities. It appears that, owing to the high rates which are charged for the transport of cattle by passenger or parcel express trains, they are usually sent by slow goods trains and frequently in badly ventilated and unsuitable trucks. The only provision on the subject at present is a railway rule that at the request and risk of owners, cattle, after travelling for 200 miles, may be unloaded at a junction or other first class station and allowed to break journey for not more than 24 hours. We think that this rule in its present permissive form is probably an insufficient safeguard. We, therefore, recommend that the Railway Board should investigate its working and make suitable amendments, if it appears that cruelty to cattle, if not permanent injury, may result from present conditions. We should ourselves see no objection to its being made a definite responsibility of the owner that cattle should be rested and fed at fixed intervals *en route* provided that the railways on their part supply reasonable facilities. We would further suggest that the feasibility of transporting all milch cattle by passenger or parcel express train at the rates at present charged for their carriage by goods train, and also of improving the type of wagon used for the transport of all cattle, should be investigated. In existing conditions, a large number of good milch cows are imported into Calcutta and Bombay by milk vendors who sell them for slaughter at the end of the lactation period as they cannot afford to stall feed them until they calve again or to send them back to the districts. In such circumstances, any measures which facilitated the rapid transport of cattle at reasonable rates would furnish a valuable contribution to the solution of some of the problems connected with animal husbandry which we have discussed in Chapter VII.

CO-OPERATION BETWEEN THE RAILWAY AND AGRICULTURAL DEPARTMENTS.

316. We consider that closer co-operation between the railway and agricultural departments would be secured if the Director of Agriculture, or preferably the marketing officer whose appointment we suggest later in this chapter, were a member of the local advisory committee which has been constituted for all the important railway systems. Individual cultivators are not in a position to use the machinery provided by the Railway Rates Advisory Committee or to bring to the notice of the railway authorities any disability under which they labour in respect of such matters as shortage of wagons, pilfering *en route* or the rough handling of goods in transit. The presence on an advisory committee of an officer with special knowledge of marketing conditions would provide a very suitable channel for the ventilation of complaints of the latter character. It would also be an important part of the duties of that officer to secure the removal of anomalies in rates for agricultural products.

317. The high cost of constructing and maintaining metalled roads for heavy traffic has led to the suggestion that a less expensive alternative to the metalled road could be found in an agricultural tramway which might actually prove a source of profit. The agricultural tramway is, in effect, a cheap type of railway built under the Indian Tramways Act of 1886 or a provincial Act and subject to the control of the provincial Government instead of that of the Government of India. The possibilities of this form of transport have been examined in some detail in the Punjab. The view there held is that, within the twelve mile radius which represents the limits within which agricultural produce flows easily to a market centre, direct marketing in the cultivator's own cart is quicker and also, if allowance is made for double handling, cheaper for all except the few villages situated on the tramway. Outside the twelve mile radius, the tramway offers no advantages which could not be better secured by railway development. The conclusion which has been reached is that, provided new railways develop along the lines and to the extent at present anticipated, no case can be made out for the introduction of tramways to develop rural transport. We entirely agree with this view in provinces where conditions are similar to the Punjab. There are, however, districts where good roads may be specially difficult to maintain and to which railway extension in the near future is unlikely. We have in view such conditions as occur in the Brahmaputra Valley or in the plains of Lower Burma.

OTHER FORMS OF TRANSPORT.

It does not appear that the introduction of the caterpillar or so-called "roadless" tractor would be of any material assistance in opening up rural areas. It is admitted that even for this the condition of all village roads and of many district roads would have to be improved and that it would be difficult, if not impossible, to provide a service on which the cultivator or the village trader could rely to transport his produce at the precise moment when he wished to market it. We are strongly of opinion, therefore, that, except in the special circumstances mentioned above, the most urgent need is to improve roads, in order, in the first place, to cheapen and facilitate carriage by cart and, in the second, to render a great extension of motor services possible. Local governments will, in our view, be well advised to devote their whole attention to the needs of the country cart and of the motor car or lorry in preference to experimenting with other forms of road transport. This applies even to mountainous districts where the production of fruit, potatoes and garden crops is seriously handicapped by bad and expensive transport. We recognise that the improvement of road communications in such areas must involve a much heavier outlay than in the plains but we have very grave doubts whether any project for opening them up by aerial ropeways could be carried to a satisfactory conclusion.

318. Waterways are a valuable and extensively used means of communication in north-eastern India and Burma. The only point brought prominently to our notice in connection with them was the extent to which their use is hampered

WATERWAYS.

by the spread of the water hyacinth in Assam, Bengal and Burma. This pest is most serious in Bengal where it not only completely blocks the smaller waterways and renders the navigation of the larger ones very difficult, but spreads during the monsoon to cultivated land which it drives out of cultivation. We were informed that an estimate that about three per cent of the occupied land in the Faridpur district was lying derelict from this cause was a reasonable one. In Madras, the water hyacinth is dealt with under the provisions of the Agricultural Pests and Diseases Act of 1919, and, in Burma and Assam, under those of the Water Hyacinth Acts of 1917 and 1926 respectively. No special legislation has been enacted in Bengal where it is most needed. The Assam legislation is of very recent date and we received no evidence as to how far it is serving its purpose. The operations against the pest in Madras appear to have been successful whilst we were informed that, in Burma, the position is practically stationary. We consider it most desirable that legislation on the lines of that in force in other provinces should be enacted immediately in Bengal and that the operations against the pest should be conducted by the Waterways and Navigation Department, the formation of which we have suggested in the preceding chapter. It is open to doubt, however, whether legislation prescribing the destruction of the water hyacinth, or measures to prevent its spread such as the construction of storage pounds or floating fences, will prove more than a palliative. Research into the possibilities of eradicating it by the adoption of scientific methods such as spraying and the utilisation of insect, fungus and bacteriological enemies of the pest has not so far yielded any tangible results. Further research is urgently needed and, in view of the fact that the pest has appeared on an extensive scale in four provinces, we consider that the formulation of a programme for work of this character should be one of the first questions to be taken up by the Council of Agricultural Research.

POST AND TELEGRAPH OFFICES.

319. The evidence we received showed that the post and telegraph facilities available in rural areas are, on the whole, as satisfactory as can be expected in present conditions. Any great expansion in these facilities must wait upon the spread of literacy. Posts and telegraphs, like railways, are a central subject but their development, in common with that of railways, is a matter in which provincial governments are closely interested and it is desirable that their views regarding the action to be taken to promote it should be respected as far as possible. The point is of importance in connection with the establishment of new offices. These are opened only if estimated to prove remunerative or if the local Government guarantee that a certain minimum revenue will be forthcoming. The guarantee is given in respect of each new office opened but it should, in our opinion, be permissible for the local Government to set off the profits of one office against the loss from another and to give their guarantee in respect of a number of offices for a term of years. The Posts and Telegraphs Department would then be concerned only with the return from all the new offices for the period fixed. The adoption of this course should lead to an appreciable increase in the activities of the

department in rural areas from which the department and the rural community would derive mutual benefit.

Marketing

MARKETING: SOME GENERAL CONSIDERATIONS.

320. The agricultural departments in India have done much to improve the quality and to increase the quantity of the cultivator's outturn, but it cannot be said that they have been able to give him substantial help in securing the best possible financial return for his improved quality and his increased outturn. Except to a limited extent, where improved quality is concerned, they have regarded the problems connected with the marketing of his produce as outside their purview. The co-operative departments, again, have been too much occupied with their primary function of organising credit to be able to devote much attention to these problems nor have they been sufficiently well equipped with the special knowledge required for dealing with them. It is only in a few instances that they have been able to give the cultivator material help in disposing of his produce. His interests have, therefore, in the main, been left to the free play of economic forces and they have suffered in the process. For he is an infinitely small unit as compared with distributors and with the consumers of his produce who, in their respective fields, become every year more highly organised and more strongly consolidated. It is their interest to secure from the producer the raw material they handle or acquire at the lowest possible price. Marketing is the sole business of the distributor whereas, from the point of view of the cultivator, it is apt to be regarded as subsidiary to production. The circumstances of the average cultivator in India favour this attitude. His farming is still largely of the subsistence type. His sales of produce are intermittent. His day to day concern is with production and upon this his attention must in the main be fixed. The traditional lore and inherited experience of his craft centre round the work on his holding; they are for the most part lacking on the commercial side of his business. Until, therefore, he realises that, as a seller of produce, he must study the art of sale, either as an individual or through combination with other producers, it is inevitable that he should come off second best in his contest with the highly specialised knowledge and the vastly superior resources of those who purchase his produce. The complaint of agriculturists that they do not obtain a fair share of the value of their produce in the market is world wide; nor are the handicaps in this respect under which the cultivator in India labours peculiar to this country though some of them are felt to a more marked degree here than elsewhere. Prominent among these handicaps are heavy indebtedness, the low standard of literacy, unsatisfactory communications, the absence of properly regulated markets and the lack of combination amongst producers. The intimate relationship between communications and marketing has been brought out in the preceding part of this chapter. The problems of indebtedness and of literacy have been dealt with in other chapters. Here we are mainly concerned with the absence of properly regulated markets and with the lack of combination among producers.

We wish to make clear, at the outset, the point of view from which we approach these problems. The aim of better marketing is not necessarily to displace any unit in the existing machine but to enable that machine to function to greater advantage. We have, therefore, no suggestions to offer which involve the elimination, root and branch, of the middleman. In the economic organisation of the modern world, he fulfils essential functions and neither in India nor elsewhere is it possible to dispense with him. Collection and distribution and the accommodation of supply to demand between locality and locality are everywhere complicated and delicate processes which would be impossible of performance without the skilled services of those who spend their lives in the business. In no country are these difficulties greater than in India, where communications are often extremely bad and where production is in the hands of a large number of petty cultivators who, for the most part, lack both the financial resources and the necessary storage to attempt any regulation of their selling in accordance with the state of the market and whose produce, as marketed, leaves much to be desired both as regards purity and quality. The services of the middleman must be paid for and, on the whole, it cannot be said that the remuneration the distributor receives, especially in these days of increasing competition, is an unduly heavy one.

Public opinion is invariably watchful towards, and often suspicious of, the middleman. This tendency has its cause partly in the recognition of the fact that intermediaries carry none of the risks incidental to production. Crop failures or cattle plagues that may ruin the cultivator inflict no mortal hurt on the business of the middleman. Indeed, periods of agricultural depression are not uncommonly those in which distributors prosper most. In the main, distributors are tolerably secure in the enjoyment of their profit margins, merchants being, as a rule, in a position, by adjusting prices, to pass on to the consumer any rise in costs, while commission agents are concerned mainly with obtaining their commission over the largest possible turn-over. It is clear, however, that public opinion is not fully informed on the costs and the risks incidental to the business of distribution in modern conditions. We deprecate easy generalities suggesting that every ill from which the cultivator suffers is traceable to the existence of hordes of rapacious and unnecessary middlemen. Such statements disturb confidence, while distracting attention from faults in the system of marketing which are capable of being remedied or removed.

That abuses exist is, however, beyond dispute. For instance, when the primary collector, who acts also as a moneylender, succeeds in getting a cultivator into his grip, he is apt to use his advantage ruthlessly. In a later paragraph of this chapter, we shall describe certain practices that obtain in the markets proper, some of which amount to nothing less than common theft. Again, it is certain that there are various services of marketing and distribution performed each by a separate intermediary which, under an ideal system, might well be rendered by a single intermediary. Bad communications and chaotic

conditions of marketing encourage a superfluity of middlemen. The pressure of life, too, particularly in the more highly populated tracts of the country, tends to operate in the same direction, since it drives men to seek a living, however insufficient and insecure, wherever opportunity offers. Apart from the organisation of producers for the sale of produce, the most effective means of removing unnecessary middlemen are the provision of good roads, and the establishment of a sufficient number of well regulated markets, easy of access to the cultivator. For the framing of a sound and comprehensive policy for improvement in marketing, exact knowledge of the methods of distribution applicable to any particular class of produce, including collection, storage, transport, and, where it exists, manipulation, together with a detailed analysis of the price structure at every stage in the operation, is essential.

DESCRIPTIVE.

321. Markets in India are numerous. In Bihar and Orissa, for instance, there are no less than 432 principal markets and 2,464 minor markets. In all provinces, markets vary greatly in character and importance. At one end of the scale are the elaborate modern *mandis* of the Punjab canal colonies which consist of a set of shops built round three or four sides of a rectangle, a wide brick pavement being provided for unloading, examining, cleaning, weighing and bagging the grain. In front of the pavement, there is a wide metalled road surrounding an open space used for parking carts. The market is as near to the railway goods platform as possible and sometimes a railway siding runs into it. In such markets, grain is the main product sold. Cotton on the way to the market is frequently intercepted by the agents of the ginneries who also, to an increasing extent, buy it before it leaves the village. Cotton brought into the market is nominally sold there before being carted to the ginneries where the real sale takes place. Adjacent to the grain market are cotton ginneries, a market for imported timber, iron and steel, and bazaars, the shops in which supply everything that the cultivator requires and which is not available in his own village. At the other end of the scale are the small village markets which are often little more than open spaces with accommodation of a very temporary character.

The organisation of the different markets also varies widely. In Bihar and Orissa, all markets are privately owned and rents or tolls are levied by the landholder on whose lands they are situated or by a person who holds a lease from him. In most provinces, there are both public and private markets, the former being directly under the control of a district board or municipality and the latter being licensed by the local authority concerned. It is only in Berar that the constitution of markets is regulated by special legislation, the Berar Cotton and Grain Markets Law of 1897, and that their management is in the hands of elected committees. An Act for the regulation of cotton markets in the Bombay Presidency has recently been passed by the Legislative Council of that province, but, at the time of writing, has not yet been brought into operation.

ABSENCE OF INFORMATION IN REGARD TO MARKETING CONDITIONS.

322. No systematic survey of the conditions under which agricultural produce is marketed in India has yet been made in any province. While it was clear from the outset of our enquiry that it would not be possible for us, from the angle of an all-India enquiry over the whole field of agriculture, to examine in detail the marketing and distribution of each important crop in every province, we hoped that the material forthcoming in answer to our questionnaire might provide us with a sufficient body of facts upon which to form general conclusions as to the marketing of the more important crops. Only to a limited extent has this proved to be the case. It is clear that the agricultural departments have hitherto had at their disposal neither the financial means nor the trained personnel required to carry out marketing surveys. Moreover, unofficial organisations of middlemen in a position to collect and collate information on matters of fact in connection with the business of their members are very rare in India. Some valuable investigations on the marketing of cotton are in process of being carried out by the Indian Central Cotton Committee. But much of the information essential to an exhaustive study of marketing conditions has never yet been collected. In a subsequent paragraph, we make suggestions for the organisation of marketing surveys and for the training of the necessary personnel. A brief description of the systems under which cotton is marketed in Khandesh, jute in Bengal and rice in Burma, based on such material as is available, will enable the reasons for the proposals we shall make for the establishment of properly regulated markets to be more readily understood.

THE MARKETING OF COTTON IN KHANDESH.

323. The investigations of the Indian Central Cotton Committee have shown that the cultivators of cotton in the Khandesh districts of the Bombay Presidency are not hampered by indebtedness in selling their produce to the same extent as are cultivators in some other tracts such as north Gujarat and are comparatively free to dispose of it as they please. The commonest method of sale is, however, in the village to a visiting trader or more rarely to a resident trader. These traders are often financed by ginneries, and by brokers known as *adatyas*. Moneylenders seldom purchase the unginned cotton. A considerable number of cultivators sell in the larger markets, the proportion being much higher in West than in East Khandesh. In the two largest markets, the number of carts of unginned cotton brought in by actual growers represented sixty and twenty-seven per cent, respectively, of the total number of carts coming into those markets. In the smaller markets, it varied from twelve to eighty-five per cent. The system of sales adopted in the markets is everywhere much the same. The carts collect in the early morning, the brokers show samples to the merchants, bids are made secretly between them under a cloth and the seller accepts the rate fixed. These samples, consisting of as much as five to eight *seers* from each cart, are invariably regarded as the perquisite of the merchant, whether or not a sale is effected. No memorandum is given to the seller at this stage. The carts are then

removed to the ginning factories where weighment and often the real bargaining take place. (Allowances are frequently claimed on the ground that the cotton is not up to sample, or is damp or has a low ginning percentage. Such claims are made after weighment is begun and the cultivator has usually no option but to accept the new rate.) A memorandum of the weight and rate is given to the cultivator and it is on this that payment is made. The enquiries made by the Indian Central Cotton Committee elicited definite instances in which deductions were made from the rate of the day, first in the market and subsequently in the ginning factory. (Sellers in almost all markets are compelled to employ a broker and cannot sell direct. In some markets, Indian firms buy direct from the seller's broker, in others, they employ brokers. Foreign firms always employ brokers. In a few markets, brokers act for both buyers and sellers. The rates are calculated by the buyers on the basis of prices telegraphed from Bombay.) In the Dhulia market in West Khandesh, the practice of posting the local rate of the day for unginned cotton is now adopted. No system of posting these rates in the markets exists elsewhere and, in all cases, the cultivator is dependent on buyers or brokers for information about rates. The system adopted for paying the men employed to weigh the cotton varies greatly from market to market. In some cases, weighmen are paid by the buyer, in some by both buyer and seller. In other markets, the weigher is the employee of the broker or the gin owner. The charges levied also differ greatly from market to market. At Amalner, the biggest market in East Khandesh, they consist of a charge of two annas per cart for ground rent and Rs. 2-0-6 for brokerage and other charges. These charges are levied on unginned cotton weighing more than 432 *seers* and less than 792 *seers*. (Of the total of Rs. 2-0-6, as. 8 is levied for weighing, as. 2-6 for porterage, Rs. 1-2-6 for commission and as. 3-6 for charities. A fixed allowance of 5 *seers* per cart is also taken by buyers, representing a loss to the seller of from one rupee to 2½ rupees.) The enquiries made by the Indian Central Cotton Committee showed that greater use of the markets is not made by cultivators because of the disputes which arise after weighment has commenced in regard to the rate and because of arbitrary deductions from the weight.

THE MARKETING OF JUTE IN BENGAL.

324. Between the cultivator of jute in Bengal and the export market on the one hand or the jute mill on the other, there may be as many as four agencies. There are the *faria*, *bepari*, *aratdar* or *mahajan* and the baler. The *faria* is a small dealer who buys small quantities of jute and sells it to the *bepari*. The *bepari* is financed by the *mahajan* or *aratdar* who passes on the jute to the baler. This chain of middlemen is not, however, universal. The *bepari* often deals direct with the cultivator and, if he is a wealthy man, dispenses with the *aratdar*. The *aratdar* is often eliminated also by the baling firms who advance money direct to the *beparis*: whilst in eastern Bengal, the cultivator frequently deals with the baling firm direct, if it has an agency within a reasonable distance. The *faria* is a dealer and not a commission agent. The *bepari* is either a dealer or a commission agent according as he works on his own capital

or on that of the *aratdar* or the baler. The *aratdar* is merely a financier who takes interest at the rate of four annas per *maund* of jute on the money he advances. The margins of the various middlemen are estimated as from two to six annas per *maund* of jute for the *faria* according to the season, four annas to one rupee for the *bepari* and four annas for the *aratdar*. The margin of the baling firms, from which they have to meet the cost of handling and storing as well as that of freight to Calcutta and insurance, is placed at Rs. 1-6. The difference between the price received by the cultivator and the price paid by the jute mill or the exporter is thus estimated at from Rs. 2 to Rs. 2-8 per *maund* which represents twenty per cent of the total price.

THE MARKETING OF RICE IN BURMA.

325. In Burma, unhusked rice is usually purchased from the threshing floor by the local trader who is known as a jungle broker. He is seldom a man of means and is merely an agent of local dealers residing in the surrounding markets and in milling centres. His commission on purchases varies from Re. 1 to Rs. 2 on each 100 baskets delivered. He is in most cases better informed than the seller as to the trend of the market but the ruling price is usually well known in the village, information obtained from the Press or by telegraphic advice from Rangoon being passed on from cultivator to cultivator. When the price is settled, difficulties arise over the size of the basket to be used for measurement, the point at issue being whether the broker's or the village basket should be used for this purpose. Carting or transport has next to be arranged for. The cost of this is naturally included in the price fixed. The cultivator may or may not agree to cart to the nearest point of shipment at a recognised rate, which varies from eight annas to one rupee per ton mile according to the supply of carts available and the urgency of moving the purchase. The jungle broker delivers the unhusked rice to his principal usually at some local railway siding or river station. The principal may either store it for a rise in the market, send it to the local rice mill to be husked or forward it to a large rice mill at Rangoon. If the second of these methods is adopted, the unhusked rice is either milled straight or first parboiled. The smaller miller is in a position to pay a better price for his produce than the larger one as he buys a more uniform sample, and, therefore, gets a better outturn from it and he has not to pay for the transport of husk. His outturn is sent to brokers or large shippers in Rangoon. The balance of the crop which is not handled by the small miller is dealt with by the large millers in the ports of Rangoon, Akyab, Bassein and Moulmein, who receive it by rail or river. It is bought on a weight-*cum*-volume basis and it is in this respect that most disputes arise. The volume recognised is a nine-gallon basket the weight of which must be forty-six pounds. A bonus is paid for any weight in excess of this and a deduction is made for any weight below it. Collusion between the weigher, the broker and the tally clerk, however, often results in the seller being deprived of the bonus to which he is entitled. We were informed that this method of sale is one of the most important defects in the system of marketing in Burma. Another great defect is the mixing of different

varieties of unhusked rice by the small brokers and adulteration by adding winnowings.

INDEBTEDNESS IN RELATION TO THE USE OF MARKETS.

326. The illustrations we have given above show what is abundantly clear from all the evidence we received on the point, namely, that marketing conditions vary greatly from province to province, and in respect of different products in the same province. None the less, in spite of the diversity of the systems under which agricultural produce is marketed in different parts of India, there are certain broad generalisations which can be made for India as a whole. It has, we think, been established that, where the cultivator is in a position to dispose of his produce in a market, however limited its scope and badly organised its character, he obtains a much better price for it, even when the cost of transport is taken into consideration, than when he disposes of it in his own village. He may be compelled so to dispose of it because communications with the nearest market are not satisfactory or because he has no cattle and carts of his own by which to transport it, but there can be no doubt that it must often be his indebtedness which compels him to resort to the village trader and to accept the terms dictated by the latter. The full benefits of improvements in market organisation cannot therefore reach the mass of cultivators unless their financial position is such that they can act as free agents and market their produce where they please. With this aspect of the problem we deal in our chapter on the Finance of Agriculture, paragraph 361. Interesting light is thrown upon it as the result of enquiries which were made in 1923 by the Punjab Communications Board which elicited that in some districts of the province, of which Karnal is one, the bulk of the crop was sold to the village trader. In the adjacent district of Rohtak, where communications are better than they are in Karnal and the co-operative movement has made greater progress, the proportion fell to one-half. In the prosperous Lyallpur district with its excellent communications and numerous *mandis*, the whole of the surplus produce was disposed of in the market centres.

THE IMPORTANCE OF PROPERLY ORGANISED MARKETS.

327. If, as we have held in the preceding paragraph, it is established that the cultivator obtains a much better price for his produce when he disposes of it in a market than when he sells it in his village, the importance to him of properly organised markets needs no emphasis. The importance of such markets lies not only in the functions they fulfil but in their reactions upon production. Well regulated markets create in the mind of the cultivator a feeling of confidence and of receiving fair play and this is the mood in which he is most ready to accept new ideas and to strive to improve his agricultural practice. Unless the cultivator can be certain of securing adequate value for the quality and purity of his produce, the effort required for an improvement in these will not be forthcoming. The value of the educative effect of well regulated markets on the producer can hardly be exaggerated but it has yet to be recognised in India. From all provinces we received complaints of the disabilities under which the cultivator labours in selling his produce in markets as at present organised. It was stated that scales and weights

framed by some local governments and have been adopted by municipal councils and district boards. It would, however, appear that they are usually ineffective in practice because the public does not know of their existence and there is no proper system of inspection.

The Government of India appointed a Committee to investigate this subject in 1913. The Committee made a number of recommendations, the most important of which was that the *maund* of 82 2/7 pounds should be declared the standard weight for India, though not for Burma. No action was taken by the Government of India on its report and matters remain much as they were prior to the appointment of the Committee. We are strongly of opinion that the time has come for a re-examination of the position. We fully realise the obstacles to all-India legislation presented by the force of local trade custom and of local tradition which is probably more powerful in this than in almost any other respect. The only hope of advance appears to us to lie in action within the limits of each province. At the same time, it is desirable that no province should undertake legislation which might embarrass an adjacent province or, at some subsequent stage, render all-India legislation impracticable. We would, therefore, recommend that the Government of India should again undertake an investigation of the subject and should lay down general principles to which provincial governments should adhere, so far as this is possible without undue interference with local trade custom. Both the Berar and the Bombay market legislation provide for the regulation of the kind and description of scales, weights and measures in use in cotton markets and for their periodical inspection, verification and correction. If a uniform system of weights and measures is prescribed for adoption not only in all the regulated markets established in each province but in all factories, gins and presses, its adoption in all transactions should follow within a very short period of time. A beginning has already been made in this direction so far as ginning and pressing factories are concerned. Under the provisions of the Cotton Ginning and Pressing Factories Act, local governments may make rules prescribing the weights and scales to be used in these factories and for their inspection and such rules have been made in a number of provinces.

Burma, where the system of weights and measures is entirely different from that in use in any other part of the Indian Empire, would require separate treatment. We are glad to note that steps in the direction we recommend above have already been taken in that province and that a Bill providing standards of weights and measures for use in Burma has been introduced in the local Legislative Council. The Bill provides, *inter alia*, that the standard measure of capacity for unhusked rice in any district outside the Arakan division shall be the basket (*tin*) which is defined as a cylindrical measure of capacity fifteen inches in height containing 2,477 cubic inches or nine gallons. For unhusked rice in the Arakan division and for agricultural produce other than unhusked rice in any part of Burma, the standard measures of capacity will be such as the local Government may prescribe by notification. The Bill further provides that the standard weights and measures only shall be used in any district on and after a date to be notified by the local Government and also for

powers of inspection and control. A striking feature is the power which is taken to recover from the villagers the cost of equipping village committees with standard weights and measures, by the imposition of a tax or a cess on lands assessed to land revenue. It is explained that the reason for this provision is that the total expenditure involved in a free supply at the cost of Government would be considerable; and that the share of each village, if the cost is distributed over all villages, will be very small and its collection will do more than anything else to advertise the fact that standard weights and measures have been provided.

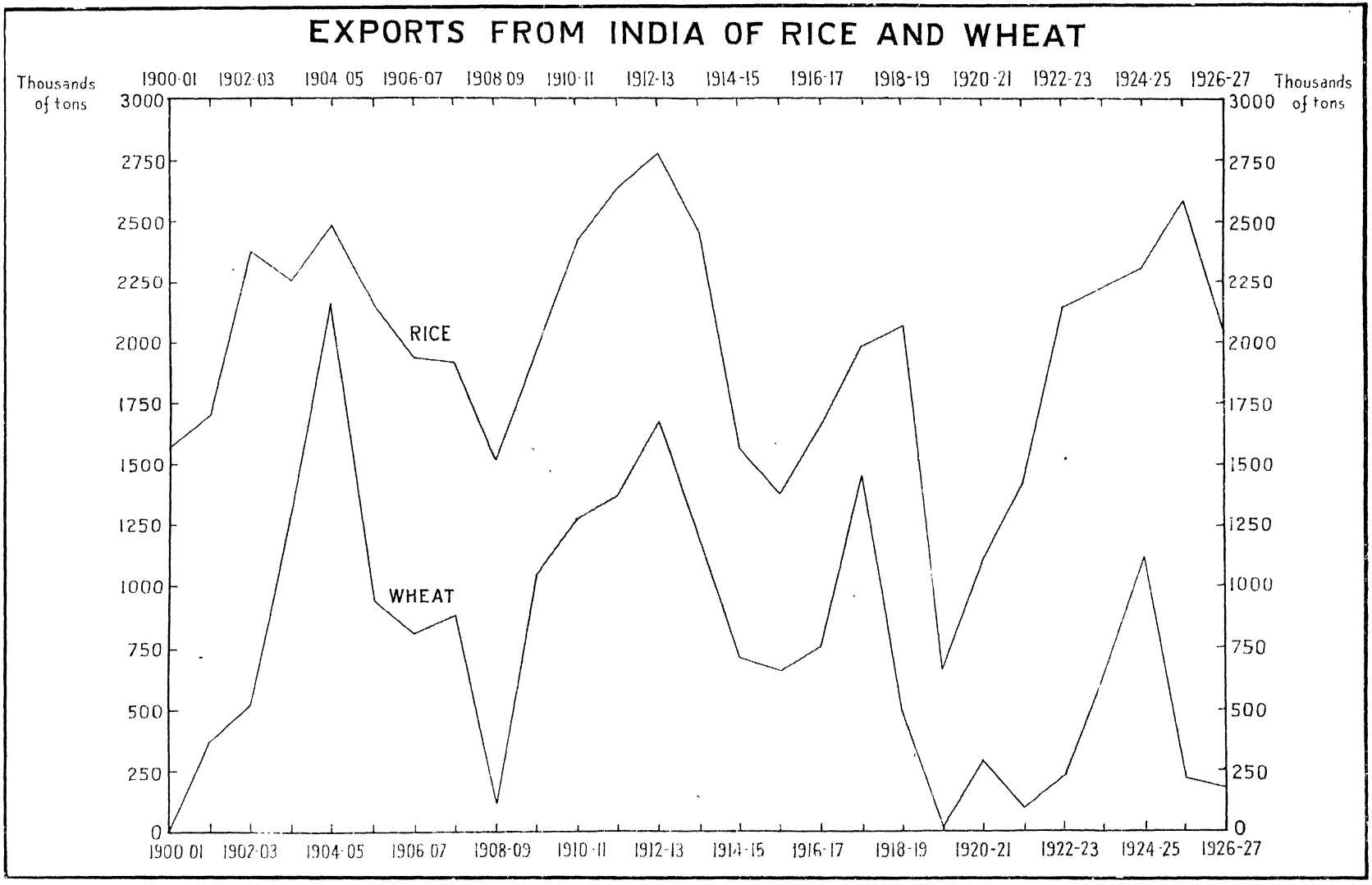
REPUTATION OF INDIAN AGRICULTURAL PRODUCTS IN THE WORLD'S MARKETS.

340. We have so far dealt with marketing as it affects the individual producer. We have shown that his position in relation to the distributors and ultimate consumers of his produce would be greatly strengthened by an improvement in the conditions in which it is marketed. But, though the establishment of properly regulated markets would mark a distinct advance towards the solution of the problem of securing for the cultivator the best possible price for his produce generally, and, in particular, the full premium for any superiority in the quality of that produce, it is not in itself sufficient to solve that problem in its entirety. (In the term "quality" we include not only the intrinsic superiority of the product resulting from the cultivation of improved varieties but also the condition in which it is marketed.) (The tendency all the world over is for local buyers to pay a flat rate for good and poor quality alike.) Adequate recognition for quality is everywhere difficult to secure. The position has been aptly summed up by an authority on English marketing conditions in the statement that produce of high grade quality subsidises low grade supplies and that, for many commodities, there is little or no incentive to raise the quality level of the produced article. This statement, though made with special reference to marketing conditions in England, is equally true of India. The incentive to grow the improved varieties introduced by the agricultural departments is *pro tanto* diminished if the cultivator fails to obtain the full premium justified by their superiority over those ordinarily grown. Again, he has little incentive to market his produce in the best possible condition unless that condition is recognised in the price he gets for it.

Before passing on to consider the steps which can be taken to assist the cultivator in obtaining the full premium for quality, it will be convenient to discuss the reputation enjoyed by Indian agricultural produce in the world's markets. (That much of it is marketed in an unsatisfactory condition was clear from the evidence we received, though it would appear that matters in this respect have considerably improved since the Board of Agriculture discussed the action which could profitably be taken by Government to discourage the adulteration and mixing of agricultural produce at its meeting in 1917. Much valuable light was thrown on the subject by the evidence we took in England.

(*i*) COTTON.

Cotton, which, in point of value, stands easily first in the list of Indian exports of raw produce, is the commodity in regard to which complaints of quality are most common



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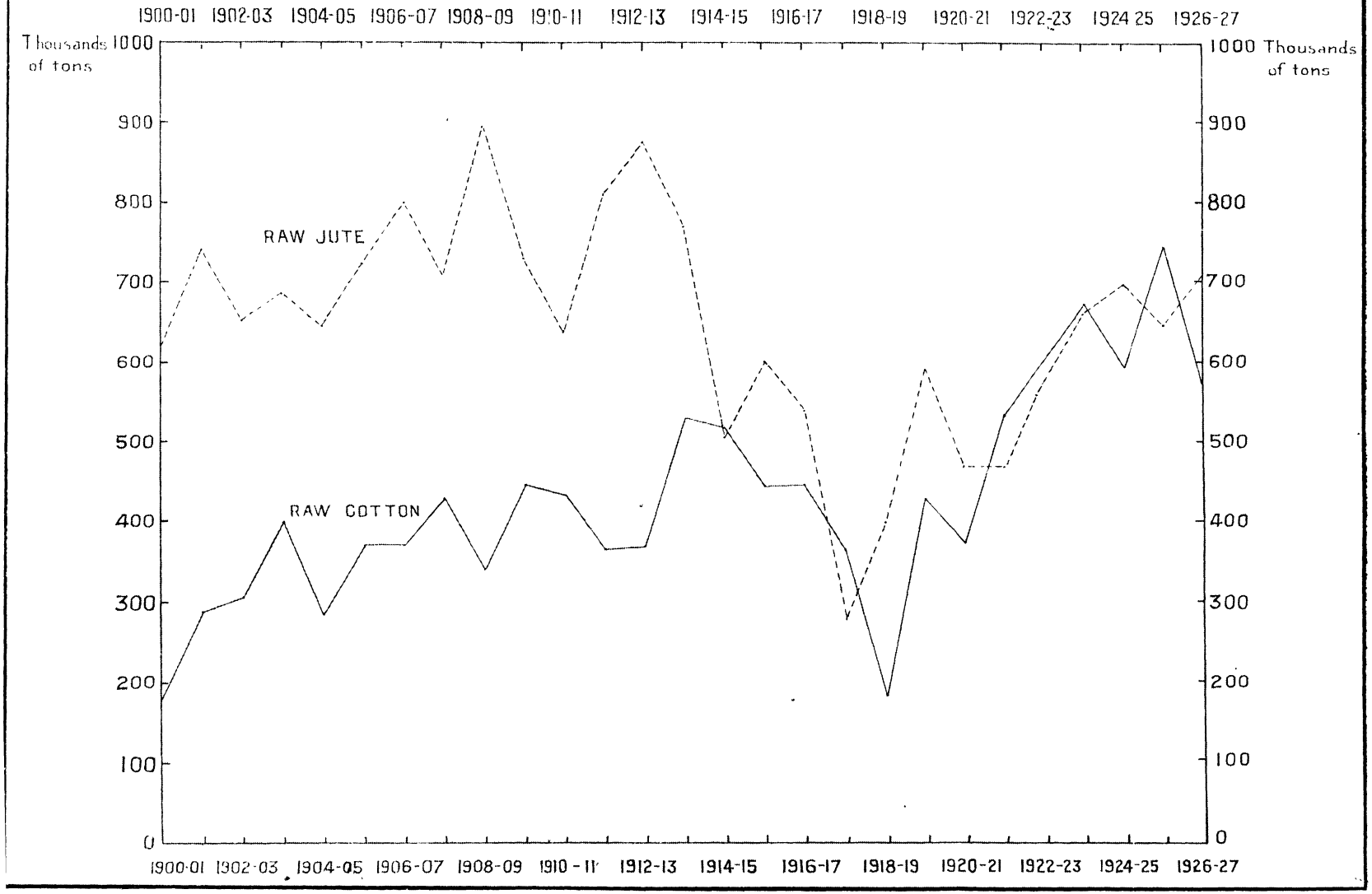
EXPORTS FROM INDIA OF RAW JUTE AND RAW COTTON



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both in India and in Europe. In spite of the work of the Indian Central Cotton Committee, and of the joint action by cotton trade associations which the Indian Central Cotton Committee is now endeavouring to secure, adulteration, mixing and damping still prevail to an undesirable degree. It has yet to be seen how far these malpractices will be checked by the operation of the Cotton Ginning and Pressing Factories Act of 1925, under the provisions of which mixed, adulterated or damped cotton can be traced back not only to the factory which ginned it but also to the original owner. It will be obvious that the prevalence of the practice of mixing short with long staple cotton very seriously hampers the work of the agricultural departments in spreading improved varieties. In paragraph 115, Chapter IV, we have pointed out that the position in respect of Punjab-American cotton is specially serious.

(ii) JUTE.

We were informed that bad retting, bad grading and selection and excessive moisture were characteristic of much of the jute exported. It was stated that the spinning qualities of the jute produced in Bengal had steadily deteriorated in recent years.

(iii) HEMP.

The most serious complaints we received had reference to Indian hemp. We were told that it was very irregular in quality, that fibre from different districts was mixed in the same bale, that it contained an excessive proportion of dust and dirt as the result mainly of retting in unclean water and that it was packed and baled in an unsatisfactory way. There has, however, been some improvement in quality of late owing to the increasing proportion of the export which is treated in Bombay and Calcutta before shipment.

(iv) GROUNDNUTS.

Complaints of excessive moisture were not confined to fibres. We were informed that the decortication of groundnuts in a wet state is common and that this results in the breaking of the nuts and in deterioration owing to the increased percentage of fatty acids which is thus set free during storage and transport.

(v) OIL-SEEDS.

On the other hand, the reports on Indian oil-seeds other than groundnuts were satisfactory. Some suggestions for improvement were made especially in regard to cotton seed which frequently contains an admixture of dirt, pieces of iron and steel and other foreign matter, and to rape seed, the various descriptions of which are not always kept distinct. Indian linseed is preferred to that from any other country.

(vi) WHEAT.

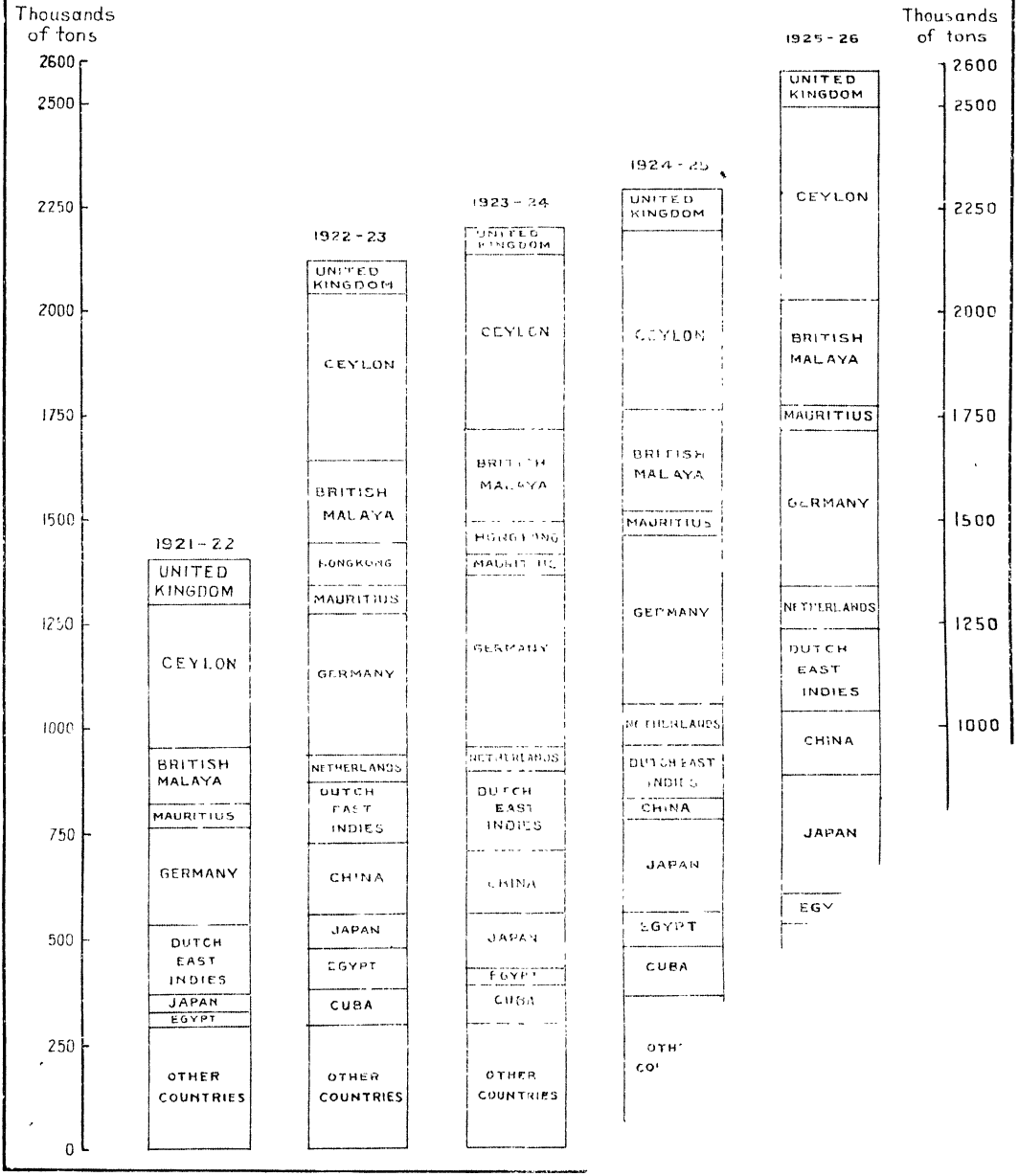
There was some difference of opinion as to the quality of Indian wheat. We were informed by one authority that Indian wheat was most excellently packed and graded, that it was almost the only grain which is always sold on the basis of analysis for impurity, that its quality is usually very even and that the allowances which have to be paid by the seller to the buyer for inferiority of quality are usually of minor importance. The witness added that the bags in which

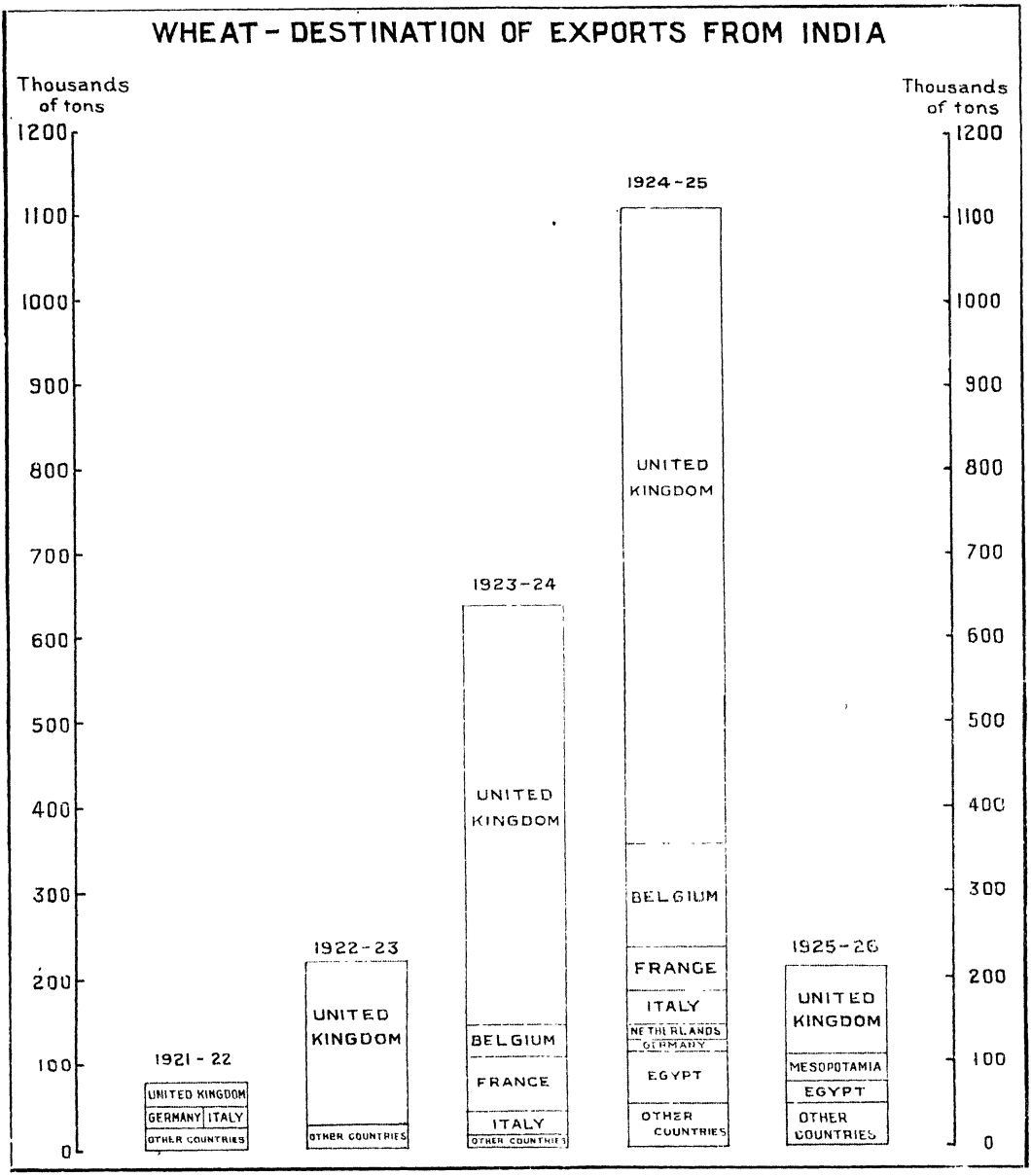
Indian grain is packed are usually better than any other bags used in the grain trade and that the stowage in ships is an example of excellence. We were, however, told by another expert witness that the quality of the wheat exported from Bombay had steadily deteriorated, that it was sometimes damaged by weevil and damp and that one of the objectionable features of the Bombay wheat was the admixture of earth. These complaints had reference to the comparatively small proportion of the Indian exports of wheat which is shipped from Bombay, and the balance of opinion appears to establish that the quality of Indian wheat is, on the whole, well suited to the particular market that it satisfies. The marked improvement in recent years was attributed mainly to the form of contract introduced by the London Corn Trade Association in 1912, under which nothing is paid for any foreign substance other than barley. A mixture up to two per cent of barley is permitted at the full contract rate but only half the rate is paid for any quantity found in excess of that percentage.

The evidence before us suggests that most of the Indian wheat imported into Great Britain attracts millers in that country partly by reason of its extreme dryness, and partly owing to the fact that its presence in flour promotes the rapid growth of yeast. We have been told that, for the most part, Indian wheats placed upon the English market are deficient in gluten and lack the complex quality known to bakers as "strength," and that they are invariably blended by millers with wheats possessing these qualities. The bulk of Indian wheat exported to Great Britain reaches that country in the months of June, July and August, at which season of the year it fills a gap in the supplies of "soft" wheats imported from other countries. In existing conditions, the market for Indian wheat is thus, in the main, a special and limited one, and it is necessary to bear this in mind in interpreting much of the evidence bearing on the question of quality given to us by witnesses representative of the export trade, both in India and England. It would appear that the nature of the existing trade has its origin partly in the fact that the wheats first exported from India were the soft red wheats of the Indus basin and the soft white wheats of the Gangetic tract. The bases of the various grades now exported are the soft white wheats distributed for cultivation at the end of the nineteenth century. Since the war, the only two varieties which have been shipped in any appreciable quantities from India are Choice White Karachi and Red Karachi, the former greatly predominating, both of which are soft wheats.

We have considered the possibilities of the export of high-grade Indian wheat in volume and regularity sufficient to create and sustain a definite demand. We think that, from the agricultural point of view, no insuperable difficulties prevent the production of a strong wheat capable of entering overseas markets on a plane of quality and of average price well above that at present enjoyed by Indian wheat. It has been established that many of the improved varieties of Indian wheats yield flour and loaves of the same class as strong American wheats, and that strong, free-milling wheats can be grown in India. Having regard to the wide fluctuations in the volume of the surplus available for export, and to the

RICE — DESTINATION OF EXPORTS FROM INDIA





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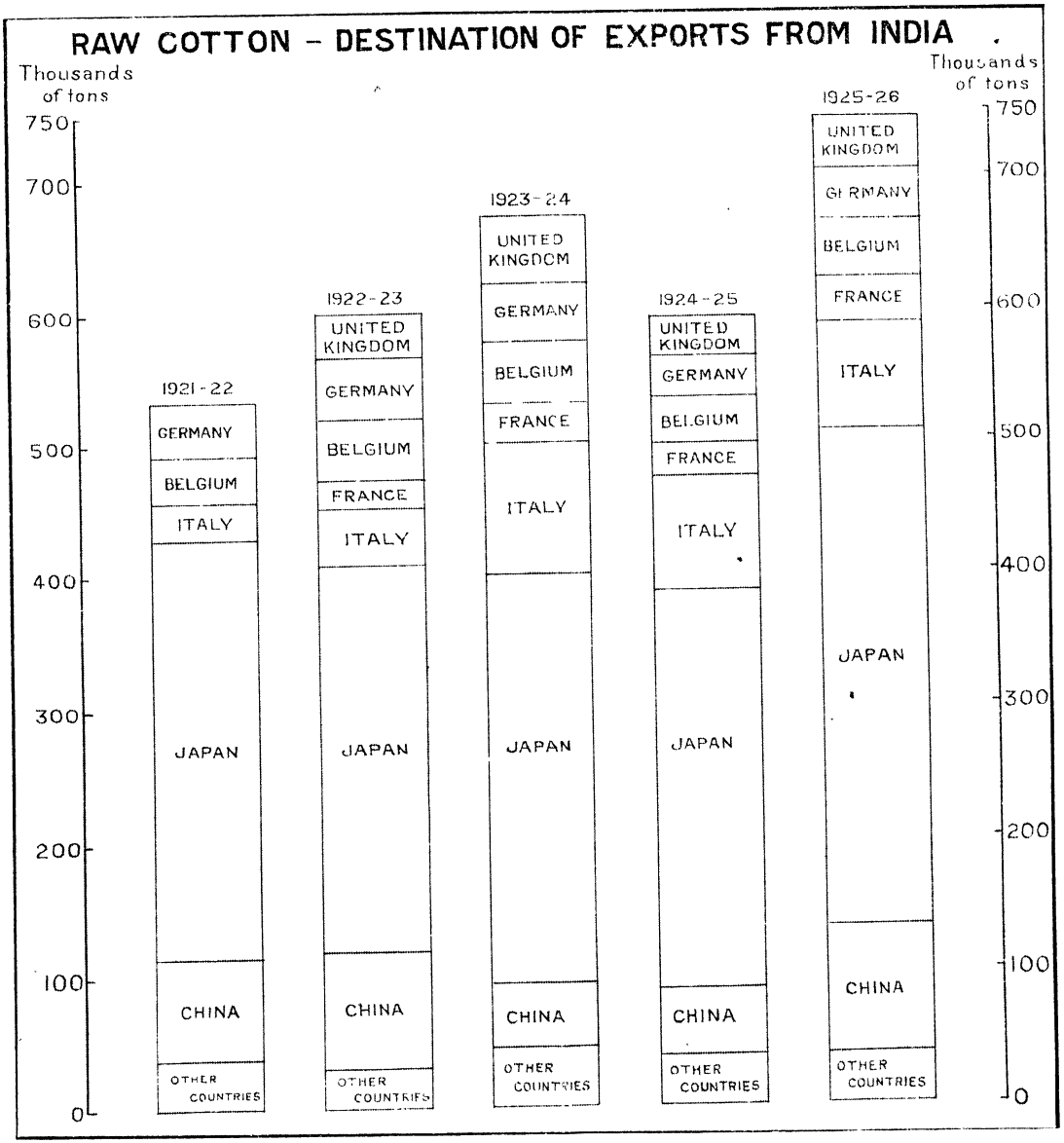

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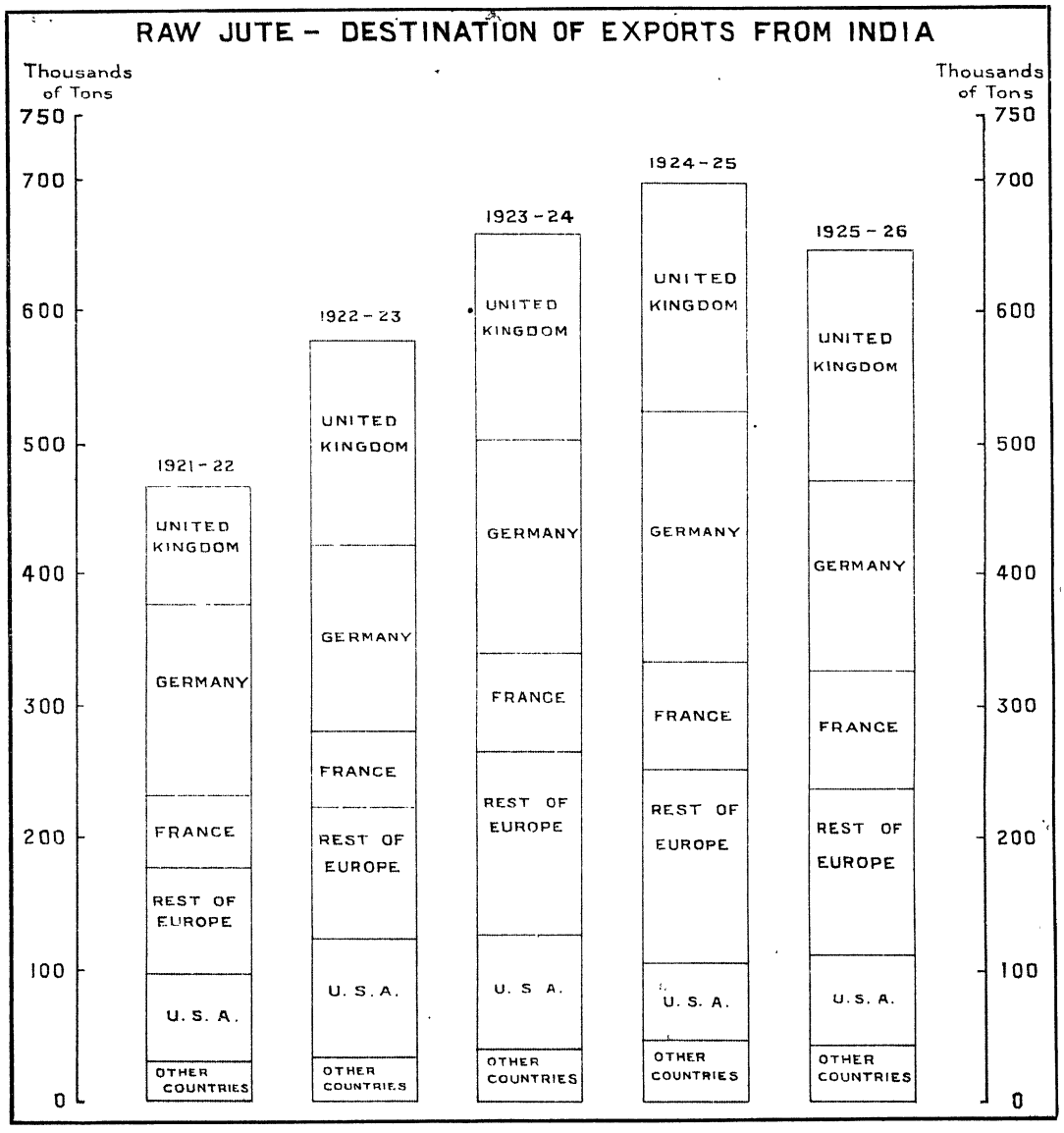

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departments. Propaganda by these departments aimed at better cultivation and better methods of preparation can only be effective if it is based on close touch with trade requirements, more especially those of the export trade, and it is for this reason amongst others that we suggest the appointment of special marketing officers in paragraph 348 below.

CO-OPERATIVE SALE.

342. The question how far any improvement in the quality of Indian produce which is effected by the methods suggested in the preceding paragraph will be immediately reflected in the price obtained by the cultivator is not one which can be answered with any degree of exactitude, but the more efficient the distributing machine, the smaller, in any given circumstances, will be the spread between producers' and consumers' prices. The most effective method of enabling the cultivator to secure a full premium for superior quality is organisation for the purpose of sale. Group marketing must be more efficient than marketing by individuals, especially in conditions such as those which exist in India where the individual producer is such a small unit. The ideal to be aimed at is, therefore, co-operative sale societies which will educate the cultivator in the production and preparation for market of his produce, will provide a sufficient volume of produce to make efficient grading possible and will bring the Indian producer into direct touch with the export market and with the large consumers in this country such as the cotton and jute mills. We are well aware that it must be long before such societies will be in a position to undertake operations on the scale of societies in such countries as the United States of America. Meanwhile, the co-operative sale societies which we discuss in our chapter on Co-operation represent a small beginning in this direction and deserve all the help the agricultural and co-operative departments can give them. The help of the agricultural departments can be given most effectively in the form of assistance in the grading of produce. It is axiomatic that properly graded produce must, in normal circumstances, command a higher price than produce of mixed quality. We, therefore, approve the action of the Agricultural Department in Bombay in lending an agricultural assistant free of charge to carry out the grading of the cotton sold by the co-operative sale societies in the southern Maratha country.

AUCTION SALES.

343. We consider that auction sales by the agricultural departments provide a useful means of securing to the cultivator an adequate premium for the superior quality of a new variety grown under their supervision. Particularly is this the case in the early stages, when the quantity available is small and the trade is without an organisation to enable it to be taken up at its intrinsic value. The rapid expansion of the cultivation of 4 F cotton in the Punjab and of the improved varieties of cotton introduced by the Bombay Agricultural Department in south Gujarat and the southern Maratha country was undoubtedly due in very large measure to the fact that, at the outset, the cotton of these varieties was graded and sold at auctions held by the

Agricultural Department. As soon as their object had been achieved the auctions were discontinued in the Punjab and in south Gujarat and, in the southern Maratha country, they were taken over by co-operative sale societies. Auction sales by the agricultural departments can, however, only be regarded as a temporary expedient. The departments have not sufficient staff available to enable them to handle very large quantities of produce nor is it desirable that their energies should be diverted to any great extent to the discharge of this task. We consider that government auctions should only be continued until they can be taken over by co-operative societies or by private agencies which are willing to co-operate with the agricultural departments in any measures the departments may consider necessary to secure an adequate premium for an improved variety or to maintain their control of seed. Occasions may arise when auctions may prove the most suitable means of reviving a trade market which has become temporarily demoralised.

GRAIN ELEVATORS.

344. An important question which has come under our consideration in connection with the storage and movement of Indian agricultural produce is the feasibility of operating a system of grain elevators in this country. A detailed investigation into this subject has recently been carried out by Major R. E. Gordon, R.E., M.C., at the instance of the North Western Railway. We are unable to accept the conclusions reached by Major Gordon in his valuable report, but we wish to acknowledge the assistance we have derived from it in formulating our own.

The establishment of a complete grain elevator system would involve the erection of three distinct types of elevators. There would be smaller elevators which would receive the grain at the primary markets and store it until it could be conveniently transported by rail to the larger stations or consuming centres. At these centres there would be terminal elevators of considerably greater storage capacity. Finally, there would be elevators at the ports which would receive the grain from the railways and load it on to steamers for export.

The advantages claimed for the elevator system are twofold. From the point of view of the railways, it is urged that the system would lead to economies in working owing to the introduction of transport in bulk, the quicker turn round of wagons and possibly a more even distribution of traffic throughout the year. From the point of view of the cultivator, it is argued that he would be freed from exploitation, and would benefit from the better prices he would receive from the sale of properly cleaned and graded produce. He would further benefit from the economies effected by bulk handling and the elimination of disputes in regard to weight and quality. Stress was laid, in the evidence before us, on the success with which the elevator system has been worked in North America and some of the British Dominions.

The question has to be examined in relation to the external and internal trade in grain respectively. Wheat is the principal grain affected for, as the Table below shows, the exports of barley are of much less importance than those of wheat.

Quantity and value of wheat and barley exported from India by sea

Year	Export of wheat		Export of barley	
	Quantity	Value	Quantity	Value
	000 tons	Rs. lakhs	000 tons	Rs. lakhs
1916-17	749	915·35	210	226·44
1917-18	1,454	1900·27	359	404·03
1918-19	476	675·31	226	276·77
1919-20	9	20·36	2	2·70
1920-21	238	410·03	6	13·70
1921-22	81	146·83	10	20·36
1922-23	220	344·02	16	19·13
1923-24	638	911·81	169	176·90
1924-25	1,112	1719·50	449	519·35
1925-26	212	360·24	42	56·23
1926-27	176	271·07	2	2·65

In our view, the figures in this Table are sufficient in themselves to condemn the elevator system as a practical measure so far as the export trade is concerned. The view taken in some of the evidence we received in this country was that the falling off in the export of wheat from Karachi from an average of a million tons in the pre-war years, 1910-14, to one of 350,000 tons in the post-war period, 1918-26, was due to the inferiority of the Indian product as compared with that of other countries and that this was largely due to the unsatisfactory conditions in which it is marketed which, in their turn, are the result of the absence of an elevator system. We are unable to accept this view. It is not borne out by the evidence we received in England, to which reference has been made in paragraph 340 above. It is our view that the fall in the exports of wheat must be attributed in the main to increasing consumption in this country. So marked is this tendency that it would appear by no means improbable that India may, within a few generations, cease to be a wheat exporting country, in spite of the increased production of wheat to be anticipated as the consequence of the extension of irrigation.

The most modest scheme for an elevator system which was placed before us involved an expenditure of nearly two millions sterling, of which £800,000 represented the cost of an elevator at the port. The figures we have given above show that, even in the years when export is most active, it is very doubtful whether it would be sufficient to justify expenditure on this scale and it is clear that, in some years, the port elevator would be practically idle. Nor does it seem that one of the advantages claimed for the elevator system, which is that it would tend to steady export throughout the year, could be secured. The evidence we received on this point in London showed that the demand for Indian wheat is most active in June and July, as it then fills a gap between supplies from other sources. The existence of an elevator system would not alter the seasonal character of the demand. It is not surprising, in these circumstances, that the proposals for an elevator system have not received any support from the export interests involved.

The question has now to be discussed from the point of view of internal trade. It was urged that a system of country and terminal elevators in the Punjab could be worked without a port elevator or terminal elevators in the consuming centres, since elevators can discharge into bags automatically weighed and bulk transport is not, therefore, essential. It may, however, be remarked in passing that, if bulk transport is not essential, one of the main arguments in favour of the elevator system, which is that it facilitates such transport, can no longer be sustained.

We should, in any circumstances, have hesitated to advocate the establishment of the elevator system for the internal trade of India without far more definite evidence on the subject than has been placed before us. We do not consider that the agricultural and marketing aspects of the problems have been sufficiently examined. We have grave doubts whether the difficulties have been sufficiently appreciated of dealing with a multitude of small and, for the most part, uneducated cultivators whose individual contributions are very much smaller than are those of farmers in countries in which the system has been successfully worked. The difficulties of persuading the cultivator to accept a system of pooling at the primary elevator, involving, as this must, the loss of identity for the individual parcel and the holding by the cultivator of a certificate bearing on its face the quantity of the parcel marketed and its grade as assessed by the staff of the elevator, must be formidable. That this difficulty is felt to be a real one we judge from the evidence given before us suggesting that, in the earlier stages of the venture, the identity of the cultivator's parcel should be preserved by storage in a separate bin. Having regard, however, to the substantial increase in cost involved in the construction of a multiplicity of bins, and in view of the small quantity of grain commonly marketed at any one time by the average cultivator, we find it impossible to accept this proposal as practicable. Again, the question of the training and control of the large subordinate staff which would be required to operate the elevators, and the opportunities for malpractice offered by any system of grading and pooling at the primary elevators, present added difficulties. Those difficulties would not be removed by the adoption of the suggestion made to us for the guarantee by Government of the certificates as to both quantity and grade. The large number of grades required to meet the needs of the internal trade is a further complication. We were informed that no less than nine such grades would be required in the initial stages of the scheme. Here again, the constructional detail required at the terminal elevators to cope with this multiplicity of grades must add largely to the cost of construction. Meantime, the mills operating at the consuming centres are equipped with the means required in the existing condition of the trade to effect the necessary grading, and we have no evidence to suggest that internal consumers would be prepared to pay for the grading and cleaning of their grain in terminal elevators. A very detailed investigation into the various points discussed above would be necessary before the introduction of the system could be recommended. But, in present conditions, the factor which tells decisively against the elevator system is its prohibitive cost. Even without the

port elevator, the scheme we have mentioned above involves a capital cost of over a million pounds and entails the construction of 78 elevators with an average capacity of 3,500 tons. It is most improbable that private enterprise would be forthcoming to undertake a scheme of this magnitude and it would, therefore, have to be financed by Government. The advantages to the cultivator which would result from it appear to us to be altogether too problematical to justify a recommendation that the scheme should be carried out by the State. Such funds as are available can, in our view, be utilised to far greater advantage in the numerous ways we have advocated elsewhere in our Report. It may be that when the Sukkur Barrage and the great irrigation schemes now in progress or under consideration in the Punjab are completed, the export trade in grain will, at least for a time, increase sufficiently to bring an elevator system within the range of practical politics. We are of opinion that, in present conditions, no further investigation into its possibilities is called for.

STANDARDISATION OF CONTAINERS.

345. In Indian conditions, the matter of containers is one which arises mainly in regard to the marketing of fruit and vegetables. It is obvious that, if one or two types of package are selected as best adapted to trade requirements and these types alone are manufactured, not only will cheaper packages be available but, with standard methods of packing, the quantity element will also be standardised. Standardisation of containers thus contributes to increased business efficiency and a corresponding reduction in marketing costs. The fruit and vegetable trade in India is mainly in the hands of small traders who do not combine to secure the advantages of bulk transport, with the result that the packages booked are small and in miscellaneous shapes and sizes, whilst the methods of packing adopted are often very primitive. In view of the climatic conditions in this country and the long distances over which much fruit has to be transported, the question of suitable containers for fruit and vegetables assumes special importance. Valuable information on the subject of containers has already been collected by the Empire Marketing Board. We recommend that this information should be obtained by the agricultural departments and that experiments should then be carried out which will enable the departments to give the growers of these products advice as to the material which can best be used for containers, with special reference to the question of the returnable against the non-returnable package and the most efficient methods of packing. In this connection, we note with satisfaction the experiments carried out in the Bombay Presidency with a view to improving the container used in marketing fresh mangoes. We have no doubt that the forest departments will be prepared to advise and assist the agricultural departments in discovering the best types of wood for the manufacture of containers. We think that a useful stimulus would be given to the trade in fruit and vegetables if the concession granted on the North Western Railway which allows " returned empties " to be despatched back to Quetta and Chaman in returning fruit vans, though booked at goods rates, were made of general application.

COLD STORAGE.

346. In paragraph 314, we have pointed out that the extensive employment on the railways of refrigerator or cold storage vans for traffic in fruit and milk—to which may be added vegetables and fish—must depend upon the extent to which this form of traffic develops and on the establishment of cold storage depôts at suitable centres. At present, cold storage depôts have only been established on a small scale in Calcutta and Bombay. The existence of a number of such depôts at the ports and in up-country centres would undoubtedly do much to stimulate the internal traffic in fruit, vegetables and fish. The possibilities of developing an export trade in certain Indian fruits such as mangoes also appear to deserve investigation. An investigation somewhat similar in character to that carried out into the question of grain elevators might, however, be undertaken under the auspices of the Railway Board with a view to determining whether it might be possible to enlist private capital in an enterprise which would make an important contribution to the welfare of the small cultivator and of the fishing community. Cold storage is in other countries playing such a remarkable part in the marketing of goods, both for export and for internal consumption, with results so generally profitable to the private enterprise undertaking the arrangements as well as to the farmer, that we do not doubt that sooner or later there will be a similar development in India. We trust that those concerned will keep abreast with the research on the subject of cold storage which is being carried out in other countries, and will, when the time comes, prosecute in India any investigations required to adapt modern practice to local conditions.

MARKET SURVEYS.

347. We have sought to make plain the extent to which the prosperity of the cultivator and his progress in agricultural efficiency depend upon sound marketing. It has been pointed out that comparatively little has been done by Government in India to assist the cultivator in his marketing operations. The collection and study of exact information on the question must necessarily precede the formulation of an effective policy for the improvement of marketing. Guesses and hearsay cannot provide the grounds for action, and, at present, the departments of agriculture are without much of the material essential for a forward move. We think the provincial departments should at once begin a study of marketing conditions. The expenses of the work should not prove unduly heavy, and we are satisfied that any funds disbursed will be amply repaid. But if such surveys are to be of value, the personnel engaged upon them must be suitably equipped and the plan of investigation both businesslike and thorough. The investigator should combine a sound knowledge of economic theory with a practical acquaintance with the conditions of production and sale of the commodity with which he is concerned. He must be prepared to develop his conclusions in accord with facts as these are established by him and must eschew the temptation to mould and colour 'facts' to suit prepossessions. He should usually concentrate his attention upon one class of produce at a time, though a group of

commodities handled throughout the length of the marketing chain by one set of intermediaries may sometimes be conveniently included in a single survey. (A survey of production, of internal consumption and of the export trade, where this exists, will form an essential preliminary to the proper understanding of the existing situation. The extent to which production is localised and, in some instances, to which it is seasonal will demand the investigator's attention.) In India, he will not, save in exceptional cases such as that of white sugar, be called upon to consider how far and in what circumstances imports compete with the home product. Where reliable and continuous statements of prices exist, he should examine the movement of prices over a period of years and the extent to which seasonal fluctuations appear and to which prices differ between one locality and another. He will attempt to analyse the whole price structure and, as far as possible, to measure the margin attributable to the various functionaries concerned. He must make himself closely acquainted with the factors which influence both the quality and quantity of supplies. (The relation between the producing and consuming centres and the state of communications will come within his purview and he will need to understand the methods by which crop forecasts and crop estimates are made.) (He will then turn to the conditions of demand and obtain a general appreciation of what is demanded in terms of both quality and quantity.) Here again, an examination of seasonal fluctuations and local differences will be required. It will not be sufficient to enquire into the nature of the demand unless the extent to which it is met by supplies at remunerative prices is also taken into consideration. A critical examination of the marketing machinery will then follow and the investigator will examine the efficiency of the markets, their physical conditions, their administration and the facilities they offer. At this stage, close attention should be given to the relation of the cultivator to his primary market, including the influence of debt upon his freedom of choice as to where and when he will dispose of his produce, the extent to which produce is sold to village traders and marketed by them and the tolls and taxes on the cart or the value of its contents which are levied by the municipal or other local authority. The extent to which a comparison of prices generally between market and market can be taken as a reliable index of market conditions is another point to which attention must be paid. The technical study of storage methods and facilities will lie outside the province of the investigator; on the other hand, the study of the amount of storage available, the costs of storage and the margin available for their recoupment, as well as the consideration of the most suitable place at which to store, are integral parts of a marketing investigation. In the penultimate stage of his enquiries, the investigator will trace the channels through which the commodity passes in its journey from the producer to the consumer. He will study the various types of middlemen and endeavour to appraise the services rendered by each. As far as data are available, he will examine the costs of distribution under different conditions. Finally, the investigator will study the position of the co-operative movement and the extent to which savings in distribution

costs can be secured by co-operative sale. At the conclusion of an investigation carried out on these lines, he will consider the existing system of market intelligence and the methods by which the utilisation of such intelligence can best be extended. He will need help in carrying out his enquiries as they will extend to the villages as well as to the marketing centres and it will not, therefore, be possible for the whole investigation to be carried out by one individual. The qualifications required in such staff as may be given him are of a somewhat different order from those which it is essential that the investigator himself should possess. They must be men with rural outlook and knowledge who can gain the confidence of the cultivator and obtain answers to the detailed questions framed in the enquiry. We need not emphasise the importance of keeping accurate records of all information collected, of the planning of the surveys and the precise methods employed in obtaining the information.

APPOINTMENT OF AN EXPERT MARKETING OFFICER.

348. The market surveys we have recommended in the preceding paragraph will be of little value unless they are carried out under proper supervision such as that of the Indian Central Cotton Committee or the Board of Economic Enquiry in the Punjab. The universities could also render valuable service in conducting them. In western universities, work of this kind has from time to time been subsidised by special grants made by Government or other outside authority for that purpose. Such surveys have also been made the subject for theses submitted for university degrees. Work on similar lines might well be done in India with some financial assistance from Government. But market surveys carried out under the supervision of these agencies will not in themselves be sufficient and we are strongly of opinion that the whole question of marketing requires to be dealt with by an expert officer. We, therefore, recommend that a whole-time officer of the status of deputy director of agriculture should be attached to the staff of the Agricultural Department in each of the major provinces. His duties, at the outset, would consist mainly in the collection of information. The investigations into marketing conditions would be carried out under his supervision in collaboration, where necessary, with the Indian Central Cotton Committee, the Board of Economic Enquiry, where one exists, and the universities.

We deal, in Chapter XIV, paragraph 427, with the composition and work of the Board of Economic Enquiry Committee in the Punjab and suggest the desirability of constituting similar boards in other provinces. Wherever these boards exist, we contemplate that the marketing officer will be intimately associated with their work. He should, we consider, invariably be a member of the board. Membership of the board would enhance his status and would enable him to obtain, from contact with the other members of the board, valuable information which might not otherwise come his way. Moreover, the board would be in a position to render the marketing officer great assistance in editing his surveys whether these were published under the auspices of the board or of the Agricultural Department. One of the specific duties of the marketing officer will be to examine the working of the regulated markets,

the establishment of which we have suggested in paragraph 329, and to make recommendations for their improvement where necessary. He would advise the market committees on any points referred to him and especially in regard to such matters as the form and manner in which marketing information should be published. He would be a member of the local advisory committees constituted for the railway systems in his province and also of the provincial Road Board where one has been formed. We do not consider it necessary to define the scope of his duties with greater precision. Sufficient has been said to indicate their general character and importance. We would add that we have considered the question whether this officer should be attached to the Agricultural or the Revenue Department. We are of opinion that it is preferable that he should be an officer of the Agricultural Department as the conditions in which agricultural produce is marketed concern that department more closely than any other.

THE INDIAN TRADE COMMISSIONER IN LONDON.

349. The evidence we received in England showed the value to trading interests both in India and Europe of the work done by the Indian Trade Commissioner in London. It was clear, however, that the usefulness of this officer has been considerably curtailed by the removal of his office from the City to the West End of London and by the drastic reduction in his establishment which followed on the recommendations of the Indian Retrenchment Committee of 1923. His time is also increasingly taken up by attendance at meetings of the numerous committees on economic subjects of Imperial importance which have come into existence since the close of the war and on which it is desirable that India should be represented. The first of the drawbacks mentioned above will be removed when the new India House in London is completed. As regards the other two, we recommend that the Indian Trade Commissioner should be given the assistance of an officer with experience of agriculture and co-operation in India. The main duty of this officer would be to keep in touch with all aspects of the trade in Indian agricultural products at the European end and with all developments of co-operation in Europe. The information he would obtain would lose much of its value if it were not passed on to the departments concerned in a manner which would enable them to utilise it to the best advantage. We, therefore, recommend that an officer of similar standing and experience should be attached to the staff of the Director General of Commercial Intelligence in Calcutta. We have pointed out that intermediaries are not as a rule greatly interested in questions of quality and have explained the reasons for this. The result, in Indian conditions, is that there is no direct line of communication available between the ultimate consumer and the producer and that any schemes designed to bring the demands of the one to bear upon the other must, in the main, be initiated by government departments such as the agricultural and the co-operative departments. It is for this reason that we recommend additions to the staff of the Indian Trade Commissioner and the Director General of Commercial Intelligence.

We are of opinion that it will ultimately be desirable that separate Trade Commissioners should be appointed for such areas as Germany, Southern France and Italy, and North America. These officers would require to be trained under the Indian Trade Commissioner in London where the widest range of experience of qualities and defects of Indian agricultural products is to be obtained. This training can best be given when the new India House is opened and the appointment of these officers can be postponed till then.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

350. The conclusions and recommendations in this chapter may be summarised as follows :—

(1) Improvement in rural communications is a most important factor in rural development (paragraph 298).

(2) The condition of the roads in India has deteriorated in recent years (paragraph 302).

(3) The rapid expansion of motor traffic has brought into existence an entirely new range of problems of road construction and maintenance (paragraph 302).

(4) Road boards with functions similar to those which have been entrusted to the Communications Boards in the Punjab and Burma should be constituted in all provinces (paragraph 305).

(5) In any ordered programme of road development, special attention should be paid to the subsidiary communications which, from the point of view of the cultivator, are of the greatest importance (paragraph 305).

(6) Liberal financial assistance should be given by local governments to local bodies to enable them to discharge their duties towards roads which do not fall within the arterial system (paragraph 306).

(7) The development of such roads would be facilitated if their construction were financed from loans rather than from current revenue (paragraph 306).

(8) The provision of roads in areas which are newly brought under irrigation is the duty of the State (paragraph 306).

(9) The policy of grants-in-aid from provincial revenues for the construction or improvement of village roads which is being adopted in certain provinces is commended (paragraph 307).

(10) The improvement of such roads must, however, in the main, depend upon the efforts of the villagers themselves and co-operative action in this direction should be encouraged in all possible ways (paragraph 307).

(11) All district boards should have the services of a qualified engineer (paragraph 308).

(12) No local body should be permitted to embark on any scheme which involves the raising of a road above the level of the surrounding

country unless the approval of the provincial Road Board or that of the local Government has been obtained (paragraph 309).

(13) The special attention of local authorities should be drawn to the concessions allowed by the railway authorities for the building of road bridges alongside of railway bridges (paragraph 310).

(14) Railways and roads should be regarded as complementary and not as competitive (paragraph 312).

(15) There should be a periodical revision of railway freight rates with a view to the adjustment of their incidence as between various sorts of produce according to their ability to bear (paragraph 313).

(16) Anomalies in the rates on agricultural implements and for conveyance of livestock require examination (paragraph 313).

(17) In the initial stages of the development of traffic in such produce as fruit and milk, it is for the agricultural departments to interpret to the railway authorities the requirements of producers (paragraph 314).

(18) The question of providing facilities for the rapid transport of cattle requires examination (paragraph 315).

(19) The marketing officer, whose appointment is recommended in paragraph 348, should be a member of the local railway advisory committees (paragraph 316).

(20) In ordinary circumstances, no case can be made out for the introduction of tramways to develop rural transport nor can "roadless" tractors be of any material assistance in opening up rural areas (paragraph 317).

(21) The water hyacinth problem in Bengal should be dealt with by legislation similar to that which has been enacted in certain other provinces (paragraph 318).

(22) The formulation of a programme for research on this pest should be one of the first questions to be taken up by the Imperial Council of Agricultural Research (paragraph 318).

(23) A local government should be permitted to give a combined guarantee in respect of a number of new post and telegraph offices (paragraph 319).

(24) Apart from the organisation of producers for the sale of produce, the most effective means of eliminating unnecessary middlemen are the provision of good roads and the establishment of well regulated markets, easy of access to the cultivator (paragraph 320).

(25) The establishment in all provinces of regulated markets on the Berar system as modified by the Bombay legislation is recommended (paragraph 329).

(26) The system of regulated markets should be extended to products other than cotton (paragraph 329).

(27) Regulated markets should only be established under provincial legislation (paragraph 330).

(28) Local governments should take the initiative in establishing regulated markets and such markets should be established immediately in a few suitable centres (paragraph 331).

(29) The initial expenditure on land and buildings incurred in starting such markets should be met from a loan from provincial revenues (paragraph 331).

(30) The relationship of a regulated market to the council of any municipality or to the local board in the area in which it is established will require careful consideration in drafting the necessary legislation (paragraph 332).

(31) Suggestions are made in regard to the personnel of the market committee (paragraph 333).

(32) Machinery should be provided for the settlement of disputes arising in regulated markets. This should take the form of a board of arbitrators (paragraph 334).

(33) Amongst the duties of the market committee should be that of placing marketing information in a suitable form at the disposal of users of the market (paragraph 335).

(34) Action should be taken to prevent brokers in a regulated market from acting for both buyers and sellers (paragraph 336).

(35) Storage accommodation on a limited scale should be provided in regulated markets (paragraph 337).

(36) Suggestions are made for the utilisation of regulated markets for purposes of propaganda in favour of agricultural improvement and of thrift (paragraph 338).

(37) The Government of India should again undertake an investigation into the possibility of standardising weights and measures throughout India and should lay down general principles to which provincial governments should adhere, so far as this is possible without undue interference with local trade custom (paragraph 339).

(38) Burma requires separate treatment in regard to the standardisation of weights and measures (paragraph 339).

(39) Much Indian agricultural produce is marketed in an unsatisfactory condition though matters in this respect have improved considerably in recent years (paragraph 340).

(40) The possibilities of developing an export trade in high class strong wheats should be borne in mind (paragraph 340).

(41) Effective pressure to secure improved quality from the producer must, in the main, be applied by the agricultural or co-operative departments. Organisation amongst the ultimate buyers is, in some instances, an effective weapon and organised trade associations in India can give great assistance (paragraph 341).

(42) The most effective method of enabling the cultivator to secure an adequate premium for superior quality is organisation for the purposes of sale. Co-operative sale societies should be encouraged

in all possible ways by the agricultural and co-operative departments (paragraph 342).

(43) Help to co-operative sale societies can best be given by agricultural departments in the form of assistance in the grading of produce (paragraph 342).

(44) Auction sales by the agricultural departments provide a useful means of securing an adequate premium for the superior quality of a new variety, especially in the earlier stages (paragraph 343).

(45) Auction sales by the agricultural departments should only be continued until they can be taken over by co-operative societies or by private agencies (paragraph 343).

(46) The establishment of a grain elevator system in India is not recommended (paragraph 344).

(47) The agricultural departments should experiment with the most suitable form of containers (paragraph 345).

(48) Investigations into the possibilities of cold storage in India should be carried out under the auspices of the Railway Board (paragraph 346).

(49) Market surveys are an essential preliminary to the formulation of an effective policy for the improvement of marketing. The lines on which such surveys should be carried out are suggested (paragraph 347).

(50) An expert marketing officer should be appointed to the staff of the agricultural departments in all the major provinces (paragraph 348).

(51) An officer with experience of agriculture and co-operation in India should be attached to the staff of the Indian Trade Commissioner in London and to that of the Director General of Commercial Intelligence in Calcutta (paragraph 349).

(52) The appointment of separate Trade Commissioners in other countries will ultimately be desirable (paragraph 349).

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CHAPTER XII

THE FINANCE OF AGRICULTURE

SCOPE OF THE CHAPTER.

351. In a country in which holdings are so small as they are in India, the question of providing the cultivator with the capital he requires and with guidance as to the manner in which it should be spent if he is to utilise his land to the best advantage and to maintain an adequate standard of living, becomes one of crucial importance. In this chapter, we are concerned only with the question of finance. It is clear that in the adoption of some form of intensive cultivation lies the greatest hope of enabling the cultivator to meet, from his small holding, his own needs and those of his family. Intensive cultivation is, however, as a rule, only possible where capital has been invested in the improvement of land or in providing it with irrigation. Throughout its history, the cultivating conditions of India have been vastly improved and its gross production immensely increased as a result of the investment of capital in this way.

The most important examples of such investment are provided by the numerous irrigation works of all kinds which have been described in our chapter on Irrigation but others on a smaller scale are to be found in the careful layout and accurate levelling of rice fields, the construction of *bunds* to hold up water, the digging of channels to divert the water of rivers and streams to the fields and the patient terracing of the hill sides. In the great plains, the level of the fields has been carefully adjusted in order to secure an even absorption of water. Scrub jungle is cleared as new canals create agriculture where none existed before and this is only one of the many directions in which the work of land improvement proceeds unabated. Year by year, the extension of irrigation facilities continues but there still remains much to be done in such directions as drainage, reclamation and fencing. The larger and more important irrigation works which are constructed by the State need no discussion here. In this chapter, we are concerned with wells and tanks and other improvements which are usually carried to completion by the labour of the cultivator and his family, supplemented, when necessary, by hiring local assistance. The area irrigated by such private works amounts approximately to twenty million acres.

The finance required for expenditure on permanent improvements of this character is usually provided by the cultivator himself from his own savings or from funds raised by borrowing, but the State has long recognised, as one of its duties, the encouragement of such improvements by the grant of loans at a rate of interest as low as conditions permit.

In addition to assistance in regard to fixed capital, the cultivator also needs occasional help in finding the intermediate capital required for the purchase of the more expensive implements, such as well gear, and of cattle, and, less often, for the erection of buildings. To the needs in these respects has to be added, for agriculture as for every

other industry, that of finance for current requirements which, in this instance, take the form of seeds, fertilisers, feeding stuffs, etc.

The greater proportion of the funds required by landholders for general agricultural purposes is provided by local moneylenders who also supply credit for domestic wants and ceremonial expenses which are often extravagant. The moneylender recognises no distinction between the capital required to finance an industry and the money needed for ordinary household expenditure. Everything goes down in a common account. The borrower also fails to distinguish in his own mind between sums borrowed for productive purposes, from the expenditure of which a more than equivalent return is to be expected, and those taken for current needs which a more prudent man would meet from savings or income. The result is financial confusion and widespread indebtedness. And since neither in the borrower's mind nor in the lender's ledger is the financing of agricultural operations of every kind kept distinct from the provision of funds for household and family expenditure, it is not possible to determine with any accuracy the proportion of the debt of the agricultural classes which is represented by investments in improvements or in stock. The general opinion is that the proportion is very low and such evidence as is available tends to confirm this view. One result of the confusion between the objects for which loans are taken from the moneylender is that it has fallen to the State to attempt the double task of assisting the finance of agriculture and of restricting credit in the interest of the improvident cultivator.

Moneylending is one of the oldest professions in India and the necessity for regulating it in the interests of the welfare of the people has led to the promulgation of edicts and laws from the age of Manu to the present day. In normal times, the village moneylender seems to have met the normal needs, but, in times of severe drought or widespread calamity, his resources proved unequal to the strain upon them; and, long before the British acquired control, the rulers of the day were accustomed to grant loans to the cultivators of the soil. This system was continued by the early British administrators, and, in 1793, various Regulations were issued providing for *taccavi* advances to proprietors, farmers, subordinate tenants and ryots for embankments, tanks, watercourses, etc. These were followed by a series of Acts which, with much improvement, are now represented by the Land Improvement Loans Act of 1883 and the Agriculturists Loans Act of 1884 and the Rules framed thereunder. The working of these two Acts will be discussed subsequently but it seems desirable first to deal with the methods of financing agriculture from private sources which preceded State action and which, though in quite a different form, that of co-operation, will, we trust, eventually oust it from any position of importance. It has never been the policy of the State to impose restrictions on the financing of agricultural operations by private individuals. Such restrictions as have been imposed have all been designed to deal with agricultural indebtedness; if they affect the village moneylender, it is solely owing to the accident that he combines the financing of agriculture with usurious moneylending which alone the restrictions are designed to control.

FIXED CAPITAL: (i) MORTGAGE CREDIT.

352. The form of long-term credit which is most common throughout India is based on the mortgage of agricultural land. The extent to which this existed before the introduction of settled law and permanent courts is fortunately a problem which it is unnecessary for us to discuss. It is sufficient to state that, when land had little or no sale value, there could not have been much security for credit based on it. The total sum advanced upon this form of security must now be a very large one and it is to be regretted that no reliable data on which an estimate of it could be based are available. A detailed enquiry carried out in the Punjab in 1920 suggested that the total sum secured on usufructuary mortgage of agricultural land in that province was Rs. 35 crores, which works out at an average of rather less than Rs. 12 for each cultivated acre. Although the average in other provinces may be much lower than this, the gross total must represent a very large sum locked away in this form of investment. When it is remembered that this type of security did not exist to any great extent before the introduction of the British legal system, it becomes possible to realise how rapidly it followed on the settlement of rights in land and the rise in land values which resulted. Such further enquiries as have been made in the Punjab tend to show that a very small fraction of the mortage debt was incurred in order to finance improvements. In no province did we receive any evidence in conflict with this view and it may be said with confidence that mortgage credit is rarely used to finance improvements in agricultural land. It is resorted to when the unsecured debt becomes larger than the lender considers safe and, in times of distress, for ordinary agricultural needs; it is too often an indication that a weak debtor has fallen into the hands of a strong creditor. The existence of a heavy burden of debt of this character exercises a most detrimental influence on agricultural progress. This is due not only to the fact that an important source of credit is drained for unproductive purposes and that the potential credit available for improvements is correspondingly curtailed, but also because it is found that, in the case of usufructuary mortgages, the mortgagor too often declines to the position of a permanent tenant under the mortgagee, paying, not a fair rent, but the utmost the lender can extract or extort.

NON-TERMINABLE MORTGAGES.

353. We discuss the possibilities of relieving the burden of mortgage indebtedness by co-operative action in the following chapter. We are here concerned with measures which are unconnected with that movement. An important question on which we invited opinion in our questionnaire was whether mortgage agreements which did not provide for their own automatic extinction after a period of years should be prohibited. In certain Acts which impose restrictions on the alienation of agricultural land, such as the Punjab Alienation of Land Act of 1900, the Bundelkhand Alienation of Land Act of 1903 and the Central Provinces Alienation of Land Act of 1916, there are provisions prescribing that usufructuary mortgages of such land, except to a member of the same

agricultural tribe or of a tribe in the same group as the mortgagor, may remain in force for a limited period of years only, after which the land must be re-delivered to the mortgagor free of all encumbrances. Where encumbered estates have been taken under government management, a similar limitation in regard to the period for which a usufructuary mortgage may be granted is prescribed by the Sind Encumbered Estates Act of 1896 and the Bundelkhand Encumbered Estates Act of 1903. The basic idea of these provisions is that the rents and profits of the land shall be taken as equivalent to the interest and sinking fund on the debt. Where no such provisions are in force, the profits from the land are usually taken as equivalent only to the interest on the debt or to a fraction of the interest and, in such circumstances, the mortgage may continue indefinitely. We mention these Acts in this immediate context, not because, in regulating the sale or mortgage of land, they discriminate between different classes or tribes, but because they contain provisions definitely limiting the life of usufructuary mortgages to a maximum period of twenty years. The evidence we received as to the desirability of prohibiting non-terminable mortgages of agricultural land was conflicting but the balance of opinion of those who have had the best opportunities of studying the question was in favour of the proposal that no usufructuary mortgage of agricultural land should be permitted by law unless provision were made for automatic redemption within a fixed period of years, of which twenty should be the maximum. We agree in this view.

The chief argument against the proposal is that the object of legislation on these lines would be defeated by collusion, that it would, for example, be easy for the mortgagee to insist on the execution by the mortgagor of a sale-deed which would remain inoperative so long as the latter remained submissive, but would be produced and enforced if he exhibited any signs of contumacy. While we recognise the risk of evasion, we think that legislation on the lines suggested would, on the whole, be beneficial. We wish, however, to make plain our opinion that no legislation, however wise or sympathetic, can save from himself the cultivator who, through ignorance or improvidence, is determined to work his own ruin. Education and the development of character are the sole specifics against both the wiles of the lender and the recklessness of the borrower.

FACILITIES FOR REDEMPTION OF MORTGAGES.

354. We received considerable evidence which pointed to the reluctance of the mortgagee to accept redemption. The reasons for this reluctance are obvious. The repayment of capital soundly invested makes it necessary to search for another equally profitable investment; mortgages which have been in force for a long period give possession of larger areas for smaller sums than do new mortgages; and there is always the disinclination of the business man to lose a satisfactory client. The Usurious Loans Act was amended in 1926 to enable a mortgagor to take advantage of its provisions when suing for redemption. To the operation of that Act we shall refer later. In the present connection, it is sufficient to say that, if the courts could be persuaded to carry out the intentions of the legislature in enacting it,

further measures to facilitate the redemption of mortgages would probably be unnecessary.

In the Punjab, mortgages in forms permitted under the Alienation of Land Act may be redeemed at any time during the currency of the mortgage by the mortgagor depositing the mortgage debt or such portion of the mortgage debt as the Deputy Commissioner may determine to be equitable. In order to facilitate the redemption of other mortgages by summary procedure, the Redemption of Mortgages Act was passed in 1913; this empowers the Collector, on petition by the mortgagor, to summon the parties, to attempt to arrive at a settlement and to order redemption if he is satisfied that the mortgagor has paid a proper sum on account of the debt. Either party, if aggrieved, may institute a regular suit, but otherwise the Collector's order is conclusive. It appears to us worthy of consideration whether the restriction of the operation of this Act to mortgages, the principal sum secured under which does not exceed Rs. 1,000, whatever the area of the land mortgaged, or to mortgages of land not exceeding thirty acres in area might not be removed. The removal of this restriction would facilitate the redemption of other mortgages by transferring possession as early as possible to a mortgagor who wished to redeem. The mortgagee would be left to prove his claim to further relief in the civil court. The evidence we received showed that legislation on the lines of these two Acts in regard to the redemption of mortgages would be welcomed in other provinces and we would commend the consideration of this point to local governments.

STATUTORY RESTRICTIONS ON ALIENATION OF LAND.

355. We turn to the question of statutory restrictions on the sale or mortgage of agricultural land by the chief hereditary cultivating classes to vendees or mortgagees not of those classes. In the Punjab, the Land Alienation Act came into force in 1901; it was amended in 1907. In accordance with its provisions, the chief ancestral cultivating classes have been notified as falling within the restrictions imposed; smaller septs are continually pressing their claims to be similarly protected while no instance has yet occurred of any class once notified seeking to be exempted. Members of the notified tribes are grouped by districts, and within such groups alienations are left subject to the ordinary customary law of the tribe; sales and mortgages by members of a group to anyone not such a member are restricted by the Act. When a mortgage in a form not permitted by the Act is made in contravention of its provisions, the Deputy Commissioner has authority to intervene. Any sale in contravention of the Act is void, and automatically takes effect as a usufructuary mortgage in the form permitted; but such sales may be sanctioned by the Deputy Commissioner. Witnesses we heard in the Punjab were almost unanimous in their testimony that the Act had proved successful in achieving its main object, namely, that of restricting the transfer of agricultural land from the agricultural to the non-agricultural classes. In this province alone, were we assured that, since the passing of the Act, the area of agricultural land under

mortgage has decreased; the agricultural classes have gained, on balance, nearly 372,000 acres from non-agriculturists.

The Punjab Land Alienation Act is also in force in the North-West Frontier Province. The local administration reports that the Act has been successful in preventing wholesale alienation but has restricted the credit of agriculturists and that many landlords, though belonging to tribes classed as agricultural, have shown no interest in the development of their land.

In the United Provinces, we were informed by the Revenue and Judicial Secretary to Government that the Bundelkhand Land Alienation Act of 1903, the provisions of which are similar to those of the Punjab Act, was working satisfactorily and from a report we received from the local Government it appears that it is very popular with the people whom it is intended to benefit. The advisability of introducing legislation to apply to the whole of that province was considered in 1909, when it was decided to take no action on the ground that conditions in the United Provinces differed fundamentally from those in the Punjab, and that it was difficult in many cases to distinguish the agricultural from the professional castes. We understand that Government are at present engaged in a re-examination of the matter with a view to ascertaining whether the tendency of the last fifteen years calls for any reconsideration of this decision.

In the Central Provinces also, a Land Alienation Act on the lines of the two Acts mentioned above has been in force since 1916 but its application is limited to members of aboriginal tribes.

Restrictions on the alienation of land by aboriginal tribes are also imposed in other provinces by provincial legislation, details of which it is unnecessary to give here. Under the Bombay Land Revenue Code, land in tracts in which an original survey and settlement has not been carried out, and land at the disposal of Government in other tracts, may be given out on a restricted tenure. About a million acres are held under this tenure in the presidency proper, mostly by members of aboriginal tribes, and about a million-and-a-half acres in Sind.

The desirability of extending the principle of statutory restriction on the alienation of land to districts or provinces other than those in which it is now operative is one which, in our view, can only be measured in the light of local conditions, including the state of mortgage debt amongst cultivators, the extent to which land is actually passing from agricultural to non-agricultural classes, and the feasibility of defining with reasonable precision those agricultural tribes or classes whose interests it is sought to protect.

We received very little evidence regarding the continuous transfer of land from the ancestral cultivating classes to non-agriculturists. Outside the Punjab, no figures were placed before us, and there does not appear to have been any systematic attempt to inquire into the cumulative effect of this process since the Famine Commission of 1901 surveyed the situation in their report. Such evidence as was given suggested

that moneylenders were steadily adding to their landed possessions in most provinces, and we consider that the time has arrived when enquiry should once more be conducted into the extent to which the hereditary cultivating class is being expropriated by those who do not themselves cultivate the land.

FIXED CAPITAL.
(ii) PRIVATE OR JOINT STOCK CREDIT.

356. We received no evidence of the extent to which joint stock banks advance loans on the security of agricultural land. The business of such banks is usually confined to the larger landholders, the planting community and others who possess tangible marketable security. It does not infringe on the field of co-operative credit and we see no reason to believe that its effect on agricultural operations, outside the narrow limits we have indicated, is at all appreciable. The joint stock banks regularly advance on the security of produce in go-downs and the Imperial Bank of India encourages co-operative societies with "crop loans." The only instance of a joint stock bank providing fixed capital which came to our notice was that of Dawson's Bank, Ltd., the operations of which are confined to the southern portion of the Irrawaddy delta in Burma. This started as a private concern but was subsequently converted into a public company registered under the Indian Companies Act. It receives no assistance from the State; it makes arrangements for its own funds as well as for assessing the credit of would-be borrowers, for supervision to ensure that the loans it makes are spent on the objects for which they are given and for collecting interest and instalments. It depends mainly on first mortgage security and furnishes a good example of what can be accomplished by private enterprise in an area in which harvests are secure, land valuable and readily marketable, and competition limited. Its chief interest for our present purpose lies in its resemblance to what appears to be the popular idea of an agricultural bank, except that it is entirely independent of official support. Various schemes for agricultural relief banks, for land improvement banks and for land improvement companies, which, in all cases, were to be regulated by the ordinary company law were placed before the Famine Commission of 1880. None of them met with the approval of the Commission but the idea of an agricultural bank was revived in 1882 by Sir William Wedderburn. Under his proposals there was to be, first, a liquidation of existing debts with the assistance of Government and then the establishment of a bank to take over the claims of Government under the liquidation scheme and to make further advances to the people. The bank, after taking over government claims, was to be entitled to recover its dues as land revenue on condition that, before recovery, the other methods available had been tried. The scheme was not approved by the Secretary of State who pointed out that, though it was nominally for the establishment of a private bank, it was for all practical purposes a scheme for a government institution. This scheme differed little in essentials from those which had been considered by the Famine Commission. The main features of all these schemes were that Government would provide funds for the clearance of debt and for

further finance and that, whilst the management of the banks would be in private hands, revenue officers would, in fact, if not in name, be officials of the bank and would be responsible for recommending and recovering loans. It was assumed that Government would subscribe largely to the share capital of the enterprise.

It will be seen that, if any of these schemes had come to fruition, most of the risk and the work would have fallen to the lot of Government whilst the part played by private enterprise would have been practically confined to the head office of the bank. The discussions on this subject led Government to revise their own machinery with the result that the Land Improvement Loans Act was passed in 1883 and the Agriculturists Loans Act in 1884. Although State funds and State officials play the prominent part in the working of the two Acts, these measures differ greatly from the previous schemes in that private management and any attempt at wholesale clearance of debt are entirely absent. The working of the two Acts is discussed in paragraphs 359 and 362 below.

EXPERIENCE IN EGYPT.

357. The ill-success which, from the point of view of promoting agricultural improvement and productiveness, has attended an enterprise which originally started on somewhat similar lines in Egypt, appears in no way to have damped the enthusiasm of those who favour the principle underlying the various schemes to which we refer in the preceding paragraph. The fortunes of the Agricultural Bank of Egypt are so instructive that we think it worth while to give a brief account of the origin and subsequent history of that institution. We are indebted for our facts to Mr. C. F. Strickland's "Studies in European Co-operation." In 1898, the National Bank of Egypt was founded under a concession on certain conditions, and one of its stated objects was to make advances to cultivators, with or without a mortgage, to meet the annual expenses of cultivation. In 1902, the sum of £400,000, or two-fifths of the bank's capital, was so employed. In the same year, the Agricultural Bank of Egypt was founded, and the agricultural loans in which the funds of the National Bank were at that date engaged were transferred to the new Agricultural Bank, the National Bank becoming interested in the new institution both financially and as regards management.

The concession under which the Agricultural Bank was founded provided that advances, known as 'A' loans, up to £20 each for a period not exceeding fifteen months, should be made to small farmers without mortgage security, while advances designated 'B' loans, not exceeding £300 each for not more than 5½ years, were to be made to small farmers against a first mortgage. The advance in the case of the 'B' loan was not to be more than half the value of the mortgaged land, while interest was limited to nine per cent and recoveries were to be made together with the government land tax by the official *sarrafs* (*patwaris* or village accountants) in return for a commission of one-half per cent paid by the bank. The Egyptian Government undertook to provide in any year such sum as might be necessary, after meeting all present claims

and exhausting the reserve fund, to make up a profit of three per cent on the capital invested in loans to small farmers. This advance represented a temporary loan without interest. In the case of the 'B' loans, the Government guaranteed interest at three-and-a-half per cent on £4¼ millions of bonds issued by the bank. The cultivators were quick to take advantage of these opportunities for abundant credit at moderate interest, and such was the demand that, in four years, the bank had advanced about £10 millions. But facile credit once again proved itself to be a grave danger to those unaccustomed to its enjoyment. The bank had not sufficient machinery to examine the suitability of applicants for loans, nor, indeed, did the duty of examining any security for loans lie with it. Over-borrowing, and the squandering in unproductive expenditure of the money borrowed, soon brought their accustomed penalties. Failure to repay was widespread, and the arrears overdue on the annual instalment rose, in 1912, to £337,000, or twenty-two per cent of the demand, and in 1913, to £368,000 or twenty-six and a half per cent of the demand. Heavy pressure by police and magistracy was exercised at an early stage in the collection of arrears, while from 1910 to 1913 a policy of foreclosure on the mortgage, with the sale of the land, was widely adopted against persistent defaulters. In 1911, the bank had in its own hands 1,185 acres of debtors' land, and in 1914, 2,256 acres, these areas being in addition to land sold through the courts, which amounted in the two years 1911 and 1914 to 686 and 890 acres respectively. The sum of these figures in each year amounted to about one per cent of the area held in mortgage by the bank. A situation of increasing seriousness had arisen. The weapon placed in the hands of the cultivator to enable him to defeat the usurious moneylender had proved itself to be two-edged. The business of the bank was operating in the direction of expropriating the small cultivating owner in favour of the larger landlord.

In 1912 the "five-feddan law" was passed, prohibiting the seizure in judicial proceedings of the land, dwelling house, or necessary agricultural stock and implements of a cultivator owning not more than five feddans.* In adopting this measure, Egypt was following the example of the Punjab Alienation of Land Act, and of similar legislation in the United States of America, France and some other European countries. This measure at once affected the business of the Agricultural Bank of Egypt, for, though 'A' loans, without mortgage, could still be advanced to a cultivator owning five feddans or less, his land which previously, even in the case of 'A' loans, had constituted the final security for the advance, could no longer be seized in execution; while a mortgage, or 'B' loan, though not illegal, was of little value where it could not be enforced. To meet this situation, the Government approved the raising of the maximum limit for 'B' mortgage loans from £300 to £1,000, and that of 'A' loans from £20 to £200, the term for 'B' loans being extended from 5½ to 20 years. The dealings of the bank with "five-feddan cultivators" had naturally declined, and, in 1923, the 'A' loans given out amounted

* The Egyptian feddan is equivalent to 1·038 acres.

to £9,600 (including loans to persons owning more than five feddans), while 'B' loans granted in the same year were £93,000. The advances in that year under both types of loan amounted to less than one-twelfth of the 1912 total. The change in the nature of the business carried on by the Agricultural Bank of Egypt had in no way prejudiced its financial stability. But from the point of view of providing small cultivators with loans carrying interest at moderate rates, it had definitely proved itself to be a failure. The history of the institution provides a wholesome corrective to the views of those who hold that the problems of rural debt are to be solved at a stroke by the provision of cheap and abundant credit. In fact, cheap credit is a blessing to a rural population only where the average cultivator is possessed of the knowledge and strength of character required to induce him, on the one hand, to limit his borrowing within the range of his capacity to repay, and on the other, to apply the greater part of the borrowed money to sound productive purposes. To lavish easy credit on those unaccustomed to its proper use is to condemn the borrowers to certain financial destruction. The provision of facilities for cheap credit must, at the outset, bring new temptations as well as extended opportunities. Those only can hope to profit by its opportunities who have learned to resist its temptations.

FIXED CAPITAL.
(*iii*) THE CAPITALIST AND THE LANDLORD.

358. Instances occur of the improvement of land being undertaken by capitalists who, though not themselves owners of the land, receive in return a permanent right to share in the produce. Thus we understand that it is common in the south-west Punjab for members of the Arora tribe to undertake the construction of wells, at their own expense, in the lands of cultivators who undertake to give them a definite share annually in the produce of the land irrigated. In the Punjab, there are also several canals privately owned by zamindars who give water to other cultivators for irrigation, on the understanding that they are to receive a certain share—usually one-fourth—of the produce. Far more common in every province is the extensive acquisition of landholder's rights by money-lenders and other capitalists. The transfer too often reduces the status of the ancestral holder to that of a tenant. There would be less objection to this if it resulted in the investment of any considerable sum in land improvement but this seldom happens. The new landlord is, as a rule, inclined to rest satisfied with his acquisition and, even more than the older type, looks only to the rent he can collect. The complaint that the larger landlords do little for the development of their estates on modern scientific lines is a very general one and the honourable exceptions to be found in every province are too few in number to do more than throw into relief the apathy of the majority. In their defence, it may be pleaded with some truth that, in some provinces, the system of tenure or the tenancy law restrains them from obtaining unrestricted possession of a compact area and, in others, prevents them from securing a full and fair return from the proceeds of their enterprise. Questions of tenure have been expressly excluded from our terms of reference but we would suggest that, where

existing systems of tenure or tenancy laws operate in such a way as to deter landlords who are willing to do so from investing capital in the improvement of their land, the subject should receive careful consideration with a view to the enactment of such amendments as may be calculated to remove the difficulties. We make this suggestion as it is from the bigger landlords only that the inauguration of improvements beyond the financial capacity of their tenants or of small holders can come. The sinking of wells, especially of tube wells, the construction of minor canals and other irrigation works, and of projects designed to protect land against floods or to drain off harmful water, and the introduction of power plant for cane-crushing or threshing may be mentioned as possible lines of profitable activity. Other directions in which large landlords can use their financial resources for the benefit of their estates and of their neighbours are the establishment of home farms and their management on modern scientific lines, the cultivation of special areas as seed farms for supplying the needs of their tenantry and the breeding and maintaining of pure line herds of stock. If, as the result of increasing interest in agricultural development, any desire to undertake work of this character becomes evident, we consider that legal obstacles should be removed and replaced, where necessary, by legislative encouragement. From the evidence we received, action to permit of the establishment of home farms appears specially necessary. This has been recognised in the Agra Tenancy Act of 1926, under the provisions of which a landlord may apply to the Collector to acquire for him land held by an ex-proprietary or occupancy tenant for the purpose of farming on improved lines. He may similarly apply for the acquisition of land held by a statutory tenant or the heir of a statutory tenant not only for this purpose but for various other purposes connected with the development of his estate. In all legislation of this character, we think it desirable that a reasonable maximum should be fixed for the area which can be acquired for the landlord for purposes we have in view.

The benefits to the country which the larger landlords can bestow are facilitated by their ready command of financial assistance. Joint stock banks in India are usually willing to advance funds to them on a first mortgage; courts of wards frequently have funds seeking investment; *taccavi* is available and, in time, co-operative land mortgage banks should prove of value to them.

Apart from direct expenditure on the improvements discussed above, there is a large field of useful activity open to enterprising landlords in financing the adoption of progressive methods by their tenantry. Without any desire to engage in moneylending, many of them assist their tenantry in a number of ways and they should be actively encouraged to stimulate the interest of those who hold land under them in the value of improved seed, implements and stock. The reply that the increasing prosperity of the tenants which may result therefrom would not be reflected in any increase in the income of the landlord is difficult to counter but, where the existing tenancy law imposes obstacles to progress which were not contemplated by its framers, the case for review gathers force.

FIXED CAPITAL.
(iv) THE LAND IMPROVEMENT LOANS ACT.

359. The conditions which brought about the enactment of the Land Improvement Loans Act have already been described. The Act is mainly an enabling Act which permits direct loans from the State and which leaves to provincial governments the framing of rules suitable to local conditions. Such rules have been framed in all provinces and have repeatedly come under review as experience of their working has disclosed defects or suggested improvements. The system was adversely criticised in some respects by several witnesses before us but there was a considerable body of well informed opinion which held that the retention of the rules in their present form is desirable in the best interest of the borrower. Changes in the direction of further simplification or greater elasticity would increase the temptation to unwise borrowing, whilst careful scrutiny of the security offered, supervision to ensure that the loan is actually expended on the improvement for which it is granted, and insistence on regular recoveries are all necessary if the ability of the borrower to repay is to be maintained. The rate of interest is fixed in relation to that at which public loans can be floated and cannot, therefore, be reduced without involving the public finances in loss. Having regard to the character of most of the improvements for which loans are granted, the period fixed for repayment does not appear too short and an extension would enhance the total interest charges without appreciably reducing the annual repayment of principal; moreover, if the recovery of a loan is unduly delayed, the borrower is apt to forget the benefits received and to regard the annual instalments as a grievance.

Delay in dealing with applications is a frequent cause of complaint but some delay is inevitable where enquiries have to be made into the prospects of the improvement and into the nature of the interest in land which is offered as security for the loan. Local governments appear to be fully alive to such defects as exist in the rules and to be ready to adopt remedies. In these circumstances we have no recommendations to make for improvement in the Act, the rules framed under it, or the manner in which it is administered except that stricter supervision might be exercised to prevent the leakage to which, judging from the evidence before us, some loans are at times subject. It has been suggested that many landholders are still unaware of the facilities offered by the Act, especially for the construction of small irrigation works. In Chapter X, we have recommended the formation of a special agency to deal with the investigation and construction of minor irrigation works and have suggested that this agency should not wait for the cultivator to consult it but should go to him and urge him to adopt the scheme best calculated to utilise his available water supply to the fullest advantage. It would be part of its duties to bring to the notice of the cultivator the fact that the Land Improvement Loans Act offers him a ready means of financing improvements of this character.

The obvious alternative to a system of loans from the State is the land mortgage bank but, as we consider that this is best founded on a co-operative basis, we reserve discussion of it until the next chapter. Here

we would state that we agree with those witnesses who suggested that part at least of the allotment under the Land Improvement Loans Act should be placed at the disposal of the land mortgage banks where these are firmly established, provided that steps are taken to ensure its utilisation on objects which fall within the scope of the Act.

FIXED CAPITAL. (r) MISCELLANEOUS.

360. Before we leave the subject of fixed capital for land improvements, it seems desirable to discuss certain common misconceptions which were reflected in the evidence we received. Speaking generally, we consider that what is lacking is not so much capital for land improvement as ideas for utilising it for productive purposes. In no province did it appear that the work of improvement was in any way restricted by shortage of funds for loans under the Land Improvement Loans Act. Local governments are everywhere willing to make a larger provision for this purpose if there is a real demand for it for productive works. There seems no reason to believe that the village moneylender hesitates to advance funds for such objects. The security for long-term loans of this character is usually a mortgage on cultivated lands and there is ample evidence that the total sum invested in such mortgages is many times that part of it which has been used for land improvement. Such limited experience of land mortgage banks as is available suggests that the loans taken from such banks are much less frequently used for land improvement than they are for the redemption of old debts. This, we were told, was also the experience of Dawson's Bank in Burma. Such demand as exists for long-term loans arises, in present conditions, far more from the desire to get better terms for old debts than from any wish to increase the productive capacity of the land. Why the pace of improvement is so slow, why more wells are not being sunk in areas in which they are known to be profitable, or, to put it differently, why the wells sunk last year were not sunk five or fifteen years ago, are questions which call for careful enquiry. An enquiry of this kind would throw valuable light on the difficulties which prevent the initiation and carrying out of improvements. In Chapter IV, we have suggested an examination of the question whether schemes for preventing soil erosion should be financed by co-operative effort or by loans to individual cultivators under the Land Improvement Loans Act, and, in Chapter X, we have proposed the appointment of a special staff to survey the possibilities of small productive irrigation works. It is doubtful if more can usefully be done at this stage.

CAPITAL FOR CURRENT NEEDS.

361. There is at present no real difference in the machinery which provides long-term and that which provides short-term credit in India. It is the village moneylender who furnishes the bulk of the funds required in both cases and, as we have seen, he is not interested in distinguishing between the objects to which these funds are applied. A distinction between long and short-term credit is, however, made in the Acts which regulate the grant of loans by the State and we hope that, in future, the co-operative movement

will be able to separate the two types into land mortgage and village society business. The supply of short-term credit by the village money-lender is so bound up with the vexed question of indebtedness that we shall deal with it under that head. The State system is discussed in the following paragraph. The part played by the big landlord has already been mentioned. Although an estimate of the annual requirements of the cultivators of India for funds to meet the costs of cultivation would undoubtedly reach a very high figure, it would give a misleading impression as so large a proportion of the costs do not appear as cash at all. The labour of the cultivator and his family and of most of the hired help is met from the harvest. Seed is similarly kept over from the previous crop and cattle are mainly fed on the produce of the holding or on what they can forage for themselves. Crops such as sugarcane which require actual financial outlay are grown on a comparatively small scale. The purchase of cattle is probably the largest single item in the cultivator's balance sheet, so great is the loss from disease. The demand for marketing credit is likely to increase as marketing facilities improve, and as the cultivator attains to a wider knowledge of the selling side of his business. Production of agricultural commodities is essentially intermittent and seasonal while consumption is relatively regular. The object of marketing credit is to enable the farmer to exercise his judgment as to when to sell. It thus tends to prevent producers in the aggregate from creating a bad market at certain seasons of the year.

The co-operative sale society, if properly organised, would prove an ideal source of marketing credit, and the loan and sale societies in Madras which store produce in godowns appear to be establishing a valuable link with commercial banks for this purpose. For the small cultivator, the necessity to sell shortly after harvest can be removed by organised thrift such as is provided by the share or compulsory deposit systems in village credit societies; the experience of such societies seems to indicate that the exercise of thrift for ten years or so would enable most cultivators to dispense to a very large extent with the necessity for borrowing for current agricultural needs.

THE AGRICULTURISTS LOANS ACT.

362. The Agriculturists Loans Act, like the Land Improvement Loans Act, is mainly an enabling Act which empowers local governments to advance loans from State funds and to frame rules governing the issue of such loans. The grant of loans is restricted to the owners and occupiers of arable land and the purposes of the loans to the relief of distress, the purchase of seed or cattle, and any other purpose not specified in the Land Improvement Loans Act but connected with agricultural objects. Since the Act came into force, it has proved of immense value in times of distress, whether arising from drought, flood, epidemic or earthquake, and is a potent weapon in the hands of any local government called upon to deal with a sudden emergency which requires the immediate issue of capital for current needs. The rules have repeatedly come under revision and are now as elastic as the interests of both

borrower and lender permit. Further elasticity would probably make abuses easier without materially assisting the cultivator. In times of distress, it is usual to appoint a special officer who tours the affected tract and disburses loans on the spot. In normal times, the routine is apt to be more lengthy, and delays and difficulties may occur. The rate of interest charged is as low as the cost of the service permits and, while there is little or no profit to the State from the difference between the rate at which it raises the funds required and that at which it lends them, unless there is a succession of bad years, there is usually little loss through failure to recover loans. The rigidity of recovery is sometimes the subject of complaint, but it is not in the real interests of the cultivator that he should be permitted to delay the repayment, beyond the harvest, of a loan taken for seed, fodder or fertilisers, nor is it wise to allow too long a period for the repayment of a loan taken for the purchase of cattle which may be carried off by disease before the debt is repaid. No system of government loans can ever be as elastic as that of the moneylender; the tactics pursued by one who too often desires to keep his client in debt should not be held up as a model to a State which desires to see the cultivator free.

The operation of the Act is not confined to occasions of distress, but there is considerable evidence in favour of the adoption of this course in practice. It is argued that, in normal times, the system of government loans is inimical to the growth of a healthy spirit of self-help; that it runs counter to the teaching of co-operation and that it leads to demoralisation inasmuch as a beneficent Government is expected to, and does, remit the loan, should severe distress continue, and this a co-operative society cannot afford to do. It is further pointed out that Government can never find the whole sum required to finance normal agricultural operations, and that, therefore, their attempt to find a part of it merely leads to anomalies. The policy adopted in Bombay is to confine loans under the Act to backward districts and to tracts in which credit is weak owing to the restrictive tenure of land or other special reasons. In the Punjab, the Act is freely used outside the canal colonies, but this is probably because, outside those fortunate areas, conditions are nearly always precarious. In Bengal, on the other hand, the Act appears to be almost a dead letter except in periods of scarcity. The view was also taken in Madras that it should only be brought into operation in times of exceptional calamity or distress, but as there are large tracts in that presidency which are liable to suffer from defective distribution of rainfall, the occasions which arise for using the Act are numerous. The experience of other provinces is very similar. The Act can never be the means for meeting all the normal requirements of agriculture; but is of great value in certain contingencies. It is being gradually displaced by the co-operative credit system which already provides far more capital annually than Government. We hold that, until the co-operative movement has reached a much more advanced stage of development, the system of government loans must continue. Where a situation arises which is beyond the capacity of the co-operative movement to meet, local governments can and do grant loans to co-operative societies or through

the societies to their members. We are of opinion that when, owing to the prolongation of distress, Government remit loans granted direct to cultivators, they should at the same time give careful consideration to the desirability of extending similar concessions in regard to loans issued to co-operative societies and their members, and should avoid any action which might suggest that the members of such societies are penalised by being accorded less generous treatment than others. Such cases are so exceptional that each must be dealt with on its merits.

On the whole, we are satisfied with the working of the Act. Local governments and their officers are keenly alive to its value and also to the necessity for careful supervision of its working in order to prevent abuses. The differences of opinion as to the circumstances in which it should be used are in the main, a reflection of the varying character of the monsoon: given a definite situation, there would probably be little difference of opinion as to the suitability of using the Act. We are of opinion that the Act must remain on the Statute Book until the spread of thrift or of co-operative credit or of both renders it obsolete.

INDEBTEDNESS.

363. In discussions on indebtedness, the various factors involved are not always sufficiently distinguished. The debtor may borrow because he has some need to satisfy or because he has credit and cannot resist the numerous temptations to enjoy its use. It is not borrowing, however, that leads to debt but failure to repay and for this there may be reasons quite distinct from those which led to the borrowing. The lender lends primarily for his own profit; the extent to which he lends depends partly upon the security of the borrower and partly upon the amount of cash he may have lying idle in his hands. Whether he presses for repayment of the principal or remains satisfied with the punctual receipt of interest ordinarily depends upon his judgment of several elements in his business. The credit of the borrower may be good or it may be deteriorating; his own unused balance may be increasing; he may know of a better investment for his money; or he may see in his client's need an opportunity for gaining a stronger hold on his assets. Or it may even be that the firm from which he has himself raised a loan is pressing for an instalment. The two factors, the importance of which is least recognised in current discussions on the subject, are that the moneylender must live by moneylending and that, as his profits accumulate, he must extend his investments. The borrower only represents one side of the transaction. Throughout recorded history, he appears to have existed and to have been in need of protection from the usurer. The references best known to Christians are to be found in the Bible, to Muhammadans in the Koran and to Hindus in the laws of Manu. The problem is thus one of the oldest that have troubled administrators in the East or the West; for generations past, it has received the continuous and anxious consideration of the Government of India. Every suggestion that has promised success has been carefully examined and many have taken concrete form in legislative or executive measures.

The predisposing causes which lead to debt are now well understood; the maintenance of law and order, the defining and recording of rights in land, the continuous reduction in the proportion borne by the land revenue demand to the produce, the rise in the value of that produce and the growth of transferable rights in land have all contributed to enhance the credit of the landholder. The rapid development of commerce and trade, the introduction of established law and permanent civil courts and the enactment of such measures as the Contract Act have strengthened the position of the moneylender. His capital has been swelled by the accumulating profits of his business which has been extended by his own thrift and intelligence. The general expansion of credit has provided scope for the investment of his savings and has averted that competition from his fellows which might otherwise have forced down the rate of interest. Throughout these developments, the cultivator has continued, in the main, illiterate; he keeps no accounts and makes no distinction between sums expended on the needs of his industry and those expended on the requirements of himself and his family. For generations he has been accustomed to a ceaseless struggle to extort a bare livelihood from an insufficient holding, and has been subject to disaster from drought, flood or epidemic. Causes which he seldom understands and cannot influence have endowed him with credit which he did not formerly possess, and he has found it difficult to resist the temptation to relieve present necessities by mortgaging his future income and even his capital.

There are other factors. Amongst the comparatively poor, where the habit of saving is not strong, the longer the interval between the successive receipts of the return for labour, the more difficult it becomes to avoid borrowing. If wages were paid monthly instead of weekly, only a very small proportion of the working classes in the world could exist without credit; but the cultivator has to wait for half a year before he receives the return of his labour, and in far too large an area, where there is only one crop a year, the interval between successive receipts may be full twelve months.

Knowledge of rural indebtedness has steadily increased as the subject has again and again come under survey. The annual reports on co-operation have contributed much information of value; village surveys in different provinces have thrown light on the details, whilst, in one province, the material has been carefully collected and thoughtfully treated by Mr. M. L. Darling, I.C.S., whose book on "The Punjab Peasant in Prosperity and Debt"* is deserving of wide attention. The evidence we received indicated that his general conclusions apply to an area far beyond the confines of a single province and the publication of his book renders much detailed description unnecessary.

Of the measures adopted to meet the evils of indebtedness, some have aimed at removing the need for borrowing by reducing the land revenue and making its collection more elastic, or by popularising the government system of loans to agriculturists; others have been directed against the excess of credit and have protected the property of the cultivator from

* Published by the Oxford University Press, 1925.

attachment and sale in execution of decrees or have limited the extent to which his land can be pledged as security for loans. For some areas, even stronger measures have been considered desirable and restrictions have been imposed upon the sale and mortgage of agricultural land and on the extent to which unpledged land and its produce can be made liable for unsecured debts. More recently, the power of the moneylender has been directly attacked. The Usurious Loans Act, 1918, gives wide powers to courts to interfere of their own motion wherever they consider that the terms of a loan are usurious, while the Co-operative Societies Act, 1912, has facilitated the introduction of village credit societies on the Raiffeisen model to replace the moneylender as a source of credit.

That the position of the moneylender should have been undermined to so small an extent by the centuries of effort to control him sufficiently illustrates the difficulty of the problem. In the present state of India, he is a necessity and, that being so, his calling will not be abolished by making it illegal. He alone is in a position to provide the bulk of the capital required for current agricultural needs and, on a recurrence of severe distress, he will continue, as in the past, to support the people by timely loans. If he is ever driven from the land, it will not be by legislation but by the growth of the co-operative movement and, more especially, by the habits of thrift inculcated by that movement. Where thrift is absent, the vagaries of the monsoon drive the people to borrow and, unless the co-operative movement spreads into every village and includes every inhabitant in its fold, borrowing will continue. No one denies the services rendered by the moneylender; the charge against him is that these services are rendered at too great a price and are accompanied by practices which result in great evils. The system is usurious; the ready lending for unproductive purposes leads to poverty and economic servitude; the steady absorption of rights in land places the moneylender in a position of uncontrolled power, and uncontrolled power is almost invariably abused. To a very great extent, the cultivator in India labours not for profit nor for a net return, but for subsistence. The crowding of the people on the land, the lack of alternative means of securing a living, the difficulty of finding any avenue of escape and the early age at which a man is burdened with dependents, combine to force the cultivator to grow food wherever he can and on whatever terms he can. Where his land has passed into the possession of his creditor, no legislation will serve his need; no tenancy law will protect him; for food he needs land and for land he must plead before a creditor to whom he probably already owes more than the total value of the whole of his assets. That creditor is too often a landlord of a different class who has no natural or historical connection with his estate and is only interested in the immediate exploitation of the property in his control.

However perfect the judicial system may be and however good his case, money can wear out the impoverished litigant. Every report on the administration of civil justice bears witness to the volume of unsatisfied decrees against cultivators. Of the extreme to which economic servitude can extend, where the moneylender's grip is strong, two instances may

be given. In Bihar and Orissa, we were told of a system known as *kamiauti* which prevails in the north of the Hazaribagh district and in the Palamau district of Chota Nagpur and in some parts of Bihar, and which is practically one of cultivation by serfs. "*Kamias* are bound servants of their masters ; in return for a loan received, they bind themselves to perform whatever menial services are required of them in lieu of the interest due on the loan. Landlords employing labour for the cultivation of their private land prefer to have a first call on the labourers they require, and hence the practice arose of binding the labourers by means of an advance, given conditionally upon their services remaining always at the call of the landlord for the purposes of agriculture. Such labourers get a daily wage in kind for those days on which they work for their creditor, and may work for anybody else when they are not required by him. In practice, the system leads to absolute degradation of the *kamias*. In the first place, the *kamia* cannot bargain about his wages ; he must accept the wage that is customary for landlords to give to his class. The wages represent only one-third of the day's wage for free labour hired, for example, by a contractor for road repair work. If the *kamia's* wife also works for his master, she receives a slightly smaller remuneration ; and their joint wages are not sufficient to feed properly themselves and the normal family of children they are certain to possess. The *kamia* never sees any money, unless it be the occasional few pice he may earn in his spare time. Consequently, he has no chance of ever repaying the principal of his debt and becoming a free man again. A *kamiauti* bond therefore involves a life sentence.

The condition becomes hereditary. Although the son is not responsible for his father's debt after his death, a new debt is always contracted on behalf of the son on the occasion of his marriage, which renders him also a *kamia* for life. Daily work is not guaranteed by the master, and no food is supplied when there is no work to be done. The result is that the master takes the *kamia's* labour at a sweated wage for most of the year, but at a time when there is no agricultural work to be done and the *kamia* has least chance of getting any daily employment elsewhere, he is left to shift for himself as best he can. He is even free to get work wherever he can, but cannot leave his village for any time in search of it, for fear that he might abscond. Actually, he is reduced to earning the most miserable existence by collecting fuel and grass for sale. The restriction of his movements renders the *kamia* nothing better than a slave. An absconding *kamia* is unable to find an asylum in any part of the area where the system is prevalent. The sale and purchase of *kamias* is by no means uncommon in the north-west of the district. The price is the amount of the *kamia's* debt."*

The Bihar and Orissa Kamiauti Agreements Act was passed in 1920 to deal with this evil. Under this Act, a *kamiauti* agreement is declared void if the period during which the labour is to be performed exceeds one year, if the agreement does not provide for the extinction of all liability after the expiry of that period in respect of any advance or debt, and

* Final Report on the Survey and Settlement Operations in the District of Hazaribagh (1908—1915) by Mr. J. D. Sifton, I.C.S.

if it fails to provide for a fair and equitable rate of remuneration. It would, however, appear that the *kamia* is too poor to set the law in motion and that the Act has proved ineffective. The local Government announced their intention to adopt additional measures should the Act fail in its object, but so far nothing has been done.

The second example of economic servitude is taken from the small industries where artisans in certain trades work for life for capitalists to whom they are indebted. The capitalist advances raw material, lends money for food and receives the manufactured article for sale. The debt is practically irredeemable and the artisan is transferred from capitalist to capitalist in a manner which practically amounts to sale and purchase. He has thus no incentive to increase his skill or efficiency, as any increased earnings are merely set off against his debt.

The examples we have given illustrate the worst effects of unchecked money power. In both instances, the most serious factor is the hereditary element and the consequent state of helplessness to which the poorer classes are reduced when burdened with a load of hereditary debt far beyond their power to redeem. The crushing burden of hereditary debt remains largely through ignorance of the legal position which is that no personal liability is transmitted and that no suit lies against the heirs of a deceased debtor except to the extent to which the property of the deceased has come into their hands by survivorship or succession. The experience of the co-operative movement is the same. It is that the people are so accustomed to be in debt, to take it over from their fathers and to pass it on to their sons, that they accept indebtedness as a settled fact, and a natural state of life.

So much is this the case that well-meant attempts to give them a fresh start by wholesale redemption of old debts have proved unsuccessful. Where co-operative societies have advanced enough to repay all the claims of moneylenders, the debtor fails to make the effort to pay regular instalments even when they are well within his capacity, and slips back into the old state of bondage. It is now generally accepted that such attempts should not be made by co-operative societies until the debtor has learned habits of punctuality and thrift. The evidence we received from Dawson's Bank showed that the authorities of that bank had also found that, once a man has obtained more favourable terms by the transfer of his debt to a less exacting institution, the tendency is for him to default in his instalments. The idea that debt is a voluntary condition in which no man need remain is to many something of a novelty. Careful enquirers have long come to the conclusion that the main cause of the debt of to-day is the debt of yesterday and that the chief obstacle in the way of relief is the attitude of the poorer classes towards this customary feature of life.

The inevitability of indebtedness, as it seems to the people, gives the moneylender enormous power. It produces an almost fatalistic acceptance of the steady transfer of land into his possession and leaves his paramount position unchallenged. From the Punjab alone was any definite evidence forthcoming of any decline in rural moneylending business resulting from the growth of co-operative credit, and yet, although the

cultivators of that province probably enjoy a higher average standard of prosperity than they do elsewhere, rural moneylending still ranks second in its yield of income-tax and super-tax.

Turning now to the future, we have no hesitation in recording our belief that the greatest hope for the salvation of the rural masses from their crushing burden of debt rests in the growth and spread of a healthy and well-organised co-operative movement based upon the careful education and systematic training of the villagers themselves. Co-operation will be dealt with at length in the next chapter but here we would state our view that, apart altogether from the question of debt, co-operative credit provides the only satisfactory means of financing agriculture on sound lines. Thrift must be encouraged by every legitimate means, for the savings resulting from the thrift of the cultivating classes form the best basis of the capital they require. If the rural community is to be contented, happy and prosperous, local governments must regard the co-operative movement as deserving all the encouragement which it lies within their powers to give.

FAILURE OF LEGISLATION.

364. The importance of the co-operative movement is accentuated by the comparative failure of legislative measures designed to deal with the problem of indebtedness to achieve their objects. We received evidence in Burma that the provisions of the Civil Procedure Code exempting the cattle, implements and produce of agriculturists from sale may be ignored by the courts. We have mentioned that the Kamiauti Agreements Act in Bihar and Orissa has proved ineffective. The provisions of the Deccan Agriculturists' Relief Act are being evaded and the Usurious Loans Act is practically a dead letter in every province in India. The working of the latter Act is discussed in the following paragraph. The history of the Deccan Agriculturists' Relief Act throws so much light on the problems discussed in this chapter that a brief description of the chief provisions of the Act, and of the results of the enquiries which have been made from time to time into its operation, seems called for. The Act, which was passed by the Government of India in 1879 after severe agrarian riots had taken place in the Deccan, laid down that, in suits by or against agriculturists, it is open to the court to examine the history of the debt and to make out an account of the money actually due. The court, in taking an account of past transactions, can reduce unreasonable interest but is precluded from arresting in execution and from selling land unless it is specifically pledged. Land can, however, be taken for management by the Collector for a period of seven years. The Act included provisions under which an agriculturist owing over Rs. 50 could be declared an insolvent on his own application and also for the appointment of conciliators. Arrangements were made for the appointment of village registrars and it was prescribed that all instruments executed by agriculturists must be executed in the presence of these registrars. There were further provisions requiring creditors to furnish accounts and grant receipts and also prescribing that mortgages by agriculturists should be in writing. In the hope that litigation would be reduced, the period of

limitation which, since 1859, had been for three years only was extended for suits against agriculturists to a period of twelve years if the suit was based on a registered deed, and to a period of six years if it was not. The Act, as passed, was applicable only to the four districts which constituted the Deccan tract of the Bombay Presidency. It was slightly amended in 1881 and 1882, mainly with a view to allow debtors to be declared insolvent on the motion of the court. In 1884, a special report on its working was submitted by the Government of Bombay. That Government considered that, on the whole, the Act had been successful but that there had been difficulties in executing decrees owing to the large exemptions in favour of agriculturists, that the management by Collectors, of attached land had proved a failure and that no practical use had been made of the insolvency provisions. As a result, the Act was again amended in 1886, partly with the object of rendering standing crops liable to attachment and of altering the term of limitation in some details, and partly with the object of making it possible for the local Government, with the sanction of the Government of India, to extend the operations of the Act in whole or in part throughout the Bombay Presidency. The Commission which enquired into the working of the Act in 1891-92, recommended a number of alterations not only in the Act itself but also in the Code of Civil Procedure and the Contract and Evidence Acts. It also proposed that a general Act should be prepared for the whole of India which should be based to a large extent on the provisions of the Deccan Act. The Government of India, however, rejected this advice but passed an amending Act in 1895 which carried out certain minor changes including the restoration of the exemption of standing crops from attachment, and the extension of the power to fix reasonable interest. The Act was again amended in 1907, when a provision was inserted by which wider powers were given to the courts to go behind the bond and determine the nature of the transaction independently of the provisions of the law regarding documentary evidence. Minor amendments were also effected in 1912 and 1920. Advantage has been taken of the power given by the Act of 1886 to extend its operations, and the bulk of the Act, with the exception of the insolvency provisions, is now applicable throughout the Bombay Presidency.

As to the manner in which the Act had fulfilled its objects, the Commission of 1892 held that one great effect had undoubtedly been to make professional moneylenders more cautious in advancing money except on the security of land, and agriculturists more reluctant to borrow where security of land was required. The data on which this assumption was based were, however, examined by the Government of India who held it difficult to avoid the conclusion that there had been a serious increase of debt in the districts affected and that each year a larger proportion of that debt became a burden on the land. The opinion of the Famine Commission of 1900 was that the Act had done but little good and that there was positive room for holding that the transfer of property both by sale and mortgage had become more frequent in the districts to which it applied. The conclusions of the Commission which reported on the

subject in 1912 were even more unfavourable. They were summarised as follows :—" It is a contest of dishonesty, in which that side is likely to gain the upper hand which is prepared to go furthest in perjury and in the production of false evidence. Witness after witness has testified to this demoralisation. Distrust has been engendered on both sides. The honest *sowcar* and honest cultivator suffer alike, since in their dealings with one another they have to allow for the judgment of a court which will presume dishonesty on both sides. Hence it is that an Act whose main object was to put the relations between agriculturists and moneylenders on a better footing, is actually having an opposite effect."

The Commission recommended that the whole Act should be replaced by a short Act which would embody, with some additions and alterations, such portions of the old Act as experience had shown to be useful. The Government of Bombay approved the proposal, but the Government of India were opposed to the perpetuation, by a fresh enactment, of the principles of the Act of 1879. Another Committee was, therefore, appointed in 1920, which reported that the condition of the agriculturists in the presidency was no longer such as to require special legislation. The Government of Bombay, therefore, suggested the repeal of the Act after three years, provided the Usurious Loans Act was amended, mainly in the direction of giving the debtor the right to sue for redemption. The Act was not, however, amended in the manner proposed till 1926.

The examination of the working of the Deccan Agriculturists' Relief Act and that of the other legislation to which we have referred above brings out the extraordinary difficulty of attaining the objects in view by means of legislation. Quite apart from the provisions of the law, it would appear that the procedure which the civil courts have to follow is too cumbrous and expensive for debtors belonging to the cultivating classes. We have considered whether revenue courts would not be a more suitable agency than the civil courts. In paragraph 354, we have already pointed out the use which is made of revenue officers in the administration of the Punjab Redemption of Mortgages Act and the Punjab Alienation of Land Act. In the paragraph immediately following, we suggest a wider application of the Usurious Loans Act and, in paragraph 366, a Moneylenders' Act, but the solution of the problem of indebtedness is only to be found in the cumulative effect of the spread of literacy and in the co-operative movement.

THE USURIOUS LOANS ACT.

365. An important feature of the Usurious Loans Act of 1918 is that the court, once seized of a case, may, of its own motion, re-open old transactions and enquire into the equity of the terms. As mentioned above, the Act was amended in 1926 to include cases in which either party to a mortgage seeks relief. Where the debt is unsecured, the debtor can draw the creditor into court and, therefore, into the sphere of this Act, by the simple expedient of refusing to renew his loan. The evidence we received showed conclusively that the Act is practically a dead letter in all provinces, but as we heard on evidence from civil judges, we are not in a position to offer

an opinion as to the reasons why so little use has been made of its provisions. We, therefore, recommend that in every province an enquiry should be made into the causes of the failure to utilise the Act, that adequate steps should be taken to ensure its application in future and that a special report on its working should be included in the annual reports on the administration of civil justice. We consider that our recommendations under this head are warranted by the potential importance of this Act. If its provisions were fully utilised, this would go far to relieve the country of some of the worst evils of uncontrolled usury and would facilitate remedial action by co-operative societies. The fact that in some provinces the rule of *damdupat* is in force has been advanced before us as an excuse for the neglect of this Act, but this ancient principle of Hindu law merely provides that, in passing a decree for principal and interest, the court shall not allow interest in excess of the amount of the principal when the claim is made. No consideration need be paid to the amount paid on account of interest during the currency of the loan, nor whether the rate is usurious, nor whether the total sum paid to the lender does or does not represent a fair repayment of both principal and interest. It protects the interests of the Hindu debtors only, regardless of the religion of the creditor, but denies a similar protection to non-Hindu debtors even though the creditor be a Hindu.

366. The Punjab Legislative Council recently passed a private Bill designed to control the operations of moneylenders in that province by enforcing the use of regular books of account and by insisting that the borrower should receive copies of all entries relating to transactions between him and the moneylender. Owing to defects in drafting, the Bill was, however, disallowed by the Governor but the Government undertook to introduce another Bill on the same lines but in an improved form. The Bill has aroused interest in other provinces but it is not possible to offer an opinion as to the manner in which it would work.

MONEYLENDERS' ACTS.

During the course of our sittings, the British Parliament has passed an Act, the Moneylenders' Act of 1927, which embodies some new factors in the battle against usury. It provides *inter alia* that all moneylenders shall take out a license, that compound interest shall be prohibited and that the moneylender shall, on demand by the borrower, supply information relating to the state of the loan and also copies of documents relating thereto. We would commend the principles underlying the Punjab Bill and the British Act to the consideration of local governments.

We do not share a common apprehension that enactments of this character will lead to so great a restriction of credit that the cultivator will be hampered in his ordinary agricultural operations. In the first place, the co-operative movement is introducing a sound system of controlled credit and, in the second, it must be remembered that the capital now invested in moneylending must find a use. The moneylender has survived more drastic measures and will survive again. His profits

may diminish, his power may decline but, for many years to come, there will still remain a wide field for honest business in supplying the legitimate needs of agricultural operations. If some of the capital, now misused to finance extravagance, is diverted to the development of industries, many problems of the country-side will be brought nearer solution.

RURAL INSOLVENCY.

367. From the reports on the co-operative movement, as well as from other and older sources, it is clear that a serious obstacle to the clearance of indebtedness is the existence of a large volume of inherited debt. On the death of an individual, it is not the custom for his assets to be realised and to meet the debts in such proportion as may prove practicable, the remainder being thereby rendered irrecoverable, but such property as he may die possessed of passes to his heirs who also shoulder his debts. In the result, accumulations of compound interest swell the total burden. We have already pointed out that, in law, the debts of a deceased person only pass to his heirs when they succeed at the death of the debtor to property and that they pass only to the extent of such property. Where no assets pass, no debts are inherited. We are informed, however, that it is a common practice for a money-lender, who has no remedy by law, to approach the son or some other relative of the deceased and, putting the matter on the grounds of legal obligation or religious duty, to induce such son or relative to execute a promissory note. The force of tradition is such that the son or relative regards the debt as a debt of honour. Having executed the promissory note, he feels himself obliged to pay and, even if the matter is taken to a civil court, will rather admit receipt of a consideration which was never received than run the risk of being thought to dishonour his father or relative. We are strongly of opinion that all who are working for the uplift of the rural community, and especially all workers in the co-operative movement, should do their best to free the poor and ignorant from this burden and, in particular, to instruct them that, in such cases, the court is empowered to give them relief.

Relief from debt, whether inherited or incurred by the individual himself, can be sought in the provisions of the Provincial Insolvency Act but those provisions are of little benefit to agriculturists, partly because they cannot be utilised except in cases of indebtedness amounting to Rs. 500, and partly because the courts are disinclined to allow the benefits of the Act to landholders whose rights are protected from sale in execution, on the ground that such persons are not insolvent within the meaning of the Act. The second point has been dealt with by the Civil Justice Committee in Chapter 14 of their Report, and we support their conclusion that the insolvency law requires special adaptation to land tenures and especially to the case of non-transferable holdings. We recognise that the question is not free from difficulty and it does not fall within our province to attempt an interpretation of the law. Two points are, however, clear. No one desires to see a wholesale resort to insolvency and no one, we trust, desires to witness a continuation of a system

under which innumerable people are born in debt, live in debt and die in debt, passing on their burden to those who follow. That there are a large number of hopelessly insolvent debtors in rural areas, is generally admitted, and we cannot regard it as making for health in the body politic that they should be allowed to remain without hope and without help.

Legal technicalities must be subordinated to economic interests and, in view of the evidence before us of the unsuitability to agricultural conditions of the existing insolvency law which was primarily designed for mercantile cases, we recommend that the whole case for a simple Rural Insolvency Act should be carefully considered in every province. The main objects of such a measure would be to relieve the debtor of what he cannot pay, whilst insisting on his paying the utmost he can within a reasonable time. When a man's debts are such that the usufruct, for fifteen years, of the land not absolutely essential for maintenance is insufficient to meet them, the balance is obviously irrecoverable and he is, therefore, a fit subject for insolvency law. Whether such a law should provide for conciliation boards or committees or whether such bodies should be regarded as an alternative to an insolvency law is an open question. We consider that, in areas where debt is known to be beyond the capacity of the people to pay, conciliation bodies might be tried. It must be clearly recognised that the worst policy towards debt is to ignore it and do nothing. We are fortified in our conclusions by the remarks on the subject of insolvency in the Report of the Civil Justice Committee. As therein pointed out, so long as debtors can be committed to prison for debt at the option of their creditors, large numbers of debtors with little or no property must be put through the insolvency court. Just as creditors have the right to insist that all the debtors' assets should be impounded and applied towards the payment of the debts, so also the debtor who has given up all his assets should have the clear right to be allowed to earn his living if he can and to be free to make a new start in life. The main difficulty with respect to rural insolvency was considered to be that of getting suitable persons to act as receivers, and we recommend that where the indebtedness of the rural population is notoriously heavy, there should be little hesitation in appointing officials for this duty.

REPORTS ON MONEY-LENDING.

368. The question of rural indebtedness is so old that its problems have become as customary as the debt itself and there is always the danger that what is accepted as a normal feature may be allowed to continue undisturbed. It is more than probable that the total rural debt has increased in the present century; whether the proportion it bears to the growing assets of the people has remained at the same level, and whether it is a heavier or lighter burden on the more prosperous cultivator than of old, are questions to which the evidence we have received does not provide an answer. In an interesting note* submitted by Mr. M. L. Darling, I.C.S., formerly Commissioner of Income-tax for the Punjab, the position of the moneylender

* See Vol. VIII—Evidence taken in the Punjab—page 592.

was reviewed in the light of information derived from the statistics of the Income-tax Department. Mr. Darling points out that, in the Punjab, the village moneylender is gradually reducing his business everywhere, except in two districts, and that the main causes of this reduction are the rapid growth of the co-operative movement, the legal protection given to the peasant borrower and the rise of the agriculturist moneylender. There is also a tendency now for the village moneylender to migrate from the village to the town. In spite, however, of the reduction in his business, rural moneylending is still the most important industry in the province ; and if salary earners are excluded, one out of every four income-tax payers is a rural moneylender. We think it would be advantageous if such a review could be made periodically in the annual report of that department.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

369. The conclusions and recommendations in this chapter may be summarised as follows :—

(1) No usufructuary mortgage of agricultural land should be permitted unless provision is made for automatic redemption within a fixed period of years, of which twenty should be the maximum (paragraph 353).

(2) The risk of collusive evasion must be recognised, but education and the development of character are the only specifics against this (paragraph 353).

(3) The question whether the restrictions on the operation of the Punjab Redemption of Mortgages Act might be removed should be considered (paragraph 354).

(4) The question whether legislation in regard to the redemption of mortgages should be enacted in other provinces is commended to the consideration of other local governments (paragraph 354).

(5) The desirability of extending the principle of statutory restriction on the alienation of land can only be measured in the light of local conditions (paragraph 355)

(6) An enquiry should be made into the extent to which the hereditary cultivating class is being expropriated by those who do not themselves cultivate the land (paragraph 355).

(7) Where existing systems of tenure or tenancy laws operate in such a way as to deter landlords from investing capital in the improvement of their lands, the subject should receive careful consideration with a view to the enactment of such amendments as may be calculated to remove the difficulties (paragraph 358).

(8) Action to permit the establishment by landlords of home farms appears specially necessary (paragraph 358).

(9) The working of the Land Improvement Loans Act is, on the whole, satisfactory but steps should be taken to make landholders better acquainted with the facilities it offers (paragraph 359).

(10) Part of the allotment under the Land Improvement Loans Act should be placed at the disposal of land mortgage banks where these are firmly established, provided that steps are taken to ensure its utilisation on objects which fall within the scope of the Act (paragraph 359).

(11) The working of the Agriculturists Loans Act is, on the whole, satisfactory (paragraph 362).

(12) Where loans under this Act granted directly to cultivators are remitted, the desirability of extending similar clemency to co-operative societies and their members should be carefully considered (paragraph 362).

(13) The Agriculturists Loans Act must remain on the Statute Book until the spread of thrift or of the co-operative movement or of both renders it obsolete (paragraph 362).

(14) The greatest hope for the salvation of the rural masses from their crushing burden of debt lies in the growth and spread of a healthy and well organised co-operative movement and local governments should, therefore, give that movement all the encouragement possible (paragraph 363).

(15) Legislative measures to deal with the problem of indebtedness have proved a comparative failure (paragraph 364).

(16) In all provinces, an enquiry should be made into the causes of the failure to utilise the Usurious Loans Act (paragraph 365).

(17) A special report on the working of the Usurious Loans Act should be included in the annual reports on the administration of civil justice (paragraph 365).

(18) If the provisions of that Act were fully utilised, this would go far to remove the worst evils of uncontrolled usury (paragraph 365).

(19) The Punjab Moneylenders' Bill and the British Moneylenders' Act of 1927 are commended to the consideration of local governments (paragraph 366).

(20) The case for a simple Rural Insolvency Act should be carefully considered in all provinces (paragraph 367).

(21) Conciliation bodies might be tried in certain areas (paragraph 367).

(22) Where the indebtedness of the rural population is very heavy, and it is difficult in insolvency cases to find suitable persons to act as receivers, officials should be appointed for this duty (paragraph 367).

(23) The position of the moneylender should be periodically reviewed by the Income-tax Department (paragraph 368).

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CHAPTER XIII

CO-OPERATION

EARLY HISTORY.

370. It is not necessary for the purposes of our Report to describe in any detail the history of the co-operative movement in India : it will suffice if its distinctive features only are discussed. Towards the close of the last century, the success of the small village banks in Germany and Italy attracted considerable attention in India and it appeared to those who were anxiously looking for assistance in solving the problem of rural poverty that the working of those institutions deserved examination. The Government of Madras took the initiative by deputing Mr. (now Sir Frederick) Nicholson to study the system, and his monumental report was published in two parts in 1895 and 1897. In the United Provinces, Mr. Dupernex, I.C.S., and in the Punjab, Mr. (now Sir Edward) Maclagan, I.C.S., and Captain Crosthwaite began to organise societies which, at that time, could only be registered under the ordinary company law. A few of the societies then organised still survive in the Punjab. The report of the Indian Famine Commission of 1901 powerfully advocated the introduction of mutual credit associations. Their recommendations, after careful consideration by two committees, took shape in the Co-operative Credit Societies Act of 1904. Three points about the new policy deserve notice. It was deliberately decided to restrict the operation of the Act to credit only and this restriction is now recognised by all informed critics to have been a wise one. The Act had perforce to be framed before any experience had been gained of the working of co-operative societies in India and so could only prescribe the general outlines and leave the details to be filled in gradually, on lines which experience of failure or success might indicate as best suited to each part of the country. It was left to a few officials to study the experience of other countries and to essay the task of introducing into India an institution of a novel type. As the experiment was confined to credit, chiefly for agricultural purposes, knowledge of the essential principles of successful rural banking had to be acquired and adapted to local conditions. There was not then available the voluminous literature on all aspects of co-operation which has since been published. Progress could only be by the process of trial and error and, in the early stages, the leaders of the blind were themselves often amongst the afflicted.

The second point to be noticed in regard to the new policy is that it was not the outcome of any popular demand. As was the case in Japan, the new legislation was essentially the act of a Government anxious to ameliorate the conditions of the people. Public opinion sufficiently instructed to criticise or to guide had to be created. The public-spirited helpers, of whom there are now such large numbers, had to be found and encouraged to come forward and assume responsibilities. In its initial stages, the movement was essentially an endeavour by the State to teach the people the advantages of organised thrift, self-help and mutual help.

The third point to be noted is that it was inevitable, in the circumstances we have described, that a government department charged with the promotion of the new policy should be established and that, as progress was achieved, this department should grow in numbers and importance.

From the commencement, the aim of the official staff was to instruct the community as a whole in the benefits of co-operation and to attract, select and train individual members of it for the work of managing the new societies in accordance with co-operative principles. When it is realised that the office holders in all co-operative organisations, from the village societies in their many thousands to the provincial banks and federations, are almost without exception non-officials elected by their fellows, the extent to which this aim has been achieved will be appreciated.

THE CO-OPERATIVE CREDIT SYSTEM.

371. The co-operative movement in this country was thus initiated by a Government which, since it had no co-operative experience in India to guide it, had to depend on the agency of an official staff to carry its policy into effect. These special features, which marked the inception of the movement, need emphasis as they have influenced it throughout its course and explain many later developments.

The original Act, as we have seen, was framed to meet the needs of primary credit societies only; it made no provision for the higher finance of the movement or for non-credit activities. These omissions were supplied by the second Act which was passed in 1912 and is still in force throughout the country, except in Bombay and Burma, where it was replaced by local legislation in 1925 and 1927 respectively. But though the limitations imposed by the original Act were removed and non-credit activities have taken numerous forms, the preponderating element is still credit. There are two main reasons for this. The most powerful obstacle in the path of rural development and the most crushing burden on the people is indebtedness. Where they are so bound to the moneylender that all their produce must be sold to him and all their purchases made from him; where the interest charges on the loans they take from him are such that they absorb what little surplus there may be and the enhanced return in a bumper year or from some improvement in seed or implements merely serves to stay the pace at which these charges mount up, it is hopeless to expect that they should lend a willing ear to the advice of the agricultural expert. Societies for purchase and sale are not for those whose every transaction must pass through the single channel of the village moneylender.

The second reason for the preponderance of the credit element lies in the well known educative value of the good credit society. Experience has amply proved the advantage of this type as a foundation for more ambitious schemes. It affords an excellent training in the handling of money, in expending it on productive purposes, and in the elements that combine to build up sound credit. It readily lends itself to organisation for mutual help throughout the country side; and, wisely guided, it encourages and stimulates the practice of thrift and illustrates vividly the advantages of even the smallest savings when they are made regularly over a series of years. We see no ground for adverse comment in the fact

that the credit aspect bulks so largely in the co-operative movement; on the other hand, it appears abundantly clear that the movement must, in the main, continue to be directed towards the expansion of credit societies until the burden of outside debt has been considerably eased. There is ample evidence that those charged with its direction are fully alive to the advantages to be gained from the application of the co-operative principle in directions other than credit. But their most important duty must, for many years to come, be that of developing a rural credit system covering the whole field of village life, and we think it should be left to their unfettered judgment to decide what part of the resources at their disposal should be directed towards the extension of the non-credit movement.

THE PRESENT POSITION OF THE MOVEMENT.

372. We have pointed out that it was in the absence of any demand from the public that the Government of the day decided to embark on an attempt to educate the people in the principles and practice of co-operative credit. In the special circumstances of rural India, such education could only be conveyed through the spoken word of touring officers, supported, supplemented and replaced by non-officials as these became available for the work. The effect of their efforts has been considerable and some elementary knowledge of the meaning and potentialities of co-operation has spread over a very wide area. So far as numbers go, the movement has made remarkably rapid progress. In 1927, there were in British India some 67,000 agricultural societies, 1,388 unions and 521 central societies. The agricultural primary societies had over two-and-a-quarter million members and their total working capital exceeded 24 crores of rupees. The statistical progress of the movement since 1915-16 will be evident from the Table given below.

Agricultural co-operative societies

	Credit			Non-credit		
	Number of societies	Number of members	Working capital	Number of societies	Number of members	Working capital
			Rs (lakhs)			Rs (lakhs)
1915-16	16,690	665,527	4,92	96	4,822	1
1916-17	19,463	723,329	5,65	160	7,186	1
1917-18	21,688	767,265	6,36	249	13,944	5
1918-19	26,214	864,500	7,34	437	24,237	13
1919-20	32,595	1,046,839	8,73	616	34,057	18
1920-21	37,673	1,204,199	10,60	857	50,212	21
1921-22	41,516	1,347,277	12,08	1,073	62,984	30
1922-23	45,043	1,442,080	13,47	937	57,320	32
1923-24	49,118	1,585,708	15,15	1,196	77,686	40
1924-25	54,390	1,749,196	17,59	1,595	99,694	49
1925-26	59,018	1,901,529	20,47	1,769	121,789	54
1926-27	65,101	2,115,746	24,14	2,133	154,322	58

The following Table is also interesting as showing the extent to which the rural population in the different provinces has been touched by the co-operative movement :—

Province	Number of members in all agricultural societies (1926-27)	Number of members in agricultural credit societies (1926-27)	Rural population (Census of 1921)	Number of rural families (estimated)	Proportion of members of agricultural societies to families in rural areas	
					All societies	Credit societies
			(In 000's)	(In 000's)	Per cent	Per cent.
Ajmer-Merwara ..	10,185	9,879	330	66	15·4	15·0
Assam	42,478	42,478	7,428	1,486	2 9	2·9
Bengal .. .	380,502	329,765	43,509	8,702	4·4	3·8
Bihar and Orissa .	205,825	205,000	32,627	6,525	3·2	3·1
Bombay	300,077	260,182	14,908	2,981	10·0	8·7
Burma . .	93,161	87,447	11,921	2,384	3·9	3 7
Central Provinces and Berar	59,459	58,039	12,519	2,504	2·4	2·3
Coorg .. .	11,223	11,223	155	31	36·2	36·2
Delhi .. .	4,250	4,250	184	37	11·5	11 5
Madras . ..	612,220	583,315	37,040	7,408	8·3	7·9
North-West Frontier Province.	681	681	1,915	383	0·2	0·2
Punjab ..	401,542	373,155	18,473	3,694	10 9	10·2
United Provinces	148,405	148,332	40,570	8,114	1·8	1·8

It will be seen from the above Table that, except in the Punjab, Bombay and Madras, the movement in the major provinces has so far reached only a small part of the rural population. We have left out of account, in this Table, figures affecting the movement in urban areas. In all provinces, there are districts where considerably greater progress has been made than in others. For instance, in the Dharwar district of Bombay and the Jullundur district of the Punjab, one-fourth, and in the South Kanara district of Madras, nearly one-fifth, of the population is now within the movement.

The main results achieved may be said to be the provision of a large amount of capital at reasonable rates of interest and the organisation of a system of rural credit which, carefully fostered, may yet relieve the cultivator of that burden of usury which he has borne so patiently throughout the ages. Knowledge of the co-operative system is now widespread ; thrift is being encouraged ; training in the handling of money and in elementary banking principles is being given. Where the co-operative movement is strongly established, there has been a general lowering of the rate of interest charged by moneylenders ; the hold of the moneylender has been loosened, with the result that a marked change has been brought about in the outlook of the people.

Inculcation of the habits of thrift has produced results no less remarkable than those following the obtaining of credit on reasonable rates. At the end of 1925-26, the two million members of agricultural societies owed their societies a sum of Rs. 18 crores, of which nearly Rs. 6¾ crores was their own money. Of this sum, Rs. 2½ crores was the share capital subscribed by them, deposits by members amounted to Rs. 1¼ crores, and the reserve fund was nearly Rs. 3 crores. Thus, out of the total capital advanced to members, more than one-third was collected from their own savings. In the Punjab, the members held Rs. 61 lakhs as share capital and Rs. 25 lakhs as deposit; while the reserve fund of the societies amounted to Rs. 88 lakhs. In Bombay, they held Rs. 15 lakhs as share capital and Rs. 70 lakhs as deposit and the reserve fund was over Rs. 30 lakhs. The figures for Madras were Rs. 52 lakhs, Rs. 7 lakhs and Rs. 23 lakhs respectively. While there is undoubtedly considerable room for improvement, the fact that so much money has already been saved, which, but for the existence of the co-operative societies would, in all probability, have either been frittered away or gone in the pockets of moneylenders, is in itself no small achievement. There are many societies now which are able to finance their members without having need to borrow from outside. There are members whose own shares or deposits amount to a sum which is enough to meet their normal requirements. When this state of things is reached, it undoubtedly affects for the better, not only the economic, but also the moral, outlook of the men concerned.

DEFECTS

373. On the technical aspects of the credit movement, we shall have but few comments to offer in the course of this chapter. The Committee on Co-operation of 1914-15, which was presided over by Sir Edward Maclagan, made an exhaustive enquiry into these, and its report contains an authoritative series of recommendations to which there is little need for us to add. The Committee was mainly concerned with credit societies as they existed at the time, but it is clear that many of the defects then found still persist, and that although, in most provinces, its recommendations have been accepted and incorporated in the policy of the co-operative departments, there is still ample room for further action everywhere on the lines suggested in its report. In all provinces, failures have frequently been due to the neglect of the wise precautions advocated by Sir Edward Maclagan and his colleagues, and we can only recommend that everyone connected with the movement should study this most valuable report afresh and should strive to secure a wider attainment of the standards therein prescribed.

We make this suggestion, as our enquiries have shown that progress has not been uniform in all provinces and that increase in numbers has not always been accompanied by improvement in quality. Neglect of the advice given by the Committee on Co-operation has, in some instances, led to serious consequences. In the Central Provinces, a thoroughly unsound system was allowed to develop into a top-heavy organisation. Little attention was paid to the education of members in co-operative principles and too much power was left in the hands of

central banks. The concentration of both authority and of fluid reserves at the centre provided opportunities for errors which precipitated a severe financial crisis; and it was only the assistance provided by the local Government, in the form of a large loan and a guarantee of a substantial cash credit, which saved the movement from immediate collapse. It is estimated that several hundred societies will have to be liquidated before the evil effects of past mistakes can be completely eradicated. In Berar, where conditions of agriculture as well as of land tenure are very different from those in the Central Provinces proper, the state of the movement is more satisfactory.

In the United Provinces, where the condition of a large number of societies gave cause for anxiety, a committee, known as the Oakden Committee, was appointed in 1925. This Committee, after careful enquiry into the state of co-operation in the province, issued a strongly worded report. It found that the village society was mostly a sham; the principles of co-operation were not understood; the staff appointed to teach was itself untaught, insufficiently trained and unfit for the work it was supposed to do. The Committee's conclusion was that a general dissolution of the movement could only be avoided by drastic reorganisation. The local Government have accepted this finding and has sanctioned measures to give effect to the Committee's recommendations.

In Madras, considerable anxiety has been caused by the steady increase in overdue loans and a committee which sat to enquire into this and other defects has recently submitted its report. In Burma, we found a considerable body of opinion in favour of a regular enquiry being held into the causes of the stagnation which has set in in Upper Burma; for some years past no progress has been made and several hundred societies are in process of liquidation, a situation which is causing some uneasiness. The Central Provinces, the United Provinces and Madras are the only provinces in which such an enquiry has so far been held and we consider that it might be undertaken with advantage in other provinces. The financial solvency of the movement generally is beyond dispute; it is the working of the societies that is defective. The members of societies delay the repayment of loans even when able to repay; understanding of the principles of co-operation and knowledge of the essentials of rural credit are lacking; office-holders refrain from taking action against defaulters and the spirit of self-help is not as prominent as it should be, if the movement is to be a live force in village life. Even where defects are obvious and admitted, there is reluctance, as dangerous as it is regrettable, to liquidate societies whose condition is beyond remedy.

For these disquieting conditions there are several causes, of which lack of training and of understanding of co-operative principles is the most important. The democratic principle is not so potent a force in checking abuses as is sometimes supposed. Members take insufficient interest in the working of their society; they exercise little restraint over their president and committee, and hesitate to evict from office an incompetent or dishonest neighbour. The office-holders, on their side, dislike incurring the unpopularity attendant on stringent action against recalcitrants and the recovery by legal process of overdue debts. The

calculated inertness of the two parties all too frequently leads to stagnation and dissolution.

374. The only remedy for these unsatisfactory conditions which appears to offer any sure prospect of success is the patient and persistent education in the principles and meaning of co-operation of the members of primary societies by teachers competent to perform the task efficiently under adequate supervision. The Committee on Co-operation in India laid great stress upon the necessity for such teaching but, from the evidence placed before us, we are constrained to conclude that it has not been sufficient or of the right type. The essence of the co-operative movement is that the people should take the management of their own affairs into their own hands, and the whole object of those charged with the education of the members of co-operative organisations should be so to teach the people that they will be able to assume complete control of their own organisations. The only test of such ability is actual trial and, if only to safeguard the interests of outside investors in co-operative societies, the trial must be made under such a degree of supervision as will afford some guarantee against serious loss. The Co-operative Societies Act insists upon regular audit and provides for inspection of the affairs of societies either at the request of creditors or when the Registrar considers this necessary. Thus, while the aim of the staff of the co-operative departments is to train the members of societies to manage them without outside interference or assistance, practical considerations render necessary some degree of audit, inspection and supervision. A balance has to be struck between apparently conflicting factors and the success or failure of the movement depends upon the adjustment of the balance. There is no great difficulty in persuading some ten cultivators to go through the simple formalities required for the registration of a society under the Act and, if there is someone to watch every action and to guide every step, it may be that a society of some use will result; but it will be very far from being truly co-operative. That there must be supervision and guidance in the early years is not in question; the problem is to decide at what time, and by what stages, supervision and guidance should be relaxed, until they are eventually withdrawn. From the evidence placed before us, we are of opinion that one of the main causes of the failures we have mentioned in the preceding paragraph is the lack of the requisite education and of adequate supervision and guidance. Members of co-operative bodies have not been sufficiently trained to assume the responsibilities thrown upon them; a natural restiveness under control has found expression in resentment against what has appeared to be undue official interference, and transactions have been embarked upon which have led to disaster.

Remedies.

We are fully aware that, in dealing with this contentious and much debated question, we are on very difficult ground, but we feel it necessary to give a clear expression of the opinions we have formed. We have great hopes that many millions of peasant proprietors may be led to a better life through a sound co-operative movement; if this is secured, much else is brought within the bounds of attainment. If co-operation fails, there will fail the best hope of rural India. It is thus of

supreme importance that the root causes of the defects that have aroused disquiet in some provinces should be clearly understood, and we must attempt to discuss them, even at the risk of being misunderstood by some who have worked hard and long for the success of the movement. The aim of co-operation is self-help, and if we have thought it necessary to recommend, for the immediate future, a continuance of official guidance and, to some extent, of official control, we have done so only because we are persuaded that such guidance and control at this stage are essential to the healthy growth of the movement. Whenever co-operators are in a position to supply, from within their own ranks, the leadership and technical knowledge required for the proper control of the movement, we should be the first to suggest the removal of redundant external control.

In all provinces, there are a number of public-spirited men who give valuable time to the promotion of co-operation. Many have made themselves almost indispensable and many more would be difficult to replace. It is impossible to estimate the services of these workers too highly. At the same time, it must be recognised that honorary workers cannot be expected to exercise that regular supervision which is essential to the success of the co-operative movement. They are frequently professional men with urgent calls on their time and with other duties, both public and private, which demand attention. They are not, therefore, in a position to devote their whole time to co-operative work as are officials. Practically all central banks are managed or directed by non-official workers. They are usually able satisfactorily to fulfil the duties involved in financing primary societies, but do not always possess the technical knowledge, experience and leisure necessary for undertaking responsibility for supervision where this has been added. In the same way and for the same reasons, honorary workers, who undertake the work of education, suffer from difficulties from which it is not always easy to escape. This is work for which special training is required, but honorary workers cannot spare time for this training to the extent that is possible for the official, and they do not always feel bound by the policy of the department, even on such important subjects as the degree of financial strictness which it is desirable to enforce. To the failure to recognise the limitations inherent in the system of utilising honorary workers must be largely attributed the very serious defects in the movement, which have been brought to our notice, and it is our firm conviction, therefore, that, at this stage of development, an increase in the number of honorary workers, valuable as their services may be, should not be regarded as a reason for eliminating the paid staff or even for reducing its numbers. The honorary worker will always find ample scope for his energies and his public spirit, and we cannot but think that those who are most keenly interested should be the first to welcome the strength given to the movement by a highly educated and well trained staff of officials. We, therefore, strongly recommend that every effort should be made to build up such a staff in all provinces. Its chief duty is to educate members up to the point at which they will be competent themselves to undertake its duties and so to dispense with its services;

to strengthen the hands of the honorary workers by furnishing them with skilled advice and guidance in the more difficult problems; to supervise the work of unions and federations engaged in the management and control of the movement; and to work out new schemes to facilitate the work of other departments, to prepare the ground for their special propaganda and to organise the people to receive and adopt expert advice. The position of the honorary workers should in no wise be weakened by the provision of expert advice; the scope for workers, in co-operative as in all other movements in the cause of village uplift, is so vast that there need be no fear that the official will oust the non-official. The problems awaiting satisfactory solution are so numerous that every contribution should be welcomed, and the honorary worker will find far more to be done than can be accomplished for a very long time to come. Nothing is further from our minds than any wish to belittle the services of the public-spirited body of workers which, without remuneration, is devoting itself to the service of the co-operative movement. Indeed, we cannot too plainly state our conviction that the whole future of the movement must depend ultimately upon the zeal and efficiency of non-official leadership. Our recommendation in favour of an expert staff to educate the people in co-operative principles is already in force in one province and has been accepted in another, whilst the evidence from three more at least showed that the need for such a staff was keenly appreciated.

CO-OPERATIVE UNIONS AND INSTITUTES.

375. Attempts have been made to federate societies into unions for purposes of supervision. Unions have been formed in the past, not only for supervision, but also for the mutual guarantee of all loans taken on the recommendation of the union. The guaranteeing unions were not, on the whole, a success, and a new type has been evolved which undertakes no financial responsibility but confines itself to supervision and guidance. In Madras, where this system of supervising unions has been adopted on an extensive scale, all societies within a radius of seven miles are affiliated to the union; in Bombay, the area comprised is usually a taluka. The union supervises the work of its affiliated societies, helps them with advice, and develops the co-operative movement generally within its area. It has at least one paid supervisor, whilst the members of the managing committee are also expected to visit societies themselves from time to time. The success of the union system depends upon the efficiency of the supervisors, and upon the interest taken by the members of the managing committees in their work. The reports on the working of the system in the two provinces where it prevails have, on the whole, been satisfactory. We would suggest that other provinces might consider the desirability of introducing it, with any modifications that may be required to suit local conditions.*

*Mr. Calvert dissents from this recommendation. The supervising union is found in the largest numbers in Madras where there are 356; and of them, the Madras Committee on Co-operation write: "A very large number of unions are not now functioning efficiently," the supervisors employed by them "are not particularly well trained" and they "are in a large number of cases inefficient." There is difficulty in collecting the contributions. If they are to be dependent upon government aid, they cannot be truly co-operative. Mr. Calvert accordingly feels that he cannot recommend to other provinces an institution admittedly so imperfect.

In European countries, where co-operation is more or less independent of Government, there are one or more strong central federations, which link together individual societies that would, otherwise, be isolated, serve as a bureau of information, undertake the work of organisation and inspection, and in many ways strengthen and stimulate the movement. This example has been followed in India, and most provinces have now a provincial union, or federation, which in some instances is known as a co-operative institute. These federations differ not only in constitution but also in the functions they undertake. Some of them are constituted entirely of representatives of all classes of societies, others of representatives of central institutions, others, again, include individual members. Some of them have as their main duty the work of auditing co-operative societies, while others devote themselves to propaganda and training. Generally, it may be said that the object of these institutions is to promote the co-operative movement in all possible ways, by serving as a centre of co-operative activity, by carrying on propaganda and publicity work, by organising and developing diverse types of societies, by organising training classes, by acting as an information bureau and by ascertaining and representing the views of co-operators on questions of general and public importance relating to the movement. These institutions have in most instances been so recently established, and their resources are so limited, that their achievements are, at present, hardly commensurate with their aims, but, in some provinces, they have already done much valuable work.

We consider that efforts in the direction of organising and developing such institutions deserve encouragement and would suggest that wherever such bodies, as also the supervising unions mentioned above, are discharging their responsibilities efficiently, they may reasonably look to Government to supplement their resources with grants-in-aid.

THE REGISTRAR.

376. If, as we hold, an efficient department must be retained to perform the essential duties of education, supervision and inspection; if the time has not yet come when the department can be weakened either in numbers or quality, the personality of the Registrar is a matter of the greatest importance. In the circumstances we have described in the opening paragraph of this chapter, it was inevitable that, at the outset, the Registrar should be the foundation of the movement. It was for him to study the experience of other countries and to bring his knowledge to the examination of the economic problems of the "agriculturists, artisans and persons of limited means" for whose relief legislation was undertaken. It was never intended that he should be merely a registering officer. He was expected to provide supervision, assistance, counsel and control and, though he was warned that he must not allow co-operation to become an official concern managed by State establishments, he was held to be primarily responsible for seeing that societies were formed on a sound basis and was given wide powers to ensure this. The Committee on Co-operation, after a careful enquiry into the movement throughout India, expressed their considered view of the qualifications required and the duties to be performed, in no ambiguous terms. "He must be

continually studying co-operative literature, which is now most extensive ; he must make himself acquainted with economic conditions and practices both throughout India and in his own province ; he must know the principles and methods of joint stock banking ; and must examine the systems of developing thrift and inculcating co-operation which have been tried in other countries. He is also head of a teaching establishment and must devise effective means for impressing a real knowledge of co-operation on the bulk of the population. He has further to control a large staff and to draft model by-laws and rules, to collect statistics and write reports, to advise Government on various subjects, and to keep in close touch with the higher finance of the movement as managed by provincial banks and central banks."

From such survey as we have been able to make of the movement, we are inclined to doubt whether these words were before some local governments when appointments to the post of Registrar were made. When the Committee on Co-operation toured India in 1914-15, the co-operative movement was still almost entirely confined to credit, and development even in that direction was still far from the stage which it has now reached. To the list of qualifications laid down by the Committee we would now add others, for the modern Registrar must be fully abreast of the activities of all departments working for the improvement of rural conditions ; he must see that there is a sound foundation of Better Business to support the superstructure of Better Farming and Better Living ; the more efficient the movement, the more will other departments make use of it to promote their own special activities. If our view is accepted, that the experts of other departments will find, in a widespread and efficient co-operative movement, the one agency enabling them to reach the mass of the rural population, the Registrar of the future will need to be very carefully selected.

We, therefore, recommend that local governments should select the best man available as Registrar; on no account should the post be regarded as a convenient refuge for an official promoted by seniority to Collector's rank. Administrative experience, knowledge of the people and their economic conditions and ability to enlist the co-operation of honorary workers are essential qualifications. A Registrar, once appointed and proved efficient, should not be transferred from the post until the full benefit of continuity of policy has been assured. The minimum period during which he should hold the appointment should not be less than five years, on the assumption that he has already had two years service as Assistant or Joint Registrar, and the maximum not more than ten. Within these limits, it should be possible, on the one hand, to gain the advantage of long experience and, on the other, to avoid committing the movement, for longer than would be prudent, to the charge of a single individual. If, during his period of office, the time should come when the Registrar would, in the normal course, be promoted to some higher post such as that of Commissioner of a division, we consider that he should retain his appointment with the emoluments and position of the higher rank. The movement is gathering force so rapidly in some

provinces that the post of Registrar is becoming one of the most important under the local government and should be recognised as such.

In order to ensure that future registrars should possess the technical qualifications we have enumerated above, we recommend that there should be an officer under training in all provinces. He could fill a leave vacancy, act for the Registrar, if he were sent on deputation to study conditions in Europe, or himself be placed on deputation for such study. Evidence of the value of deputation for this purpose was given by several officers who appeared before us and we consider it desirable that it should be encouraged. We think that it should usually be preceded by considerable study and experience of the movement in India, in order to ensure a full acquaintance with the nature of the problems on which further light is to be sought. Full advantage should, we think, be taken by officers on deputation of the opportunities of obtaining a special training in technique and field work which are provided by the Horace Plunkett Foundation in London and the Irish Agricultural Organisation in Dublin respectively. Both these institutions have very generously offered to train a limited number of honorary workers free of charge. If honorary workers willing to take advantage of this offer are forthcoming, we consider that they should be encouraged to do so, by a grant from Government towards the expenses involved in a visit to Great Britain and Ireland.

In this connection, we would suggest that the Government of the Central Provinces should consider the desirability of appointing a whole-time Registrar in that province. The number of societies in the Central Provinces falls little short of the number in Bombay, whilst the population of the province is greater than that of Burma. We are aware that the total membership of societies is much smaller than it is in either of the other two provinces mentioned, but we cannot regard as satisfactory the present arrangement under which the Registrar of Co-operative Societies in the Central Provinces is also Director of Industries and Registrar of Joint Stock Companies. We consider that the appointment of a whole-time incumbent would assist in removing the defects on which we have had occasion to comment in earlier paragraphs of this chapter.

THE STAFF OF THE DEPARTMENT.

377. In only one province are systematic arrangements made for the training of members of the staff. In the Punjab, there are three "education inspectors" whose main duties are to give a course of intensive training in rural economics to approved candidates for the post of inspector in the Co-operative Department, and to hold classes for training sub-inspectors. The class for inspectors lasts for three months and that for sub-inspectors for one month. Refresher courses, which are attended by inspectors and sub-inspectors, are also held annually in each assistant registrar's circle. Each course lasts for eight days. At the end of their period of training which, inclusive of training in the field, lasts for at least fifteen months, inspectors, who are usually graduates, have to undergo a severe examination. We consider this system deserving of imitation elsewhere. We further recommend for adoption the

Bombay system under which auditors have to pass an examination in co-operative accountancy conducted by the Government Accountancy Diploma Board.

It is clear that a proportion of the paid staff is insufficiently trained in co-operative law and principles. Again, some have not been recruited from the classes which are most likely to be intimately acquainted with the life of, and in full sympathy with, the cultivators and artisans of the villages, and, where this is the case, their teaching tends to lack potency. The best judge of the fitness of any member of the staff must be the member of the primary society whose ear he has to secure and retain. The staff sent to teach must be acceptable to the taught, and the idiosyncrasies of those it will be called upon to instruct must be kept in view in selecting it.

Once that selection has been made, the staff should be kept at a high level of efficiency by regular courses, so that its teaching may always be fresh and inspiring. Its main function is to educate members to assume full charge of the affairs of their societies, and, to do this successfully, it must itself thoroughly understand the underlying principles and their application to every new problem that faces the managing committees. It is almost impossible to exaggerate the importance of efficient teaching and, wherever there is any difficulty in securing a sufficient number of qualified members of the general public to carry on this work, there must be paid officials to fill the gap.

In general, the work of supervision and inspection is on a more satisfactory basis than that of education ; it is certainly not overdone and, while we recognise the weakening influence of too frequent visits from an outside agency, we think that there is need for closer attention in areas in which the movement is lacking in vitality. It appears to be generally recognised that such supervision is only called for until societies are able to dispense with it and the fact that, where societies are classified, the highest class is reserved for those which require no supervision, serves as an effective reminder of this. But it must be remembered that supervision by an authority outside the society is equally detrimental to the growth of a proper spirit of self-help whether it is performed by a paid official or an honorary worker. The ideal aimed at in some provinces has been to organise a supervising agency from within by federating primary societies into special unions. In some provinces, supervision is largely undertaken by provincial unions which maintain paid staffs for whose education, training and efficiency they are responsible. We have described the constitution and work of these unions in paragraph 375 above.

The attempt to devolve the work of supervision on central banks has proved a failure and we consider it desirable that finance and supervision should be under separate control. Financial perfection is not the main object of co-operative effort and the work of village societies cannot be judged solely by their relations with their financing agencies. In certain areas, inspectors are sent out by the provincial or central banks to examine the working of primary societies and it is not

intended to discredit this practice. The duties of these inspectors should be clearly defined and they should be strictly confined to them ; their training and education should be such as to fit them for the efficient discharge of those duties and should not be of a lower standard than is demanded from officials. The Co-operative Societies Act of 1912 and the Bombay and Burma Acts all agree that a creditor has the right to insist upon an inspection, but that it shall be carried out by some one "authorised by the Registrar"; this provision should be strictly observed through the selection and authorisation of a person qualified to carry out the duty.

GOVERNMENT AID.

378. There appears to be some misapprehension as to the extent to which Government should share in the various activities designed to promote a sound co-operative movement. The movement has from its early stages won the willing help and support of the members of the general public. The prominent part they take in co-operative activities is a tribute to the spirit of goodwill between the staff and the public, which is the keynote of the success of the co-operative departments. We think that local governments should encourage the enlistment of honorary workers by contributing towards their out-of-pocket expenses, both whilst they are under training and whilst they are working in the field.

Public funds may also reasonably be spent in assisting institutions whose object is to spread education in the application of co-operative principles to various objects and also, as we have recommended above, in assisting unions for supervision. We found that government aid was usually given for propaganda work and we approve this. In consideration of the prevailing illiteracy and the consequent difficulty in reaching the people by paper or pamphlet, we think that Government have a special interest in promoting organisations on a co-operative basis to facilitate the activities of the agricultural, veterinary, educational and public health departments and that assistance should, therefore, be freely given to ventures of a novel nature.

The extent to which State aid is required outside these limits must depend upon the success of the educational side of the movement ; but the overwhelming interest of Government in any measures which contribute to the welfare and prosperity of the poorer classes justifies a larger contribution than is at present made to the expenses of the movement in backward tracts, such as some of the minor administrations, where the people are unable to find funds themselves. In the early stages, liberal assistance should also be given in all provinces to the more specialised forms of co-operative activity such as consolidation of holdings, adult education, irrigation, and the like.

Different views are held as to the part which should be taken by the official staff in the audit of societies. In some provinces, the government contribution to the movement takes the form of provision for the audit of societies and, in such provinces, no adequate staff is maintained for education and inspection beyond that which follows naturally from audit, though assistance may be given to unions organised for this work. In

some provinces, the Government insist upon societies paying for audit which is carried out by the staff of the provincial union. In this case, except in Bihar and Orissa, where the provincial union receives a subsidy, the government contribution takes the form of providing an expert staff for education and inspection including super audit. In the remaining provinces, the Government receive fees for audit but maintain an official staff for the work and usually spend on it not less than they receive.

Thus, in considering the question of the financial assistance that should be given to the co-operative movement, the local governments have to consider the proportion in which they should devote such funds as are available, to education and to audit respectively. We have no hesitation in recommending that, where expenditure on audit would involve the comparative neglect of education, education should be given preference and that the statutory audit should be paid for by societies. We do not consider that the audit of a healthy society is a proper charge on public funds. Public expenditure must first be devoted to education although Government may subscribe to raise the efficiency of audit.

GOVERNMENT CONCESSIONS.

379. A number of concessions have been granted under the Co-operative Acts. These take the form of exemption from income tax, from stamp duty and from registration fees and the provision of facilities for the transfer of funds at par by means of remittance transfer receipts. The shares or interest of members in co-operative societies are not liable to attachment by the decree of a civil court. Societies have also been given prior claim over other creditors in enforcing recovery of their dues in certain cases. In some provinces, additional steps have been taken to assist the operations of the societies by the grant of further concessions and it may be useful if we record our opinion on such as deserve mention.

In a few provinces, the local Government refund to societies three-fourths of the commission on postal money orders when these are employed for remittances between societies. This is justified on several grounds. The rate of commission is a flat rate for all India and there is no reduction for remittances within the limits of a province or even of a district. Most co-operative remittances are between societies and their financing agencies within the same district and a charge of one per cent on a loan and on its repayment would either eliminate any profit from the transaction or involve an increase in the rate of interest on the loan in order to cover the money order commission. We consider that this concession is fully justified by its value and recommend that it should be extended generally. Whether any limit should be imposed on the charge on provincial revenues, involved by the grant of the concession, must be decided in the light of local circumstances, but we consider that such a limit should only be imposed on strong grounds.

The movement of money for financing agriculture can be facilitated by permitting co-operative societies to take full advantage of the facilities afforded by the district treasuries and sub-treasuries. Such use is already permitted within narrow limits and we consider that, so long as this does

not impose any appreciable extra cost on the State, the limits now prescribed might be relaxed to permit free use of the treasury facilities for *bona fide* transactions in the ordinary business of agricultural credit.

Under section 19 of the Co-operative Societies Act of 1912, a society has a prior claim on certain property of its members where this has been purchased by a loan from the society or consists of a crop grown from seed obtained by such a loan. Except in Bombay, the existing law permits any creditor possessed of a decree to attach and sell this property, as the prior claim only holds good where the society also holds a decree. In the new Bombay Act of 1925, the prior claim has been replaced by a "first charge," and we consider that this amendment might usefully be adopted in all provinces.

THE POSITION OF GOVERNMENT OFFICERS.

380. The extent to which government officers not directly connected with the co-operative departments should assist the activities of those departments is another question on which it is desirable that our opinion should be on record. A broad survey of the position will clear the issue.

The modern conception of the co-operative movement differs markedly from that commonly held at the close of the last century; the term "agricultural organisation" or, better still, "rural reconstruction" expresses more accurately the nature of the activities included within the movement. It is now accepted that co-operative principles can be used in overcoming most of the obstacles to progress in rural communities. Wherever agriculture is the predominant industry, co-operation is coming to be regarded as the natural basis for economic, social and educational development, and India is no exception. Whatever view is taken of the failures and disappointments, it cannot be denied that, in almost all provinces, there are to be found outstanding examples of the successful application of co-operation to the problems of rural life; and, where success has been obtained, it should be within the power of the people to repeat it. Although the most striking successes have so far been gained in the organisation of credit for small holders, there are many encouraging examples of positive achievement in the fields of improved agriculture, cattle breeding, purchase and sale, the consolidation of fragmented holdings, education and other forms of economic uplift. As Government are directly interested in whatever contributes to the economic welfare of the rural population, their officers of all departments should, at all times, render such assistance to the promotion of the movement as the nature of their particular duties permits. It is not only the district officer who is concerned; sympathy and encouragement from him are everywhere acknowledged and greatly valued. It is the duty of all government officers to assist all the activities of Government and, where these activities are designed to improve the economic conditions of the mass of the people, that duty assumes special importance. We consider it very desirable, therefore, that local governments should impress upon the officers of all departments the importance they themselves attach to an active interest in every phase of co-operative activity. It is not suggested that there should be any active interference in the affairs of societies. This would probably in

most cases do more harm than good, but Government should let it be known that an unsympathetic attitude to the movement will be regarded with disfavour.

LAND MORTGAGE BANKS.

381. The framers of the original Co-operative Credit Societies Act of 1904 carefully considered whether the village credit society of the type they contemplated should be allowed to undertake land mortgage business, but found the question one of great difficulty. Experience in other countries amply indicates the unsuitability of mortgage security for the ordinary credit society which relies for its funds on short-term loans or deposits withdrawable at short notice. Funds of this nature cannot be locked up in land mortgage business without serious risk. The main business of such a society should lie in small loans for short periods with prompt recoveries. Its main source of credit should be the individual character of its members. It cannot afford to tie up its slender resources in a form of security which cannot be readily realised, and it should not be distracted from its chief function by becoming involved in the legal proceedings attendant upon foreclosure. On the other hand, if the acceptance of mortgage security is prohibited, a member of a society must be refused the credit to which his property in land fairly entitles him and may be driven to the moneylender for the loan which his society might be willing to advance and which it would advance if it were permitted to do so.

It was eventually decided to permit mortgage security and local governments were empowered to regulate it to such an extent as might be found advisable for any society or class of societies The provisions of the law under this head still remain in force and have been retained in the Bombay and Burma Acts. The present position is, thus, that land mortgage business can be carried on by societies registered under the existing Acts, unless the local Government otherwise direct. In most provinces, the village societies have resorted to mortgage security to a small extent but, in Bihar and Orissa, mortgages are generally taken as collateral security for large loans, and, in Madras, nearly half the outstanding loans are similarly secured. In both these provinces and in Bengal, however, experience of the difficulties involved in realising such securities deters societies from adopting this course.

As the co-operative movement grew, it became evident that loans from rural co-operative societies could not be confined to those required to meet agricultural needs and that, if societies were to retain the loyalty of their members, they must be prepared to advance loans for other purposes. If, as the Famine Commission of 1901 contemplated, the people were still to resort to the village moneylenders for loans for such other purposes, then the load of debt and usury would continue to increase. Experience has shown that the chief object of borrowing from the village societies has been the desire to substitute a loan on reasonable terms for the usurious contract with the moneylender. Such loans are usually large in amount, the period of repayment is apt to extend beyond what is usually regarded as a short term, and in such conditions personal security is not always suitable. Loans are also required for marriage and other

ceremonial expenses. It is the duty of committees of co-operative societies to use all their powers of persuasion to reduce extravagant expenditure on this account and much good has undoubtedly resulted from their efforts in this direction. Whilst it is desirable that members of societies should not be driven to the moneylender even for this class of loans, we think that they should be reduced to limits which are not beyond the capacity of the ordinary primary societies to advance, and that they should not come within the purview of the land mortgage banks, the institution of which we recommend below. There is also a constant, though relatively small, demand for finance for land improvements such as the construction of wells and embankments, and there is a desire for the redemption of old mortgages, the terms of which have become entirely unsuitable to changed conditions. For such purposes, the amount required is apt to be quite disproportionate to the resources of the small village society and very much greater than that needed to meet the current expenses of cultivation. By law, rule or custom, other countries have fixed a comparatively small sum as the maximum which can be advanced upon personal security. In India, far higher loans have become common, not because any local conditions have given added safety but simply because the society regards it as of primary importance to save its members from resorting to a moneylender. Moreover, the Raiffeisen type of village bank is expressly designed to meet the requirements of the small cultivator with small needs and small resources; it was never intended to meet those of the large landed proprietor, and it is the large landed proprietor of India who forms the moneylender's easiest and readiest prey. Whether he can be saved from chronic debt by any co-operative institution may be a matter of opinion but there can be no difference of opinion as to the entire unsuitability of the small village bank for such a task.

In the circumstances we have described, it is not surprising that there should be a widespread tendency to look for a financing agency which wields greater resources than the village credit society. As we have pointed out in the preceding chapter, the agricultural bank seems to hold for many a fascination which can only be explained by the distance from which it is viewed. The local conditions in which Dawson's Bank carries on its business appear to be peculiar to the Irrawaddy delta and no attempt to establish a similar institution elsewhere has been brought to our notice. For a solution of the problems arising from the demand for large loans for long terms, attention has naturally been directed to the land mortgage banks of Germany, and, in some provinces, the question of introducing institutions on this model has received careful study. The first experiment took shape in the Punjab in the Jhang Co-operative Land Mortgage Bank, Ltd., and altogether there are now a dozen organisations of this type in that province while Madras has fifteen, of which, however, only three are doing real work. Schemes for establishing similar institutions have been under consideration for some time in Bombay and Burma. As the Jhang Co-operative Land Mortgage Bank was for long

the only one of its kind in existence in India, European experience, gathered either from the published literature on the subject or by officers on deputation, has had to be drawn on, in framing schemes for the establishment of land mortgage banks in this country. The question was carefully examined by the Conference of Registrars held in Bombay in January, 1926, and the resolution finally adopted by that conference has our full support. It ran as follows:—

"(1) Mortgage banks based on co-operative principles are desirable in many parts of India. No transaction should be undertaken which is not economically profitable to the borrower.

(2) *Objects.*—The principal objects should be—

(*a*) The redemption of the land and houses of agriculturists,

(*b*) the improvement of land and of methods of cultivation and the building of houses of agriculturists,

(*c*) the liquidation of old debts, and

(*d*) the purchase of land in special cases to be prescribed by the by-laws.

(3) *Area and management.*—The area of operation should be the smallest unit consistent with competent management. The imposition of liability on village credit societies or the confinement of mortgage loans to members of such societies is not recommended, but the bank should consult the village society in the case of all loans to members of such society. Where there is no legal obstacle, preferably a mortgage with possession should be taken and the mortgagor should be retained as a tenant of the bank. Punctuality in repayment should be rigidly enforced by mortgage banks.

(4) *Finance.*—A reasonable total of share money should be raised by each bank in order to reassure the investing public.

In provinces in which the property can be sold on foreclosure, no loan should exceed half the value of the mortgage property. No excess liability is required beyond the amount actually borrowed by a member *plus* his share money.

If no excess liability is imposed, the share money of a borrower should not be less than one-twentieth of his loan. The minimum loan should be such as to repay the costs of the transaction to the bank and such as a primary credit society cannot conveniently give.

Each bank should prescribe in its by-laws a maximum loan from time to time according to its financial position.

Debentures should be issued by a central financing body in each province rather than by the separate mortgage banks.

Loans.—In the earlier stages, a certain measure of assistance from Government is required. A guarantee of interest by Government for a certain period is of the highest importance and a sinking fund should be so arranged as to secure the redemption of the debentures on the expiry of that period. Subscription by Government to the debentures is also desirable.

The Imperial Bank should be asked to assist in the flotation of debentures and, as the repository of State funds, should be invited to make advances, under section 20 of the Trust Act, against mortgages taken by a mortgage bank and endorsed in favour of the Imperial Bank.

(5) In provinces in which a full valuation of the mortgaged property is needed, expert valuers should be employed who should not be government servants. Government should, however, in the initial stages, make a contribution towards the cost of valuation. In return for its assistance, Government should be entitled to representation on the Board either of Directors or of Trustees.

All existing concessions in the form of exemption from stamp duties, registration fees, etc., should be continued in favour of mortgage banks."

Such experience of the practical working of land mortgage banks as has been gained since this resolution was passed has not shown the need for any alteration in it, nor has our own examination of the case suggested any alteration.

NECESSITY FOR SPECIAL LEGISLATION.

382. We have already pointed out that the existing Co-operative Acts provide for land mortgage credit and, in the absence of any evidence to the contrary, we are of opinion that land mortgage banks should be organised under these Acts and that any modifications, which further experience may indicate to be necessary, should be made as they are called for. It is doubtful if any attempt to frame a new Bill *ad hoc*, without the guidance to be expected from practical experience of the working of the system in Indian conditions, would prove successful. The draft Bill, which is under consideration in Burma, seems to us somewhat complicated and to be open to the criticism that it is based more on a desire for theoretical perfection than on a study of the practical difficulties of the scheme. The system of short-term credit on co-operative lines has been working long enough in India to provide valuable information on the subject of rural finance; it has enlisted a large number of honorary workers, who are now familiar with the character of the problems that come up for daily decision, and it has called into existence staffs trained in the management and direction of rural organisations. All these will be at the disposal of the land mortgage banks, if they are registered under the same Act and placed under the same Registrar as the ordinary co-operative societies. We recommend that this policy should be adopted and retained until practical experience indicates the need for a change.

THE DEBENTURE PROBLEM.

383. The evidence we received disclosed complete unanimity as to the need for government assistance in the earlier stages. Land mortgage banks usually raise funds by the flotation of debentures, and such debentures are as yet practically unknown in India. Over large parts of the country, it is rarely that any form of security, either public or private, is seen

and it is, therefore, to be expected that the experiment of issuing debentures by a non-official body should proceed somewhat slowly. In Bombay and the Punjab, the provincial co-operative banks have issued debentures secured by a floating charge on all their assets; in both cases, the local governments have guaranteed interest but not principal and this seems to have proved sufficient. The Bombay debentures have now been on the market for a number of years. No objection has been raised to this form of security and no difficulty has appeared. The Punjab issue was at once taken up and there is every reason to believe that a further issue would be readily absorbed. It is extremely unlikely that the guarantee of interest will ever involve Government in loss, whilst the sinking funds are increasing at a rate which should prevent the debentures from falling much below par for any considerable period. It is improbable that such issues will in any degree restrict the market for government loans, so that the State is able to inspire confidence in an important movement without any loss or embarrassment to itself. We recommend that this form of aid should be adopted as the best means of encouraging the investment of long-term money in land mortgage banks. In return for their guarantee of interest, the local Government must insist on measures calculated to protect it against loss, and the form of agreement adopted in Bombay and the Punjab would seem to provide all that is necessary. A simple floating charge on the assets created in favour of the debenture holders does not, in the absence of special conditions, prevent these assets from being pledged as cover for loans from, or overdrafts with, the Imperial Bank of India and so imposes no restriction on legitimate business.

It has been suggested that, in order to inspire confidence, the local Government should take up a proportion of the debentures. This has already been done in Madras where the Government have undertaken to take up as many of the debentures issued by five of the land mortgage banks in that province as are taken up by the general public, subject, however, to a maximum limit of Rs. 50,000 for each bank. The value of the debentures so far taken up by the Government under this arrangement is Rs. 93,000. It may be that, in the very early stages, some such form of encouragement is required but we cannot recommend the general adoption of the policy of giving it in this way, and the Madras Committee on Co-operation does not support it. If funds from State sources are needed, a simple loan offers the most suitable means of providing them; the Co-operative Acts provide special facilities for the recovery of such loans and the risk of loss would be small. Loans from Government are specially appropriate when the money is required for any of the objects to which the Land Improvement Loans Act applies and, as mortgage banks become established on a satisfactory basis, they should provide machinery for the distribution of State loans which should be free from many of the objections which have been urged against the existing system of distribution through purely official channels. In the Bombay Presidency, it is already the policy to distribute loans to members of co-operative societies under the Land Improvement Loans Act through the Provincial Co-operative Bank.

Under Act XXI of 1917, the debentures of the Bombay Provincial Co-operative Bank have been included in the list of securities given in section 20 of the Indian Trusts Act, 1882. We do not think that any objection can be taken to this course. In the agreement with the bank in which the local Government guarantee the interest on these debentures, they have taken ample power to interfere in case of maladministration and this appears sufficient to reduce the risk of loss to the holders of the debentures to a minimum. We, therefore, recommend that the debentures of co-operative land mortgage banks registered under the Co-operative Societies Act, which are similarly secured, and the interest on which is guaranteed by the local Government, should be added to the list of trustee securities.

If mortgage debentures of the kind now under discussion are to be floated in any considerable numbers, some control over their issue will become necessary. In Bombay and the Punjab, the intention is that the issue of these debentures shall be restricted to a central organisation, that is, either to the existing provincial co-operative bank or its counterpart in the mortgage business. The Madras Committee on Co-operation has recommended a similar course in substitution for the issues by individual banks. The restriction of issue to a single organisation in each province seems to us to possess such advantages that this system should be preferred wherever there are no strong local reasons in favour of any other policy. The system of issue by separate mortgage banks would inevitably result in a number of small institutions flooding the market with competing issues; control would become difficult; the security offered would be low; the interest rate would be forced up in consequence of this and of the competition from purchasers, and there would always be the danger that the whole system of debentures would be brought into disrepute by the mismanagement of a single institution.

THE NEED FOR CAUTION.

384. Whilst we think that there is scope for the establishment of land mortgage banks in India to meet the demand for long-term credit, we are strongly of opinion that these should only be organised after the most careful preliminary enquiry. Efficient management is essential, and, unless this is assured, no step forward should be taken. It must be remembered that, while the demand for long-term loans for productive purposes is limited, that for money for other purposes is almost insatiable. The greater proportion of the loans will be taken in order to redeem old mortgages by effecting new agreements on easier terms, and the easier terms will be far more attractive than the prospect of redeeming the mortgaged land by the payment of regular instalments over a long series of years. The small measure of resort to State loans under the Land Improvement Loans Act cannot be explained away by ascribing it to the unpopularity of the system of administering that Act. No small part of the unpopularity is due to the strictness with which repayment is insisted on and this feature cannot be omitted or softened in the mortgage bank. Lands will have to be accurately valued and rights carefully established; the objects for which loans are granted will need thorough

scrutiny and the application of the money to those objects must be carefully supervised. The chief source of funds will be debentures and the reputation of these debentures in the market will depend upon the efficient management of the mortgage banks as a whole. Confidence in the good banks may be lost by the default of the bad and the taint of insecurity, once attached, will be very difficult to remove.

In no circumstances should any attempt be made to hurry such institutions into existence to meet a popular demand. Sufficient has been said to indicate that, whilst there is some demand for facilities to repay old debts or redeem mortgages, there is no very strong demand for long-term money for land improvements. Land mortgage banks will neither fill a gap nor meet a long-felt want; they should replace the system of State loans and displace the moneylender from the long-term loan business; they should introduce a valuable element of control into that business, but their greatest service may be the lowering of interest to a level which will bring many improvements within the class of productive works.

The ultimate form which these institutions should take can only be determined by experience but, inasmuch as loans will be given for long periods and arrangements for funds will have to be made accordingly, unusual care will be necessary in the drawing up of all agreements and contracts. Continuity of policy is essential and all liabilities will have to be foreseen and provided against for a long time ahead.

If the banks are to be managed by their members, their working must be simple and their constitution readily understood. Unnecessary complications will tend to throw undue power into the hands of the paid staff and to scare away the honorary helper. It is probable that great difficulty will be found in bringing home to members a proper appreciation of their liability to the bank and the debenture holders, and the nature and extent of this liability should, therefore, be expressed in the simplest way. It must be possible for every member to ascertain, at any time, exactly what his guarantee amounts to.

In view of the paramount need for continuity in management and of our recommendation that Government should guarantee the interest on debentures, we think that, for some years to come, there should be an official member on the committee of management of each bank.

It seems advisable to add a final word of warning against a tendency, which besets all institutions of this character, to become possessed of land by foreclosure. As has been explained, punctuality in repayment must be insisted on, and it is inevitable that cases should occur in which the banks will have to take over the land pledged as security and to dispose of it. Such action will be necessary and unavoidable but its frequent repetition will lead to deplorable results. The best way to minimise the danger is to keep it well in view in managing the bank's affairs. If the committee rests satisfied with the covering of the loan by a sufficient security and neglects to measure the prospects of repayment in the light of the character and business reputation of the borrower,

their institution will merely develop into a machine for dispossessing the ancestral owner. This evil can only be avoided by the adoption of every precaution calculated to ensure repayment by the borrower.

385. The reason for the restriction of the original scheme for co-operative societies to credit has already been explained and the development of this side of the movement has been described. It has also been made clear that the credit side must continue to absorb the main activities of the officials of the department and their honorary collaborators until the burden of rural debt has been definitely lifted from the shoulders of the cultivator. It is generally recognised that there is a wide field for the beneficial application of the co-operative principle which extends far beyond the problems of debt, and the scope for other forms of co-operation has received very careful consideration in all provinces. A considerable variety of societies for purposes other than credit is to be found and much valuable experience of the difficulties facing these institutions has been gained. The credit society has proved easy to manage; its principles are readily understood; its requirements are within the capacity of the villagers to provide and it has done much to inculcate the value of self-help and of mutual help. A successful credit society is the best basis on which to organise other types but it is not easy to educate the people to the advantages of those types. Debt is felt as a burden but there is not the same ready appreciation of the value of joint purchase and sale, of insurance or of the many other schemes with which experiments have been made. Where business activities are involved, business management is required and it is not easy to find the capacity for this from amongst the members of societies. Such talent in this direction as exists usually prefers to find scope in working for private gain and several promising societies have come to grief owing to the secession of an important office holder who, seeing the possibilities of profit, decides to put his own interests first and to start a rival business. Lack of training in such matters as the combined purchase of agricultural requirements and the sale of produce has limited the choice of members of committees, and, where the men most fitted to serve in this capacity in credit and non-credit societies are the same, the question arises whether the same society should serve more than one purpose or whether there should be separate organisations for separate objects. No hard and fast rule or practice in this respect has yet been established in any province. Where the secondary object is of minor importance, such as the distribution of seed once or twice a year, or where the work involved is too slight to justify the establishment of a separate society, the credit society has usually undertaken the additional duty. But, where the new object is of such a different character that it appeals to a different membership, separate societies are usually formed. The fact that, under the law, rural credit societies must have unlimited liability is recognised as an impediment to their undertaking business for which limited liability is more suitable, and, where societies with unlimited liability are undertaking other functions, it is usual to keep separate accounts for

NON-CREDIT CO-OPERATION
(i) OBJECTS.

the latter. We found that, on the whole, the single purpose idea met with general acceptance, and that, where exceptions occurred, these were based on reasonable grounds. The multiple purpose society is nowhere advocated on grounds of policy; it is usual to describe the objects of a society in the by-laws in such a general way as to permit of secondary functions being performed without a breach of the law, but this is for convenience only and has not led to societies attempting to combine incompatible activities or risking their unlimited liability in transactions for which it is entirely unsuitable.

386. Co-operation for credit has now become well established and its importance is appreciated, but the need for the application of the co-operative principle in other directions is less thoroughly realised. It is quicker and easier in so many cases to do something for others than to teach them to do it for themselves, and the narrow limitations to the former method are apt to be overlooked. A considerable amount of seed can, for instance, be distributed by the official staff of the Agricultural Department and a million or more acres may be covered with a new type of cotton or wheat; but this result, although satisfactory in itself, is a comparatively small contribution to the problem of covering every acre in India with good seed of an improved type. Where the problems of half a million villages are in question, it becomes at once evident that no official organisation can possibly hope to reach every individual in those villages. To do this, the people must be organised to help themselves and their local organisations must be grouped into larger unions, until a machinery has been built up to convey to every village whatever the different expert departments have to send it. It is by such a system and by such a system alone that the whole ground can be covered. Only through the medium of co-operative associations can the teaching of the expert be brought to multitudes who would never be reached individually. The argument advanced in Great Britain that the State is interested in co-operation in order that its agricultural propaganda may be the more effective applies with even greater force to India and we should like to see the agricultural departments converted wholeheartedly to the view that the spread of a sound co-operative movement is the best guarantee of their own success. That their propaganda is more likely to be effective when addressed through organised groups than when aimed directly at the individual is recognised in most provinces, but not so fully as we consider necessary, and certainly not so fully as to lead to the complete abandonment of dispersed propaganda in favour of concentration. We have dealt with this point in our chapter on Demonstration and Propaganda, but the principle applies to an even wider sphere than was there under consideration. If the cultivators of India in the mass are to be won over to the use of better seeds, to improved methods of cultivation, to the better care of cattle, to the adoption of precautions against animal or plant disease, it must be through the agency of their own organisations. Nothing else will suffice. With the mass of the cultivators enlisted in the campaign for their own improvement, miracles can be achieved. Without that, a minority

(*ii*) Its great importance.

only will benefit from the labours of the experts. Once local opinion can be moulded in favour of change, more is gained than from the conversion of an isolated individual. A whole village organised to carry out the advice of the expert is a fertile field for the propagandist; where novelty has become fashionable, the path of the reformer is made easy. What is needed in India is a new public opinion which will break away from old custom and lead people to adopt those measures which careful research has proved to be most beneficial. It is the primary function of the co-operative departments to effect this change by patient and continuous education within the villages. The object of the society is of less importance than the education required to make it a success; a village converted to the use of pure seed or an improved plough will the more readily adopt advice on animal husbandry or listen to the case for compulsory education or for conserving manure. The sound teaching, without which no co-operative society can be a permanent success, can as easily be based upon one subject as on another, and if, as a result, public opinion has moved in the direction of seed or sale, it will move with less friction in the direction of purchase or cattle breeding. Outside the credit movement, the main function of the co-operative departments is to prepare the ground for the advice of the experts. The argument may be illustrated by instances. The adult education movement in the Punjab is the organisation of local public opinion in favour of this particular idea; without an effective public opinion in the village, no school for adults could last for a week. Adult education once accepted paves the way for compulsory education. The Better Farming societies in that province, of which there are now a hundred, and the cattle breeding societies, of which there are 176, represent organised public opinion in favour of adopting the advice of the agricultural and veterinary experts. Having secured the written agreement of a large number of cultivators that they will carry out the injunctions received, the co-operative staff can, with confidence, invite agricultural or veterinary officers to visit the villages and those officers can, in their turn, accept the invitation with equal confidence that their time will not be wasted. Similarly, the co-operative sale societies in Bombay represent organised public opinion in favour of the adoption of better methods of marketing, though here the expert advice is not yet forthcoming, and it is for this, amongst other reasons, that we have suggested the appointment of an expert marketing officer in Chapter XI. As this kind of organisation increases, the effectiveness of the technical propaganda must increase and the influence of the technical expert must expand. It is for reasons such as these that, where a choice has to be made, preference both of time and attention should always be given to a co-operatively organised body of cultivators over isolated individuals. Financial considerations make it impossible to contemplate an extension of the staff paid from government funds which would be sufficient to enable the whole ground in a province to be covered, unless that ground had been well prepared by co-operative effort.

This reasoning applies with special force to the machinery for distributing seed. The staff of the agricultural departments may be able

to do this work more quickly and more efficiently than an inefficient society but there are such narrow limits to their unaided efforts that any further substantial advance in seed distribution soon becomes impossible and, in the end, the people must be organised to distribute the seed themselves. It is better to accept the inevitable at the outset and to give preference in all cases to co-operative seed distribution agencies, where these are known to be efficient and well managed. The same argument applies to artificial manures and, to a less extent, to implements.

It has been explained that the function of the co-operative departments is to educate the people to accept the teaching of the expert and to prepare the ground for the adoption of his advice. The various types of agricultural society, including societies for the promotion of rural industries, have therefore been dealt with in the appropriate chapters of our Report and it is not necessary to repeat here what will be found elsewhere. A few remarks are, however, needed to complete our review of this important movement.

(*iii*) SOCIETIES FOR PURCHASE AND SALE.

387. Those who have interested themselves in the many-sided developments of the co-operative movement in Europe, America and elsewhere have expressed regret that the organisation of societies for purchase and sale has made so little progress in India, but such a criticism is not made by those who are acquainted with the special difficulties which have to be faced. Many experiments have been made ; many failures and some successes have been recorded ; but it is still doubtful whether the time is ripe for expansion of co-operative activity in this direction on a large scale. The power of age-long custom has confined the business of purchase of agricultural requirements and the sale of agricultural produce to castes and tribes other than those whose traditional occupation is husbandry, and the accumulated knowledge and experience possessed by members of those castes and tribes are not readily available to others. Moreover, there are features of the village shopkeepers' business which cannot be imitated by the co-operative society. The private shopkeeper prefers to sell on credit and to buy in advance ; he keeps his accounts himself and adds interest at the rate he considers suitable ; what may be the actual rate at which he buys or sells is known only to himself, and that very often not until he balances the account at the end of the half year or when the end of the period of limitation for the debt is approaching. He makes small profit on his turnover but gains much from interest and often from dishonest weighment and false book-keeping. A co-operative society for purchase or sale aims at a fair price, but, from the fair price alone, there is little profit to be derived ; it cannot, like its rival, seek to cover expenses and risk by malpractices. Before anything approaching a widespread movement for purchase or sale can come into being, there must be intensive education of the people in such matters as the benefits to be derived from cash purchase, the evils of forward buying, the relation of prices to accurate weighment, and loyalty in face of inducement to the contrary.

There are, however, societies of this kind doing good work in most provinces and their business is steadily expanding. The work done in connection with the co-operative sale of agricultural produce in the Punjab and Bombay demands special mention. The co-operative commission shop in the Punjab arranges to sell, on commission, goods brought to it by its members. It thus performs exactly the same functions as the ordinary commission agent, but secures for the producer fair weighment, fair dealing, and a fair price. Working in close touch with the village society, it strives to break down the evil system of credit on which the *adatyas* and village traders are mainly dependent for their business. In Bombay, there are two types of sale societies which deal mainly in cotton. The first type is the small society consisting of agriculturists of three or four villages growing the same variety of cotton, who pool their cotton and sell it jointly. In the second type, the area of operation is much larger and the membership is composed of both individuals and societies. These grow cotton of improved varieties, the seed of which is supplied partly by the Agricultural Department and partly by their own members. The produce is brought to the society for sale and, should the price prevailing in the market be low, the member concerned may store his produce in the society's godown and, in the meantime, obtain an advance upon it. The cotton is graded by officers of the Agricultural Department whose services are lent to the society for the purpose, and is then sold in lots at auction sales held periodically. Grading plays an important part in securing a higher price, as does also the fact that improved varieties of cotton are sold in bulk.

Experience has shown that great care is required in the organisation of sale societies. Skilled technical advice and guidance are necessary but even more important is proper business management. Unless this is available, the society must inevitably come to grief. Even when it is forthcoming, other difficulties arise, the most formidable of which is usually the opposition of local vested interests. A case of this kind was brought to our notice in the course of the evidence we received in Bombay. During the last two years, one of the oldest and most successful societies in that province, the Gadag Cotton Sale Society, which had been doing good business, has been boycotted by the local *dalals*, the chief reason for this being the increased hold which the society has obtained on the cultivators in the tract it serves. It was only with great difficulty that the society was able to dispose of the produce brought to it for sale. It is very desirable in cases of this kind that large buyers should extend to the society all the help possible, as it is in their ultimate interest, as much as in that of the producer that such societies, which aim not only at reducing the number of unnecessary middlemen but also in putting on the market improved and unadulterated produce, should prove successful.

Another class of societies, of which mention may be made here, is the co-operative irrigation society which has for its object the construction of new sources of irrigation and the improvement of those already in existence. Co-operative societies of this character have done good work in the Bankura and Birbhum districts of Bengal

where they now control an irrigable area of over 23,000 acres. The organisation of these societies is reported to have changed the whole outlook of the people and to have strengthened their economic position. Their development would have been more marked had it not been for the lack of expert guidance and advice—a point to which further reference is made below.

Where education is the main requirement, it is not easy to suggest means whereby Government can assist in other directions, but the example of other countries suggests that, if the obstacles peculiar to India are removed, much could be done. It seems anomalous, for example, that, while local governments are attempting to build up an organisation for co-operative sale, government departments should purchase their requirements from other sources. If the rice, wheat, and other commodities annually purchased for the Army or the jails were bought from co-operators, the encouragement would be of great value, and there is no reason to believe that the commodity or its price would be less suitable. The force of this argument has been recognised by the Government of Bombay which, in 1925, directed that co-operative producers' societies should be encouraged by being given preference in the purchase of articles of a kind made by them or in tendering for contracts, provided that no financial loss was thereby caused to Government.

(*iv*) PROVISION OF EXPERT ADVICE.

388. If there is to be any substantial progress along special lines, it will be necessary to provide the co-operative departments with expert advice. The business of sale, for instance, is not a matter for amateurs nor for those who have perforce devoted the greater part of their study to rural credit. In Chapter XI, we have recommended the appointment of special officers for the study of marketing in all provinces and these officers should be able to afford valuable assistance to those engaged in the organisation of societies for the sale of agricultural produce. In the Punjab, officers of the agricultural and veterinary departments are being deputed to assist the Better Farming and cattle-breeding societies; in Bombay, the Superintending Engineer on special duty to investigate natural resources for the protection of lands from famine should be able to encourage the formation of co-operative land improvement societies. Whether such advice should be given by the technical department concerned with the special form of activity, or by the loan of technical officers to the Co-operative Department, must depend upon the stage of development of the particular form of co-operative activity which it is desired to foster. The experience of the Bengal co-operative irrigation societies would probably have been more fortunate if an officer of the Irrigation Department had been lent to them instead of their being dependent upon such assistance as the Irrigation Department could give them in the course of its ordinary duties. The Madras Committee on Co-operation has recently recommended that there should be a special officer of the grade of deputy director of agriculture working under the Registrar whose duty it would be to encourage, improve and increase by all possible means the existing non-credit societies, and

to explore all other forms of co-operative activity which would better the lot of the cultivator. We would suggest that the desirability of a similar appointment might be examined in other provinces.

CONFERENCES OF REGISTRARS.

389. It has been suggested that the time is ripe for another Committee of Enquiry to review the progress of the movement and the defects which have been revealed since the Committee on Co-operation sat in 1914-15. In paragraph 373, we have suggested that an enquiry on the lines followed in the Central Provinces, the United Provinces and Madras might be undertaken with advantage in other provinces. We consider this sufficient. The provincial departments are working out lines of advance to suit their special local conditions; the general features of the movement in any one province are known in others and there would be some danger that an all-India committee might, by an attempt to secure uniformity, actually present obstacles to progress in the more advanced provinces. But we fully appreciate the advantages to be gained from formal exchange of views and comparison of experience and we welcome the renewal of the conferences of registrars which proved so valuable in the earlier stages of the movement. The last of these was held at Bombay in 1926 and we understand that another will shortly meet at Simla. Whether in addition to such official gatherings, to which a small number of non-officials can, with due regard to practical exigencies, be invited, there should also be meetings of non-officials, we do not feel called upon to decide. We feel confident that, subject to the limitations imposed by practical considerations, leading honorary workers will continue to be invited to the conferences of registrars.

In order to facilitate the study of new developments of co-operation in India, we recommend that both official and honorary workers should be given every facility, in the matter of allowances and in other ways, to visit provinces other than their own. The expense will be small and the advantages considerable.

CONCLUDING REMARKS.

390. Throughout this chapter, we have endeavoured to bring out the great importance we attach to the development of a strong and healthy co-operative movement. We have explained that, in our opinion, the chief function of Government in this connection is the provision of the most efficient means for the education of the people in the principles and practice of co-operation. Few things have struck us more forcibly in the course of our enquiry than the comparative failure of the movement in some provinces; it is, of course, true that defects are apt to be more prominent than successes and we fully appreciate the undoubted fact that, in every province, there are outstanding examples of benefits accruing from the application of the co-operative principles to local problems. Our examination of the movement has, however, convinced us that the necessity for a high standard of efficiency in work which has been shortly but accurately described as "Better Business" is not everywhere sufficiently realised. We agree with Sir Horace Plunkett that "Better Business is the foundation alike of Better Farming and Better Living." It has been made clear to us in some provinces that

the movement does not inspire confidence amongst workers in allied fields and no small part of the disinclination to make use of it has been due to its internal defects. The recommendations we have made in favour of preference being shown to co-operative organisations in the field work of other departments will fail in their effect unless such organisations are well managed, efficient and active.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

391. The conclusions and recommendations in this chapter may be summarised as follows :—

(1) The main activities of the co-operative movement must continue to be directed to the expansion of the rural credit system (paragraph 371).

(2) Further effort to fulfil the standards laid down by the Committee on Co-operation in India is required (paragraph 373).

(3) An inquiry into the working of the co-operative movement on the lines followed in the Central Provinces, the United Provinces, and Madras might, with advantage, be undertaken in other provinces (paragraph 373).

(4) The only remedy for the unsatisfactory condition of the movement in some provinces is the patient and persistent education of the members of co-operative societies in the principles and meaning of co-operation (paragraph 374).

(5) Every effort should be made by the co-operative departments in all provinces to build up a highly educated and well trained official staff (paragraph 374).

(6) The provision of such a staff should not weaken the position of the honorary worker (paragraph 374).

(7) Progress in the organisation of a supervising agency by federating primary societies into supervising unions has been sufficiently satisfactory to justify further experiments in this direction (paragraph 375).

(8) Where supervising unions or provincial unions or institutes are discharging their responsibilities efficiently, they may reasonably look to Government to supplement their resources with grants-in-aid (paragraph 375).

(9) The best man available should be selected as Registrar of Co-operative Societies and should hold the appointment for not less than five years or more than ten (paragraph 376).

(10) There should be an officer under training in all provinces to succeed the Registrar (paragraph 376).

(11) Deputation to study the co-operative movement in Europe is desirable both for the registrars and for officers under training to succeed them (paragraph 376).

(12) A whole-time Registrar should be appointed in the Central Provinces (paragraph 376).

(13) The Punjab system of training the staff of the Co-operative Department is deserving of imitation elsewhere, as is the Bombay

system of requiring auditors to pass an examination in co-operative accountancy (paragraph 377).

(14) The financing and the supervision of primary societies should be under separate control but there is no objection to the practice of deputing inspectors from provincial or central banks to examine the working of such societies, provided the inspectors are properly qualified, their duties are clearly defined and they are strictly confined to them (paragraph 377).

(15) There is justification for a larger contribution from government funds to the expenses of the movement in backward tracts, such as some of the minor administrations (paragraph 378).

(16) Government should give liberal assistance in the early stages to the more specialised forms of co-operative activity such as consolidation of holdings, adult education, irrigation and the like (paragraph 378).

(17) Where expenditure by Government on audit would involve the comparative neglect of education, education should be given preference and the statutory audit should be paid for by societies (paragraph 378).

(18) Certain concessions to co-operative societies which are at present given by Government in some provinces are recommended for all provinces (paragraph 378).

(19) Co-operative societies should be permitted to take full advantage of the facilities afforded by the district treasuries and sub-treasuries (paragraph 379).

(20) Local governments should impress upon the officers of all departments the importance they themselves attach to a sympathetic attitude towards all phases of co-operative activity (paragraph 380).

(21) The resolution passed by the Conference of Registrars of 1926 in favour of the establishment of land mortgage banks is endorsed (paragraph 381).

(22) Land mortgage banks should be established under the provisions of the Co-operative Acts (paragraph 382).

(23) The guarantee of interest on the debentures of land mortgage banks is the most suitable form in which assistance to these banks can be given by Government (paragraph 383).

(24) Government assistance to land mortgage banks in the form of subscription to their debentures is not recommended (paragraph 383).

(25) Land mortgage banks should provide a suitable agency for the distribution of loans under the Land Improvement Loans Act (paragraph 383).

(26) The debentures of land mortgage banks, the interest on which is guaranteed by Government, should be added to the list of trustee securities under the Trustees' Act (paragraph 383).

(27) The issue of the debentures of land mortgage banks should be controlled by a central organisation (paragraph 383).

(28) Land mortgage banks should only be organised after the most careful preliminary enquiry and their constitution and working should be as simple as possible (paragraph 384).

(29) For some years to come, there should be an official member of the committee of management of each bank (paragraph 384).

(30) Co-operative societies for a single purpose are to be preferred to multiple purpose societies (paragraph 385).

(31) Outside the credit movement, the main function of the co-operative departments is to prepare the ground for the advice of the experts (paragraph 386).

(32) In the propaganda work of other departments, preference both of time and attention should always be given to a co-operatively organised body of cultivators rather than to isolated individuals (paragraph 386).

(33) Before a widespread movement for co-operative purchase and sale can come into being, intensive education in its advantages is necessary (paragraph 387).

(34) It would be in the interests of both the producers and of the large buyers if the latter were to render all the help possible to co-operative sale societies (paragraph 387).

(35) Preference in the purchase of the requirements of government departments should be given to co-operative societies, provided that no financial loss to Government is thereby caused (paragraph 387).

(36) Substantial progress in non-credit co-operation can only be secured if expert advice is liberally given (paragraph 388).

(37) Whether such advice should be given by the technical department concerned or by the loan of technical officers to the Co-operative Department, must depend on the stage of development and the particular form of co-operative activity which it is desired to foster (paragraph 388).

(38) The desirability of appointing a special officer of the grade of deputy director of agriculture to work under the Registrar, as recommended by the Madras Committee on Co-operation, might be examined in other provinces (paragraph 388).

(39) The appointment of an all-India Committee of Enquiry to review the progress of the movement and the defects which have been revealed since the Committee on Co-operation sat in 1914-15 is not recommended (paragraph 389).

(40) Official and honorary workers should be encouraged to study co-operative developments in other provinces (paragraph 389).

CHAPTER XIV

THE VILLAGE

SCOPE OF THE CHAPTER.

392. In the course of our enquiry, much emphasis has been laid by witnesses on the opportunities that exist for an improvement in the general rural environment of the cultivator and in the conditions in which he lives. The necessity for a strong forward policy in matters of medical relief and public health and the importance of investigations into the problems of nutrition and diet have been forcibly brought to our notice. In this chapter, therefore, we propose to examine some of these problems and to describe the steps already being taken by official and non-official agency to improve the amenities of rural life and generally to make conditions in the villages more attractive.

The problems broadly divide themselves into two main groups. We shall first discuss the duties of the State in the investigation of basic medical problems, in enunciating sound principles of public health administration and in carrying these into effect. We shall then discuss the extent to which the public can carry State action a stage further and can assist generally in improving rural conditions by the brightening of village life. It would be beyond our province to make detailed recommendations. Medical research and public health are subjects which are adequately dealt with by their own departments, while public opinion is awakening to a sense of duty in matters affecting the general welfare of the masses. Our object is rather to show what is being done by the departments of Government concerned and to note any striking line of action by private bodies or individuals which may seem worthy of consideration by workers in different parts of the country. We desire, in short, to bring out the fact that much is being done both by the State and by private agency and that the general economic trend of events is conducive to, and suggests the possibility of, a rapid improvement in rural conditions at no distant date. The matter very largely rests with the people themselves.

GENERAL FEATURES OF RURAL LIFE.

393. In other parts of the Report, more especially in Chapter I, we have endeavoured to give a general description of rural life in India. Some amplification of that description seems desirable as an introduction to the subject matter of this chapter and we also propose to indicate some of the economic and administrative factors at work which may render the rural community more receptive to new ideas and facilitate the introduction of measures tending to improve rural conditions.

In a comprehensive survey of the great sub-continent of India, one cannot but be struck by the apparent diversities it presents. Its vast area comprises many varieties of climate ; all classes of soil and cultivation are to be found within its borders. Its physical configuration includes lofty mountains and deep valleys, wide uplands and plateaus

and great alluvial plains. Its population comprises many different elements and almost every stage of social development is represented. In such circumstances, it might seem well-nigh hopeless to frame generalisations of value regarding the cultivator and his surroundings. But there are certain economic and social conditions which are common to almost the whole of India. There are very few large cities or urban areas; agriculture is by far the most important industry; the typical unit of cultivation is a holding of a few acres; the financial resources of the cultivator are slender. In rural areas, a resident middle class is almost entirely absent; illiteracy is the rule and not, as in western countries, the exception; status rather than contract is the cement of a social structure which, almost everywhere, has considerable elaboration in the village community and, among the Hindus, finds a fundamental expression in caste.

Progress in social and economic development is due to the growth of new ideas and desires stimulated by contact with the outer world and opportunity to work for new ideals. The needs of the Indian cultivator have hitherto been few. So far, village life has been self-contained and the villager has had little contact with the great world outside. But history shows that the peasant benefits from the stimulus of urban centres in his midst and from the standards set by an industrial population. The average Indian cultivator knows nothing of cities and almost nothing of industry. Illiterate himself, he has, as a rule, no one in his village to whom he can turn for advice. In the vast majority of the villages, he does not want, because he has never known, such amenities as modern sanitation, pure drinking water or skilled medical aid. Outbreaks of seasonal diseases, such as cholera and malaria, do not prompt him to action since he does not connect them with the absence of such amenities. He regards visitations of epidemics as part of the natural order of the world.

Such are his disabilities. His assets are, however, by no means inconsiderable. From time immemorial, he and his fellows have been accustomed to rely on their own exertions. The village has grown, and in the great majority of cases still grows, its own food; the penalty of failure until quite recently has been starvation and, in extreme cases, death. It has maintained, and still very largely maintains, all the artisans which a simple agriculture and manner of life require—the smith, the carpenter, the weaver, the potter and the worker in leather. It has financed and still, to a large extent, finances its crops and the marketing of the surplus through moneylenders of various types and designations, although, in an increasing number of villages, the co-operative departments provide the cultivator with an alternative means of finance and are thus a new factor which has begun to play an important part in rural life.

Lastly, but by no means of least importance, the village very largely governs itself. The authority exercised by the headman and the mode of his appointment vary among different communities. But the headman is a characteristic feature of Indian village life. Though his office is frequently hereditary, he is by no means an autocrat. He has definite

duties towards the Government at whose will he holds office and he must carry with him the opinion of the village elders.

The cultivator is thus a member of a definitely organised community, which has, as far back as the history of social organisation in India can be traced, been dependent on itself for the means of living and, to a very large extent, for its government. As a result, the typical cultivator is, within the sphere of his experience, self-reliant and both his methods of cultivation and his social organisation exhibit that settled order which is characteristic of all countries in which the cultivating peasant has long lived in, and closely adapted himself to, the conditions of a particular environment.

394. Upon this ancient structure of village life certain influences are at work which must sooner or later profoundly modify its characteristic self-sufficiency and which, in some parts of the country, have already begun to produce their effects. These influences are partly economic and partly administrative.

SIGNS OF CHANGE. (i) ECONOMIC.

The economic influences are both internal and external. Internally, there is a steady, if slow, development of industry and an increase in the demands from urban centres. Although large scale industries are still mainly grouped round the large ports of Bombay, Calcutta, Rangoon and Madras, with outlying factories at a few up-country centres, there is a decided tendency for the primary manufacturing processes of agricultural products to extend to the small towns and even to the larger villages. Oil mills, cotton ginneries, rice-hulling mills, sugar and tobacco factories establish themselves wherever the combination of the particular crop, good communications by rail or river, and suitable power is to be found. At present, over the country as a whole, the influences of these factories are relatively unimportant, but, in the localities in which they are situated, they are undoubtedly having a marked economic effect. This development of industry away from the large centres provides a much needed outlet for the surplus capital of the local moneylender. The labour required is supplied in large measure by the poorer local cultivator; for the busy season at the factory is his off season, since it is with his harvested crop that the factory deals. In short, the factory finds employment for the men and money of the locality in which it is established and brings to it the stir of new ideas. The establishment of factories and the creation of industrialised urban centres lead to a demand for agricultural produce and for such articles as fruits, vegetables and dairy produce. A tendency arises to produce milk, fruits and vegetables intensively where conditions of climate and soil are favourable and transport facilities to industrial centres are available. Such specialised cultivation means that the cultivator gets money for his own products, but must, in many cases, buy some of his foodstuffs, and that the self-subsistent economy of the villages throughout these areas of specialised production tends to decline.

The growing external demand for special products also steadily invades the seclusion of village life. Bumper harvests no longer rot on the fields, after the requirements of the village have been met, because no external markets exist. The "money crop" element in Indian agriculture

—cotton, oil-seeds, jute, tea and tobacco—is now becoming more and more a factor in the world supplies. Buyers for the large export firms are to be found in increasing numbers in up-country centres. Interest in the quality of the country's produce grows with the raising of the world's standards. Firms selling fertilisers and machinery are no longer content to confine their operations to the large cities but send their agents out into the country districts. It is easy to exaggerate the present strength of this inter-connection between an Indian village and the world markets, both as regards the area affected and the degree of influence exerted. The village so affected is still the exception, but, in considering the signs of change, it is impossible to ignore the potentialities of this factor.

Railways and river transport take an increasing share in linking the villages with the towns. There is another influence at work which is likely to have a profound effect in this respect, the great development of motor passenger services and the large use made of them by the villagers. The effect of this development of rural life will ultimately be the same as it has proved to be in all other countries. Where such services ply, the artisans of the villages along their route will have to face the competition of the town bazaar. The interchange of produce between towns and villages will be extended. The forces of conservatism in an Indian village are strong, but the experience of all ages and countries has been that the opening up of communications is a most powerful factor in bringing about economic and social change. To this experience we believe that the Indian village will be no exception. We are not prepared to affirm that contact with the towns must invariably, and in all respects, exercise an improving influence on the countryman. There can, however, be no doubt that such contact sharpens the wits of rural folk, and renders them more easily receptive of new ideas, and more anxious to grasp new opportunities.

(*ii*) ADMINISTRATIVE.

395. In matters of administration, the isolation of the village is being steadily, if slowly, overcome. By a series of local government enactments between 1919 and 1926, the powers of district boards in respect of education, health, conservancy, public works, and certain other matters, have been, in most provinces, delegated in some measure to *panchayats* or other small administrative units. In some cases, the unit is one village only; in others, a group of villages. The composition and duties of these village bodies, whether known as *panchayats*, union boards or union committees, are very similar. Their duties include the supply of water for domestic use; the cleansing of public roads, drains, tanks and wells (other than tanks and wells used exclusively for irrigation), and other public places or works in the village; the construction, maintenance and repair of minor roads, drains and bridges; sanitation, conservancy and the prevention and abatement of nuisances; the preservation and improvement of the public health; the maintenance and regulation of the use of public buildings vested in the *panchayats* or local committees, and the control of grazing lands; the lighting of the village, the supervision

of the village school, and the management and maintenance of cattle pounds. In addition to these executive duties, village committees are empowered to try certain trivial offences, especially breaches of the by-laws regulating the performance of their executive duties. Their expenses are met from the village fund which is partly maintained by contributions from Government and district local boards, and partly by house and other village taxes. The powers obtained have, in very many cases, not yet been used, and, where a beginning has been made, the machinery is not yet working vigorously. The difficulties which have arisen are mainly due to inexperience and to the reluctance to impose local taxation. The fact remains, however, that power now generally exists to make the administration of the village far more efficient than formerly and to link it with the district and provincial administration. The mere existence of this power is an important indication of the increasing attention being paid to the village in the administration of the provinces.

Thus, in matters of local self-government, the tendency of recent years has been to emphasise the importance of the village as the unit of administration. Generally, we are satisfied that, in the sphere of administration, provision exists to enable the villages to maintain and develop self-government while participating in the larger life of the province. The distances, the size of the population, and the limited resources in men and money make it difficult for the provincial governments to do more than point the way in matters affecting the welfare of the villages.

PUBLIC HEALTH.

ITS RELEVANCE TO THE ENQUIRY AND ITS INTRINSIC IMPORTANCE.

396. Our primary concern with the dwellers in the villages we have just described is with what may be called the technique of agricultural improvement and the various scientific and economic factors which we consider necessary to achieve such improvement. But it is also an instruction to us "in particular to investigate the main factors affecting rural prosperity and the welfare of the agricultural population." A striking challenge to such an investigation is contained in a Resolution which was passed in identical terms at the all-India Conferences of Medical Research Workers, held in 1924 and 1926. The Resolution runs as follows :—

" This Conference believes that the average number of deaths resulting every year from preventible disease is about five to six millions, that the average number of days lost to labour by each person in India, from preventible disease, is not less than a fortnight to three weeks in each year, that the percentage loss of efficiency of the average person in India from preventible malnutrition and disease is not less than twenty per cent and that the percentage of infants born in India who reach a wage-earning age is about 50, whereas it is quite possible to raise this percentage to 80 to 90. The Conference believes that these estimates are under-statements rather than exaggerations, but, allowing for the greatest possible margin of error, it is absolutely certain that the wastage of life and efficiency which result from preventible disease costs

India several hundreds of crores of rupees each year. Added to this is the great suffering which affects many millions of people every year.

This Conference believes that it is possible to prevent a great proportion of this waste at a cost which is small in comparison with the expenditure.

The recent census shows that the position in India is one of grave emergency. The Conference recognises that the problem is very complicated and involves not merely medical research, but also questions of public health, medical relief, medical education, propaganda, and social and economic considerations.

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The Conference believes that the greatest cause of poverty and financial stringency in India is loss of efficiency resulting from preventible disease and, therefore, considers that lack of funds, far from being a reason for postponing the enquiry, is a strong reason for immediate investigation of the question."

THE INTERACTION OF AGRICULTURE AND PUBLIC HEALTH.

397. The close relationship between agriculture and public health is obvious and the two react upon each other to a remarkable degree. Economic wastage due to disease cannot be over-exaggerated. Malaria slays its thousands and lowers the economic efficiency of hundreds of thousands; plague and cholera sweep the country from time to time; hookworm disease, kala-azar and diseases arising from diet deficiency insidiously reduce the labour power of the cultivating classes. Any enquiry, therefore, into the general condition of agriculture and the position of the cultivator must take account of the public health aspect of his life; of the suitability of his diet; of the sanitary conditions under which he lives and of his general rural environment. In order that, as a result of the "better farming" to which we hope our proposals will lead, the cultivator may have that "better living" which should follow from it, it is necessary to take stock of existing conditions and consider what steps are necessary to improve them. These conditions in the rural areas are certainly bad. Sanitation, in any accepted sense of the word, is practically non-existent. The public latrine is too often the bank of a stream or the margin of a tank. This predisposes to hookworm infestation and to the spread of all the diseases which are caused by a polluted water supply, for the same water is in many places used both for drinking and bathing purposes. The use of the open field may not in all cases be open to the same objections, but here also every endeavour should be used to protect catchment areas of tanks and streams. As soon as the villager is sufficiently instructed in health matters to appreciate the advantages of proper latrines and the need for keeping them in a decent condition, we consider that their establishment would on all grounds be desirable. Risks to health would be minimised and a valuable source of manure conserved. Unprotected wells and tanks; unswept village streets; close pent windows excluding all ventilation: it is in such conditions that the average villager lives and yet succeeds in maintaining a remarkably high standard of personal cleanliness and tidiness. The tragedy is that such a state

of affairs should exist when, with corporate action on the part of the villagers, the evils would be so easily remediable. A common determination to protect wells, to keep villages clean and to avoid as far as possible the pollution of rivers would undoubtedly lead to an enormous improvement of the public health.

POLICY AND PROGRESS.

398. In the course of our investigations, we have had the advantage of examining the public health representatives of the Government of India and of all local governments. The impression we have gathered from our enquiries is that a distinct forward movement in the investigation of public health problems is in progress. It has been pointed out that, for the past eighty years, the Government of India have slowly, but persistently and unostentatiously, been advancing medical research, education and relief. Emphasis has been laid on the point that public health principles must not be unduly forced upon a people bound by ancient customs many of which are linked up with their religious practices. The policy, therefore, has been to press on with research and investigation, and, by judicious and well-considered propaganda, to try to foster in the people a public health conscience which will make the application of the principles recommended an easy matter when such a conscience has been generally awakened. There are signs that such an awakening is slowly taking place in urban areas ; should it be stirred in rural areas, the improvement in health conditions may be rapid and general. Such an awakening must, however, largely depend, in the first instance, on an expansion of the public health personnel and we had abundant evidence in the course of our tour that this is rapidly taking place in most provinces. It was also a matter of gratification to find that the attitude of the local legislatures to public health matters is sympathetic and that there seems to be a general desire for progress in this direction.

PRINCIPLES OF PUBLIC HEALTH ADMINISTRATION.

399. Under the present constitutional arrangements, " Public Health " is a transferred subject and its detailed administration rests with local bodies. The State provides technical advice and staff and assists with money grants, but the carrying out of schemes in detail must, in the main, be a matter for the people themselves. The only aspect of public health in which the central Government can now intervene is in the framing of all-India legislation, so far as the Indian Legislature may deem necessary, in respect of contagious and infectious diseases. Central agencies and institutions for medical research, however, remain under the control of the Government of India but there is no restriction on such research being undertaken in provincial institutions, and indeed much research work is carried out locally

THE PROVINCIAL PUBLIC HEALTH DEPARTMENTS : OBJECTS AND GENERAL ORGANISATION.

400. The concern of the provincial public health departments is the establishment, throughout the country, of such precautionary conditions as render the incidence or spread of disease less likely. In recent years, there has been a great forward movement in this direction and questions of improved water supply, sanitary and conservancy arrangements

have received an increasing amount of attention. Public Health, formerly in the charge of the Inspector General of Civil Hospitals, is now a separate department under its own Director. The organisation of the departments varies somewhat in the different provinces. As a rule, the staff consists of a Director with one or two assistant directors, and special officers such as malariologists, directors of vaccine institutes and chemical examiners. The districts are reached by the district health officers with a staff of health inspectors and sanitary inspectors (for municipalities), and it is only by the rapid expansion of such a staff that improvement in the sanitary and health conditions of rural areas can be effected. The most highly developed department in this respect is the Madras department and we think it desirable to give in some detail an account of its organisation, as an indication of what we consider necessary in all provinces, if the rural problems waiting for solution are to be efficiently and speedily dealt with.

MADRAS DISTRICT HEALTH SCHEME.

401. The health scheme was introduced in every district in Madras in 1923. Three assistant directors of public health were put in charge of a bureau in the office of the Director of Public Health instead of being in charge of territorial areas as they formerly were. A trained health officer is now in complete charge of the public health administration of a district and, in each taluk, there is at least one health inspector who works under the immediate supervision and control of the district health officer. There are now 26 district health officers and 261 health inspectors. This health staff also supervises the work of the vaccinators employed by local bodies. Members of the health staff are government officers and their services are placed at the disposal of the local bodies to carry out the provisions of the Local Boards Act (1920) which deals with the health, safety and convenience of the rural population. The salaries of all health officers in rural areas are paid by Government, but the whole expenditure in connection with the prevention of epidemics and the improvement of sanitation is a charge on local bodies.

The subjects with which this district health staff deals are the investigation and control of communicable diseases in rural areas, the supervision of vaccination and preventive measures, and the superintendence of the registration of vital statistics. In addition, it drafts plans and estimates for simple sanitary projects and takes steps to remedy defects in village drainage and water supplies. It is also responsible for health propaganda work by means of lantern lectures and posters, etc. When outbreaks of cholera or plague occur, it is expected to take all precautionary measures against its spread and to localise the outbreaks in co-operation, where necessary, with the staff of other districts. It also investigates hookworm infestation and other similar parasitic infections.

Much has been effected by the introduction of this scheme. It has been possible, by preventive measures, to check the spread of epidemics

such as cholera and relapsing fevers. Progress in vaccination and improvement in the registration of births and deaths have been achieved. The advance in the education of the public in health matters as the result of lectures, lantern exhibitions and posters has been marked. Medical inspection of pupils in secondary schools is compulsory and the principles of hygiene are taught more generally and more intelligently. The demand from the public is now for more staff and for a wider extension of activities. This attitude indicates that all that is wanted is a lead and that public interest will rapidly follow.

THE INDIAN RESEARCH FUND ASSOCIATION: ITS ORGANISATION AND WORK.

402. With regard to the causation as opposed to the prevention of disease, the greater part of the medical research undertaken by the central Government is carried out by officers working under the Indian Research Fund Association. The objects of this Association are the promotion and assistance of research, the propagation of knowledge, and experimental measures generally in connection with the causation, mode of spread and prevention of diseases primarily of a communicable nature. The entire control and management of the affairs, funds and work of the Association is vested in, and rests with, the Governing Body. This Governing Body, of which the Member of the Governor General's Council in charge of the portfolio of the Department of Education, Health and Lands is president, consists of five members appointed in virtue of their office and others who may be selected by the president from among members of the Association who have shown special interest in the objects for which the Association is established. The Association consists of permanent and temporary members. The permanent members are the president and members of the Governing Body, and every donor of Rs. 500 or upwards. All members of the "working committees" (if they are not already permanent members of the Association) and every contributor of Rs. 100 and upwards annually during the currency of his subscription are temporary members. The Governing Body appoints a Scientific Advisory Board of whom not less than three members are members of the Governing Body. This Body examines all proposals in connection with the scientific objects of the Association which are submitted to it by the Governing Body and reports as to their feasibility. The scientific objects of the Association are carried out with the aid of the working committees appointed by, and working under the direction of, the Scientific Advisory Board. The funds of the Association (both capital and interest) are under the entire control of the Governing Body for the scientific objects of the Association, and are applied to the payment of current expenses and charges incidental to the execution of the duties of the Governing Body, the Scientific Advisory Board and the working committees.

The enquiries and investigations instituted under the auspices of the Association are conducted mostly by officers of the Medical Research Department who may be officers of the Indian Medical Service or private workers. Their pay and allowances are met from a grant made by the Government of India for the purpose. The Association also receives

an annual subsidy from the Government of India of about five lakhs of rupees. Its other funds are derived from donations by the public. Much research work has been done under the auspices of the Association in connection with such diseases as cholera, plague, malaria, kala-azar and in the investigation of problems of diet deficiency. This research is not at present centralised in one institute. The Association carries out its operations all over India in the areas in which material is available for the particular investigation in hand. The constitution and the work of the Indian Research Fund Association appear to us to be excellent. We have described its constitution in detail because it is a valuable combination of official and non-official control, money and experience for the promotion of the general welfare. Progress in the immediate future, in a country so large as India, must depend on the degree to which private effort and official experience can co-operate in joint schemes of social amelioration.

VILLAGE MEDICAL AID SCHEME IN BOMBAY.

403. In the Bombay Presidency, a scheme has been inaugurated for the supply of medical relief in rural areas which are out of reach of hospitals, dispensaries and of medical practitioners. Under this arrangement, a certain number of selected primary teachers are given a training of about 2½ months' duration at the civil hospitals, in what may be called first aid. At the end of the course, they return to their schools and act as first-aid doctors in the vicinity. Thirty men thus trained have been established in villages of about 1,000 to 1,500 inhabitants in five districts. In addition to their school duties, they help villagers in minor ailments and send on cases, with which they are not themselves capable of dealing, to the nearest hospital or dispensary. During the first sixteen months the scheme was in operation these *upacharaks*, as they are called, dealt with over 120,000 cases, and Collectors, civil surgeons, and presidents of municipalities and local boards have borne testimony to the quality and value of their work. The villages selected are within easy reach of headquarters, so as to facilitate inspection, and the headmasters selected for training are ordinarily chosen from schools with two or more masters. A small allowance is paid to the men thus trained and employed. We consider the scheme a promising one, as it provides for simple medical aid in areas which cannot support a dispensary or a qualified practitioner and must, from the position of a headmaster in a village, ultimately be a powerful factor in creating local interest in questions of rural hygiene and sanitation. Further, the employment of schoolmasters, while it has limitations, obviates the objections which might be raised to the creation of a separate class of inferior practitioner.

SUBSIDIES TO PRIVATE MEDICAL PRACTITIONERS.

404. In connection with the expansion of medical facilities in rural areas, we desire to draw attention to a scheme which has been adopted in some provinces, under which a monthly subsidy is given to qualified practitioners to induce them to settle in small towns or villages. Apart from the provision of trained medical skill, the presence of a man of education and position in the village must have a considerable effect.

Economic pressure will probably ultimately induce many qualified medical men to leave the larger for the smaller towns and the grant of a subsidy may accelerate the process. The local doctor should, in course of time, become the natural leader in matters affecting village amenities. We consider that schemes of this nature have great potentialities and that they should be encouraged.

MIDWIVES.

405. A matter which very closely affects the welfare of the community, and which has in recent years attracted much attention, is the improvement of the training of nurses and midwives. It has to be admitted that, so far, little progress has been possible outside municipalities or large towns, but it is a matter for satisfaction that even such a beginning has been made. Progress in this direction must depend on the awakening of the public conscience and on the appreciation of the appalling wastage of infant and maternal life which results from the terrible rigours of childbirth. Advance must be slow, but it is satisfactory to note that it has begun. A number of provinces have Nurses and Midwives Acts. As a rule, these Acts provide for the registration of nurses and midwives and for the registration of *dais* (village midwives) and limit the appointments to hospitals and dispensaries supported by public funds to nurses or midwives so registered. In some cases, the Act provides that no subsidy shall be paid by the local government or local authorities to any medical practitioner who employs a *dai* other than one who is registered. The training of *dais* is a great difficulty and, indeed, is the crux of the whole matter. In this connection, we may refer to Lady Wilson's Village Baby Scheme under which existing *dais* in any village will be divided into two groups, which will be brought in succession to some centre such as Poona or Bombay and shown. for a period of ten days to a fortnight, how cleanliness and non-interference are observed in midwifery cases in the hospitals. This scheme, which was first tried experimentally in the Poona district, has proved so satisfactory that in July, 1927, a larger scheme known as the Lady Wilson Village Maternity Association has been embarked upon, the object being to extend the work all over the presidency. The Government of Bombay are prepared to assist the scheme with a grant equal to one-third of the expenditure, up to a maximum of Rs. 10,000 annually. There seems to be no doubt that the training of the indigenous *dais*, under these very simple methods, in the principles of their profession, will ultimately have a very marked effect.

In Bengal, grants are given to district boards to organise the training of *dais* by means of their dispensary medical officers, a small allowance being given to the *dais* as an inducement to attend the classes regularly.

Apart from legislative enactments concerned with nurses and midwives, the interests of the mothers and children are now the concern of a large and increasing body of ladies of all nationalities and classes, who have formed themselves into maternity relief and child welfare associations. Unfortunately, again, the great majority of these are in the larger towns.

Their activities lie mainly in the direction of infant welfare societies, but in some cases include the provision of small lying-in hospitals and the supply and training of midwives.

The Gurgaon district of the Punjab may be mentioned as one notable instance where this welfare work is beginning to be extended to the villages, as part of an intensive campaign of rural uplift organised by a most enthusiastic deputy commissioner and his wife—Mr. and Mrs. F. L. Brayne. This village work is undertaken by lady health visitors of whom there are now four. They advise pregnant women on necessary precautions and preparations and on the selection of a good *dai*, etc. *Dais* are trained by the Lady Health Officer at the district headquarters.

WELLS.

406. We have limited ourselves strictly to a description of the more notable official efforts to deal with public health affairs, as an examination in detail of the work done would involve technical questions which do not fall within our province.

But we have been very much impressed, in the course of our tour, by the insistent demand for an improved water supply. We consider this a matter of paramount importance and would urge upon local governments the desirability of encouraging the conversion of step wells into lift wells provided with parapets and suitable gear. The sinking of tube wells will often provide an ample supply of potable water where other sources are unsatisfactory. These are measures which it is not easy for the village community to carry out unaided. Money, and not labour, plays the chief part, and it is in the collection of funds that the common endeavour of a village is least effective. Recent enactments give local boards and village authorities power to impose taxation in various forms; we observe, however, that power to impose a special cess for a particular object has not been granted. A village which would object to the permanent levy of a general cess might often welcome a special levy for the purpose of a well or a tank. Some local governments are already making annual grants to local authorities for the improvement, under the supervision of the public health departments, of the potable water supplies. Remembering the heavy charges on public funds involved in dealing with epidemics of diseases known to be water-borne, we suggest that all governments may well regard expenditure on capital works of the nature described above as constituting a sound policy of insurance.

THE EFFORTS OF NON-OFFICIAL AGENCIES TO IMPROVE THE HEALTH AND WELFARE OF THE COUNTRY-SIDE.

407. In the course of our tour, we have been much impressed by the great awakening of non-official interest in the health and welfare of the country-side. It is from this manifestation of public interest that we derive our greatest encouragement and hope. This awakening is general and is not confined to any particular province. We propose to refer to a few non-official schemes which seem to us to be worthy of mention and imitation.

408. The social work of the Servants of India Society, which was founded by the late Mr. Gokhale, is an interesting example of non-official effort. It is directed by the Poona Seva Sadan Society which was established in 1910 as a movement to promote the education of women. Its activities extend to all branches of education, literary, industrial, medical and cultural, but the basic ideal is social service. Whilst all its efforts, therefore, have a bearing on the problems of rural environment, special mention should be made of the facilities which it provides for medical education amongst women. In its last report, 78 women are shown as attending courses of instruction in midwifery and nursing and as students of the Public Health School at Poona. Infant welfare centres are attached to the Ahmednagar and Sholapur maternity hospitals, and 148 and 117 women respectively are being trained in midwifery, nursing and child welfare work. There are also branches of the institution at Nagpur and Gwalior where similar work is carried on. In addition to instructional work, and the conduct of infant welfare centres, the society distributes free of cost, medicine, milk and clothes to the children of the poor, while free advice and treatment are given to expectant mothers. The society is also extending maternity and child welfare activities in other stations and now has in all five small maternity hospitals and dispensaries and seven infant welfare centres. A number of trained nurses are also available for work in the districts.

TYPICAL EXAMPLES OF SUCH EFFORTS.

(i) THE SEVA SADAN SOCIETY.

409 We would also mention the Central Co-operative Anti-Malaria Society of Calcutta, founded by Rai Bahadur Dr. G. C. Chatterjee with the express purpose of controlling preventible diseases like malaria, kala-azar and cholera by co-operative effort. The possibilities of this movement have been recognised by Government which assists the Society by annual grants amounting up to date to about Rs. 70,000. An appreciable improvement has been effected in the water supply and sanitation of villages where societies formed under the auspices of the central society exist. In some cases, the societies maintain medical officers of their own. At the time of our examination of Dr. Chatterjee, there were 950 anti-malaria village societies of which 700 were regarded as active and 250 as more or less moribund. Out of the 700 societies, 300 were registered under the Co-operative Societies Act. Unfortunately, not all of these societies are effectively linked up with the central society nor is the connection with local bodies as close as it might be. Apart from these weaknesses in organisation, there is no doubt that the movement has done a great amount of practical good by arousing Bengal villagers to the necessity and the possibility of improving the health of their villages by their own efforts.

(ii) THE CO-OPERATIVE ANTI-MALARIA SOCIETY OF BENGAL.

410. As another example of the work being done by private organisations, we would mention the Rural Reconstruction centres of the Indian Young Men's Christian Association, of which six have so far been established in southern India. Some of us visited the centre at Ramanadapuram, a village on the outskirts of Coimbatore. The main

(iii) RURAL RECONSTRUCTION CENTRES OF THE INDIAN Y. M. C. A.

object of these centres is to bring to notice by means of exhibits in markets, the distribution of literature and dramatic performances, the facilities which co-operation, education, and sanitation offer for a better and fuller life. This Association has recently founded a Students' Association for Rural Service.

MALARIA AND QUININE. (i) GENERAL.

411. The devastating incidence of malaria in India is graphically brought out in a statement by the Public Health Commissioner with the Government of India. In the health statistics for the whole of India for 1923, nearly 3¾ million of deaths are recorded as due to fevers. On this Colonel Graham remarks :—" The application of an arbitrary correction figure of ¼ for fever mortality figures still shows over a million deaths from malaria, the morbidity of which is very great. As we have a record of nearly eight million people being treated for it at our dispensaries and hospitals, we can surmise how appalling is the maiming due to it. Further, its relation to agriculture is very close through methods of cultivation and canal irrigation which may lead to final depopulation. It is of primary importance in opening up jungle tracts to tea, coffee and rubber, whilst its connection with rice cultivation is a very complex one which occupied the attention of the recent International Malarial Conference at Rome. Christophers* in estimating the morbidity says that, for one million deaths in adult males between 15-50 years of age, there should be at least two millions constantly sick and the equivalent of fifty million admissions to hospitals."

Municipalities have anti-malarial campaigns and the rural population can obtain small packets of quinine through local post offices and other agencies. But there is little, if any, systematic effort to control malaria in rural areas except on the large planting estates. It is only through concerted action on the part of the people themselves with the guidance and assistance of the State, as far as its limited resources in men and money may allow, that a substantial measure of success in controlling malaria can be achieved. It is for this reason that we have drawn special attention, in paragraph 409, to the work of the anti-malaria co-operative societies in Bengal.

Not the least of Government's responsibilities in the matter is connected with its policy in regard to the manufacture of quinine and cinchona febrifuges—the principal prophylactic in the treatment of malaria. Both for the prevention and for the treatment of malaria, a much wider distribution of quinine is necessary. At present, the high price of quinine militates against this. The total annual consumption of quinine in India is estimated at 160,000 lbs. of which only 42,000 lbs. are manufactured in the country. In these circumstances, the Indian price is determined by the world price and this, as is well known, is a monopoly price owing to the fact that ninety per cent of the world's surplus of quinine comes from Java. To reduce the internal price to a level at which the Government of India would be able to embark on an intensive anti-malaria campaign, it would be necessary

*Presidential address, Eleventh Indian Science Congress (Medical Research Section.)

that India should produce all its own requirements of quinine and thus be able to reduce the monopoly price.

With the exception of those which were started in 1923 in the Mergui district in Burma, all the cinchona plantations and the factories for the manufacture of quinine are owned by the governments of Bengal and Madras. Under the Devolution Rules, however, the Government of India have full powers to regulate the planting programme of the local governments, to fix the issue price of quinine on a uniform basis and to prohibit the purchase and sale of quinine by local governments. They thus exercise a controlling authority over the industry.

If India is to embark on any large campaign for fighting malaria, we are convinced that it will first be necessary to reduce considerably the price of quinine within India and this can only be effected if India is self-supporting in production. To achieve this self-sufficiency, a considerable extension of the present area under cinchona will be required. Investigations into the possibility of extending the area, and into the problems of development and manufacture, are, in our opinion, matters for the Government of India and not for provincial governments. Quinine is required throughout India but the cinchona tree can be successfully cultivated only in certain provinces. Some of these provinces have not the resources to enable them to embark on this specialised branch of industry and the Government of India, owing to their larger resources, are in a better position than any provincial government to undertake experiments and to develop any areas capable of yielding quinine for the benefit of the country as a whole. If the question of malaria is to be seriously tackled, we are strongly of opinion that the development of cinchona cultivation in all provinces which contain areas suitable for its growth, the manufacture of quinine, and the control of its distribution so far as price within India is concerned, should be taken over by the Government of India. In view of the all-India importance of the question, it is not one which should be left to local governments, however efficiently they may in the past have carried out their obligations in the matter.

412. We have been informed that, as a result of the selection of seed, the percentage of quinine yielded by trees in Bengal has been doubled in the past twenty years. This consequence of scientific study is an illustration of what might be looked for, if other problems hindering the progress of cinchona cultivation were systematically attacked, and we are of opinion that a research institute for the investigation of cultural difficulties met with in the growing of cinchona is desirable.

(*ii*) THE NEED FOR INCREASED SCIENTIFIC INVESTIGATION.

A good deal of general information respecting the soils and climates suited for cinchona has been collected; but these subjects appear to have received little detailed study and the lack of precise information which can only be gained by scientific investigation has already led to costly failures in cinchona plantations. If a scientific staff were assembled for the study of cinchona questions from the point of view of the chemist, the plant breeder and the meteorologist, and if this staff were enabled to

carry out carefully planned experiments in localities in which it was proposed to start new plantations, it is unlikely that large scale failures would be repeated.

The possibility of extending the area under cinchona cultivation and of cheapening quinine affords other reasons for scientific study. The cinchonas are exotics which have not taken kindly to Indian conditions, and, as a group, they remain difficult to satisfy. Efforts to find soil and conditions suitable for their cultivation have meantime brought some 40,000 acres only under consideration. This position raises for plant breeders the question of the possibility of altering the character of the tree so as better to adapt it to the Indian climate, and for chemists the possibility of effecting soil improvement at a cost which would be found economical by the cinchona planter.

We have been informed in evidence that the cultivation of *Cinchona Ledgeriana*, the most valuable species, is restricted by the fact that it can stand neither frost nor high temperatures. But the plant hybridises readily and promising natural hybrids have been found. Cross-fertilisation has been resorted to, but the conditions in which it has been carried on have been unfavourable. In a case of this kind, it is hardly open to doubt that, if plant breeders took up the work in suitable conditions, varieties could be produced more tolerant of the Indian climate than the existing cultivated species. There is also the possibility of increasing the yield of quinine; selection has already provided a crop much more valuable than the original type, and there is no reason to suppose that finality has been reached. Continued selection, with or without hybridisation as the circumstances may require,would almost certainly be rewarded.

Again, we have been informed that this valuable yellow bark cinchona is the species on which the Java industry depends, and that there it thrives on deep soils of volcanic origin; but that it has not done well in Madras plantations, where the underlying rock is different in character. The Madras soil may be unsuitable for different reasons, some remediable, others not. In view of the difficulty of finding soils suited to cinchona, we think that the possibilities of soil improvement should be carefully examined.

As we have had no opportunity of visiting cinchona plantations or of seeing the experimental work now in progress, we make no recommendation respecting the size of laboratory and laboratory staff necessary, or on the extent of the facilities for field experimental studies that are desirable. We are, however, satisfied that in view of the great importance of extending cinchona cultivation and cheapening quinine, much more scientific investigation is called for than has been undertaken in the past.

PUBLIC HEALTH—CONCLUSIONS.

413. Enough has been said to show that the medical and public health authorities are fully alive to the problems which face them and are doing all that is possible with present resources to further medical relief and sanitation by curative or preventive measures. Release from the strangle-hold of disease in which large areas of the country are at

present gripped would enormously enhance its general prosperity. In the interests, therefore, of the community as a whole, no less than of the rural population which forms such an overwhelming part of it, we would emphasise the urgency of the need of developing the rural medical and public health services to the utmost possible extent and with the utmost speed. We would impress, both on the Government of India and on local governments, our most earnest conviction that assistance to these services and to all unofficial efforts of proved merit should be given without stint of men or money. We feel confident, from the steps already taken by the Government of India and the provincial governments, that this recommendation will receive their most sympathetic consideration.

NUTRITION. (i) HUMAN NUTRITION.

414. We now pass to another aspect of the problem. There is a close relation between nutrition problems and agricultural practice and conditions. The food value of crops from the deficiency disease aspect; the necessity of supplementing a staple food diet by the growth or importation of food-stuffs containing the nutrient substances which the staple food lacks; the resulting necessity for cheap transport: all these are questions in which nutrition and agricultural research are inseparably linked.

The question of diet values and the relation of diet to disease have only recently come into prominence. Though such inquiries on any scale are still in their infancy in India, individual workers have, from time to time, made studies of Indian dietaries, principally with reference to the diet of prisoners in the various jails. The most important of these were conducted some fifteen years ago by Colonel McCay into the jail dietaries of Bengal and of the United Provinces, but the larger question of the influence of diet on the physical development and well-being of the people was only incidentally touched on. Colonel McCay's conclusions were that, other things being equal, diet is the all-important factor in determining the degree of physical development and general well-being of the people, and that with a low protein consumption, deficient stamina, moral and physical, must be expected. He considered that the general lack of physique and vigour in Bengal was most probably due to a deficiency of protein in the diet, whilst the inclusion of wheat in gradually increasing proportions, as one passes north from Bihar and Orissa and the United Provinces to the Punjab, has led to a marked physical change in the population. He pointed out, further, that where a full rice diet is the custom, absorption of protein is retarded owing to the bulkiness of the rice diet; but if a proportion of wheat is added to the diet, protein assimilation is increased, thus indicating the value of a well-balanced diet of rice, *dal* and wheat, which is further improved by the addition of small quantities of meat and fish. Roughly, it may be said that the food of the population of India and the agriculture producing it are very largely determined, in so far as the quantity is concerned, by the actual dietetic needs of the population, though particular diets are deficient in several important ingredients. Where there is a deficiency of protein in the diet, bulky carbohydrate meals are consumed (as amongst the rice-eating peoples of India) and the tendency is to the

multiplication of digestive troubles. These tend to disappear in areas in which the local diet is sufficiently rich in protein.

A more intensive study of the question of malnutrition, as a cause of physical inefficiency and ill-health among the masses of India, has been taken up by Colonel McCarrison, who is in charge of the enquiry into deficiency diseases which is being carried out under the Research Fund Association, and is at present working at the Pasteur Institute at Coonoor. We visited his laboratory and obtained from him, in evidence, a detailed account of the work in progress. We do not propose to describe this work in detail, but would invite a reference to the account of it given at pages 95 *et seq.*, Volume I, Part II, of our evidence.

The importance of Colonel McCarrison's work from the point of view of our inquiry is the emphasis which he lays on malnutrition as a problem facing those engaged in agricultural research. He points out that the ultimate aim of the investigator of disease and the agricultural worker is the same, that is, the adequate nutrition of the people. He insists, therefore, that there should be the closest co-operation between them to the mutual advantage of both. The causes underlying the malnutrition of domestic animals are often similar in character to those underlying malnutrition in human beings. It is, therefore, desirable that work on human nutrition and on the nutrition of farm animals should be carried out, if not in the same laboratory, at least in the closest co-operation, or, in other words, that there should be team work by workers with a knowledge of different branches of the science of nutrition and also continuity of work. It may be remarked that, at the Rowett Research Institute at Aberdeen, the research work into animal nutrition and that on human nutrition are going on side by side, and the Director of that Institute gave it as his opinion that it was very important that both lines of research should be carried on in the same institute, because the fundamental principles of human nutrition and of the nutrition of farm animals are the same.

In the pursuit of his investigations into deficient diets, Colonel McCarrison has interested himself in the conditions which influence these deficiencies. It is obvious that such investigations must be closely linked up with agricultural research. It may be assumed that the soil conditions which may influence the nutritive value of food-grains are the chemical composition of the soil itself, the manurial treatment to which it is subjected, and the effect of irrigation as compared with normal rainfall. These are clearly problems in the solution of which the agricultural departments can take a hand.

Before we leave this subject of malnutrition, it seems advisable that we should endeavour to dispel the idea that malnutrition and starvation are the same, and that deaths resulting from the one may be ascribed to the other. Actually, a person suffering from malnutrition may be consuming more than his system can utilise, and more than he would normally consume if the diet were properly constituted.

Deficiency diseases result from the absence of some essential element in the diet. Their occurrence is, therefore, no indication of poverty and consequent scarcity of food. A dietary conducing to malnutrition may cost more than a well-balanced dietary which promotes health.

(*ii*) FISH AS AN ARTICLE OF DIET.

415. We have been struck with the comparative failure to develop the fisheries of the country as a source of food. We are aware that, in certain parts of the country, there are religious objections to the use of fish as an article of diet. But in Madras and Bengal, it is readily taken and much relished by some four-fifths of the total population. In Burma, it is universally liked and in the form of a fish paste (*ngapi*) is regarded as an indispensable condiment. In Bombay, the United Provinces and Bihar and Orissa, large classes of the population take it when they can get it and, in the Punjab, there has been, since the war, a largely increased demand for it. Fish forms a specially valuable addition to a diet the staple of which is rice.

We note with regret that the Fishery Department in Bengal was abolished as a measure of economy in 1923. We understand that the Government of Bengal are desirous of reconstituting it for work on inland fisheries only, as soon as their finances permit. We consider that the development of inland fisheries in Bengal should be regarded as one of the most urgent measures of rural amelioration and we recommend that, if the financial situation does not permit at present of the reconstitution of the department, at least one officer possessed of the necessary qualifications should be placed on special duty to promote interest among local authorities in the stocking of tanks with suitable fish and their conservation. The existing fishery departments in the Punjab, Bihar and Orissa and Madras should be strengthened for the same purpose. A special officer has been recently appointed in Burma with a view to submitting proposals for increasing the efficiency of the inland fisheries. We suggest that his investigations should include an examination of the case for entrusting the development of these fisheries to a properly organised department. We recognise that a certain amount of work is already being done in some provinces in regard to the conservation of the existing stocks of fish. Ladders are being constructed over weirs at the head works of canals, regulations prohibit the capture of fish by dynamiting, poisoning and the use of small meshed nets, and rewards are being given for the destruction of various enemies to edible fish. Propaganda is also being undertaken to enlist the sympathies of the professional fishermen in the working of such beneficial regulations. There is clearly, however, room for further development in conservancy work along these lines in all provinces.

Generally, we note that it has been the policy of local governments to insist upon the Fishery Department paying its own way and that, in consequence, the staff has been restricted to a few members. We regard this as a mistake and recommend that a longer view should be taken of the possibilities of development of the fish resources of the country in

the interests of the people as a whole. The chief object of the department should not be revenue but public benefit.

We are fully aware that, if material progress is to be made in augmenting in this way the food supply of rural areas, it will be essential for the district boards, and the rural community generally, to play their part in the stocking of local waters and in their conservancy. It will be for the public health officers and for all organisations interested in the welfare of the people to disseminate a knowledge of the value of the addition of fish to diet. But without some expert authority at provincial headquarters, there will be a risk that ill-advised experiments in stocking may be made and the resultant failures will seriously endanger the prospects of success for the movement as a whole.

Improvement in the cultivator's diet holds out such promise of improvement in his general health and the addition of fish to his diet impresses us as being so much the most promising way of providing it over large areas of the country, that we consider that we are more than justified in making recommendations which, to those who know the difficulties, may well appear to err somewhat on the side of optimism.

(iii) Animal nutrition.

416. Colonel McCarrison's work, which has been described in paragraph 414, deals mainly with the deficiencies in the human dietaries of India and with the possible effects of improved agricultural practice on the dietetic value of crops. The investigation of animal nutrition problems is in the charge of the Physiological Chemist at the Imperial Institute of Animal Husbandry and Dairying at Bangalore.

Until this section was opened in 1921, practically no scientific inquiry had been made into the problems of animal nutrition in India. These problems are vast and the Physiological Chemist has, we think wisely, laid down as his guiding principle the acquisition of wide experience so as to ascertain systematically the real needs of the country. Feeding tests have, therefore, been carried out wherever and whenever an opportunity has offered, invariably with a definite and limited object in view. But there has always been behind these tests the general idea of a search for more fundamental problems. The lines of work so far undertaken have been described in our chapter on Animal Husbandry.

(iv) Conclusions

417. It will thus be seen that the position in India as regards problems of nutrition is much the same as it was in England till work on the subject was organised. In India there are two separate workers in independent laboratories, in touch with each other so far as personal arrangements can be made, but not linked up or connected with each other officially. The assistance which they get from the chemical and botanical staff of the various agricultural departments is also on the same basis. We consider questions of human and of animal nutrition of such fundamental importance to the whole problem of improved

agriculture that we are of opinion that steps similar to those taken in Great Britain should be adopted to regularise and systematise the investigation of nutrition problems in India. In this connection, we would note that the evidence we have taken does not indicate the absolute necessity of investigations in all branches of nutrition being carried out at the same institute or under one roof. It is enough that there should be the closest touch between workers and that they should realise that they are all working with a common aim. This consideration is of the greatest importance in India on account of the departmental system of administration which prevails. In point of fact, two departments are at present interested in the subject in India—the Medical and the Agricultural. Fortunately, however, they are both under the same Member of the Governor General's Council. We would, therefore, recommend that the various workers on nutrition problems should be formed into a Committee on Nutrition which would meet at regular intervals to discuss common questions. Assistance from the agricultural departments on the botanical or chemical side could be obtained by personal arrangement, and the officers assisting in such investigations should be invited to attend meetings of the proposed Committee on Nutrition. Although, as has been said, it is not necessary that both branches of nutrition work—human and animal—should be carried out in the same building, it is desirable, in order to secure the closest possible connection between the research workers in both these branches, that the respective institutes should be, if possible, at no great distance from each other. Our proposals for the development of research into animal nutrition will be found in Chapter VII.

We also regard it as highly desirable that immediate steps should be taken to assure the future of the work at present being carried on at Coonoor under the Indian Research Fund Association, on the problems of human nutrition. We would recommend that, while developing the Institute of Animal Nutrition, the Government of India should also set up a Central Institute of Human Nutrition in order to ensure continuity of the work and the training of the staff capable of carrying it on. We consider these enquiries to be of first rate importance to the improvement of Indian agriculture, as the problems investigated so closely affect the efficiency and prosperity of the cultivator, and would recommend to local governments the desirability of undertaking similar investigations, either in provincial institutes or by individual workers in collaboration with the central institute which we suggest. We would emphasise that more will be effected in the investigation of these problems, which are of almost universal applicability, by mutual goodwill between workers than by executive orders. We venture to hope that this spirit of goodwill may lead not only to the closest collaboration in the investigation of the nutrition problems in India but also that it may be reflected in the linking up of the work being done in India with that being carried on in other parts of the Empire. The problems are so vast that all the staff and material available should be mobilised to assist in their solution.

GENERAL.

IMPORTANCE OF GOOD COMMUNICATIONS.

418. So far, we have been concerned mainly with what may be called the "health aspects" of the cultivator's life. While these undoubtedly are most important, there are other respects in which his rural environment can be improved simultaneously with a gradual advancement in sanitary and health conditions. Many of these improvements will, in point of fact, facilitate health and sanitation propaganda.

We have referred in our chapter on Communications and Marketing to the value of good roads. They are necessary not only for the transport of agricultural produce, but for the promotion of rural welfare generally. The expansion of the motor passenger services, to which we have already referred, is likely to arouse and make effective a local demand that the competent authorities shall bestir themselves in this matter. Upon the linking of the village in this way with the smaller town must ultimately depend, in large measure, the possibility of bringing medical assistance to villages and providing labour for any large extension of smaller industries. It must also profoundly affect education, both male and female, and lead to an extension of post and telegraph facilities.

THE ADJUSTMENT OF VILLAGE LIFE TO CHANGING CONDITIONS.

419. In the opening paragraphs of this chapter, we have indicated the various influences that are bringing about a change in the conditions of rural life in India and the increased powers delegated to villages in the administrative field. We have also drawn attention to the problems of public health and of diet. We now propose to consider the help which can be given to the villagers to enable them both to adjust themselves to changing conditions and to reap the fullest advantages from the various technical services with which they are now coming increasingly into contact.

Already, complaints are heard of the decay of corporate work for the good of the village, of the decline of old time domestic and village industries and of difficulties in regard to labour—familiar signs of the adjustment of an ancient economy to new conditions. These complaints, naturally, first arise in the neighbourhood of large centres of population and attract, thereby, special attention which easily leads to an exaggeration of their real importance in the general perspective. But it is true that the factors making for change which we have indicated are growing and that they are all unfavourable to the maintenance of the isolation of the Indian village. Nor do we think that such maintenance is to be wished for, even if it were possible. There are many directions in which the villager will gain much from participation in the wider life of the province. That there may be losses as well as gains we do not deny. It should be the aim of all those who wish to do him service to prevent these losses and to expedite these gains. Help should be given in such a way as will preserve his independent outlook and direct his capacity for corporate action to new and useful ends. There is room and to spare in this field for all workers, educational, economic, and social.

THE OUTLOOK OF THE CULTIVATOR.

420. Throughout our investigation, we have constantly been impressed with the thought that mere material improvement alone will not bring lasting benefit to the agricultural population. Increase in yield by better seed and better cultivation; security of the harvests gained by the expansion of irrigation; immunity from losses due to pests or pestilence; higher prices from improved communications and conditions of marketing; everything, in short, which we have advocated for the material advancement of the people will merely postpone the effects of the growing pressure of the population on the soil. No lasting improvement in the standard of living of the great mass of the population can possibly be attained if every enhancement in the purchasing power of the cultivator is to be followed by a proportionate increase in the population. The Report of the Indian Famine Commission of 1901 dealt with this issue in words that deserve remembering, and concluded that only prudence, knowledge and the practice of thrift could relieve the people. In a memorandum submitted to us, Mr. W. H. Moreland describes the ideal as that "every individual born in India should have a reasonable chance of developing his capacities to the utmost in the interests of the country as a whole...." He proceeds "It may be affirmed with confidence that the welfare and prosperity of the rural population will not come by technical advances alone; if it is true that better living can be secured only by a combination of better farming and better business, it is equally true that the will to live better must furnish the driving power that is required; at the heart of the problem lies the development of the desire for a higher standard of living.....A vague aspiration now exists, and, I suspect, always has existed, but it is rendered ineffective by an inhibition, which has to be broken up before large scale progress is possible. In other words, the central problem is now psychological, not technical....The will to live better must furnish the driving power without which improvements in agriculture and commerce will not give an adequate return. The dominant feature of rural India at the present day is that the will to live better is not a force to be reckoned with, except in particular circumstances."

Mr. Moreland regards the climate as of secondary importance only, and finds in history an adequate explanation of those features of the peasant's mentality which now constitute the main obstacle to economic progress. He adds that "The inhibition against better living is wearing thin, and in a few places cracking; the main task of the Commission, as I conceive it, is thus how to strengthen the forces already in operation, and how to summon new forces to their aid; or, in other words, to promote mass education in the widest sense....."

In this Report, we have in their proper places stressed the importance of primary education, adult education and that more special form, the education in the economics of daily life, provided in some provinces through the agency of the co-operative staffs, from which it will be clear that we accept the general accuracy of Mr. Moreland's diagnosis. In this chapter, we have already dealt with other specialised forms of "adult

education in its widest sense" and we must now turn to other means calculated to stimulate the desire for better living.

VILLAGE GUIDANCE. (i) OBJECTS.

421. We are strongly of opinion that, here, guidance is far more called for than anything in the nature of what, for want of a better term, we shall call charitable assistance. What is required is to increase, in desirable directions, the number of the villager's wants and to show him how to satisfy them by his own efforts. The small size of his holding, its liability to subdivision and its frequent fragmentation will compel the cultivator to co-operate with his fellows if, after the requirements of mere subsistence are satisfied, he is to secure a reasonable share in the good things of life. The villagers have ample time at their disposal for co-operative action. For the most striking feature about typical Indian agriculture is the amount of leisure it allows. As we have emphasised in our chapter on Rural Industries and Labour, if the cultivator requires more money, the best occupation for his spare time is more intensive cultivation and the next best a suitable spare-time occupation. But we trust that the whole weight of those to whom the villager looks for guidance will be thrown into suggestions how to improve, during his spare time, the amenities of the village. Fortunately, there is a tradition of corporate action for mutual benefit to which to appeal. In the olden days, tanks were dug or cleaned out, wells sunk and roads made or repaired in this way. Although this good custom has largely fallen into disrepute, we think that, if its advantages were brought home to the villager, a voluntary revival of it for these and other purposes such as the provision of a good supply of drinking water, drainage and street improvement should be possible. If revival is not possible, hope of radically improving the amenities of the village must be abandoned. The cultivator himself is not well enough off to pay for hired labour and it is certain that neither the local bodies nor the provincial governments can provide either the men or the finance for carrying out such undertakings. There may, however, be other ways in which help can be given. In some provinces, the village site is seriously congested, and expansion is stopped by the fact that the more valuable fields surrounding the village are owned by the richer and more influential villagers. Again, few schools have been provided with adequate playing fields, and we recommend that this need should be taken into consideration and measures adopted to secure, for communal use, a sufficient area of open ground.

(ii) AGENCIES.

422. It cannot, however, be reasonably expected of the cultivator that he should, unaided, revive this ancient custom of corporate action and utilise it for the improvement of the village and its surroundings. He lacks leadership. No one corresponding to the squire, the doctor and the parson is to be found in an Indian village. The educated man is not willing to live his life in a village except in a few rare cases where ideals of social service overcome the absence of social amenities. What alternative source of leadership is available?

The village teacher is one obvious suggestion. Where he is trained in general citizenship by methods such as those adopted at Ghakkar and Moga in the Punjab, he should be admirably qualified to fill this rôle. Education is, however, so important that we should regret to see too many additional responsibilities assigned to the teacher. These might distract him from his proper duties. We have already commended the scheme under which he will be trained to provide elementary medical aid to the villagers. If he does this and also, in addition to his normal teaching duties, implants in the minds of his pupils that ideal of corporate labour for the common benefit which he has himself been taught, we think that he will have done all that can reasonably be asked of him. If the exceptional man feels that he still has time for social service, he will, we think, put it to the best use by educating the parents of his pupils and by keeping alive the literacy he has implanted by organising a library and arranging for the supply to it of interesting books and periodicals.

In most parts of the country, each village has a headman and, in addition, there is in most provinces a numerous staff of subordinate revenue officials, known variously as *patwaris*, *kulkarnis*, *tapedars*, *talatis* or *karnams*; and, in some cases, these men are put through a course of training in their duties. If ideals of village improvement were instilled into these thousands of humble officials, we cherish the hope that some seed might fall on fertile ground.

(iii) THE "GUIDE" IDEA.

423. A possible solution which has attracted us greatly, is the system of village guides devised by Mr. F. L. Brayne, Deputy Commissioner of the Gurgaon district in the Punjab. Sons of cultivators are given a special course of training which, in addition to imbuing them with a sense of the dignity of corporate labour for mutual benefit, is designed to familiarise them with the principles of sanitation, elementary medical aid, co-operation, agricultural improvement, and to give them some knowledge of the simpler home industries, in order that each man may, when his training is completed, act as "guide, philosopher and friend" to the group of villages to which he is posted. In technical matters, his knowledge is meant to enable him to direct the villagers where to go for advice rather than to give that advice himself. We are much attracted by this "Guide" idea. We think that there is a distinct risk of the villager being confused by a multiplicity of services offered to him. Skilled advice on agricultural, veterinary, medical and sanitary matters is just beginning to be made available in many districts. It is most important that the cultivator should have some one individual to whom he can go for direction as to how to obtain the information he requires. We ourselves propose to add to the number of expert officers and have, for example, suggested the special appointment of irrigation engineers for minor projects and of officers who will give advice on the management of village fuel reserves and grazing grounds. Village guides, therefore, appeal to us as likely to be extremely valuable and we recommend this idea to the most careful consideration of all those interested in village improvement.

We think, however, that the object aimed at may be achieved in several ways and that different methods will suit different localities.

(iv) GURGAON UPLIFT.

424. But village guides alone, without some organisation behind them to strengthen their efforts and to maintain a never-ceasing flow of ideas, encouragement and reward, would be liable in the course of time to lapse into inactivity. To break up the inhibition on the will to live better, there is required a strong central driving force that will encourage enthusiasm, develop public spirit, and provide suitable material for active workers in their campaign in favour of the improvement of village life. We were favourably impressed with a striking attempt to fulfil this need which is being made in the Gurgaon district. The scheme embraces the work of every department of Government engaged in rural areas; it seeks to assist in securing the adoption of the advice of the expert by a well-planned propaganda campaign; it depends for its success on the enlistment, in the cause, of every one willing and able to assist, official or non-official, and more especially of the people themselves whose welfare is in the balance. Lecture, song, drama, magic lantern, cinema, and even the loud speaker are made to contribute what they can to arouse the people to a realisation that they themselves are largely responsible for their own undesirable condition. The attention of the villagers is thus attracted; their every action is challenged by its effect on their prosperity or poverty; the economic and social consequences of their neglect and omissions are stressed in vigorous language, and advice is tendered in words calculated to sting everyone into activity. Side by side with the propaganda campaign, there are provided facilities for those who wish to try the advice so tendered. Good seed, selected bulls, ploughs, well-gear, quinine, inoculation, and so on, are readily available. Co-operative societies, adult schools, domestic economy classes and every other means calculated to assist the spirit of service and self-help are at hand. Every thing useful is brought within easy reach of those who need it. The willing convert is pressed to act on his new found belief before he has time to reflect on the addition to his responsibilities he has undertaken. The scheme, like others, is open to criticism, but it undoubtedly has already achieved substantial progress in many directions. Its chief value, in our eyes, is its illustration of the great benefit which accrues from an all-round effort at village improvement by everyone interested. For readers accustomed to conditions in other provinces, the most striking achievement is, perhaps, the concentration of nearly 600 stud bulls from the Hissar cattle farm in a single district, but this is merely an example of the dimensions of the effort to improve everything in village life that appears amenable to treatment. The experiment is, of course, far from complete and many years of work are required before efforts can be relaxed. Like most experiments on novel lines, it owes its inspiration to a single individual who happens, in this instance, also to be an officer of Government, and, fortunately for the progress of the experiment, to have been stationed in one district for an unusually long period. But

whatever may be the happy accidents that have facilitated the work, the results are there for all to see, and should prove stimulating to all who have the welfare of the cultivator at heart.

(v) LINKS BETWEEN THE VILLAGE AND THE TOWN.

425. Next to making some one individual resident in the village itself responsible for advising the villagers where to go for advice and how best to utilise their own skill and resources in improving the amenities of the village in their spare time, we attach most importance to linking the village with the social life of the towns. It would be a tragedy if, during the period of transition, which, we believe, lies before the Indian cultivator, he received no effective assistance from the educated elements in the country. The work started by the Servants of India Society in the Bhil country in the Panch Mahals district of Bombay, and by such societies as the Poona Seva Sadan Society, to which reference has already been made, is full of promise for the future. But, in the main, the attention of social workers has so far been directed to the towns and their vicinity rather than to the country. We are of opinion that work done by societies has a great advantage over individual effort, however devoted. Continuity of policy and steady pressure over a long period are required if permanent results are to be obtained.

For some time to come, it will probably be necessary for the State to interest itself in the work that any societies may start in rural areas. The problem of reaching even a fraction of the 500,000 villages in rural India is so vast that, until these societies increase in number and acquire strength and the self-confidence which success inspires, they will require official encouragement and advice.

(vi) THE UNIVERSITIES.

426. The influence for good which the universities can exercise over rural development is, we think, very great, and in our opinion, they have a definite obligation to use that influence. For universities necessarily draw a large proportion of their students from country districts and they should recognise the obligation of instilling in country students an ideal of home service. There are two directions in which the universities can render most valuable assistance; in regard to such technical matters as economic surveys of social conditions and, secondly, in imbuing rural communities with ideals of leadership and of service.

The work of the Board of Economic Enquiry in the Punjab, which we describe below, and the economic studies of rural conditions both by official and private investigators which have been published indicate the vastness of the field which remains unexplored and the lack of that precise information without which it is impossible to formulate a sound policy for dealing with such a problem as the burden of indebtedness. Valuable economic data in regard to this and kindred subjects are to be found in government records, more especially in the reports of settlement officers which are a mine of information on many aspects of rural life, and, as we recommended in paragraph 536, Chapter XVIII, *bona fide* investigators should be given every facility for studying these. There has been a very marked advance,

in recent years, in the statistical methods of handling material such as this and it is essential that investigators should be skilled in these methods and that their investigations should be carried out on an ordered plan and in a systematic manner. The universities might themselves initiate and organise economic surveys of this character and the Inter-University Board appears to be admirably fitted to arrange an agreed programme. Of the part that universities can play in encouraging in the villages a spirit of self-help and progress we shall have more to say in our chapter on Education.

(vii) THE CASE FOR ECONOMIC ENQUIRY.

427. The rural reformer will be handicapped by the lack of readily available information as to details of village life and by divergent views on what ought to be readily ascertainable facts; for instance, outside the Punjab, there is no exact information as to the size of holdings actually cultivated per cultivator, nor as to the precise extent of subdivision and fragmentation; there is very little information as to mortgages of agricultural land or of unsecured debt, and practically none as to the extent to which hereditary cultivators, holding direct from the State, as proprietors or ryots, are being reduced to the status of tenants under moneylenders who have bought up their rights.

For the systematic promotion of the welfare and prosperity of the agricultural population, exact and detailed information is required of the forces at work tending to produce a decline or an improvement in their economic condition; and it is difficult to frame remedial measures in the absence of accurate data on which the probable effects of such measures could be calculated. Outside the Punjab, there has, apart from a few special studies, been no attempt to survey, village by village, the causes perpetuating poverty or obstructing efforts to promote prosperity. In that province, a Board of Economic Enquiry was formed in 1919, and it has already issued a series of studies sufficient in variety and quality to indicate the great potential value of such permanent machinery. As at present constituted, it is a non-official body; its members are both officials and non-officials interested in economic studies; it is practically dependent on a government grant for funds. This grant is paid to the credit of the Board in the Imperial Bank, so that the Board is free from financial rules except one requiring an annual audit. The funds are mainly devoted to the pay of investigators and the cost of publication of their results. Owing to the increase of work, the secretary now receives a small allowance, but the members are honorary workers. Investigators are carefully selected for their personal fitness for the particular inquiry which the Board has decided to undertake; they are regularly supervised by a member of the Board or by someone specially fitted by experience and knowledge for this work; their results are examined by the Board and every effort is made to secure accuracy and reliability. It is hoped that as experience is gained, the value of the publications will grow; they have already attracted notice throughout India and are beginning to claim attention abroad, and the foundations have been laid of a Bureau of Rural Economic Research. The advantages to be gained from such a board

have already been brought to the notice of other provinces by the Indian Economic Inquiry Committee, and we agree that the establishment in all provinces of a permanent institution on similar lines would prove of value.

PUNJAB CENTRAL RURAL COMMUNITY BOARD AND RURAL COMMUNITY COUNCILS. (i) DESCRIPTIVE.

428. We are much attracted by the rural community movement which has recently been started in the Punjab. The Central Rural Community Board, the personnel of which is at present predominantly official, is linked with a rural community council which has been set up in each district of the province. The membership of these councils, in contrast to that of the central board, is predominantly non-official. Each council is assisted in its work by the attendance of representatives of the various departments concerned with rural development, namely, educational, agricultural, veterinary and co-operative officers. The Rural Community Board is financed by Government and its chief functions are to distribute funds to the councils and to provide literature. The intention is that each district community council should co-ordinate the propaganda work of all the development departments. With this end in view, lantern lectures are organised for the villages and some councils have fostered an interest in natural history through the circulation of charts. The Rural Community Board has also defrayed the cost of preparing a film on co-operative subjects. The councils have considerable freedom in expenditure. The Community Council in the Gurgaon district, for example, has subsidised dramatic societies in the villages. The secretary of each district council is usually the local district inspector of schools in the employ of the district board and touch is thus maintained with the local administration. Neither the Rural Community Board nor the councils have any concern with village administration, but the councils especially are naturally brought into contact with it at many points in the course of their activities, which are, however, of a purely advisory character.

(ii) CONCLUSION.

429. How far this organisation may be suited to the needs of other provinces has yet to be ascertained. It makes considerable demands on the public revenues and on the time of a good many public officials. Time alone can reveal the practical efficiency of these councils in terms of the work done and the cost involved. As in the case of other associations, such as the taluka development associations in Bombay and agricultural associations elsewhere, the work of the councils is reported to be uneven. But the council system certainly combines the advantages of both the official and the private type of organisation. It is more elastic than a purely official organisation can be. A direct grant-in-aid from Government to village dramatic societies might possibly evoke criticism if made by the Minister on the advice of officials only. The inclusion of officials in the organisation, on the other hand, secures continuity of policy and enables agreement with the general aims of the public departments charged with the development of rural areas to be more easily maintained

than would be possible if the composition of the Board and councils were purely non-official.

The movement will, in our opinion, gain in power for good if it develops a women's side to its activities. A start might be made by establishing, in a few selected villages, an institute for women which would form a centre for educational and co-operative activities as well as for the mother and infant welfare work to which reference has already been made. The existence of such an institution in a village might remove the present obstacles to the employment, in the village school, of women teachers.

So far as we are aware, no other province has an organisation of a similar character and we think that the experiment in the Punjab deserves close attention and consideration. Rural community councils are exactly the kind of bodies to be entrusted with the type of work which is being done in the Gurgaon district by an officer of the Indian Civil Service. In promoting such work, the rural community councils will, in fact, become a link between the village and headquarters and will be the medium through which the headman of the village or the "guide" stationed in it will obtain assistance for the villagers in cases where they cannot help themselves.

BETTER LIVING SOCIETIES.

430. The problem of eradicating causes of poverty and encouraging everything that makes for rural welfare can be tackled more directly by the organisation of local public opinion in favour of particular measures. In order to secure permanency and create a centre of resistance to lapse, there are advantages in working along co-operative lines. The Better Living societies which are rapidly becoming popular in the Punjab illustrate what can be done. Wherever there is evinced any effective desire to reform old ways, such a society can be organised to strengthen it. Restriction of expenditure on marriage and other ceremonies, the promotion of temperance, or any other reform may be adopted as the object, and due observance is secured by the power to fine recalcitrants conferred upon the committee by the by-laws. Caste is a common and useful basis, but success must depend upon the extent to which the women can be recruited to the cause. They appear to be responding well to the teaching of a special inspectress, but women of all countries are fond of ornaments and jewels, and to wean them from this form of extravagance is not the work of a day.

LITIGATION AND ARBITRATION.

431. In all discussions of rural indebtedness, litigation finds mention as one of the chief causes of borrowing. Most litigation in India is of a very trivial nature and a larger proportion of the cases are not really disputed. In 1925, over one million civil suits were valued at less than fifty rupees each, and no less than 1,581,000 (including the foregoing) or 65 per cent were under one hundred rupees. In the same year, 1,645,000 or 77 per cent of the suits decided were settled without contest or without trial. Of alleged crimes not cognisable by the police, nearly 600,000 complaints were unproved and 600,000 persons were proceeded against without being

convicted. The figures are repeated year by year with remarkable steadiness, are regularly commented upon and as regularly fail to evoke effective remedy. Of 2,760,000 civil suits before the Courts, only 14,472 were decided by reference to arbitration.

The evils resulting are widely appreciated and attempts to reduce them have been made by the revival of *panchayats* and other means.

The Civil Justice Committee in 1925 discussed the history of village tribunals on pages 105 to 117 of their Report; and recommended that "in all the provinces, endeavour should be made to develop this system so as to withdraw all simple money suits of smaller value from the munsiffs and small cause courts." They further considered that exclusive jurisdiction should be given to these tribunals "as and when experience shows it will be safe." The matter appears to us to be of such fundamental importance to rural welfare that we make no apology for inviting urgent attention to the following extracts from this valuable Report.

"In the course of our investigation, we were told in the various provinces by some witnesses that communal differences and factions are in the way of any further extension of the jurisdiction of these tribunals. There is some force in this objection, but it is, in our opinion, overstated. In villages where there are common interests to be protected, common services to be rendered and common funds to be administered, it is idle to ignore the common life of the village in which the necessities of neighbourhood have held their own or have prevailed against the divisions of caste. Those who have organised co-operative credit societies assure us that caste or communal differences do not in any way affect the success of the *panchayats* or committees of those societies which are composed of individuals of different castes as well as those who are outside the pale of caste. Whatever may be the operation of the factious spirit in the matter of social or religious institutions, it has not, so far as we understand, affected the success of the co-operative movement in which members with unlimited liability work in harmony, and punctually and promptly discharge their duties. Indeed, wherever these co-operative societies are constituted, the tendency is for the *panchayats* to adjudicate on local disputes and determine local quarrels and they do these things promptly and satisfactorily. In some cases, as time goes on, it may become possible to provide, by way of safeguard, that in the election of *panchayats* the principle of proportionate representation may be employed.

Among the other advantages of village courts is the fact that they are close to the residence of the parties. The expense of litigation in them is negligible as pleaders are not allowed and witnesses have not to be brought from a long distance. There is not the same difficulty in seeing that the processes are duly executed and the fact that parties are speaking before their fellow-villagers in their own village makes for a more easy determination of the truth."

A further development in the Punjab has attracted our notice and we describe it also in the words of the Civil Justice Committee.

"The Registrar of Co-operative Societies, realising that litigation was a curse in the province and a source of great economic loss as well as the frequent origin of serious crimes, formed arbitration societies designed to organise public opinion in favour of the settlement of disputes by arbitration without the intervention of court. These societies met for a time with a remarkable measure of success. In 1922, there were 148 societies with 16,628 members. Many of the cases decided by the society related to cattle trespass and boundary disputes, trivial matters which, however, often lead to riots and expensive civil suits. The moneylender and trader also took advantage of these societies to have their claims amicably and inexpensively settled in the village, instead of undergoing all the trouble and expense of getting a decree in the regular court and executing it. Moreover, the claims when decided by the society were usually settled promptly, for the award had the public on its side. But the organisation of these societies has apparently now been stopped since the new Panchayat Act was passed."

These arbitration societies were closed down some years ago, but, with a change of policy on the part of the Punjab Government, they have now been re-started and are reported to number 27 and to have over 3,000 members. A point in favour of arbitration societies is that they can, by agreement between the parties, deal with cases beyond the money jurisdiction of *panchayats*.

Any measure that promises to bring about a reduction of litigation deserves support and we are of opinion that the case for facilitating the settlement of village disputes by local arbitration calls for careful consideration by all local governments.

We regret to observe that the Civil Justice Committee comment on the small measure of support the reform has received in the Bombay Presidency; we, therefore, commend it particularly to the attention of the voluntary workers in the co-operative movement to that province.

THE DEPRESSED CLASSES. (i) GENERAL.

432. We hold it to be no part of our duty, wide as are the terms of our enquiry, to examine in detail the position and prospects of the depressed classes. But their mere numbers give them an importance in the life of the country, which requires that the problems with which they have become associated shall not be passed over in silence.

The Census Report for 1921 gave the figure of 52,680,000, or one-sixth of the entire population of India, as a rough estimate of the minimum numbers which may be considered to form the "depressed classes" of the Hindu community. The disabilities under which these people labour differ according to the degree of their ceremonial impurity. This "varies in different tracts and is most conspicuous in southern India where, perhaps owing to more settled conditions, orthodox Hindu sentiment has been able to develop an intensity of social differentiation which the more complex conditions in northern India would tend to modify" (Census Report of 1921). That one-fifth of the total population are, in varying degree, denied the common intercourse of life, refused permission to obtain water from the village well, refused even the meagre facilities available for the education of their children, are

facts which every impartial student of social life in India cannot but admit and, admitting, must deplore. But the Hindu community of to-day cannot be justly criticised for results the causes of which lie far back in the social history of an ancient country and are themselves very imperfectly known. An increasing number of the Hindu community are striving with all the resources at their command to remove the stigma of social inferiority from these classes. Although, in some cases, removal from their surroundings and colonisation of areas newly won for cultivation, on the lines of the labour colonies started by the Madras Government, may be a beneficial step, the vastness of the population affected makes it clear that the problem, as a whole, cannot be solved by such special measures. The influence which education has in raising their status is remarkable. The Namasudras of the Bengal Presidency have shown a remarkable desire for, and success in obtaining, education with the result that large sections of the caste who have become educated are now no longer regarded as depressed. We, therefore, affirm our belief in education as the only completely satisfactory solution.

(ii) Difficulties confronting the social reformer.

433. But here it must be recognised that the social reformer is confronted with the serious difficulty that the depressed classes as a whole do not desire education for their children. They require, in many cases, the earnings of their children to supplement their own. Nevertheless, progress in education is being made throughout the country. It is impossible to obtain accurate statistics regarding that progress, as no satisfactory definition of what constitutes a "depressed class" can be made. "From the point of view of the educationist, a child may be said to belong to a depressed class if his or her presence in the common school is resented by respectable parents.*" Much encouragement can legitimately be drawn from the fact that this resentment is not an unchanging factor. All social students whom we have met in the course of our enquiry are agreed that, in the past quarter of a century, there has been a general decline in its degree and extent. We agree with the educational authorities that it is important from every point of view that special schools should not be established, but that wherever practicable, the admission of the children of these classes to the ordinary schools should be insisted on. In certain parts of the country, the introduction of the compulsory system may intensify the problem of common education, but we trust that it will be squarely met by all members of the community and not shirked by a resort to special schools or to segregation within the common school. It is scarcely necessary for us to point out that, in no field of work in the villages, have private organisations a greater opportunity for usefulness than in the raising of the depressed element of the community into full membership of the common life.

(iii) Policy to be pursued.

434. In bringing to a close this brief notice of a very important problem, we would emphasise the importance of all such work being educative rather than charitable in

* Progress of Education in India, 1917-1922 (page 206).

spirit. We are convinced that the best way to help the depressed classes is to get them to help themselves. To instil in them a desire for education and for a removal of their disabilities, is to win far more than half the battle of their emancipation.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

435. The conclusions and recommendations in this chapter may be summarised as follows:

(1) The isolation and the self-subsistent economy of village life are tending to break down (paragraph 394).

(2) In the administrative sphere, satisfactory provision already exists to enable the villages to maintain and develop self-government and, at the same time, to participate in the wider life of the province (paragraph 395).

(3) The interaction of agriculture and public health is close and important (paragraph 397).

(4) The working of the Madras district health scheme shows how public interest in health matters can be developed under official guidance (paragraph 401).

(5) The Indian Research Fund Association is an admirable example of that combination of private and official effort on the extension of which rural development of all kinds must depend (paragraph 402).

(6) The principles embodied in the Bombay village medical aid scheme are commended (paragraph 403).

(7) Schemes for subsidising medical practitioners to settle in small towns and villages are also commended (paragraph 404).

(8) An improved water supply is so important that all measures possible to secure this should be undertaken by the local authorities and the State (paragraph 406).

(9) Substantial progress in the campaign against malaria can only be achieved by concerted action by the people themselves assisted by guidance and, within limits, by finance, from Government (paragraph 411).

(10) A much wider distribution of quinine is necessary and to this end the development of cinchona cultivation, the manufacture of quinine, and the control of distribution so far as price within India is concerned should be made a responsibility of the central Government (paragraph 411).

(11) In view of the great importance of extending cinchona cultivation and cheapening quinine, much more scientific investigation is called for than has been undertaken in the past (paragraph 412).

(12) The efforts of the medical and public health departments and of non-official agencies in their fight against disease and insanitary conditions are of the first importance to the prosperity of the country. These efforts should, therefore, be supported by the central and the provincial governments with all the resources, financial and otherwise, at their command (paragraph 413).

(13) Research into problems of human nutrition is of special importance in Indian conditions and the agricultural departments can do much to assist in the solution of these problems (paragraph 414).

(14) The addition of fish to the diet of the cultivator seems to be the most promising way of securing that improvement in his nutrition which is so much needed and all measures practicable to this end should be taken (paragraph 415).

(15) The problems of human and animal nutrition are closely linked but work on them need not be carried on in the same institute (paragraph 417).

(16) A committee of workers on human and animal nutrition should be formed and should meet at regular intervals (paragraph 417).

(17) The establishment of a Central Institute of Human Nutrition is recommended (paragraph 417).

(18) Local governments should consider the desirability of undertaking research in problems of human nutrition either in provincial institutes or through individual officers. In both cases, the research should be conducted in collaboration with the Central Institute (paragraph 417).

(19) Work in India on human nutrition should be linked up with similar work in other parts of the Empire (paragraph 417).

(20) Too much emphasis cannot be placed on the importance, for rural welfare generally, of improving communications of all kinds (paragraph 418).

(21) No lasting improvement in the standard of living of the great mass of the population can possibly be attained if every enhancement in the purchasing power of the cultivator is to be followed by a proportionate increase in the population (paragraph 420).

(22) Villagers have ample time at their disposal for improving the amenities of their village by co-operative action. Specific directions in which assistance may be given them are, the extension of village sites where these are congested and facilities for providing schools with adequate playing fields (paragraph 421).

(23) For these and other purposes, villagers are much in need of leadership. Instruction of village headmen and subordinate revenue officials in the ideals of village improvement might, in some cases, be productive of good results. In other cases, a "guide" for a group of villages trained on the lines adopted in the Gurgaon district of the Punjab would seem to offer the best solution (paragraphs 422 and 423).

(24) Valuable lessons are to be drawn from the Gurgaon uplift campaign (paragraph 424).

(25) It is important that village and town life should be linked by the efforts of social workers, preferably organised into societies (paragraph 425).

(26) Universities have at once an obligation and a great opportunity to assist in the work of rural development on both its economic and educative sides (paragraph 426).

(27) The establishment of a Bureau of Rural Economic Research in each of the provinces on lines similar to those on which the Board of Economic Inquiry in the Punjab has been established would prove of value (paragraph 427).

(28) The rural community movement in the Punjab combines the advantages of both the official and the private type of organisation (paragraph 429).

(29) The rural community movement will gain in power for good if it develops a women's side to its activities (paragraph 429).

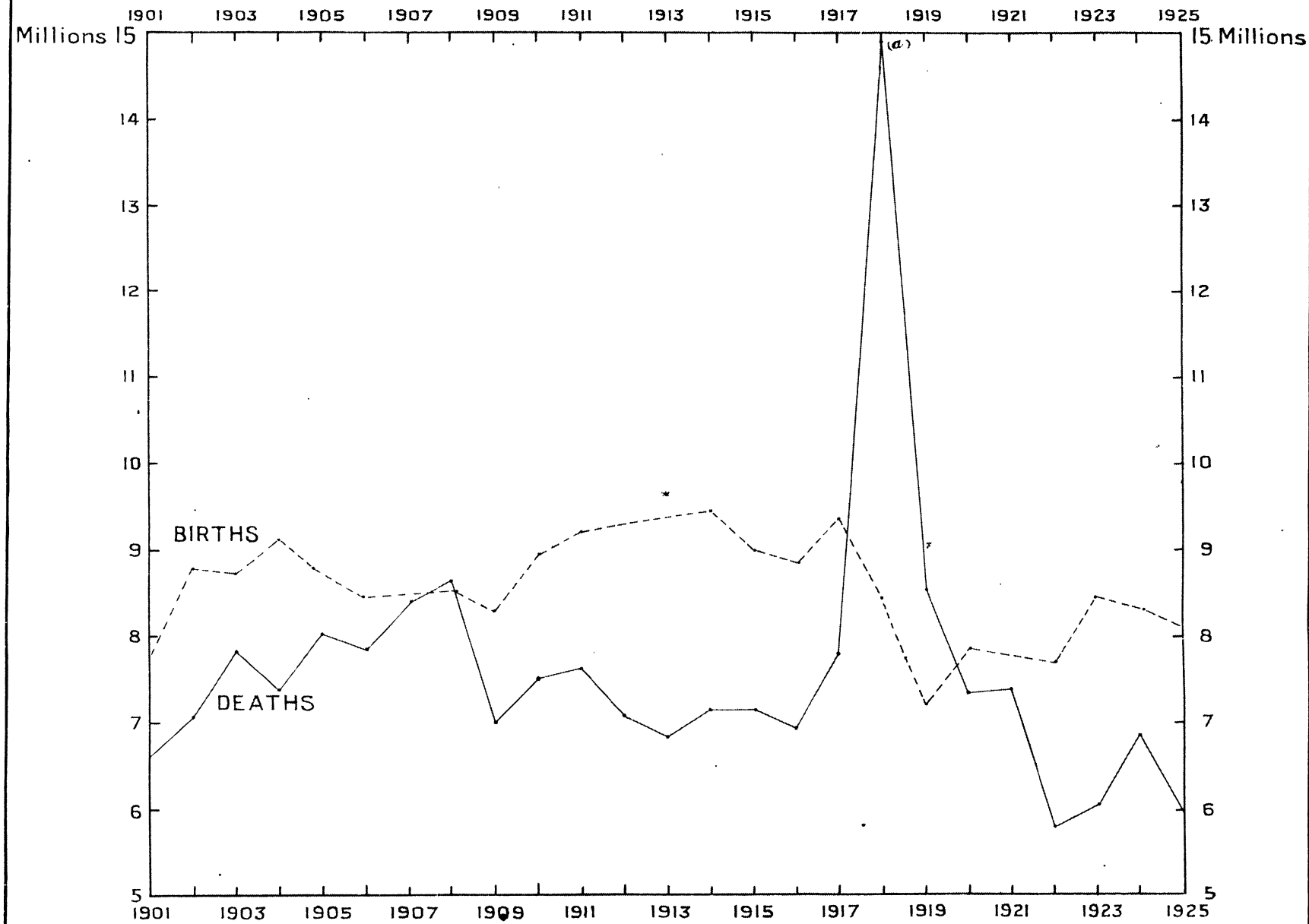
(30) In particular, the establishment of a women's institute in a village would supply a centre for educational and co-operative activities and might remove the obstacles to the employment of women teachers in village schools (paragraph 429).

(31) The possibility of facilitating the settlement of village disputes by local arbitrators calls for careful consideration (paragraph 431).

(32) In no field of rural work have private organisations a greater opportunity for usefulness than in the raising of the members of the depressed classes in the village into full membership of the common life (paragraph 433).

(33) The best means of effecting this are education and the inculcation of self-help (paragraph 434).

NUMBER OF BIRTHS AND DEATHS REGISTERED IN BRITISH INDIA



(a) Influenza epidemic of 1918.

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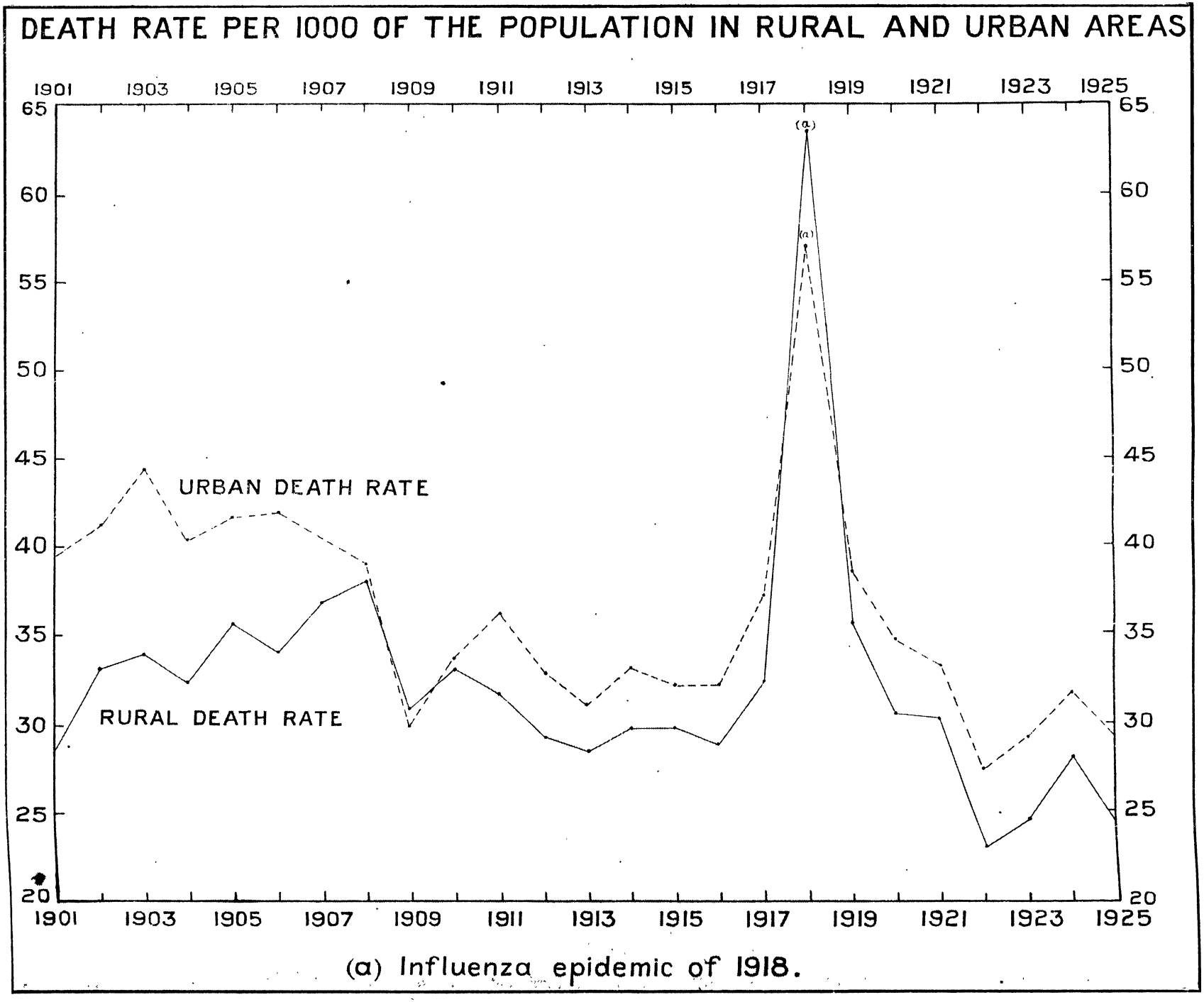

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CHAPTER XV

EDUCATION

436. Few educational problems have been more anxiously, or more widely, debated than that of the type of education best adapted to the needs of an agricultural population. That so many of the outstanding features of this problem recur with little variation, wherever rural education exists, is no doubt due to the fact that most of the essentials of rural life are common to all agricultural countries. The agriculturist lives a simple life in comparative isolation, away from large towns and the modern amenities they provide. Agriculture, more than any other industry, is indissolubly bound up with the lives of the workers. It dominates the whole social and domestic outlook of the individual, whether farmer or labourer, to a degree unknown in any other calling. The comparative loneliness of his life, and the restriction of neighbourly relations to workers in the same industry, react on his whole mental outlook. Unlike the factory hand, the farm worker does not escape from his working environment at the end of his day's toil. The nature of his business makes it impracticable for him rigidly to limit the exercise of his calling within certain definite periods of the day, and his hours of leisure are perforce spent in much the same surroundings as are those of his working life. In no profession is the fortune of the individual worker, however humble his lot, more dependent upon his own skill and judgment, and in none is the possession of a sound elementary education, and of the balanced and progressive outlook that it imparts, more likely to prove of commercial advantage. Thus it is that in dealing with the problems of rural education, it becomes difficult, if not impossible, entirely to dissociate elements which are purely cultural from those that are technical. That which broadens the cultivator's views on life must inevitably widen his outlook on his calling, and, conversely, much of the technical knowledge proper to his industry is of service in his private and domestic life.

SCOPE OF THE CHAPTER.

The idea that education in rural areas should bear a close relationship to the daily lives of the people is but the recognition of the truth that the environment in which rural workers live is different from that of the towns. It is essential to the happiness and efficiency of children in the villages that their up-bringing should be in harmony with their environment, and to this end it is most desirable that every element in the education they receive in their village schools should draw strength and inspiration from the life of the country-side.

Viewed from this aspect, the problems of rural education are divisible into the teacher, his character and training; the curriculum with its text-books; and the organisation of the school. In no particular must these be at discord with the rural environment, and, to secure this, the directing and supervising authorities should themselves be in close

sympathy with the life of the cultivator. It has even been suggested to us that the end we have in view cannot be attained without a complete cleavage of the Education Department, one section of which would be exclusively concerned with rural needs.

But it is not only the outdoor environment that calls for careful thought; the home life of the growing child wields a profound influence on his development, and we have found it necessary, in dealing with primary education for boys, to include in our survey the linked problems of education for girls and adults. As we shall show, it is the wastage in the primary classes, coupled with the subsequent relapse into illiteracy of a proportion of those passing through the primary schools, that are in the main responsible for the slow growth of literacy. If these two obstacles can be overcome, a far higher degree of efficiency will be obtained even with the present expenditure on education and the present number of primary schools. Without a satisfactory all-round advance in primary education, there can be little hope of any widespread economic progress.

While we have attempted, in the succeeding paragraphs, to offer criticism of a constructive kind in many fields of rural education, we are not unmindful of the enormous difficulties which confronted those who set out to devise and to initiate a system of primary education in British India; nor, having regard to those difficulties, are we inclined to belittle the amount of success that has been achieved since the first attempts were launched.

So long as the level of general education remains as low as at present, the candidates for higher and technical training must be limited. There are, however, under existing conditions, many improvements possible in the higher spheres of education. In pursuing our survey through the secondary and collegiate stages to the universities, we have found numerous problems urgently calling for solution.

It should be noticed that the available statistics for pupils, institutions, and expenditure do not distinguish clearly between rural and urban elements. For this reason, amongst others, figures alone, more especially when they appear as percentages of the whole population, are apt to be misleading. The actual condition of literacy among the rural population is certainly worse than the averages suggest, while comparisons between province and province are apt to be vitiated by the varying proportion of the more literate classes within their respective borders. Other points on which caution is required are mentioned in the relevant paragraphs. We have throughout the chapter omitted all reference to the problems of European education, as our primary concern is with the agricultural classes.

GENERAL FEATURES OF EDUCATIONAL ADMINISTRATION.

137. Education, with the exception of European education, is a transferred subject in all the major provinces. Technical and professional education is in general allotted to the departments concerned; the education given in agricultural colleges and middle schools thus falls within the province of the Minister who holds the portfolio of Agriculture. The responsibilities of the Government of India in regard to education are

confined to the North-West Frontier Province and the minor administrations, and to the management of certain special institutions. These responsibilities are exercised with the assistance, where necessary, of the Educational Commissioner with the Government of India.

For administrative purposes, educational institutions are divided into two classes, those recognised by the departments of education and those which are not so recognised and are, therefore, not inspected by government agency. The proportion the two classes bear to each other varies greatly from province to province, but, except in Burma, unrecognised institutions make no important contribution to education. Over British India as a whole, institutions that are recognised are six times as numerous as those unrecognised. Sixty-five per cent of these recognised institutions are privately managed, though subject to government inspection, and, of the remainder, thirty-three per cent are managed by district boards and municipal councils and two per cent are under direct government management. From the point of view of the services rendered to education, the importance of the institutions under direct government management is out of all proportion to their number, comprising, as they do, the majority of the professional colleges in which such subjects as medicine, agriculture, engineering, science and commerce are taught. At the apex of the educational system of India stand the universities, the constitution of which is regulated by legislative enactments. There are fifteen of these in British India. A more detailed description of the universities and the arts colleges from the agricultural standpoint will be found in paragraphs 463-466 below.

FUNCTIONS OF LOCAL AUTHORITIES.

438. It is unnecessary, here, to describe the legislation which governs the educational functions of local bodies in the different provinces. It will suffice to say that the most important additions to this legislation in recent years have been Primary Education Acts, one of the main objects of which has been to empower local bodies to introduce compulsory primary education in selected areas.

Although some local bodies maintain or aid secondary English schools, their chief concern is with elementary education in the vernacular. This they provide either directly through the medium of schools under their own management or indirectly by grants-in-aid to schools under private management. The policy adopted in this respect varies greatly in the different provinces. This divergence dates back to the beginnings of vernacular education in this country when Bengal and Madras, for example, adopted the system of grants-in-aid for financing primary education whilst Bombay, the Punjab and the United Provinces developed the system of government or local board schools. The position to-day is that the expenditure on aided schools is far higher than that on government and board schools in Bengal, Bihar and Orissa and Burma and that the reverse is the case in Bombay, the United Provinces, the Punjab, the Central Provinces and Assam. In Madras, there is no great disparity between the expenditure on government and

board schools and that on aided schools. Bengal relies, to a far greater extent than any other province, on income from fees, some forty-one per cent of its total expenditure on education in 1925-26 being derived from this source.

The departments of education aim at securing efficiency in the education provided by local authorities partly through an inspectorate, upon satisfying which, in theory at least, the continued recognition of an institution depends; and partly through the opportunities for persuasion which present themselves by reason of the fact that so large a proportion of the expenditure on education—about forty-eight per cent in 1925-26—is borne by provincial resources. In practice, departmental control over education is generally admitted to be somewhat less effective than the threefold safeguard of inspection, recognition and assistance from government funds might suggest. The standard of recognition is a minimum standard and withdrawal of recognition, once accorded, is rarely resorted to, whilst the assistance furnished from provincial revenues bears, as a rule, some proportion to the amount provided by the local authority from its own resources. The proportion furnished from provincial revenues has greatly increased in recent years.

The recognition of privately managed institutions loses much of its value from the reluctance shown in withdrawing recognition. The grant-in-aid, however, furnishes a more potent weapon of control over these institutions, as the majority of the schools which receive such grants are largely dependent upon them for the continuance of their existence. If used judiciously, therefore, they should enable the departments of education, either directly or through the medium of the body administering the grant, to insist upon the elements necessary for a sound education. These elements would include the employment of properly qualified and adequately trained teachers, and the provision and maintenance of suitable accommodation and equipment.

IMPORTANCE OF THE INSPECTORATE.

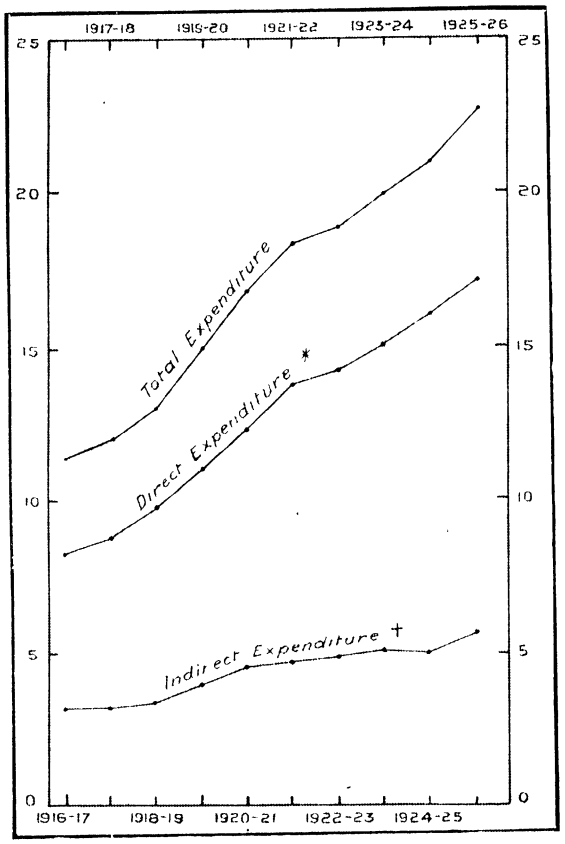
439. The brief outline of the educational system of India which has been given above will have made it clear that, in the long run, the efficiency of that system rests mainly on the efficiency and courage of the inspectorate maintained by the provincial governments. The inspectorate is provided by the Indian and provincial educational services. Recruitment for the Indian Educational Service, as for all services working in the transferred field of the administration, has now ceased and it is intended that its duties should be taken over by the superior provincial educational services. The present position in regard to these services is similar to that of the agricultural services which are described in paragraph 33, Chapter II. Their responsibilities will be heavy.

STATISTICAL.

440. The salient features of the total expenditure on education in British India during recent years are conveniently illustrated by the graphs opposite.

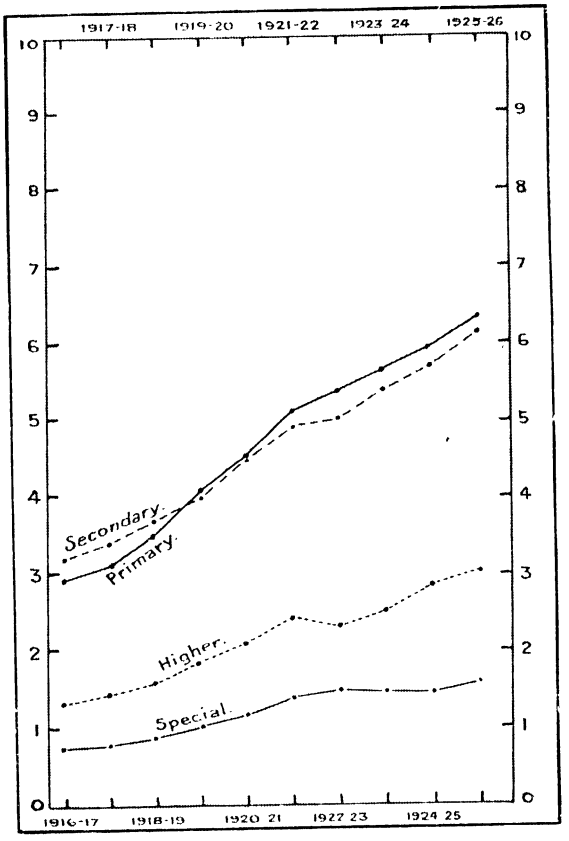
Total Expenditure on Education and Division between Direct and Indirect Expenditure

Expenditure in Crores of Rupees.



Direct Expenditure on Education

Expenditure in Crores of Rupees.



* Division of the Direct Expenditure between Primary, Secondary, Higher and Special School Education is shown in the right-hand graph, the scale of which is 2½ times the scale of the left-hand graph.

† Indirect Expenditure consists of Expenditure on Direction, Inspection, Buildings, Furniture, Apparatus, and Miscellaneous Expenditure. The division of the Indirect Expenditure between the various stages of education is not shown in reports.

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The expenditure on all forms of education in recognised institutions is given separately for each of the nine major provinces and for British India as a whole in 1926-27, in the Table below :—

Province	Population (census of 1921)	Total Expenditure	Cost per scholar
		Rs.	Rs.
Assam	7,606,000	43,84,150	16
Bengal	46,696,000	3,97,76,068	17
Bihar and Orissa ..	34,005,000	1,77,23,772	17
Bombay	19,292,000	3,81,49,449	34
Burma	13,212,000	1,93,83,804	44
Central Provinces and Berar	13,913,000	1,13,63,933	20
Madras	42,319,000	4,52,72,432	19
Punjab	20,685,000	2,87,65,763	26
United Provinces ..	45,376,000	3,37,79,166	26
British India* (including minor administrations).	247,098,000	22,77,92,532	23

Province	Percentage of expenditure from			
	Government funds	Board funds	Fees	Other sources †
Assam	57	13	17	13
Bengal	37	6	41	16
Bihar and Orissa ..	41	28	18	13
Bombay	52	19	17	12
Burma	49	18	18	15
Central Provinces and Berar	63	18½	10½	8
Madras	45	15	19	21
Punjab	53	14	20	13
United Provinces ..	58	13	14	15
British India* (including minor administrations).	48	14	22	16

* 1925-26 figures, 1926-27 figures not available.
† i.e., income from endowments, subscriptions, contributions, etc.

Further light is thrown on the present educational position in India by the figures in the Table below :—

Province	Percentage distribution of scholars in recognised institutions							
	For males				For females			
	Primary stage	Secondary stage	† Special Schools	Universities	Primary stage	Secondary stage	† Special Schools	Universities
Assam	89·0	8·5	2·0	0·5	94·1	5·5	0·4	..
Bengal	82·4	10·3	5·8	1·5	98·3	1·1	10·5	0·1
Bihar and Orissa ..	92·7	5·2	1·7	0·4	97·9	1·0	1·1	..
Bombay	81·2	16·0	1·8	1·0	90·0	8·7	1·3	..
Burma	86·0	10·1	3·5	0·4	90·8	7·8	1·4	..
Central Provinces and Berar..	86·9	12·0	0·6	0·5	92·0	5·8	2·2	..
Madras	92 0	6·3	1·0	0·7	94·0	4 3	1·5	0·2
Punjab	72·1	16·3	10·7	0·9	94·1	3·9	1·9	0·1
United Provinces ..	88·2	9·7	1·4	0·7	94·9	4·0	1·1	..
British India*	87·1	8·8	3·2	0·9	95·2	3·6	1·1	0·1

Province	Percentage of scholars in the primary stage in recognised and unrecognised institutions to population of school-going age (*viz.*, 15 per cent of the total population) in 1921-22‡		Percentage of literacy among the total population of 20 years of age and over (census of 1921)	
	Male	Female	Male	Female
Assam	28·6	5·0	15·0	1·3
Bengal	35·9	10·2	22·5	2·1
Bihar and Orissa ..	26·0	4·1	12·6	0·7
Bombay	45·4	12·9	18·4	2·4
Burma	40·2	12·2	62·0	11·8
Central Provinces and Berar..	25·6	3·6	10·4	0·9
Madras	41·9	11·5	21·4	2·2
Punjab	25·2	5·9	9·4	0·9
United Provinces ..	22·8	2·9	8·9	0·7
British India	32·2	7·6	18·3	1·9

* 1925-26 figures, 1926-27 figures not available.

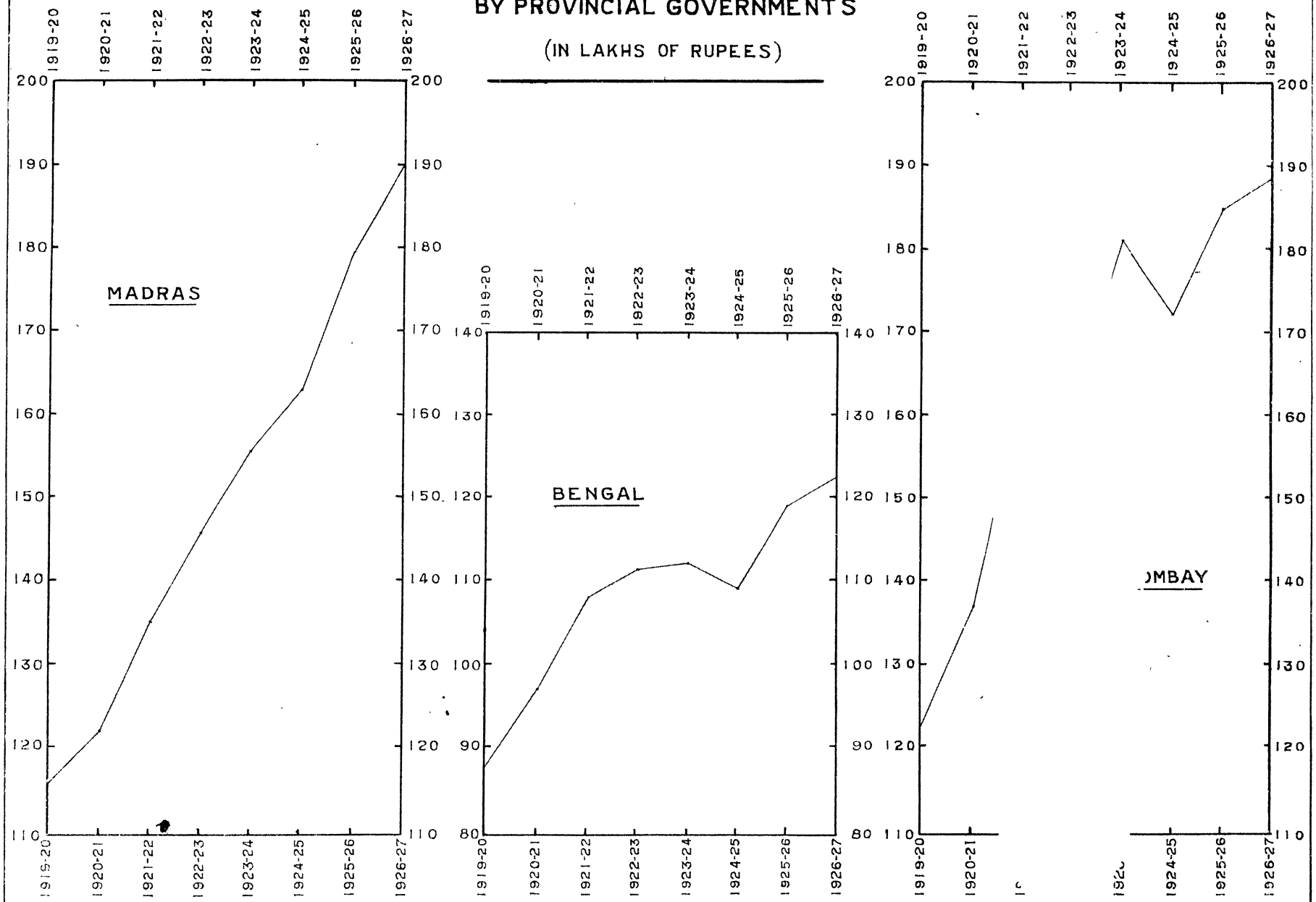
† Special schools consist of technical and industrial schools, normal and training schools, commercial, medical and reformatory schools, schools for adults, schools for defectives, etc.

‡ Statistics are not available which would enable a Table in this form to be prepared for any year subsequent to 1921-22. From the general educational information available, it may be inferred that the percentages shown in the Table have increased since that date, notably in the Punjab.

NET EXPENDITURE ON EDUCATION

BY PROVINCIAL GOVERNMENTS

(IN LAKHS OF RUPEES)



NOTE. The figures used in these graphs exclude Expenditure in England and for the years 1919-20 and 1920-21 relate to the expenditure of the Government of India in the respective provinces

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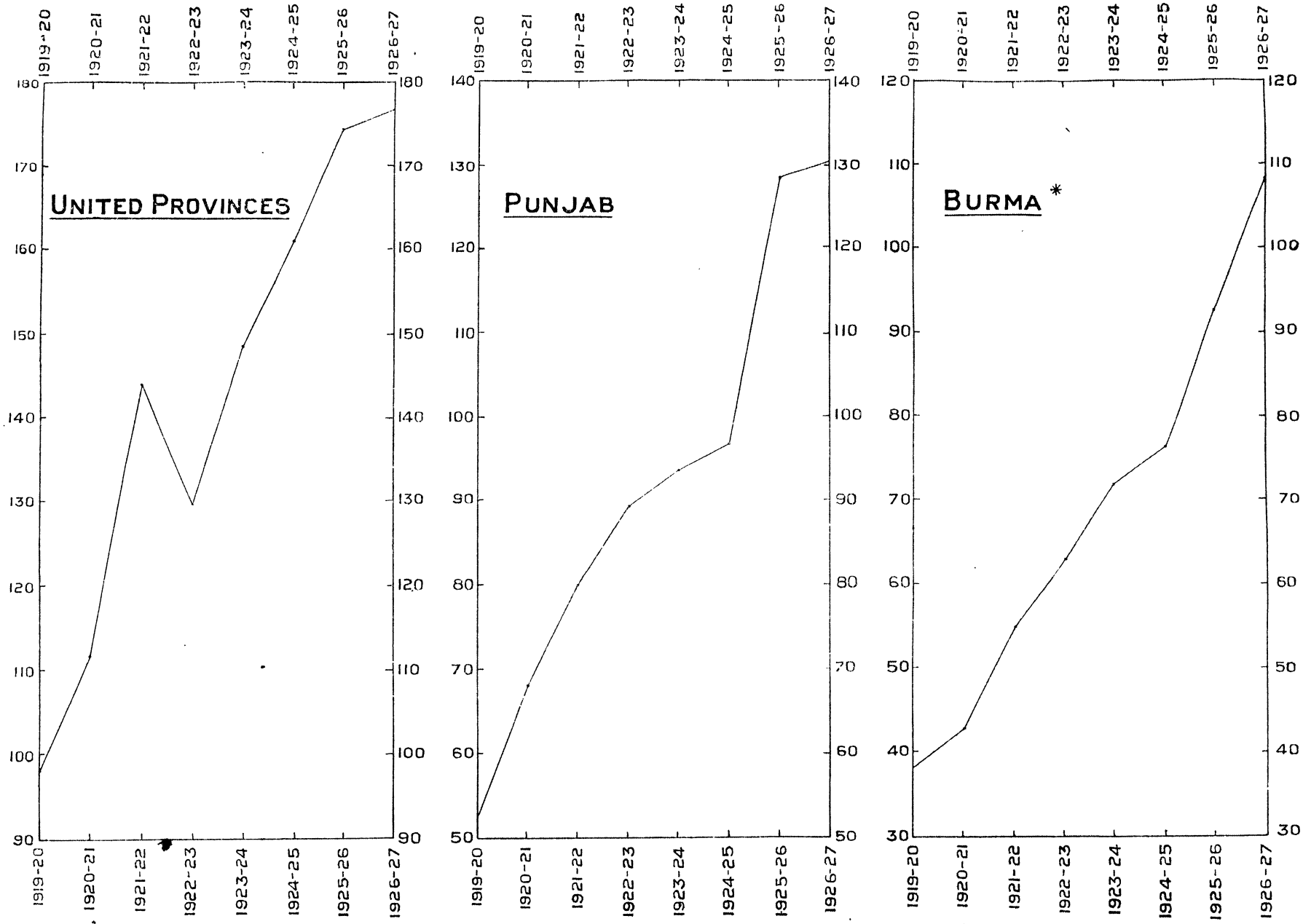
NET EXPENDITURE ON EDUCATION BY PROVINCIAL GOVERNMENTS (IN LAKHS OF RUPEES)



NOTE. The figures used in these graphs exclude Expenditure in England and for the years 1919-20 and 1920-21 relate to the expenditure of the Government of India in the respective provinces.

* Including Shan States.

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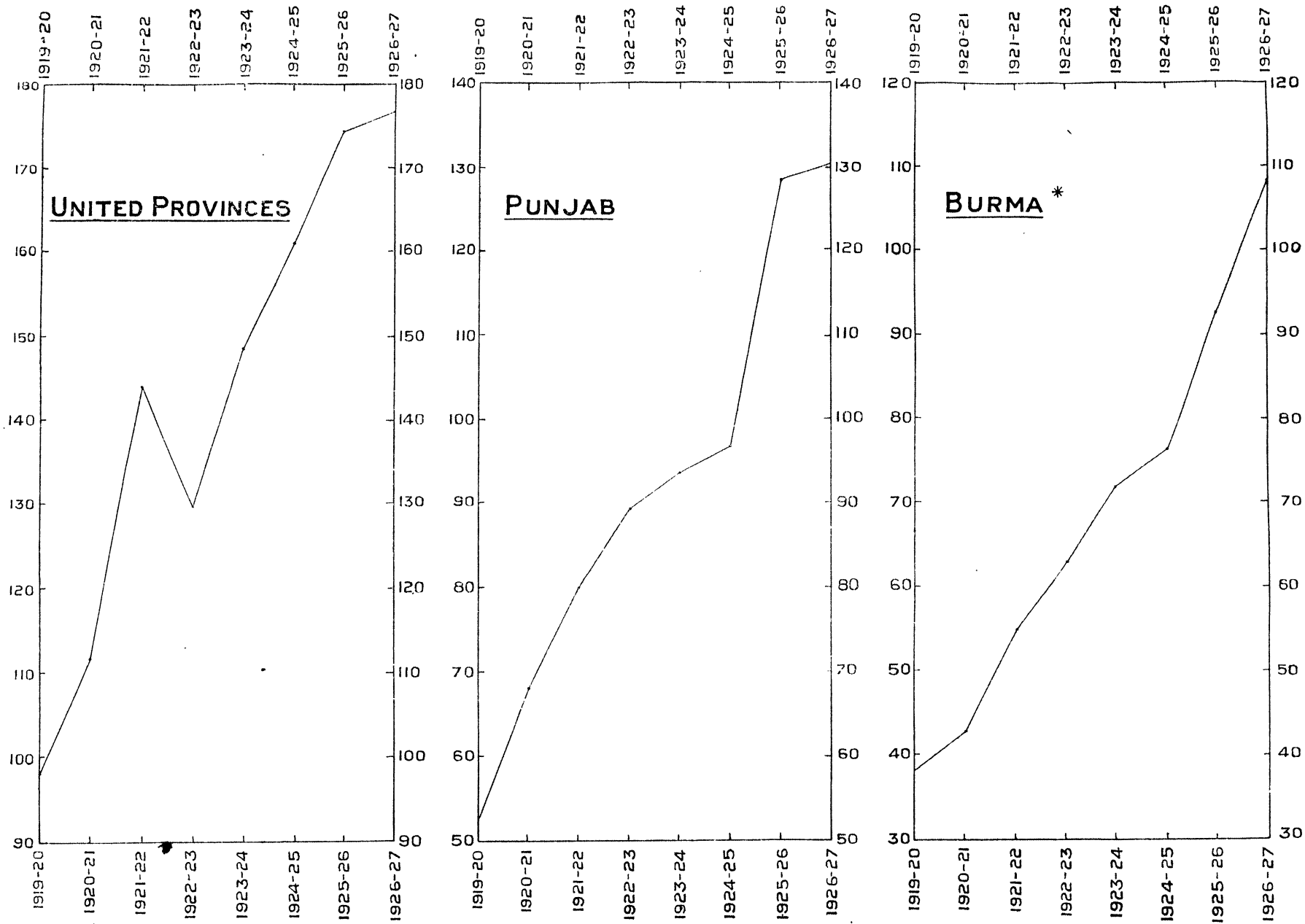
NET EXPENDITURE ON EDUCATION BY PROVINCIAL GOVERNMENTS (IN LAKHS OF RUPEES)



NOTE. The figures used in these graphs exclude Expenditure in England and for the years 1919-20 and 1920-21 relate to the expenditure of the Government of India in the respective provinces.

* Including Shan States.

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The figures of literacy and female education reveal in very striking fashion what are admittedly the weakest points in the educational position in India. To impart literacy is the essential object of education at the primary stage and little progress in rural development can be hoped for without it. The subject calls for further discussion. We deal separately with female education in paragraph 444 below.

PRIMARY EDUCATION WITH REFERENCE TO AN INCREASE IN LITERACY.

441. The spread of literacy in India can be gauged in two different ways: from the figures of attendance at primary schools and by a study of the census returns of literates.

According to the census returns of 1921, the male population of British India was approximately 127 millions, of whom 14·66 per cent were from 5 to 10 years old. The number of boys of primary school age was thus about 18½ millions. In 1916-17, the number of pupils at recognised primary schools was reported as 4·78 millions. In 1925-26, it had increased to 6·88 millions. In the ten years ending with 1925-26, therefore, the number of pupils attending primary schools for boys increased by 44 per cent as compared with an increase in the total male population of 1·7 per cent in the last census decade. It is clear, therefore, that the increase in the numbers attending primary schools is not due only to the increase in the population, and that, during these ten years, the percentage of boys of primary school age who have attended school has steadily risen.

The figures of literacy of the census of 1921 are the latest which are available. The census of 1911 was the first for which a definite standard of literacy was prescribed. It was not a high one, consisting as it did merely of ability to write a letter to a friend and to read the reply to it. The percentage of males over 20 years of age who satisfied this test was returned at 16·1. As was observed in the report on the census, it would doubtless have been considerably higher if those who could decipher the pages of a printed book with more or less difficulty had been included as literates. The same definition was retained at the census of 1921 when the percentage of literates was 18·3. No satisfactory comparison with the figures of the census of 1901 can be made owing to the absence of a precise standard at that census but the corresponding figure was then 14·8. If the increase in male population is correlated to the increase in literate population, the result is as shown below.

Year	Male population	Increase per cent	Male population of 20 and over	Percentage of literacy of male population of 20 and over	Literate male population of 20 and over	Increase per cent
1901 ..	117,804,900	..	61,089,300	14·8	9,021,000	..
1911 ..	124,873,700	6·0	65,456,100	16·1	10,557,000	17·0
1921 ..	126,872,100	1·6	66,440,700	18·3	12,152,500	15·1

The conclusions which stand out from a study of these data are that the proportion of boys of school-going age attending primary schools is

still disappointingly small though it is increasing with some rapidity, and that the proportion of literates is very low both absolutely and relatively to the number of boys attending school.

The figures of progress in attendance at primary schools would furnish more solid ground for satisfaction if it could be assumed that all the boys attending such schools remained at them long enough to ensure their reaching the minimum standard of literacy but this, unfortunately, is not the case. No definite information is available as to the extent to which those who reach this standard remain literate after their school-going days are over but there is reason to believe that relapse into illiteracy is not uncommon.

REASONS FOR THE UNSATISFACTORY STATE OF PRIMARY EDUCATION.

442. Though there has undoubtedly been a marked advance in the field of primary education in India in recent years, the review of the situation in the preceding paragraphs will have shown that it is still very far from satisfactory. For the failure to achieve more rapid progress there are various reasons. Chief among these is the inefficient teacher. The complaint is that he has failed to spread in the village a desire for education; that he has failed to overcome the deficiencies of his own training and to surmount the obstacles arising from the apathy and indifference of the people; and that he has, therefore, failed to attract to his school the boys of his neighbours or to keep at school those whom their parents have sent. In mitigation of his failure, the teacher may urge with some reason that the pay and prospects of the profession are not, and never have been, such as to encourage good work. The parents, on their part, may urge that facilities for education are inadequate, that, even where no school fees are charged, there arise various items of expenditure which amount to a considerable burden on their slender resources, that the teaching is inefficient and that the boys are required at home for looking after cattle or doing light work on the land.

The plea of the parents that facilities are inadequate receives some support from the fact that there are not more than 157,000 primary schools for boys for over 500,000 towns and villages, but it is largely discounted by the extent to which facilities already in existence remain unutilised. The evidence we have received is conflicting as to whether, to any appreciable extent, the cost deters parents from sending their boys to school. The character of the teaching given is undoubtedly a factor of importance. The villager may be illiterate but he is usually shrewd enough to appraise the value, or lack of value, of the tuition given in relation to the life he knows. Where so large a proportion of the people have no experience of the value of education, and may be unwilling, if not unable, to incur expenditure on it, the tendency to follow custom and keep the boys from school must be strong.

WASTAGE IN THE PRIMARY SCHOOL.

443. The shortness of the period for which most boys remain at a primary school is not evident from the statistics of attendance which are based on the total number on the rolls in the classes which make up the primary school. It is not, therefore, generally realised how serious is the handicap to the spread of literacy presented by the fact that so many of the boys

attending primary schools do not stay for more than a year and that of those who do, only half complete the course. The position will be clear from the following Table :—

Table showing the wastage in primary schools for boys

Class and year	Number of pupils	Wastage in Class I, per cent
I in 1922-23	3,453,046	....
II ,, 1923-24	1,218,758	64·7
III ,, 1924-25	897,512	74·0
IV ,, 1925-26	655,101	81·0

There are three striking deductions to be drawn from these figures to which we wish to draw attention. The first is that very few boys (less than twenty per cent) stay four years at school. As it takes at least four years to achieve lasting literacy, it may be said that a very large proportion of the expenditure on primary education is wasted so far as its aim is to make the people literate. The truth is that the parent too often regards the primary school as a crèche. The causes of the wastage throughout the primary school course are largely those which account for the small proportion of children who attend school at all. The problem of removing these causes is at once the most important and most difficult of solution of the many that confront the educational authorities.

The second point is that, when calculations are made on the basis of information supplied by the census reports, it appears that the total number of pupils in recognised schools who pass through class IV is a little more than the normal loss due to death among literate males of 20 years of age and over. In the three provinces of Bengal, Bihar and Orissa and Burma, the annual loss due to death exceeds the number of pupils in class IV and the literate population is only maintained with the help of unrecognised institutions.

The third point is that, without any increase in the total number of pupils (about 6,000,000) attending the first four primary classes, the number in class IV might be increased from 600,000 to 1,500,000, or, in other words, if only 1,500,000 pupils attended class I and could be kept in attendance till they had passed class IV, over twice the present number of pupils would achieve lasting literacy without any necessary increase in expenditure.

FEMALE EDUCATION.

444. Before we proceed to discuss remedies of an administrative kind for decreasing the wastage of effort that now characterises the early stages of education, we propose to refer to the subject of female education, since our enquiries into the educational system of India in its bearing on rural development have left us firmly convinced of the great importance to rural development in this country of the spread of literacy among the women of India. How small has been the progress already made in this direction is shown by the figures for female literacy which were returned at the census of 1921. The total female population in that year was 120,000,000. The

number of females undergoing any form of education at school or college was estimated, in 1924-25, at 1,600,000, which gives a percentage of scholars to the total female population of school-going age of 9.

Since 1916-17, the number of females undergoing instruction has risen by 480,000 or forty per cent. The relative increase has, therefore, been considerable. Progress has not, however, been as satisfactory as would appear at first sight; for an analysis of the figures shows that thirty-one per cent of the increase is due to an increase in the number of primary scholars, most of whom leave after their first or second year, before literacy has been firmly attained. Of the 914,000 pupils in the first four primary classes in schools for girls, in 1924-25, 625,000 were in the lowest class and there were only 149,000 in class II, 87,000 in class III and 53,000 in class IV. The wastage is thus even more pronounced than it is in the case of boys.

The inertia of conservatism and prejudice, reinforced by the *purdah* system and the custom of early marriage, the lack of qualified teachers, the difficulty of making arrangements which will be considered satisfactory by the parents for the transit of girls to and from school and the difficulty of providing suitable accommodation for women teachers in the smaller villages are all formidable obstacles to rapid expansion. There are indications that a change in the general attitude towards female education has set in. A valuable stimulus is coming from women themselves. Though it will probably be long before this is powerful enough to make itself felt throughout the country as a whole, it is impossible to read the proceedings of the all-India women's conferences on educational reform without realising the greatness of the possibilities in this direction. The co-operative movement can do much to assist. It is already doing so in the Punjab where co-operative education societies are interested in the education of women and girls as well as in that of men and boys. Improvements in communications, tending as they do to extend the influence of the better educated urban communities on the rural population in the neighbourhood of towns, should also promote the spread of female literacy. An experiment has been undertaken in Bengal, designed to assist *purdah* women to educate themselves by means of correspondence courses carried out under the supervision of a visiting governess. The results obtained should provide a valuable guide to the possibility of further development in this direction.

We feel strongly, however, that progress will be slow if it depends on nothing more than the operation of the factors we have just discussed. The value to the community of the education of its women lies particularly in its effect upon the spread of lasting literacy amongst the young. Steps should be taken fully to record the educational history and subsequent development of children of typical cultivating families in which the mother is literate, while like particulars of illiterate homes in the same neighbourhood and conditions of life should be tabulated for the purpose of comparison with their more fortunate neighbours. It is essential, however, that the families chosen should be of entirely rural condition and not urban. Where no literate homes of the cultivating classes are available we think a definite effort should be made to impart

literacy to a certain number of young mothers selected where conditions are most suitable and where no similar experiment has been tried before. We have little doubt that the result of this comparison will show a markedly stronger tendency on the part of the literate parent both to send the children to school and to keep them there till literacy, which the mother has come to value, has been fairly achieved.

We think that the trouble and expense involved in the collection of the necessary facts will be amply repaid if, as we anticipate, the result is to provide convincing propaganda which can be used to demonstrate, in ways that all will understand, the true relation between female literacy and the spread of general literacy. This is but one expedient that suggests itself to our minds, and we do not doubt that there are others better suited to particular localities. We would add that, in our view, this is a matter in which methods at once novel and unorthodox may well prove themselves to be possessed of a publicity value and a power of popular appeal denied to blue books and even to official pronouncements.

445. We are convinced that the progressive adoption of the compulsory system is the only means by which may be overcome the unwillingness of parents to send their children to school and to keep them there till literacy is attained. The provision of a sufficiency of trained teachers and of suitably equipped buildings must, of course, precede the enforcement of compulsory school attendance. We fully realise that the expenditure involved in the introduction of compulsion will be very heavy and that the greater part of it must fall upon provincial revenues. On this ground alone, it is obvious that uniform progress in all provinces, or even in different parts of the same province, is not to be expected.

REMEDIES. (i) COMPULSION.

In 1911, the late Mr. Gokhale initiated a movement for compulsory primary education. Since that date, a desire for increased primary education has found strong expression throughout India and legislative enactments for the introduction of compulsion at the discretion of local bodies in rural areas now exist in all provinces except Bengal where, however, a Primary Education Bill is under consideration. The desire for the expansion of education is also reflected in the largely increased expenditure on primary education in recent years by local bodies as well as by local governments.

Active steps, however, to give effect to the legislation enacted still remain to be taken in most provinces. The Punjab, the Central Provinces, Bihar and Orissa, and Madras are the only provinces in which steps have been taken to make primary education compulsory in any rural area and the Punjab is the only province in which any measure of success can be said to have been achieved. In all the provincial legislation on the subject, the onus of proposing the establishment of a compulsory area is placed on the local body concerned with primary education. It is, therefore, essential to convince local bodies that a bolder policy is needed if primary education as a vital factor in rural development is to be efficient and widespread, and that the heavy responsibility lies on them of making the rural communities realise that nothing hinders their moral and material well-being so much as delay

or reluctance in bringing primary education within the borders of their villages. It is needless to point out that nothing does more to promote and facilitate the co-operative movement in all directions than primary education. The moral improvement which flows from an intelligent application of the co-operative principle is rightly emphasised by the leaders of the Indian co-operative movement. Equal emphasis must be laid upon the principle that the development and strengthening of character, which is one of the most valuable results of that movement, cannot proceed far unless it is based on the secure foundation provided by an efficient system of primary education.

Provincial governments, who contribute largely from their revenues to the cost of primary education, should also bring the local authorities to realise that, in present conditions, expenditure on primary education is largely wasted and this waste can only be effectively stopped by the gradual introduction of the compulsory system. We attach importance to driving home the wastefulness of the present voluntary system. We believe that this is an argument of which the force will be readily appreciated and that it should not be difficult to convince local bodies of the unwisdom of failure on their part to obtain good value for money spent.

In recommending that compulsion should be introduced as rapidly as possible, we do not contemplate the creation of an army of attendance officers, and wholesale prosecutions. The mere presence of an Act upon the Statute Book and its application to a particular area go far to ensure obedience to its provisions. We are inclined to favour the view adopted in the Punjab, that compulsion should be used more to keep at school boys already sent there than to bring in the last boy in the village. It is more important to stop the wastage we have mentioned than to strain after the last truant.

(*a*) The introduction of a contract system.

446. The time required for the general introduction of compulsion throughout the rural areas of India must be measured in decades rather than in years and the question, therefore, arises whether anything can be done in the meantime to ensure a better return for the expenditure on primary education. Over six crores of rupees were so spent in 1925-26 and, as we have shown above, no inconsiderable part of this sum must be held to have been wasted. We have considered whether a partial solution of the problem of securing the retention of children at school for a period sufficiently long to enable them to attain the minimum standard of literacy might not be found in a system of contract. This might take the positive form of requiring the deposit by the parent, at the outset of the boy's school career, of a sum of money, the whole or a proportion of which would be sequestrated if the boy were removed, except for good reasons, before the end of the school course, or the negative form of forfeiture of a small bonus which would have been earned if the boy had remained at school for the whole period. We doubt, however, whether such a system as this could be satisfactorily worked by government agency. Any movement in this direction must come from the people themselves and, in our view, the most desirable form it can take is that of co-operative societies, the members of which

pledge themselves under penalties to keep their children at school. Co-operative societies of this character have been formed in the Punjab and there are at present 158 of them with a membership of 7,000 parents who bind themselves to send their children to school for four years continuously, or until the completion of the fourth standard. These societies are rapidly increasing in numbers and we were informed that the withdrawal of a member on whom a penalty has been imposed is very rare. Such societies are intended to pave the way towards, and not to replace, legal compulsion, and in the Punjab have been closed down as the people have been won over to general legal compulsion.

(iii) Improvements in organisation.

447. Inefficient teaching and its consequent effects on attendance may be due to the shortcomings of the teacher or the fact that too much is expected of him. The remedy for the one is an improvement in training. The remedy for the other is an increase in the number of trained teachers.

It is most unfortunate that women are seldom available as primary school teachers in India, for experience all the world over has shown that a woman makes a far better teacher for young children than a man and nowhere has universal education been attained without the aid of the female teacher. We consider that a determined attempt ought to be made to remove the difficulties which at present stand in the way of women becoming teachers. Improvement in their pay is desirable on general grounds, and we recommend this strongly for we consider that, in many provinces, the standard of pay is inadequate. But it seems doubtful whether an improvement in pay such as would be financially possible would be sufficient to enable them to make for themselves suitable arrangements for their residence in villages. The selection and training of promising girls from the villages who, on the completion of their training, would return to their own villages, and the training of the wives of the male teachers would appear to be the most promising expedients immediately practicable.

We have pointed out that the number of primary schools in India is still far from sufficient for the number of villages whose needs they are called upon to serve, but the multiplication of inadequately staffed schools will not help matters. We entirely agree with those educational authorities who hold that no primary school can be efficient which has less than two teachers. Unless the school which has at present one teacher can be provided with an additional teacher or converted into a branch school consisting of one or two classes only, with the object of providing teaching for young children until they are old enough to walk to the central school, it is better closed, for it is both ineffective and extravagant. We realise that financial considerations militate against the provision of a second teacher for the small primary school. It is estimated that the minimum number of pupils required for a primary school from the point of view of economical administration is about a hundred, whereas the average number attending each primary school at the end of 1925-26 was only 43. But nothing is to be gained by failure to face the fact that a village which has a primary school with only one teacher might almost as well be without a school at

all. We therefore recommend that, wherever possible, the policy of establishing 'central' schools and of converting 'single teacher' schools into 'branch' schools should be adopted.

We were informed that a marked improvement in the standard of primary education had been effected in the Punjab by the conversion of primary schools into lower middle schools with six classes, and of lower middle schools into full middle schools with eight classes. This improvement is doubtless to be attributed to the better leadership and direction to be found in middle schools, to the fact that the teaching is, therefore, far better, and also in no small degree to the stimulus larger numbers bring to the pupils themselves. All these factors make for a longer period of school life and more regular attendance. The advance made in this direction in the Punjab is strikingly illustrated by the following figures :—

Punjab

(Schools for boys)

Year	Primary schools	Percentage of increase(+) or decrease (−)	Lower middle schools	Percentage of increase	Upper middle schools	Percentage of increase
1920-21	5,369		402		213	..
1921-22	5,627	4·8	412	2·5	244	14·5
1922-23	5,738	+ 2·0	438	6·3	270	10·7
1923-24	5,679	− 1·0	588	34·3	299	10·7
1924-25	5,562	− 2·1	883	50·2	323	8·0
1925-26	5,714	+ 2·7	1,342	52·0	391	21·1
1926-27	5,912	+ 3·5	1,658	23·5	456	16 6

Although other provinces also have a certain number of primary pupils in middle schools, they have not so far initiated a definite policy of converting primary schools into lower middle schools and the number of primary scholars in these schools is accordingly much fewer than it is in the Punjab, as is shown by the following comparison :—

1926-27

Province	Primary pupils in primary schools	Primary pupils in secondary schools	Total primary pupils	Percentage of primary pupils in secondary schools to total primary pupils
Assam	199,343	25,687	225,030	11·4
Bengal	1,399,535	187,566	1,587,101	11·8
Bihar and Orissa ..	875,666	45,756	921,422	5·0
Central Provinces and Berar	270,072	46,184	316,256	14·6
Punjab .. .	393,160	330,054	723,214	45·6
United Provinces ..	1,038,452	18,644	1,057,096	1·8

Similar figures for Bombay and Madras are not available as the middle vernacular schools in those provinces are classed as primary schools.

The reasons which have led to the conversion of primary schools into lower middle schools in the Punjab appear to be convincing and we commend the desirability of adopting a similar procedure to the consideration of other local governments.

THE TEACHER AND THE CURRICULUM.

448. We have so far dealt with the instruction in primary schools from the point of view of its effect on the spread of permanent literacy and have shown that, judged by the only possible test, that of literacy achieved, the system of primary education in India has been costly without being efficient. We now turn to the consideration of the teacher, the methods of teaching and the medium of instruction, from the more particular standpoint of their relation to agricultural progress.

From the agricultural standpoint, it is essential that the pupil should be encouraged to seek his interests in the every day life of the countryside. The years from five to ten are important formative years. If, during this period, the boy comes under a teacher who takes little or no interest in country affairs, if he learns his lessons and does his sums in terms of urban life and is given no explanation of the life that passes under his own eyes, he is apt to conclude that town life is the ideal. The more the primary teacher knows about the rural surroundings in which he finds himself and is in sympathy with them, the better teacher he will make. The general tenor of the evidence we received was in favour of teachers being drawn from amongst those who are familiar with rural life wherever this is possible, but no general desire was expressed that the supply of teachers for rural schools should be rigidly restricted to men who are themselves of rural origin and upbringing. While a rigid restriction would in our opinion be unsound in itself and would make still more difficult the supply of primary school teachers required to make effective the introduction of a compulsory system of education, we are in favour of recruiting rural teachers to the utmost practical extent from men of rural origin and upbringing.

After the teacher, the most important influence in keeping instruction in rural schools on the right lines is that of the text book he uses. We are, therefore, glad to be able to place on record our high opinion of the work which is being done by the Text Book Committee in the Punjab and to note the special interest evinced by Mr. M. West, the Principal of the Teachers' Training College at Dacca, in Bengali textbooks which was reflected in a most interesting exhibition arranged by him at the Dacca Agricultural Show which we visited in January, 1927. We could wish that work of this character was not so exceptional, but there appears reason to believe that text book committees in general are apt to dissociate themselves from any responsibility for securing the supply of the right class of text-books and to confine themselves to the rôle of censors. It would also seem that, in some instances, they find it difficult to resist the prejudices of local authorities and the importunities of the authors of school books. We advise that authors of school text-books should not be nominated to text book committees. In our opinion, the part the text book committee can play in developing

primary education on right lines is so important that it is essential that it should be constituted in such a way as to command the respect and confidence of all who are interested in education.

If it can be secured that the teacher in primary schools, though not himself necessarily of rural origin and upbringing, has a genuine interest in country life, that the school text-books are rural in tone and that the boys are given such opportunities of observing plant and animal life as are afforded by occasional school walks through neighbouring cultivation, the minimum standard at which we think it desirable to aim will have been achieved. Where a government farm is easily accessible, arrangements might be made for the older boys to visit it from time to time. If the teacher happens to be a keen and well informed gardener or has qualifications for teaching nature study on sound lines, he should be encouraged to impart his knowledge to such of his pupils as are willing to learn. A stimulus in this direction might be given to the teacher by a supplement to his pay. But a pretence of teaching agricultural methods to boys five to ten years old, whether theoretically in the guise of nature study or practically in school gardens, should be avoided. All experience shows the futility of such attempts. If, at the end of his primary course, a boy can read and write with facility and intelligence and can do simple calculations in terms of the marketing of his father's produce; if he knows the simple rules of health, has been taught the use of his hands and has been imbued with a love for the country-side and a sense of fair play to his neighbours and to dumb animals, then there will be firmly established both the desire and the power to make the village a better place to live in, and both the teacher and the system may be held to have abundantly succeeded.

We cannot leave the subject of the teacher and his training without referring to a movement which offers bright hopes for escape from the difficulties which clog the progress of education. The new scheme for training teachers, which has been worked out by the Presbyterian Mission at Moga, has been adopted and extended by the Punjab Education Department, and now prevails in every training institution for vernacular teachers in the province. The teachers are trained in community work and service; they are taught to participate in the healthful activities of village life and to put their hands to practical use in whatever way they can. We visited the training school at Gurgaon and were favourably impressed with the results of this attempt to evolve a new type of teacher for village schools who would be looked up to as a source of help and advice outside as well as inside the school-room. If, in the past, the deficiencies of the teacher have been an important cause of the failure of the expensive efforts to spread primary education, it may well be that the training of his successor on new lines may prove to be an important factor in achieving success. This system of training at Moga is but one example of the valuable pioneering and experimental work accomplished by missions, to which education in India owes so great a debt.

ADULT EDUCATION.

449. Our discussion of the system of primary education in India would be incomplete without an examination of the possibilities of attacking the immense problem of rural illiteracy by the short cut of instructing the adult cultivator. It is clear that while a universal system of rural education for children is obviously indispensable for the future, it cannot affect the present situation, and if it is not to be supplemented by a determined effort to spread adult education, many of the improvements in agriculture which we so earnestly desire to see must be postponed until a new generation has sprung up fitted by early tuition to reap the advantages we seek to place within their reach. That appreciable progress has been achieved in popularising the idea of adult education indicates that the people are willing to accept new opportunities and to depart from old custom. The very fact that adult schools have been started is evidence that some adults have been convinced that it is worth their while to attend. It may be that disappointments have been great and failures many, but it is encouraging that efforts have been made, have been responded to and have even met with some measure of success. Active steps to promote adult education date from about 1920-21. Since then their progress has been rapid and, in 1925-26, the number of pupils undergoing instruction was 122,649. The movement is still, however, practically confined to two provinces, the Punjab and Bengal, and, as the following figures for the Punjab will show, it is in that province that its main strength lies :—

Punjab

—	1924	1925	1926	1927
Number of institutions ..	1,531	2,374	3,208	3,786
Expenditure ..	Rs. 32,841	Rs. 47,183	Rs. 1,01,950	Rs. 1,28,561
Total number of pupils ..	40,931	61,991	85,422	98,467
Number of agriculturists ..	17,469	35,879	48,984	58,800

The impetus in rural areas has, in the main, been furnished by the Co-operative Department and once schools have been successfully established by that department, they are handed over to the Education Department. It should be mentioned that provision is made for female as well as for male education. In Bengal, where there were, in 1926, 926 adult schools with 20,319 pupils on the rolls, the movement has not the same intimate connection with the Co operative Department as it has in the Punjab and it is perhaps for this reason that doubts have been expressed whether, in many cases, the schools are functioning with success. The figures for Bengal include 17 schools, with 442 pupils, situated in urban areas. In addition to schools in the large cities, Government in the Bombay Presidency maintain 116 primary schools for the education of adults and, in 1925, 4,012 pupils were educated in them at a cost of Rs. 17,038. These schools were chiefly night schools. Some 37 schools under the auspices of the Provincial Co-operative Institute were started in 1922 for the education of adults. A private donor supplied the necessary funds for three years. After his death in 1924, the schools had to be discontinued for want of funds.

We are much attracted by the possibilities which a development of adult education on a large scale holds out. Such a development would antedate by at least a generation that great advance in literacy which, in our view, is essential to progress in all directions. Its influence in enlarging the scope of the cultivator's horizon and in increasing his willingness to adopt agricultural improvements and his capacity to watch over his own interests in buying and selling commodities and produce would be immense. Valuable time would thus be gained at a somewhat critical period, since conditions may not remain as favourable as they have been, and still are, for the introduction of the agricultural products of India to the world's markets with the beneficial reactions on internal prosperity which may be expected to follow. Even more important is the stimulus which would be given to the spread of primary education amongst the youth of both sexes. As we have seen, a great obstacle to educational advance is presented by the apathy of the parents and no better method of overcoming this can be devised than by inducing them to realise in their own persons the benefits of education. When that apathy is overcome, the financial difficulty is also in a fair way to removal, for a community which is convinced of the benefits of education may be expected to be willing to tax itself to secure them. Again, what may be described as the " after care " of the literacy won at the primary school stage will be immensely facilitated, for the spread of literacy amongst the parents will create a demand for a supply of the printed matter which is still seldom met with in rural districts in India and will thus give to the village libraries, which now require fostering care from educational and other official authorities, the secure basis of popular support.

We have considered whether the education departments might not participate in the movement for adult education to a much larger extent than they do at present in view of its great possibilities for good. We have, however, come somewhat reluctantly to the conclusion that such participation would impose too great a strain on the primary school organisation. Village school masters, if they do their duty properly by the children under their care, cannot be expected as a body to undertake the additional work involved in night classes for the parents of those children and the same consideration applies to the school inspectorate and to the educational organisation at headquarters, which would inevitably have additional work thrown on them if the Government were to start an extensive campaign to further adult education. Work of this kind is, in our view, work which co-operative societies and associations of public spirited individuals who are anxious to promote the development of the country-side are specially fitted to undertake. We trust, however, that there will be the closest possible co-ordination between the education departments and the co-operative departments and of both departments with associations which may interest themselves in the promotion of adult education. In suggesting it as a field for non-official activity, we would express the hope that the lessons to be drawn from the failure of the schools started under the auspices of the Co-operative Institute, Bombay, will not be overlooked.

If the movement is to be successful, it must be based on popular support and not on funds and initiative supplied from outside. Popular support can only be secured as the result of active propaganda and much preliminary spade work.

Whilst we hold that the advance of adult education is a matter for non-official activity rather than for the government departments, we consider that there may be a case for assisting co-operative societies financially in the matter of adult education. Such assistance might take the form of a *pro rata* contribution from provincial revenues to the funds which a society has been able to raise privately. It should, however, be made an invariable condition of all such assistance that the schools should be subject to inspection by educational officers. School buildings should be freely placed at the disposal of organisers and every facility compatible with the due discharge of their primary duty of educating the young should be given to teachers who are willing to undertake the additional work involved.

SECONDARY EDUCATION.

450. Secondary schools in India fall into two classes. Immediately above the primary schools are the vernacular middle schools and Anglo-vernacular schools. In some provinces, these are termed English middle schools. The vernacular middle and Anglo-vernacular (English middle) schools are parallel institutions, the former in the main serving the needs of rural areas and the latter, except in Bengal, those of urban areas. The boys attending these schools are from ten to fourteen years old. Above these schools come the high schools which boys enter at the age of thirteen or fourteen and where they remain until they are sixteen or seventeen, after which they proceed to the intermediate colleges and the universities which are dealt with in paragraphs 463-466 below. The figures for secondary schools for boys as they stood in 1925-26, are given in the Table below:—

Class of institution	Number	Number of students	Total expenditure	Percentage of expenditure *borne by			
				Government funds	Board and Municipal funds	Fees	Other sources
			Rs.				
Vernacular middle schools.	4,401	542,920	71,50,411	36·9	20·3	28·2	14·6
Anglo-vernacular (English middle) schools.	3,070	325,517	99,38,682				
High schools ..	2,396	714,655	3,60,44,066	32·1	2·4	50·9	14·6
Total ..	9,867	1,583,092	5,31,32,562				

These figures, however, hardly give a correct view of the position. In Bombay and Madras, as has been already explained, vernacular middle schools are classed as primary schools and, in the other provinces, secondary schools have primary classes attached to them. On the one hand, therefore, a small addition has to be made to the figures given in

* These percentages are based on expenditure in 1924-25 as later figures are not available.

the Table above for the primary scholars in the Bombay and Madras vernacular middle schools and, on the other, a very large deduction has to be made for the scholars who, in other provinces, are reading in the primary departments attached to secondary schools. The one by no means offsets the other. According to the last estimate made (1922), the total number of secondary scholars was less by half a million than that shown in the statistics. The presence of half a million primary scholars in high and middle schools is a point of great importance in considering the proportion of public funds spent on primary and secondary education.

Mention may here conveniently be made of the demand for the teaching of English in vernacular schools which is especially keen in Bombay and the Punjab. In Bombay, it is met by the addition of an English class to vernacular schools, in the Punjab by the establishment of Anglo-vernacular schools in rural areas.

451. From the agricultural standpoint, interest in secondary education centres in the vernacular and Anglo-vernacular (English middle) schools.

IMPROVEMENTS IN SECONDARY EDUCATION.

As far as we are in a position to judge, the desirability of an improvement in the training and status of teachers and in school buildings and their equipment is receiving adequate attention, whilst the problem of devising a suitable curriculum which shall be more scientific and less purely literary in character is being attacked in earnest. From the standpoint of our enquiries, an improvement in the teaching of, and in the provision of apparatus for, elementary science is the most important desideratum, as a solid grounding in science at this stage of his educational career would save the future candidate for admission to the agricultural and veterinary colleges much valuable time at a later stage and would enable him to derive far greater benefit from his collegiate course.

In relation to rural welfare, the secondary educational system presents no general problem of interest comparable with that presented by the problem of literacy at the primary stage. In accordance, therefore, with the plan of this chapter as set out in its opening paragraph, we propose to pass at once to the consideration of agricultural education in secondary schools and to a discussion of the modifications in the present arrangements which appear to us desirable.

452. Since the subject first came up for discussion shortly after the reorganisation of the agricultural departments in 1905, there have been great divergencies of opinion in regard to the scope and character of the agricultural education which should be given in secondary schools. These divergencies have taken concrete shape in the evolution of two entirely different types of school. Of the one policy, that of establishing vocational schools, the Bombay Presidency has been the chief exponent. In the adoption of the other, that of including elementary agriculture in the curriculum of the ordinary rural secondary school, the Punjab has led the way. A brief description of the two types of school will provide the material for a judgment on their comparative merits.

AGRICULTURAL EDUCATION IN SECONDARY SCHOOLS.

453. The first school of the vocational type was established in Bombay at Kirkee in 1910. In 1914, it was transferred to Lonikalbhor in the Poona district, about ten miles from Poona city. The official name of the school is the Marathi Agricultural School, but in all the discussions which have centred round the policy it represents, it is referred to as the "Loni" school. Admission is limited to fifty boys and the qualifications laid down for it are that the applicant must belong either to a cultivating or a landholding class, that he must have completed his education up to the fourth Marathi standard, that he must be between fourteen and seventeen years of age and that his object in coming to the school must be to train himself for work on his own land and not for service in a government department. There are at present no boys from the Loni village at the Marathi Agricultural School.

THE BOMBAY TYPE OF AGRICULTURAL SCHOOL.

The course lasts for two years and the instruction which is given in the vernacular is both theoretical and practical. The subjects included in the theoretical part of the course are the principles of agriculture, animal husbandry, dairying, elementary botany and entomology, agricultural arithmetic and surveying, and the physical and agricultural geography of India generally and of the Bombay Presidency in particular. Lectures are also given on secondary rural occupations, village life and citizenship. Three hours daily are devoted to practical work on the farm of twenty-two acres which is attached to the school and the whole area of which is worked by the boys. In his second year, each boy is made responsible for the cultivation and cropping of an area of about one-quarter of an acre; he is also required to keep a diary of his daily work and a cultivation sheet of expenses and realisations.

Two crops are raised during the year, one dry and one irrigated. The care of the milking herd and of the farm bullocks is entrusted to the boys. The school has a workshop in which they learn smithy and carpentry work and also an oil engine and power-driven farm machinery which they manage. Weekly visits are paid to neighbouring cultivation and, during their second year, the boys are taken on an extensive tour throughout the presidency.

The school thus provides vocational education on a plan which has been very carefully thought out. It is important to note that, if the student remains at the school for the whole of the course, this education is provided free of all cost except the small amount which has to be deposited to meet current expenses. There are now six schools of this type in the Bombay Presidency, all of which are administered by the Bombay Agricultural Department in close co-operation with the Education Department.

454. Schools of the vocational type have made but little headway in other provinces. Of the two schools established in the Madras Presidency, that at Anakapalle has been closed down; the one at Taliparamba is said to be "holding its own." The school at Chandkhuri in the rice tract of the Central Provinces

SCHOOLS OF THE BOMBAY TYPE IN OTHER PROVINCES.

has been closed, its failure being attributed to the fact that it was established in a backward tract, in which the people have yet to learn the advantages of better methods of agriculture. The school at Powarkhera near Hoshangabad in the wheat tract of the Central Provinces has been gradually changed from a vocational to a pre-vocational school and is now described as being, to all intents, a vernacular middle school which takes boys from the fifth to the eighth standards and provides a course which replaces elementary science, drawing and history by agriculture and surveying and gives the boys two hours' practical work every day on the farm which is attached to it. It is reported that, in this form, it shows signs of proving popular among the better class cultivators and landowners of the locality in which it is situated. In other words, such measure of success as it has obtained is due to its conversion from the vocational type to the Punjab type which is discussed in the next paragraph. Of the two schools in Bengal, that at Chinsura was closed in 1924. The school at Dacca, in spite of wide advertisement and the offer of a stipend of Rs. 10 per mensem, has only half its proper complement of students and the vacant places have been utilised to give demonstrators already in the service a refresher course. At Bulandshahr, the only school in the United Provinces approximating to the type in question, the average age is nineteen which is considerably older than that obtaining at other institutions of the kind. The Bulandshahr school is also used to some extent as a training centre for teachers for the agricultural classes which are being established in the vernacular middle schools. Steps are being taken to open two other schools of this type in the United Provinces. The two missionary schools of this character are at Pathra in Bihar and Orissa and Pyinmana in Burma. Both of these are in receipt of a subsidy from Government.

THE PUNJAB TYPE.

455. The Punjab Educational Department has dealt with the problem on entirely different lines. In that province, elementary agriculture is included as an optional subject in the curriculum of the ordinary vernacular middle schools. In the words of a circular which was issued in 1923: "The aim is to enrich the middle school course in rural areas by the inclusion of agricultural training and thus to bring it more in keeping with the environment of the pupils; and the object is to use agriculture as a means of mental discipline and training and as an important accessory to the general subjects taught in these schools."

Under this system, the instruction given in the class room is both illustrated and supplemented by practical work in all agricultural processes on the land. For this purpose, farms of about three acres in extent were attached to the schools in which the new course was first introduced but, owing to financial stringency, the alternative of school gardens, half an acre to an acre in extent, was adopted in 1923. Six periods per week are devoted to the course by each of the four classes which make up the vernacular middle school in the Punjab. All the work on the farms and gardens except that of looking after the bullocks is done by the boys themselves and it is interesting

to note that many of the farms and gardens are not only self-supporting but have an annual balance to their credit. The teaching is in the hands of trained and carefully selected teachers who have first taken the ordinary senior vernacular training course and have then completed a separate course in agriculture at the Lyallpur Agricultural College. An additional link between the agricultural and educational departments is provided by the fact that the general supervision of these activities is entrusted to an adviser in agricultural training who is an officer of the Education Department. His headquarters are at the Lyallpur Agricultural College. When we visited the Punjab, there were 66 schools of this type, 26 of which had farms attached to them and 40 had gardens. It was hoped to increase the number in 1927-28 to 121, of which 64 would have farms and the others gardens.

The Punjab model has been followed very closely in the United Provinces, the principal variation being that the agricultural course is compulsory for all boys in the fifth to seventh classes. There are, or shortly will be, some twenty of these schools in that province. The farms attached to them are about five acres in extent and, as has been mentioned, the teachers are trained at Bulandshahr.

In addition to the six schools of the Loni type, there are in Bombay forty-three schools generally known as 'agricultural bias' schools. Although the school course is not so purely agricultural as it is in the Punjab, the difference appears to be one of degree rather than of character. An agricultural teacher replaces a member of the ordinary staff. These teachers receive a special training at one of the three agricultural schools maintained by the Agricultural Department in the presidency proper. Teachers destined for work in Sind are trained at the Lyallpur Agricultural College. The plots attached to the schools are from half an acre to an acre in extent and are usually given by the villagers either rent free or at a moderate rental. All the practical work on these plots is done by the boys themselves under the guidance of the teacher.

No school of this type has so far been opened in any province other than the three mentioned above. It has, however, been decided to make a beginning in Bengal and the possibility of starting such schools in the Central Provinces, where the Powarkhera school already approximates very closely to the Punjab type, is under consideration.

CRITICISM OF THE BOMBAY TYPE.

456. We took much evidence as to the comparative merits of the two systems described in the preceding paragraphs. We have acquainted ourselves with the extensive literature which exists on the subject of the introduction of agricultural training in middle schools. We visited the school at Lonikalbhor and also a school of the Punjab type in the neighbourhood of Jullundur. Our examination of the question has forced us to the conclusion that in no scheme of rural education the cost of which is defrayed by Government ought schools of the Bombay type to find a place. We have received no evidence in support of the claim advanced by the Bombay authorities that there is a popular demand for this type of education.

The Director of Agriculture, Bombay, himself admitted that the inducement of free tuition and lodging had to be held out, if the schools were to be filled, whilst an officer who had been Deputy Director of Agriculture in the North Central division expressed doubts whether the demand for these schools was a real reflection of the cultivator's requirements. Our survey of the position of vocational schools in provinces other than Bombay confirms our conviction that they are an artificial addition to the educational system and, in no way, a natural development of it. The element of cost must bulk largely in any discussion of this subject. The late Director of Agriculture, Bombay, estimated the annual cost at Rs. 262 for each boy as compared with an average of Rs. 53 in the ordinary middle school. 180 boys are now being educated in the six agricultural middle schools in the Bombay Presidency. On the assumption that these boys would otherwise have gone to an ordinary middle school, the additional annual cost must be put at Rs. 37,620. We were informed by the Director of Agriculture, Bombay, that it is the policy of the Government of Bombay to establish an agricultural middle school in each of the twenty-five districts of the presidency. If the attendance at these schools averaged thirty, the total additional cost would rise to over Rs. 1½ lakhs. Critics of schools of this type object further that they lead nowhere. The boys who attend them receive no instruction in the subjects required by high school or college. It is only in exceptional circumstances that a parent is prepared to decide upon the future career of a promising boy at the early age of thirteen or fourteen. The establishment of schools of the Bombay type merely means that an agency far more expensive than the normal is employed to train boys destined for work on the land.

In arriving at these conclusions, we have not overlooked the consideration that schools of this type are used both in the Bombay Presidency and in the United Provinces for training teachers for the agricultural classes which have been started in the middle schools. The Director of Agriculture, Bombay, informed us that, if it had not been for the existence of the schools, it would not have been possible to train these teachers. When Dr. Mann gave evidence before us, in October 1926, there were only eighteen teachers undergoing training. Even if this number were largely increased, we do not consider that the retention of the schools could be justified on this ground. Whilst conditions differ in the different provinces, and whilst we do not, therefore, wish to lay down any precise method for training teachers of agriculture in the middle schools, we hold that the most suitable training is provided by the normal training course for teachers in vernacular middle schools supplemented by a course of agricultural instruction at a suitable agricultural centre which would ordinarily be the agricultural college of the province, where one exists. It is contact with the methods of agricultural education, both theoretical and practical, which these teachers require and this can far better be secured by attaching them to established centres of agricultural training than by isolating them at special centres.

We, therefore, recommend that no more agricultural schools of this type should be opened and that the existing schools in their present

form should be closed.* The use to which the existing buildings and farms can best be put must be determined by local circumstances. Acceptance of the recommendations which we have made in our chapter on Demonstration and Propaganda will involve the recruitment of a large number of additional demonstrators. We anticipate that these demonstrators will either be graduates of agricultural colleges or will at least have taken short courses at those colleges, and that their practical training will be obtained by attaching them to government farms. But the demonstrators will require intelligent assistants of the 'fieldman' type and the agricultural schools might be useful centres for training men of this class who would enter them at the age of about seventeen and would stay for the period considered necessary to equip them for explaining to the cultivators, in simple language, the advantages of the improvements which are being recommended. The schools might also prove useful centres at which short courses for cultivators could be given in localities in which there are no government farms within a convenient distance.

The Director of Agriculture in the United Provinces informed us that there was a demand from the local Legislative Council for the establishment of more schools of the vocational type. But it is beyond dispute that there is no demand for this type of education from parents who are willing to pay the actual cost. In that province, these schools are primarily intended for the sons of the smaller zamindars. Whilst we agree that it is desirable that the interest of this class in the cultivation of their land should be fostered, we do not consider that expenditure by Government on the scale which the establishment of these schools involves can be justified, especially when regard is had to the expenditure on primary education which is still required to make it reasonably efficient. If the interest of the zamindar in the schools is genuine, it should take concrete form in the establishment of schools on a self-supporting basis. It is not equitable, in our view, that the small cultivator should be taxed to subsidise a form of agricultural education for which the larger landholder can well afford to pay.

THE ADVANTAGES OF THE PUNJAB TYPE.

457. We consider, on the other hand, that the Punjab type of school has much to recommend it. It is true that this method of imparting instruction in elementary agriculture in rural middle schools has not been in use sufficiently long to enable conclusions as to its merits to be reached. It may be, as we were told in Bombay, that most of the boys

* Professor Gangulee and Mr. Kamat dissent from this recommendation. They agree with the criticism regarding the expensive character of these schools. They consider, however, that the local governments should re-examine the position of existing schools of this type with a view to ascertaining whether a substantial reduction in cost could not be effected by the abolition of free lodging and boarding. Tuition would remain free. They agree that there is no justification now for providing, free of cost, agricultural education for the sons of well-to-do cultivators; and they hope that with the increasing support these schools have recently received from local bodies it would be possible to make the instruction more efficient and less expensive than it is at present. Should the removal of the concessions now enjoyed by the pupils result in reducing the attendance, it would then show that there was no real demand for this type of education; and the local governments would then be justified in closing the schools.

who pass through the course will prefer to become teachers or village accountants rather than to farm their own land. But even if this should prove to be so, the value of the training in agriculture they have received will not be lost to the country-side and there would still remain a large residuum who would take up agriculture as their occupation. In the meantime, there is no doubt that the classes have so far proved a great success and that they have enjoyed a popularity which has been denied to schools of the vocational type. Although no approximation to a final solution has been attained, it is, in our view, in this direction that the true solution of the problem of relating the instruction given in middle schools in rural areas to their environment is to be found. We, therefore, cordially approve the expansion of this movement which is in progress in the Punjab, the United Provinces and Bombay and recommend that the policy followed in these provinces should be adopted by other provincial governments as soon as the necessary arrangements for carrying it into effect can be made. It may be hoped that schools of this type will develop into rural community centres.

SCHOOL FARMS *versus* SCHOOL GARDENS.

458. Some difference of opinion appears to exist as to whether farms of about three acres or gardens of half an acre to an acre in extent should be attached to the schools. This is a question which can best be decided in each case on its merits and we do not, therefore, propose to lay down any general rule. But, when financial considerations permit and the local conditions are favourable, we consider that the farm is the more suitable as it should enable the conditions of the local cultivation to be more faithfully reproduced. Provided, therefore, that the teacher is competent to demonstrate the latest agricultural improvements to the boys, and incidentally to the neighbourhood, and can be adequately supervised by officers of the Agricultural Department, we are of opinion that the school farm is to be preferred to the school garden. The competence of the teacher is a point on which it is impossible to lay too much stress. It is essential to the success of both farm and garden, though the garden is the more easily handled. Should there be any doubt of the competence of the teacher to manage the larger area, he should certainly not be entrusted with it, for nothing is more calculated to bring into disrepute the work of both the educational and agricultural departments than to teach agriculture in such a way as to incur the contempt of the experienced cultivators of the neighbourhood. From this point of view, it is satisfactory to find that the school farms in the Punjab are becoming useful centres of propaganda for the Agricultural Department and that the local cultivators are turning more and more to them for advice. We understand that, at present, all the produce from the farms and gardens is sold as a set-off against their cost. We think that it would be well worth while to sacrifice some part, if not the whole, of the income from this source and, as is done in the Bombay Presidency, to give the boys a personal interest in the results of their labour by permitting them to retain the produce which they have raised, or by giving the sale proceeds as prizes for the best work in the farms and gardens.

459. In a memorandum submitted to us by the Punjab Government at the outset of our enquiries, the question of English teaching was specifically raised. "Parallel with but antagonistic to, the successful introduction of agriculture" it was remarked, "is the ever increasing desire for English teaching in vernacular middle schools." We were, therefore, asked for our advice on the problems to which this tendency gives rise. It is by no means confined to the Punjab. In Bombay and Madras, the desire for English teaching is also especially keen. In Bengal, there are very few vernacular middle schools and the English middle schools are everywhere in the majority.

ENGLISH IN VERNACULAR MIDDLE SCHOOLS.

To what extent instruction in English in rural schools stimulates the drift of intelligent boys to the towns it is difficult to say, but that it does so is not open to doubt. We do not, however, consider that the policy of refusing such instruction in rural areas is in the least likely to prove successful in keeping boys on the land. On the contrary, if the teaching is good, we see positive advantages in meeting the popular demand for it, as the early acquirement of facility in English would be of very material benefit to the boy who intends to proceed to advanced studies in agriculture or science.

We do not feel competent to express an opinion whether the teaching of English should be encouraged in vernacular middle schools by the addition of optional classes or whether the establishment of Anglo-vernacular schools is preferable.

460. We pass now to the more general question of the effect which higher education has on the boy who has been born and brought up in a village. In what estimation is he held in his village? What is expected of him and what does he expect for himself? Such questions would be almost meaningless in a western environment where literacy is the rule and not, as in India, the exception, but the evidence we have received shows that they possess a very definite meaning in India and that no enquiry into rural educational problems can pretend to completeness if they are left unanswered. In a population where only one man in six is even literate and where, until recently, little more than the minimum of secondary education sufficed to make employment under Government or in some business house practically certain of attainment, it is obvious that the boy from the village who had acquired that education found himself in a very special position. His fellows regarded him as possessing a qualification in virtue of which he could, almost for the asking, obtain employment of a kind which was beyond their reach. Scarcity of a desirable thing always gives it a high, even if it be a fictitious, value. That value, in the case of secondary education for the boy from a rural area, has hitherto lain in the road it has opened out to him for work in the towns. This has contributed to the drift of educated boys from the village to the town which still continues though the conditions which gave rise to it are rapidly changing. The supply of educated men for ordinary routine work under Government and in business houses now exceeds the demand.

EDUCATION IN RELATION TO RURAL ENVIRONMENT

In three provinces, Madras, Bombay and Bengal, the saturation point was reached some years ago. The seriousness of the problem presented by unoccupied middle class youth in these provinces is shown by the fact that, in all three, it has been found necessary to appoint a committee to examine it and to suggest remedies. In so far as it is accentuated by the drift of educated boys from the villages to the towns, there to swell the ranks of the educated unemployed, it can, in our view, only be remedied by the spread of education in rural areas in combination with an improvement in the amenities of village life. It is hopeless to endeavour to put the clock back by restricting education to a minimum and all attempts to do so, however well intentioned, are bound to fail in their object. When the percentage of male literacy rises to seventy-five, as it is hoped that it will in the Punjab before many years are past, we believe that the feeling, which undoubtedly exists at present that, in cultivating his holding and undertaking manual labour generally, an educated man is failing to make the best use of his opportunities, will have largely disappeared. Long before seventy-five per cent of the male population is literate, what is perhaps already suspected will, we hope, become generally appreciated, namely, that the number of clerical posts available is quite insufficient to absorb all those who have attained the standard of a moderate secondary education. The day will then have come when literacy, once coveted as the passport from field to office, will take its due place as a bare requirement of rural respectability.

HIGH SCHOOLS.

461. The great majority of the boys who proceed from the middle to the high school find that this is the end of their formal educational career. The high school course, therefore, includes, in addition to the usual subjects required for the matriculation examination, a variety of optional subjects which have a more direct bearing on a boy's future employment, including service in subordinate government posts. We are altogether opposed to the purely theoretical teaching of agriculture at the high school stage as this would merely mean the addition of another subject which would be regarded as an easy one to be "crammed" for the matriculation examination; nor, where high schools are situated in the towns and are filled by town lads, do we advise the addition of any course in agriculture. Where, however, schools contain a large proportion of boys from rural areas and have facilities for the provision of a farm or a garden, the case is different. The high school curriculum has been broadened in recent years by the introduction of such practical subjects as hygiene and manual work and this might well be carried a stage further by the addition of practical as well as theoretical instruction in agriculture. The addition to the curriculum of a combined course of practical and theoretical instruction in elementary agriculture somewhat on the lines of that now given in the middle schools of the Punjab type but of a rather more advanced character would, we believe, be productive of good results. It was, indeed, the intention of the Punjab Government, who have made it part of their educational policy in recent years to establish high schools in outlying country districts, to introduce a course of this kind in such schools, but

financial stringency has proved an obstacle to any general development in this direction, though a farm has been attached to the high school at Renala. The institution of such a course should not be allowed in any way to interfere with the instruction of the boys in science and the improvement of the present standard of teaching it. Adequate instruction in elementary science at this stage is of the greatest importance for the boy who intends to go on to an agricultural college.

TECHNICAL EDUCATION.

462. In the following chapter, we discuss the relation to agriculture of the industries which are, or can be, carried on in rural areas. The modernising of traditional practice in established crafts and the introduction of new industries will be greatly stimulated if technical training at the hands of skilled teachers is made available at suitable centres for those who intend to engage as supervisors in these activities. We would instance dyeing, preparations of lac and of medicinal, tanning, and other industrial extracts from plants and trees, the manufacture of oils and soaps and the preparation of fruit and vegetable preserves as industries for which such trained supervision is specially necessary.

The Cawnpore Technological Institute, which we visited during our stay in the United Provinces, appears to us to provide training of the practical character required, as does the Victoria Technical Institute in Bombay and other institutions which, unfortunately, we had not an opportunity of inspecting. The Indian Institute of Science at Bangalore, which we also visited, seemed to us to be admirably equipped for teaching applied science in various directions, notably on the agricultural side in respect of the hydrogenation of oils. If rural industries develop and if those who practise them adopt co-operative methods, as we trust they will, it should not be long before they appreciate the need for the skilled supervision which would be provided by students from institutions of this kind and are in a position to pay for it. The result would be that employment of a character well suited for youths with a scientific bent and a liking for country life would be available.

It is obviously essential that instruction in applied science should be of a high standard, if it is to be worth while, and it is no less essential that the output of trained men from technological institutes should be proportioned as closely as possible to the commercial demand for their services. The departments of industries in the provinces should be able to render valuable help in the latter respect, provided they are sufficiently in touch, not only with the development of industries in rural areas under co-operative or other auspices but also with the general trend of commercial development and with the personnel of the business world, to be in a position to advise technological institutes of the probable demand far enough ahead to enable the authorities of the institutions to regulate the admission of students and to advise them as to the particular branch of study most likely to lead to employment. Government technical scholarships should be allocated on the same principle. If this course were followed, the hopeless discontent which failure to secure employment at the end of a period of technical training is bound to arouse

in the minds of the student and of his family should to a large extent be avoided. Care would, however, have to be taken, to make it clear to the student and to those responsible for his education that the acceptance of the advice thus tendered by the authorities did not imply any guarantee on their part that an appointment would be obtained.

THE UNIVERSITIES.

463. We now come to the last rung of the educational ladder. No less than ten of the fifteen universities in British India have been established since 1916. Of the five older universities, those of Calcutta, Madras and Bombay date from 1857, whilst the Punjab University was founded in 1882 and the Allahabad University in 1887. These five universities were all of the examining type, the teaching being carried on in the constituent colleges, sometimes several hundred miles apart but bound together by a legally constituted central organisation. It was found that these loose agglomerations of teaching units did not make for efficiency and the tendency now is to develop residential university life in this country. The older universities are now also developing a teaching side, though the instruction given is mainly of a post-graduate character. The Allahabad University has gone further. It was reconstructed in 1921 as a residential university with an external side and, on July 1st, 1927, the latter was transferred to the newly constituted Agra University. Madras, Bombay, the Punjab and Nagpur universities have faculties of agriculture, whilst the University of Calcutta has established a Chair in that subject. It is worthy of mention that Benares University has just been enabled by a munificent donation from His Highness the Maharaja of Jodhpur to found a Chair of Agriculture and to institute a number of scholarships to promote the study of that subject and of veterinary science. The Chair will bear the name of "The Lord Irwin Chair." The total number of students on the rolls of all the universities in British India in 1924-25 was 83,150. The total number of graduates in arts and science that year was only 6,818. The greater part of this large total was contributed by the older universities, the aggregate number of students at the Calcutta University in 1924-25 reaching the enormous number of 29,000, whilst the Madras University had over 17,000 students in that year and the Punjab and Bombay universities over 10,000 each. The teaching universities are smaller bodies, but even for those which have no external side the aggregate number of students reached the high figure of 6,979. The total number of students graduating from these five teaching universities in arts and science in 1924 25 was 808.

SOME RECENT DEVELOPMENTS OF UNIVERSITY EDUCATION.

464. With numbers as large as those just mentioned, corporate organisation and the attainment of a high standard of instruction obviously present peculiar difficulties. As the result of the Universities Commission of 1902 which was followed by the Universities Act of 1904, and of the more recent Calcutta University Commission of 1917-1919, which made many valuable recommendations of a general character, much progress has been made in overcoming these difficulties though it is generally recognised that, owing to the large numbers who present themselves for examination, ceaseless vigilance is required, if

the improvement so far effected is to be maintained and further advance made.

One of the improvements suggested by the Calcutta University Commission may be mentioned here as it has a bearing on the curriculum of the agricultural colleges. In order to lighten the burden imposed on the universities by the mere number of students, the Commission recommended that entrance to them should be confined to those who have passed the intermediate examination, in other words, that the intermediate classes should be separated from the sphere of university work. The proposed change entails either the addition of two intermediate classes to high schools or the creation of separate intermediate colleges which would take over some—the Calcutta University Commission suggested two—of the existing high school classes and add to them two intermediate classes proper. The suggestion has so far only been acted on in the Punjab where seven intermediate colleges have been opened, in the United Provinces, and in Burma where an Intermediate Arts College has been established at Mandalay. The attainment of the intermediate standard has been substituted for the high school final examination as the qualification for admission to the Patna University in Bihar and Orissa, the All-India Muslim University at Aligarh in the United Provinces and the Dacca University in Bengal.

In addition to measures of internal reorganisation, links are being forged between the universities themselves. As the outcome of the Conference of Indian Universities, the first of its kind, which was held in 1925 and was attended by the representatives of all the thirteen universities at that time established by law in British India and of the two universities in Indian States, the Osmania University of Hyderabad and the Mysore University, an Inter-University Board was established to act, *inter alia*, as a bureau of educational information and as a co-ordinating agency. We trust that, amongst its functions, that of bringing the universities into closer touch with rural development will be regarded as not the least important.

AFFILIATION OF AGRICULTURAL INSTITUTIONS TO UNIVERSITIES.

465. In Chapter III, we have discussed at length the position of the universities in relation to agricultural research. We are here more especially concerned with their relations to agricultural colleges on the teaching side. The present position is that the agricultural colleges at Coimbatore, Poona, Nagpur and Lyallpur are affiliated to the provincial universities and that the Cawnpore College appears likely to be affiliated in the near future. The affiliation of the only private agricultural college in India, the Agricultural Institute at Allahabad, to the Allahabad University is under consideration. The Khalsa College, Amritsar, has an agricultural course and is affiliated up to the Intermediate B.Sc. (Ag.). The affiliation both of government and private agricultural colleges to universities may, therefore, be regarded as the accepted policy. We cordially approve this policy. It has the advantage of attracting to the agricultural colleges promising students who might be deterred from entering

them, if the course did not end in a degree. Moreover, as our recommendations in regard to the organisation of agricultural research will have shown, we contemplate closer relations between the universities and the agricultural colleges in the future and, though affiliation for the purpose of obtaining a degree is not essential to such relations, it undoubtedly tends to promote them. The limitations of the affiliation system are now well understood and, in these circumstances, we consider that the interest in agriculture, which is evinced by a university in granting an agricultural institution the privilege of affiliation to it, is to be welcomed.

INFLUENCE OF UNIVERSITIES ON RURAL DEVELOPMENT.

466. From the point of view of agricultural development, we need not emphasise the importance of the part that the universities must play in educating those who will become the administrators, the technologists, and the research workers of the future. Here, however, we are concerned with the urgent need of instilling in rural communities the ideals of leadership and service, and we wish to make plain our conviction that the universities have it in their power to make a valuable contribution to this end. It is their highest mission to develop in the student that public spirit and zeal for the welfare of his fellows which, when he goes out into the world, will impel him to take a full and active part in the life of the community in which his lot is cast. But universities are commonly situated in large centres of population, and those of their members who are attracted by the call of social service naturally tend to apply themselves first to the problems of the town. We wish strongly to press the claim of the rural areas upon the time and interest of the best of India's youth. It is upon the homes and fields of the cultivators that the strength of the country and the foundations of its prosperity must ultimately rest. We appeal to both past and present members of Indian universities to apply themselves to the social and economic problems of the country-side, and so to fit themselves to take the lead in the movement for the uplift of the rural classes. We trust that the authorities and teachers of universities may do all in their power to encourage the study of these most important subjects. The opportunities open in India to men able and willing to play a selfless and patriotic role in the field of local leadership and of service to the public are unbounded. Membership of village *panchayats*, local boards and the like, and work in connection with the co-operative and adult education movements as well as that carried out by non-official bodies concerned with the well-being and advancement of the rural population offer scope for the exercise of a wide range of talent and inclination. Such service is of the utmost value to the State, for the welfare and happiness of the peasant must be largely dependent on the purity and efficiency with which local services are administered. Among a people whose history goes back as far as does that of India, and in a society upon which the fetters of custom are so firmly bound, the inertia of centuries can only be overcome by the ready self-sacrifice, by the enthusiasm and by the sustained efforts of those who themselves enjoy the blessings of a liberal education.

THE AGRICULTURAL COLLEGES.

467. From the consideration of the general educational system of India, we now turn to that of higher agricultural education. The government agricultural colleges are six in number and, as has been mentioned, are situated at Poona, Coimbatore, Lyallpur, Nagpur, Cawnpore and Mandalay. All the colleges are under the management of the provincial departments of agriculture and combine the functions of education with those of research. We are here concerned mainly with their educational activities.

None of the colleges is intended to provide training exclusively for government posts and the proper way in which to regard them, therefore, is as an integral part of the system of higher education in the provinces in which they are situated.

The course leading up to a degree in the four colleges which are affiliated to universities is governed by university requirements, as are the qualifications for admission. At Coimbatore and Poona, the degree course lasts for three years. The qualification for admission to the Coimbatore College is the intermediate examination in science of the Madras University or an equivalent examination. That for admission to the Poona College is a certificate from the principal of an arts college affiliated to the Bombay University that the candidate has satisfactorily carried out the work prescribed for the first year of the university course or an equivalent qualification recognised by the University of Bombay. The courses at Nagpur and Lyallpur last for four years; the high school examination of the Central Provinces and Berar or the matriculation examination of any university in British India qualifies for admission to the former, and the passing of the matriculation examination of the Punjab University or an equivalent examination to the latter. The Nagpur and Lyallpur colleges have, in addition, a short course of two years' duration and, at the Poona College, there is a short course of one year. A number of other short courses of varying length have also been instituted at Lyallpur. There is now no short course at Coimbatore and no short course has yet been instituted at Mandalay which has still to be affiliated to a university and where the diploma of agriculture is given on the results of a four years' course. Cawnpore has both a diploma course of four years' duration and a short course lasting for two years; the qualification for admission to the diploma course is the school leaving certificate or the matriculation examination of the provincial universities. The limits of age prescribed for admission to the different colleges vary considerably. None are mentioned in the prospectus of the Poona College. The Coimbatore College imposes a minimum age limit of 18 but no maximum. The Lyallpur College, on the other hand, lays down no minimum age limit but fixes the maximum at 21 though the principal has discretion to admit candidates whose age exceeds this up to five per cent of the total number of entrants. The age limits prescribed for the Nagpur College are from 17 to 22, and for Cawnpore from 15 to 19 for the diploma course and from 15 to 21 for the short courses. The minimum age limit prescribed for admission to the Cawnpore College appears to us too low but it will be automatically raised if the Cawnpore College

is affiliated to a university and if the qualification for admission to the college is the intermediate examination. The age limits have doubtless been fixed with regard to the local conditions and we see no special reasons for uniformity in this respect.

OBJECTS OF THE AGRICULTURAL COLLEGES AS SET OUT IN THE COLLEGE PROSPECTUSES.

468. The aims of the several colleges, as set out in the prospectus which each issues, vary somewhat. Except in the prospectus of the Mandalay College, the one most recently founded, stress is laid on the fact that the colleges offer a general agricultural education, suitable for equipping a student for the scientific cultivation of his own land or that of others. The openings in government service available to successful students are precisely stated, except in the case of the Poona College, where the only reference to service in government departments consists of a warning that the opportunities of entering such departments are strictly limited. The prospectus of the Mandalay College lays down definitely that the primary object of the college is to train staff for the Agricultural Department and for such other government departments for appointment to which the college course may be considered to fit students. It will be convenient to give a summary of the government appointments referred to in the various college prospectuses. At Coimbatore, the degree of B.Sc. (Ag.) qualifies for appointments in the Upper Subordinate Service in Madras on a commencing salary of Rs. 85 per mensem. At Lyallpur, the degree of B.Sc.(Ag.) qualifies the holder for employment in the "A" division of agricultural assistants on a commencing salary of Rs. 100 per mensem, and also for appointments in other executive branches of government service such as the Revenue, Irrigation and Co-operative departments; the holder of this degree is also qualified for direct appointment to the Provincial Agricultural Service, but, so far, only one appointment has been made. The leaving certificate given at the end of the two years' course qualifies for the "B" division of agricultural assistants on a commencing salary of Rs. 70 per mensem and for appointment as *zilladars* in the Irrigation Department. At Nagpur, the degree of B.Sc. qualifies for appointment to the Upper Subordinate Service of the Agricultural Department on a minimum pay of Rs. 70 per mensem. The agricultural certificate which is awarded on the completion of the two years' course makes the student eligible for an appointment in the Lower Subordinate Service on probation on a pay of Rs. 50 per mensem. This certificate is also granted to students who have failed to reach a satisfactory standard on the completion of part I of the degree course, provided they have done particularly well in 'agriculture'. The possession of the diploma of the Cawnpore College qualifies for admission to the Agricultural Department on a minimum pay of Rs. 110 per mensem. Students who pass the two years' course are eligible for admission to the Lower Subordinate Service on an initial pay of Rs. 65 per mensem. The prospectus of the Mandalay College gives no details of the appointments open to successful students. Those who were admitted when the college was opened in 1924 were given a promise

of employment in the Upper Subordinate Service on obtaining the diploma at the end of the four years' course.

CONDITIONS IN THE COLLEGES.

469. The great variations in agricultural conditions to be found within the limits of any province in India make it impossible that an agricultural college should be located in a tract which is typical of the conditions of the whole province and no criticisms can, we think, be levelled against the sites which have been selected. Expenditure on buildings has been lavish and, both in this respect and in that of equipment, the colleges are more liberally furnished than similar institutions in western countries. The physical welfare of the students is not neglected and ample recreation grounds are provided. No fees are charged at the Coimbatore, Nagpur and Mandalay colleges for students from the province and the fees charged at Lyallpur, Cawnpore and Poona are very moderate and much below the actual cost of education. The students are required to live in hostels but accommodation is provided either free or at a nominal charge. Food, clothing, books and other essentials have to be paid for. The total obligatory expenses vary somewhat at the different colleges but, at Lyallpur, where fees are charged for tuition and lodging, the annual expenses are estimated at Rs. 40 to Rs. 45 for first and second year students and at Rs. 45 to Rs. 50 for third and fourth year students. Numerous stipends and scholarships are available. The arrangement at Lyallpur, under which students can earn money by labour on the farm in their spare time, is worthy of mention and also of imitation, as it affords poor students a most appropriate means of self-help. Some of the colleges have had a distinctly chequered career in the matter of numbers but, at present, the applications for admission greatly exceed the vacant places and it may be accepted that the conditions in which the students live and work are excellent.

OBJECTS OF THE COLLEGES.

470. We pass now to examine the curricula of the colleges and the qualifications of the staff in relation both to the present responsibilities of the colleges and to those which may be imposed on them in the near future. We shall also consider the competing claims of teaching and research.

The objective of the agricultural colleges in India is, as we have mentioned, to equip students who pass out from them either for posts in government service or for farming their own land or that of others. No distinction between these two classes of students is, however, made in the courses which are provided. Even the short courses at Lyallpur, Nagpur and Cawnpore qualify for admission to the public service. One of the criticisms which have been brought against the agricultural colleges ever since their inception is that they have failed to attract youths who desire an agricultural education for its own sake and that they have been almost entirely filled by aspirants for employment under the State. There are signs of change in this respect, but it is still true that the colleges are, in the main, regarded as avenues to employment in the agricultural departments. The suggestion has been made that the two objects should be entirely divorced and that those who desire an

agricultural education with a view to farming on their own account should either undergo a course of an entirely different character from that intended for entrants to the public service or should receive their training in a separate institution. This suggestion has been put forward mainly on the ground that association with those who desire to enter public service frequently diverts from his purpose the student who originally intended to farm on his own account. We do not regard this consideration as in any way important. If there are vacancies in the public service in which such students can be employed, we see no objection to their filling them. If there are not and if they prefer to remain unemployed rather than to pursue their original intention of undertaking private work, the blame must be attributed to defects of character which it should be the aim of college life to eradicate. It is further urged that the cost to the State of turning out agricultural graduates is so high that it can only be justified in the case of those who are being trained for public appointments. We are unable to agree. It is plain that a most important function of the colleges must be to train the men required by the agricultural departments as without such men the departments must cease to exist; but the agricultural student who goes back to his own land after passing through the college course may be, individually, every whit as great an asset to his province as is the student who enters the public service. He has obtained the inestimable benefit of a general scientific training and the result should be to make his own land at once a demonstration centre of approved agricultural practice for the neighbourhood and, if he is of that turn of mind, an experimental centre also.

There can, therefore, be no justification for denying him the facilities available to the future official. Moreover, it is probable that the cost of duplicating the staff, and possibly the buildings and equipment, involved in the provision of entirely separate courses would cancel any savings resulting from a simplified curriculum for the student bent on a private career. The existing demand for agricultural education for its own sake is certainly not such as to warrant the institution of separate courses. We shall suggest certain arrangments to meet the special needs of this class of student but, beyond this, we do not consider that any alteration in the present system is called for.

An overwhelming proportion of those who receive their training at the agricultural colleges enter public service in the agricultural departments, and comparatively few join the colleges with the object of fitting themselves to farm on their own account, or in the hope of employment on large farms and estates. Every student who enters them should be encouraged to realise that, given the capacity and application, his foot is set on the road which leads to post-graduate training and thereafter to the highest distinctions in the fields of science and agriculture. But it is also important that the influence of each agricultural college should extend beyond the range of the pupils attending it and should be felt in all branches of rural education throughout the province. To this end, it is most desirable that the colleges should be broadly cultural in their tone and outlook. They should provide training for the teachers who will, we

hope, be required in increasing numbers for the agricultural instruction given in middle schools. They should meet any demand which may arise for short vernacular courses of a few weeks' or months' duration such as are at present conducted at the Lyallpur College. They should also provide brief courses in rural economy for young officers in the administrative services, on the lines of the course which has been instituted at that college. This is a point to which we have referred in chapters VIII and X. The college farms and workshops should be centres of instruction in the use of implements, especially those driven by power, and of water-lift devices and the like. The instruction given in the short courses should be specific and entirely practical. The man who desires to learn how to handle and repair an oil engine or a tractor should be able to take a course confined to this single subject. We attach the greatest importance to short courses of this character and consider that they should be regarded as an important means whereby the colleges can serve the cultivating classes and assist them with technical instruction which, owing to the expensive character of the education ordinarily given at the colleges, they could not otherwise hope to obtain. The existing staff and equipment of the colleges will no doubt require expansion to enable them to undertake the additional work involved.

QUALIFICATIONS FOR ADMISSION TO AGRICULTURAL COLLEGES AND THE DURATION OF THE COURSE.

471. At only one agricultural college, that at Coimbatore, has the intermediate examination in science of the provincial university been prescribed as a qualification for admission. We are strongly of opinion that it should be made the qualification for admission to the full course at all the colleges. We regard this as a very necessary step in the interests both of the student and of the college staff; of the student, as he cannot utilise the educational facilities provided for him to the best advantage without the grounding in science which passing the intermediate examination connotes and of the college staff as these agricultural officers should not be distracted from their special work by the task of teaching elementary science.

We realise that the raising of the standard of admission to the colleges may reduce the number of candidates seeking entry but we think that the advantages of the change are so great that this risk should be run. Where colleges are affiliated to universities, we trust that this change will be generally agreed to by the universities. Sufficient notice of the change should be given.

If the intermediate examination in science is prescribed as an essential qualification for admission, we regard the length (three years) of the present course at Coimbatore and Poona as sufficient and we consider that the present four years' course at Lyallpur, Nagpur and Cawnpore could be reduced to three. If the four years' course at the last three colleges were maintained in combination with the higher standard of admission, it would be six years from the time a boy left school before the expenditure on his education would begin to yield any return, and we consider that this is a longer period than parents will, in general, be willing to face.

THE COLLEGE CURRICULUM: (i) THE DEGREE OR DIPLOMA COURSE.

472. The curricula of the agricultural colleges have been framed on much the same general lines and, except in the respect mentioned below, appear to us to be well designed both in regard to the subjects taught and the proportion of time allotted to theoretical and practical work. Instruction in agricultural economics is included as an item in the course in "agriculture" but, except at Poona and Lyallpur, it is given by the ordinary college staff who have no special qualifications for teaching such an important subject. It is only at the Poona College that a professorship in agricultural economics has been established and that advanced agricultural economics has been recognised as an optional subject which may be taken for the degree course. The Lyallpur College has an assistant professorship in agricultural economics. We are inclined to doubt whether, even at the Poona and Lyallpur colleges, the importance of instruction in agricultural economics has been sufficiently recognised. The success of all demonstration and propaganda work must greatly depend on the extent to which such work is based on knowledge of the economic aspects of agricultural improvements and of economic conditions in the villages. The agricultural departments are, for example, obviously in a much better position to help the cultivator if their staffs possess a thorough acquaintance with the conditions which govern the successful marketing of his produce. There will, we anticipate, be in the future a demand for the services of those capable of planning and directing economic enquiries in the fields of production and marketing. A knowledge of this subject should also be of value to the student whose intention it is to farm his own land and that of others. We, therefore, recommend that agricultural economics should be recognised as a separate subject in the degree course or in the course leading up to the college diploma and that instruction in it should, in all colleges, be given by a properly qualified professor or lecturer. The selection of the teachers for this work will require to be made with great care as it is a subject of which the possession of a superficial knowledge is particularly dangerous. The universities have here an important opportunity to render service to the agricultural development of their provinces. It is probable that the teaching of rural economics in the agricultural colleges would be of a higher standard if the subject were adopted by all universities as an optional subject for the B.A. degree examination. The increased interest which will, we hope, be taken in the teaching of agricultural economics should lead to the production of suitable text-books for the study of the subject with special reference to Indian conditions, and we commend the practice of local governments which grant an honorarium for good work in this direction.

The position in regard to instruction in the management of a farm and in the conduct of what may be called its every day business is somewhat similar. Instruction in 'farm records and accounts' is included as an item in the course in "agriculture" but we do not consider that this provides an adequate training in estate management for those who propose to farm their own land and that of others, and it is possibly the

realisation of this fact that has deterred large landholders from looking to the colleges to a greater extent than they have done for managers for their estates. We realise the danger of overloading the college curriculum, and we therefore consider that the best solution will be for the directors of agriculture to make it their special care to provide students, after they have completed the college course, with opportunities of gaining experience of estate management on the departmental farms and in such other ways as they may be able to arrange. Students should be assisted as in England to use their vacations to obtain some practical experience of agricultural work, where possible, on a basis of payment.

(ii) THE TWO YEARS' SHORT COURSE.

473. A short course of two years' duration is at present given at the Cawnpore, Lyallpur and Nagpur colleges. The main object of the course is to train the student to be a practical agriculturist, or to fill a subordinate post in the Agricultural Department such as that of demonstrator, for which all that is required is ability to understand the nature of the improvements which it is sought to bring to the notice of the cultivator and to explain them intelligently. We consider that the intention of the courses is excellent but that they are open to the same criticism which has been brought against the full course, which is that they fail to attract men who desire to take up commercial farming and are regarded merely as an additional avenue to employment under Government. It is no doubt true that, over India as a whole, commercial farming has hitherto hardly come within the purview of the ordinary landholder. Subsistence farming with a surplus of varying amount for disposal is the great characteristic of Indian agriculture. But this generalisation does not apply to all parts of the country. It does not hold good for the Punjab canal colonies or the Irrawaddy delta, and evidence we received in the United Provinces suggests that some of the larger landholders in that province are turning their attention to farming by modern methods on a commercial scale. Neither the present full course nor the short course turn out men of sufficient practical experience to be employed at once on estate management. The potential demand for men of the type required for such work must, we think, be recognised by the agricultural colleges. We are, therefore, of opinion that the short courses should be revised in order to permit of greater attention being devoted to agricultural economics and estate management. We are glad to note that the large organisations for promoting the use of artificial fertilisers in India are beginning to employ passed students from the agricultural colleges to promote the sale of their products. The revision both of the full and the short courses in accordance with our recommendations should assist in enlarging the demand on the colleges for men for this work.

(iii) MISCELLANEOUS SHORT COURSES.

474. We have said that we attach the greatest importance to short courses of a few weeks' duration at the agricultural colleges as a means of making the colleges and their equipment of more service to the small cultivator.

The subjects of such courses and the degree of thoroughness with which they are studied must depend upon the object to be attained and the time available. We would recommend that colleges should initiate such courses and accept responsibility for creating a demand for them. The engineering section should pay special attention to the training of artisans with a view to promoting the establishment of private repairing works for agricultural implements of all kinds. We consider that no course should ordinarily terminate without the test of an examination which should, so far as the nature of the subject admits, be of a practical character.

THE POSITION OF THE MANDALAY COLLEGE.

475. The University of Rangoon has only been in existence for a few years and the recent establishment of faculties of Engineering and Forestry is likely for a time to affect recruitment to the Agricultural College at Mandalay. We consider, therefore, that for the present the policy adopted at the Mandalay Agricultural College is the correct one, namely, to confine itself to training staff for the Agricultural Department and for entry to other government departments, for which an agricultural training may be considered a qualification. The competition of the faculties to which we have referred, leading as they do to more highly paid appointments, may, for the time being, render recruitment for the agricultural college somewhat difficult. But these difficulties will, we hope, be only temporary and we trust that the admirably equipped research institute in which the college is located will not be diverted to any other purpose, even if at present it is not found possible to utilise to its fullest capacity the portion of the building devoted to teaching. The diversion of portions of the building to purposes other than that for which it was erected would, in our opinion, be fatal to its primary objective which is the prosecution of research.

The question of affiliation to the University of Rangoon is at present in abeyance. In view of our recommendations in paragraph 481 below, we consider that this question should be revived. In a country like Burma where the rural element is so strong, the usefulness of an agricultural training to officials in various branches of the public service cannot be overstressed.

PRACTICAL TRAINING.

476. Complaints were made to us by some witnesses that the training given in the agricultural colleges was not of a sufficiently practical character. It was, for instance, stated that the inability of agricultural demonstrators to handle bullocks or to plough properly made the villagers, whom they were sent to instruct, contemptuous of their advice. We consider that there is some justification for complaints of this character but we would add that they are not peculiar to India and that they are not necessarily a reflection on the training given in the agricultural colleges in which due consideration has to be paid to the requirements of theoretical as well as of practical work. Whilst we hope that our suggestion that more attention should be paid to instruction in practical processes, in agricultural economics and in farm management may to some extent supply the deficiency,

we are under no illusion that this or any other academic device will entirely remove the cause of complaint. It is most important that it should be removed; for lack of confidence amongst the cultivators in the soundness of the advice given by the local representative of the Agricultural Department is fatal not only to that officer's own usefulness but also, in the long run, to the credit of the department as a whole. The only way in which the student can be so equipped as to command the necessary confidence is by the provision of further facilities for obtaining practical experience than are to be afforded by the college course even where part of the college farm is set aside to be run entirely by the students themselves. The system followed at the Nagpur College appears to us to be worthy of general imitation. At that college, the class of second year students works a farm of its own, of about ten to twelve acres in extent, on which the local field crops are grown on commercial lines. The work is carried out co-operatively under the supervision of an agricultural assistant. The land, implements and bullocks are supplied by the principal as landlord. The class undertakes to make certain returns of fodder crops and to carry out land improvement in lieu of rent. Cultivation is done on a fixed cropping scheme, the predominant main crop being supplemented by subsidiary crops. The cultivation record and accounts are kept by the class which does all the field work and retains all the profits.

The further practical training required to supplement the college course in the case of a recruit to the district staff of the agricultural departments can best be given by attaching him to a government farm for a period of at least one year. Facilities for the acquirement of similar practical experience should also be given, as far as possible, to students who intend to take up farming for themselves or to manage estates. In this connection, the scheme which is at present under the consideration of the Punjab Government is deserving of mention. The object of that scheme is to give a practical training to the raw graduate from the university in order that he may gain the essential practical experience which will enable him to farm on sound lines, or to give advice to others which will have been tested by practical experience. It is proposed that five selected graduates of the Lyallpur College will each be allotted an area of land on which, for a period of five years, they can practise agriculture on their own responsibility but under the general supervision of the Agricultural Department. The area to be granted will be sufficiently large to enable them, with careful work, to obtain a livelihood commensurate with their position. The experiment is a most interesting one and whether it succeeds or fails the results should throw useful light on the commercial value of the training which the graduates have received in the Lyallpur College.

THE COLLEGE STAFF. (i) THE PRINCIPAL.

477. The success of an agricultural college must depend in very great measure on the personality of the principal. The head of an institution which combines research and teaching requires special qualifications, among which administrative capacity and breadth of outlook are as important as high scientific attainments. So long as the great majority of

the students at the agricultural colleges ultimately seek employment in the agricultural departments, it appears desirable that the principals should continue to be selected, as a rule, from the Agricultural Service. In the event of a suitable officer not being available from this service, the selection of an officer from the Educational Service should be considered. Nothing should be permitted to stand in the way of the selection of the best man available. It should not have been necessary to emphasise this point, but there is reason to believe that considerations of seniority and of administrative convenience have occasionally been given undue weight in the selection for a post which is only second in importance to that of Director of Agriculture. Continuity of administration of a college is so desirable that we are strongly of opinion that a successful principal should be retained in that appointment even if there is a vacancy in the directorship of agriculture which his seniority and other qualifications give him a claim to fill. In such circumstances, he should receive a personal allowance equal to the difference between the salary of the principal and that of the Director of Agriculture.

Coimbatore is the only college which at present has a whole-time principal. If the colleges are adequately to fulfil the function we have assigned them, that of acting as a focus of all provincial educational activities in regard to agriculture, we are of opinion that a whole-time principal should be appointed to all of them. The administrative work involved in the charge of institutions of the magnitude of the existing colleges cannot, in our view, be satisfactorily combined with any other duties, more especially if the activities of the colleges expand in the directions we have suggested.

The principal will normally exercise full control over the teaching given in the colleges subject to the general supervision of the Director. The extent to which he should exercise control over research work is a matter which we think should be investigated by the Council of Agricultural Research which should lay down general principles governing the subject

(vi) THE TEACHING AND RESEARCH STAFF.

478. As in the case of the principal, the selection of members both of the teaching and research staffs of the agricultural colleges requires to be made with special care. It by no means follows that an officer who has been successful in district work will make a good professor or research worker and we consider that interchange between the administrative and the research and the teaching branches of the agricultural services should ordinarily be restricted to the earlier years of service. We revert to this point in paragraph 553 of our chapter on The Agricultural Services. In existing conditions, candidates are occasionally appointed direct to posts on the college staff but such posts are usually filled by the appointment of officers already in service. We should be glad to see the field of selection widened by the direct appointment of distinguished graduates in science of Indian universities as this would tend to strengthen the association between the universities and the colleges, the importance of which we have emphasised in our

chapter on The Organisation of Agricultural Research. In this connection, we would again instance the example of Rothamsted where the scientific staff is chosen from the best science schools in the United Kingdom and agricultural knowledge is not regarded as an essential qualification. If the recommendation which we have made in regard to the revision of the college curricula is accepted, the teaching staff of most of the colleges, if not of all of them, will require to be strengthened on the economic side and this is a direction in which the universities can render immediate assistance. In making this recommendation, we have not overlooked the consideration that, if the field of selection is widened in the manner we have suggested, this may be regarded by officers at present in service as depriving them of posts to which they may have a claim. We cannot, however, allow this consideration to override the great advantages which we believe will follow from the acceptance of our proposal. In any event, the rapid expansion of agricultural activities which may reasonably be anticipated in the near future should provide existing members of the agricultural services with full compensation elsewhere for the loss, on occasion, of posts on the staff of the agricultural colleges to which they may regard themselves as having legitimate claims.

COMBINATION OF RESEARCH AND TEACHING.

479. We have carefully considered the question whether it is desirable that the research activities of the agricultural colleges should be entirely divorced from the teaching work which is carried on at those institutions. The scientific experts we examined were practically unanimous in holding that the combination of research and teaching, within reasonable limits, is beneficial both to research workers and to teachers. The research worker who undertakes a certain amount of teaching is compelled from time to time to review his subject as a whole and is brought into contact with new ideas. The teacher, by engaging in research work, is also prevented from getting into a groove, is kept in touch with the latest developments in his special branch of knowledge, and is enabled to retain a freshness of outlook which cannot fail to prove a source of inspiration to his pupils. No hard and fast rule can be laid down as to the extent to which research workers should undertake teaching or as to the time which the teacher should devote to research. Much must depend upon individual aptitude but there can, in our view, be no doubt that the combination of research with teaching is of mutual benefit to both. In these circumstances, we entirely approve the system under which, at all the agricultural colleges, the heads of sections, while largely engaged in research work, also give instruction in their special subjects, and have associated with them lecturers who, while dealing with most of the routine of instruction, engage also to a limited extent in research work.

TRAINING OF THE NEW SUPERIOR PROVINCIAL SERVICES.

480 We have mentioned in Chapter II that, as the result of the Report of the Royal Commission of 1924 on the Superior Civil Services in India, it was decided that no further recruitment should be made to the all-India services operating in the transferred fields

and that the personnel required for those branches of administration should, in future, be recruited by local governments. Recruitment to the Indian Agricultural Service has accordingly ceased but no definite decision has yet been reached in any province as to the manner in which the new superior provincial services which will, in due course, entirely replace the Indian Agricultural Service in the provinces, should be recruited, the qualifications which should be required for candidates seeking to enter it and the salary and other conditions which should be attached to it. We are here concerned only with the qualifications which should be prescribed for the new services and with those only in so far as they can be obtained in India. The question of the recruitment of candidates from outside India or of Indian candidates who have undergone training abroad is dealt with in our chapter on The Agricultural Services. The situation which arises from the decision to cease recruitment for the Indian Agricultural Service has received our most anxious consideration for it is certain that failure to obtain in the future a supply of officers of the calibre of those who, since the reorganisation of 1905, have brought the departments to their present stage of efficiency would not only put an end to further development but would result in the disastrous failure of the organisation which has been built up. Lavish expenditure on buildings and equipment is of no avail unless there is a highly trained staff under adequate direction which can utilise to the best advantage the means thus provided. The agricultural colleges have, since their inception, turned out men who have filled positions in the provincial agricultural services and, in certain cases, in the Indian Agricultural Service with credit. There is every reason to believe that, as general education spreads and as the standard of teaching of pure science in the colleges and universities rises, the calibre of those who pass through the college course will continue to improve. But there can be no doubt that the ordinary degree or diploma course of the agricultural college does not provide an adequate training for direct recruitment to the higher posts in the agricultural departments and that, for candidates for such posts, a further period of post-graduate study is essential. The agricultural colleges are not in a position to provide intensive training of the character required. The number of recruits to the new Superior Provincial Agricultural Service in each province is not likely to exceed two or three annually. It would usually be difficult to fit such a small number of post-graduate students into the ordinary college system. Neither the research nor the teaching staff of the college could give them the individual attention necessary, even where it is in other respects fully qualified to do so. As the scientific side of the universities develops, they may be expected to provide facilities for post-graduate study in pure science but, for the present and for some time to come, we consider that the post-graduate course should ordinarily be taken at Pusa which, in present conditions, is the only institution in India in which facilities for higher instruction in all branches of agricultural science are available. We have discussed this question in relation to Pusa in Chapter III.

481. We have carefully considered the question of the extent to which it is desirable that openings in departments other than the agricultural departments should be provided for passed students from the agricultural colleges. We have made plain our view that, in existing conditions, the great majority of the students passing through the colleges will continue to seek public service in the agricultural departments while relatively few of those trained in the colleges will take to the business of farming on their own account. The cost to the State of the education given in agricultural colleges is high and full value cannot be obtained from the expenditure incurred unless the men who pass out of the colleges are active in promoting agricultural development either in the public service or actually on the land. If openings in other departments were held out as inducements to enter agricultural colleges, there would be danger that the best men from these colleges would be attracted to employment other than that connected directly with agriculture. There are, however, distinct advantages arising from the presence of men who possess a knowledge of agriculture and sympathy with the agricultural classes in departments which are, directly or indirectly, connected with the welfare of the rural community such as the revenue, irrigation and co-operative departments. Whilst, therefore, we do not recommend that any preference in regard to appointments other than appointments in the agricultural departments should be given to passed students from the agricultural colleges, we hold that an agricultural degree or diploma should be placed on the same level as a degree in arts or science as a qualification for appointments in such departments as the revenue, irrigation and co-operative departments. In this connection, we cannot but regret that more use has not been made of passed students from the colleges on estates under the courts of wards and on military grass and dairy farms. Such farms provide work for which they should be well suited and, if they had been employed to a greater extent on it, it is probable that the larger landholders would have been stimulated to use them much more freely than they have done in the management of their estates or of their home farms. We consider that the courts of wards should give a full trial to graduates in agriculture as assistant managers and, after sufficient experience, as managers.

OPENINGS IN OTHER DEPARTMENTS FOR PASSED STUDENTS FROM THE COLLEGES.

482. The lack of facilities for higher agricultural education in the three provinces of north-eastern India has received our close attention. The Agricultural College at Sabour in Bihar, which formerly served the needs of Bihar and Orissa, Bengal and Assam, was closed early in 1923 as it had failed to attract any students from Bihar and Orissa. The present position is, therefore, that neither in that province nor in Bengal or Assam is there any institution which gives instruction in agriculture beyond the elementary stage. If agriculture in Bengal and Bihar and Orissa is to undergo that intensification which we regard as the only practical means of raising the standard of living of the teeming population of those provinces, if Assam is to develop to the full the great agricultural potentialities of its thinly peopled districts, it is essential

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that the provincial agricultural departments should possess a properly trained agricultural staff. There are two ways in which this staff could be obtained. One is by the employment of graduates from the agricultural colleges of other provinces who have been given a pericd of subsequent training, in the areas in which they are to work, sufficient thoroughly to familiarise them with the local conditions. The other is by the establishment of one or more agricultural colleges. We are strongly of opinion that the latter alternative is the one which should be adopted, for a student who has received all his training in the tract in which his agricultural career will be spent should prove far more useful than one who has received most of it in some other part of India.

In Bengal, proposals have for some time been under consideration for the establishment of an agricultural institute at Dacca. The selection of Dacca as the site for the institute appeared to us a suitable one as there are advantages in locating it at a centre which already possesses not only a residential university giving a training in pure science but also a large farm which can provide the facilities required for practical training. We were informed by the Director of Agriculture, Bengal, that it was proposed that the students admitted to the institute should be preferably of agricultural parentage and that they should have received a training in pure science up to the standard of the examination in intermediate science. Accepted candidates would first receive another year's special tuition at Dacca University in pure science including physics, chemistry and botany after which they would spend two years at the institute undergoing an almost entirely practical course. The proposed course would thus be of three years' duration and, in these circumstances, we see no reason why it should not follow much the same general lines as those we have suggested for the existing agricultural colleges. We understand that, owing to financial stringency, it has been decided not to proceed for the present with this scheme. We cannot but think that the postponement of provision in Bengal for higher agricultural education is much to be regretted. It is our considered opinion that the provision of a centre for higher agricultural education is essential to the development, on sound lines, of the activities of the Agricultural Department in that province.

We, therefore, recommend that an agricultural college should be established at Dacca and that the suggestions we have made in the preceding paragraphs should apply equally to such a college. We consider it most desirable that the miscellaneous shcrt courses discussed in paragraph 474 should be given at this college but the question whether a short course of two years' duration on the lines of that at Cawnpore, Lyallpur and Nagpur should also be instituted should, in our view, be decided in the light of the probable local demand for it.

We desire also, in this connection, to refer to the recommendations of the Calcutta University Commission in regard to agricultural teaching in the University of Calcutta. The Commission recommended "that there

should be a departmental school of agriculture in the university organised at first on modest lines and making use so far as possible of existing resources; it should have attached to it a demonstration and experimental farm in the neighbourhood of the city; and it should work in close relationship with the Government Institute of Agriculture which it is proposed to establish." The object of this recommendation was to enable students aiming at taking a high degree in science to pursue their studies from an agricultural standpoint. In our opinion, there is room for developing a training of this type in addition to the more specialised training that would be provided by the agricultural college the establishment of which we recommend above. We further consider that, in view of the prominent place given to scientific studies in the university, Calcutta should prove a suitable centre in which to train science students who propose to engage themselves in agricultural research. It is not necessary, however, that a farm should be provided. The object in this case is not the training of agriculturists but of agricultural chemists, physicists and botanists. An experimental field of ten to fifteen acres equipped with field laboratory and a pot-culture station would provide the necessary facilities for field studies. We look to the necessary finance being provided from private sources which have in the past enabled the University of Calcutta to develop higher scientific education in Bengal.

We consider that a centre for higher agricultural training should be established in Bihar and Orissa. Provision on a considerable scale is now being made at Patna for veterinary education. It appears to us an anomaly that a province which stands much in need of agricultural development should make provision for training officers for its Veterinary Department but should continue to lack the means of training men for its Agricultural Department. It is useless to expand the activities of the Agricultural Department unless an assured supply of well-trained officers is available and a province of the size and population of Bihar and Orissa ought not to depend on other agricultural colleges as its sole means of obtaining personnel. We make no suggestion as to the place where this college should be established as this must depend on considerations which are best settled locally. But the possibility of establishing an agricultural college in close association with the veterinary college will doubtless receive due consideration in view of its obvious advantages.

The case of Assam is different. The resources of the province are small and for the present, therefore, we consider that Assam may properly rely on obtaining recruits for its Agricultural Department from among graduates trained in the agricultural colleges of other provinces.

CONCLUSION.

483. Before summarising our principal conclusions and recommendations in this chapter, we desire to emphasise our considered opinion that illiteracy presents the most formidable single obstacle to rural development in the widest sense. The fact that, of the population of twenty years of age and over, nearly ninety per cent cannot be reached directly

by the printed word creates a barrier between them and every branch of useful knowledge. The resources in personnel and money which are available are entirely unequal to the task of helping the mass of the cultivators by the spoken word. It is the more unfortunate that it should be so as the evidence we received shows that the rural community is by no means slow to adopt any form of improvement, of the value of which it is convinced. We are persuaded that the only hope of substantial progress lies in the mobilisation of all the available forces, both public and private, in a determined attack upon illiteracy. It is not to be expected that all provinces, or indeed all parts of the same province, should advance at equal speed. This apparent drawback has the advantage that the more backward tracts can learn from the experiments carried out in more advanced areas, always provided that there is effective liaison between the various educational authorities. The Educational Commissioner with the Government of India, whose evidence we heard at Simla in the autumn of 1926, deplored the abandonment during the past eight years of the frequent conferences of educational officers which were formerly held and expressed the view that there had been in consequence a loss of touch between the provinces in educational matters. It is regrettable that this should have happened as we found no lack of readiness to experiment with new educational ideas either among the departments of education or private individuals. The occasional reports issued by the Education Department of the Government of India and the trial which is now being made in Bengal of correspondence courses for *purdah* women may be cited as instances of this so far as government officers are concerned. The work which is done by missionary enterprise at Allahabad in the United Provinces, at Moga in the Punjab, in Madras and in several other places is evidence of a similar readiness on the part of private individuals. The problem is so vast and the means available for dealing with it so limited that it would be deplorable if efforts were wasted in one province on experiments which have proved a failure in another or if a province were allowed to remain in ignorance of measures which have proved successful elsewhere. We are, therefore, glad to be able to record that the Conference of Educational Officers was revived early in 1927 and we trust that henceforward it will be held annually. We recommend that all means may be taken, whether by general conference, by the meeting of individuals, or by the circulation of printed matter, to ensure a complete interchange of opinion and experience in educational matters throughout India.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

484. The conclusions and recommendations in this chapter may be summarised as follows :—

(1) The spread of literacy among the women of India is of great importance to rural development (paragraph 444).

(2) The influence of female education in spreading lasting literacy among the young should be ascertained, with a view to demonstrating the true relation between female literacy and the spread of general literacy (paragraph 444).

(3) The only remedy for the unsatisfactory state of primary education in India is the introduction of the compulsory system (paragraph 445).

(4) Compulsion should be introduced as rapidly as local conditions permit and should be preceded by a campaign of explanation and persuasion (paragraph 445).

(5) As an interim measure pending the introduction of compulsion, a system of contract to ensure the attendance of children at school could not be worked satisfactorily by government agency (paragraph 446).

(6) Co-operative education societies on the lines of those formed in the Punjab offer a hopeful means of securing attendance at school in present conditions (paragraph 446).

(7) Inefficient teaching and its consequent effect on attendance can be remedied by improvements in the training of teachers and in the organisation of primary schools (paragraph 447).

(8) Wherever possible, the policy of establishing 'central' schools should be adopted and 'single teacher' schools converted into 'branch' schools (paragraph 447).

(9) The desirability of converting primary schools into lower middle schools as in the Punjab is commended to the consideration of other local governments (paragraph 447).

(10) Teachers should be recruited to the utmost practical extent from men of rural origin and upbringing (paragraph 448).

(11) The preparation of suitable text-books for use in primary schools in rural areas is a matter of the greatest importance. It is essential that text-book committees should be so constituted as to command confidence (paragraph 448).

(12) No attempt should be made to teach agriculture to boys in primary schools, either theoretically as nature study or practically in school gardens (paragraph 448).

(13) The advancement of adult education is a matter for non-official activity rather than for government departments but the latter should assist it in all possible ways (paragraph 449).

(14) There is no genuine demand for middle schools of the "Loni" type which provide a vocational education in agriculture, and they are unduly expensive (paragraph 456).

(15) No more schools of this type should be opened and the existing schools in their present form should be closed (paragraph 456).

(16) Vernacular middle schools on the lines of the Punjab experiment which include agriculture as an optional subject in the curriculum are preferable to those of the "Loni" type (paragraph 457).

(17) The policy followed in regard to the establishment of such schools in the Punjab, the United Provinces and Bombay should be adopted in other provinces (paragraph 457).

(18) School farms are preferable to school gardens, provided teachers competent to manage them can be obtained (paragraph 458).

(19) Boys should be allowed to retain the produce of such farm and gardens either in whole or in part (paragraph 458).

(20) There are advantages in meeting the popular demand for the teaching of English in vernacular middle schools (paragraph 459).

(21) The addition to the curriculum of high schools in rural areas of a course in agriculture on the lines of that given in vernacular middle schools of the Punjab type but of a more advanced character should be productive of good results (paragraph 461).

(22) For the proper development of industries which can be carried on in rural areas, technical instruction of a high standard is essential (paragraph 462).

(23) The affiliation of agricultural colleges to universities is desirable (paragraph 465).

(24) The universities can make a valuable contribution to rural development (paragraph 466).

(25) Separate courses at the agricultural colleges for those whose aim is employment under Government and for those who propose to farm their own land or that of others are not desirable (paragraph 470).

(26) The agricultural colleges should make their influence felt in all branches of rural education and it is, therefore, most desirable that their tone and outlook should be broadly cultural (paragraph 470).

(27) The intermediate examination in science of the provincial university or an equivalent examination should be made an essential qualification for admission to all agricultural colleges (paragraph 471).

(28) If recommendation (27) is accepted, the length of the full college course should be three years (paragraph 471).

(29) Greater prominence should be given to agricultural economics in the college course and fully qualified teachers should be appointed to give instruction in this subject (paragraph 472).

(30) Greater attention should also be paid to instruction in farm management (paragraph 472).

(31) The short courses given at certain colleges should be revised in order to permit of greater attention being devoted to agricultural economics and estate management (paragraph 473).

(32) The miscellaneous short courses given at the colleges are a most valuable form of educational activity. They should ordinarily terminate in an examination of a practical character (paragraph 474).

(33) The diversion of any part of the building of the Mandalay Agricultural College to purposes other than that for which it was erected is to be deprecated (paragraph 475).

(34) The question of the affiliation of the Mandalay Agricultural College to the Rangoon University, at present in abeyance, should be revived (paragraph 475).

(35) Facilities should be provided to enable passed students of the colleges to obtain further practical experience before commencing active work either in the public service or on their own lands (paragraph 476).

(36) Very high qualifications are required for the principalship of an agricultural college and the best man available should be selected for the appointment and retained in it (paragraph 477).

(37) A whole-time principal should be appointed to all agricultural colleges. He should continue to be selected, as a rule, from the Agricultural Service. In the event of a suitable officer not being available, the selection of an officer from the Educational Service should be considered (paragraph 477).

(38) The principal will normally exercise full control over the teaching given in the colleges, subject to the general supervision of the Director. The extent to which he should exercise control over research work is a matter for investigation by the Council of Agricultural Research (paragraph 477).

(39) Interchange between the administrative and the research and teaching branches of the agricultural services should ordinarily be restricted to the earlier years of service (paragraph 478).

(40) The field of selection for the college staff might be widened by the direct appointment of distinguished graduates in science of the Indian universities (paragraph 478).

(41) The combination, within reasonable limits, of research with teaching work at the agricultural colleges, is of great benefit to both (paragraph 479).

(42) A period of post-graduate training should be an essential qualification for all candidates from the agricultural colleges for direct recruitment to the higher posts in the agricultural departments (paragraph 480).

(43) The post-graduate training recommended in (42) should ordinarily be given at Pusa (paragraph 480).

(44) An agricultural degree or diploma should be placed on the same level as a degree in arts or science as a qualification for appointments in such departments as the revenue, irrigation and co-operative departments (paragraph 481).

(45) An agricultural college on the model of the existing colleges should be established at Dacca (paragraph 482).

(46) An agricultural college should similarly be established in Bihar and Orissa (paragraph 482).

(47) All possible means should be taken to ensure a complete interchange of opinion and experience in educational matters throughout India (paragraph 483).

CHAPTER XVI

RURAL INDUSTRIES AND LABOUR

INTRODUCTION.

(i) GENERAL INDUSTRIAL POLICY.

485. A consideration of the general industrial policy of the country, profoundly though it must affect agriculture, does not fall within our terms of reference. At the same time, since we are charged with the investigation of the main factors affecting rural prosperity and the welfare of the agricultural population, we would record our opinion that it should be the special duty of the Government of India to consider at every step the effect of its industrial policy on the agricultural population. Many circumstances combine to render the agricultural classes less vocal in advancing their views than are the more easily organised and more literate urban communities. When, therefore, questions of principle in regard to industrial policy arise, Government should regard themselves as, in a very special sense, the guardian of the cultivators' interests.

(ii) SCOPE OF THE CHAPTER.

486. In dealing with the question of industries in relation to agriculture, we desire to make it clear that our main object in the present chapter is to consider only how the villager can best use his spare time for the improvement of his position. There appears to be an impression amongst certain sections of the community that a cultivator can find temporary employment, as and when he likes, in any of the industries which go on around him. This view ignores the obvious fact that the cultivator, within limits, is an expert in his own subject, just as a blacksmith, or a carpenter, or any other mechanic is in his. It is only in exceptional cases that the agriculturist can be anything more than an unskilled labourer in any industry other than his own. Speaking broadly, there can be no satisfactory blending of two avocations. If, therefore, a marked reduction of pressure on the land is required, it must be achieved by a definite diversion of the surplus labour of the country to industrial centres. In other words, the agriculturist who seeks to change his occupation and to become an industrialist must be prepared to undergo the training necessary to make him an efficient one.

The industries of India are to a very great extent based on its agriculture,—which is itself the chief of them. Especially closely related to agriculture are industries carrying out the primary processing of the agricultural products of the rural districts, or, like sericulture, practised in villages by the cultivator and his family, or, again, those which form part of the day-to-day economy of the village (for example, the work of the village artisan, the blacksmith, the carpenter, and the potter).

The general economic relations, which necessarily exist between the cultivator who has for disposal any product surplus to his own requirements, the purchaser and the ultimate consumers of that product—relations which are obviously of vital importance to the cultivator—have already received such consideration in our chapter on

Communications and Marketing as we consider relevant to the purpose of our enquiry. We do not, therefore, recur to this subject in the present chapter.

Throughout the chapter, we shall assume an acquaintance with the Report of the Indian Industrial Commission of 1916-18, in which the whole industrial position in India, including the relations between industries and agriculture, was reviewed in detail. The main features of that position have not changed in the comparatively short interval which has elapsed and, so far as assistance from agricultural departments is concerned, effect has been given to most of the recommendations. We do not, therefore, propose to traverse the ground covered by that Commission nor to deal with the technical aspects of any of the industries on which we may comment. The Industrial Commission has indicated the lines on which action should be taken to develop and organise industries.

We propose, also, to deal with the question of agricultural labour, including emigration from India as well as migration within the country; for movements of labour have an intimate connection both with the industries pursued by the cultivator and his family and with the general economic conditions of the rural population.

DISTRIBUTION OF INDUSTRIES.

487. In order that the industries which have more particular relations to agriculture may be seen in their proper perspective, it seems desirable to give, at the outset, a brief outline of the general industrial position. In 1925, the number of factories in British India subject to the Indian Factories Act* was returned as 6,926, employing about 1,500,000 persons. In the last census (1921), the total number of actual workers employed in British India in industry of one kind or another, including factories, was 11,800,000, or 10½ per cent of the total working population. The distribution of the factories over the country and the articles of manufacture are of interest. In the main, the factories are situated in the territories which came earliest under British administration as no less than 3,627, or fifty-two per cent, of the factories in British India are distributed in about equal proportions between the three presidencies of Madras, Bombay and Bengal and these employ seventy per cent of the total factory workers.

In only five centres outside the three presidencies is there a concentration of industry which at all resembles the situation in Bengal, Bombay and Madras. These centres are Cawnpore in the United Provinces where there are important cotton and woollen mills, tanneries and

*In the Indian Factories (Amendment) Act, 1922, a "factory" is defined as,

(*a*) Any premises wherein, or within the precincts of which, on any one day in the year not less than twenty persons are simultaneously employed and steam, water or other mechanical power or electrical power is used in aid of any process for, or incidental to, making, altering, repairing, ornamenting, finishing or otherwise adapting for use, for transport or for sale any article or part of an article; or

(*b*) Any premises wherein, or within the precincts of which, on any one day in the year not less than ten persons are simultaneously employed and any such process is carried on, whether any such power is used in aid thereof or not which have been declared by the Local Government, by notification in the local official Gazette, to be a factory.

engineering works, Nagpur in the Central Provinces where large cotton mills have been established, the coalfields in Bihar and Orissa, Jamshedpur in that province where important iron and steel foundries and allied industries are situated, and Rangoon, where the greater proportion of the Burma rice crop is milled.

In addition to these large scale industries, there are a number of smaller industrial establishments which are naturally located in areas in which there is a large supply of a particular crop or product—rice mills, oil mills, cotton ginneries, sugar refineries, saw-mills and tobacco factories. These factories are of special interest to the rural population as most of them are open only for that part of the year when agricultural occupation is at its lowest ebb and the cultivator and his family, therefore, supply a considerable proportion of the labour employed in them. If, however, we take the country as a whole, these industries are unimportant, as is shown by the fact that the total annual labour force employed in them numbers only some 250,000 hands, that is, 0·3 per cent of the total number employed in agriculture.

THE AMOUNT OF SPARE TIME AT THE CULTIVATOR'S DISPOSAL.

488. As we have seen in our chapter on The Village, a prominent feature of Indian agriculture is the amount of spare time which it leaves to the cultivator. This varies very greatly according to the local agricultural conditions, but it may be assumed as a broad generalisation, that by far the greater number of cultivators have at least from two to four months absolute leisure in the year.

The methods of bringing within the cultivator's reach industrial opportunities to fill up his spare time must vary with local circumstances. Where congested conditions prevail, as, for example, over great parts of Bengal, Bihar and Orissa, Madras, and the United Provinces, the diversion of surplus agricultural labour to industrial pursuits and migration to other parts of the country seem the most promising solutions. As agriculture over the greater part of India cannot offer employment for the whole of the year, the problem elsewhere is to suggest lines of work which can suitably be undertaken by the cultivator or his family in their spare time and without detriment to the cultivation of their land.

CLASSIFICATION OF INDUSTRIES.

489. It will be convenient to consider the relations between the rura population and various industries under three heads. Under the first head are included industries of the ordinary factory type located in rural areas. The sole direct connection between the cultivator and industries of this type is his employment as a labourer in local factories during the time when there is no work for him to do on his own holding. Typical industries are rice-hulling and oil-crushing factories, sugar refineries and cotton ginneries. These are industries dealing with agricultural products. But this class includes also any factory or occupation in rural areas, which can employ unskilled casual labour, such as brick works or road-making. Under the second head come village and domestic industries. To this class belong weaving, *gur*-making, hand

hulling of rice, the extraction of oil in the village oil press, silk filatures and the work of the village artisans generally. Under the third head comes sale by the cultivator of his labour during the period when there is little or no work to be done on his holding. In certain parts of India, this is an important feature of the cultivator's economy and is closely linked up with the first group of industries that we have mentioned.

RURAL INDUSTRIES OF THE FACTORY TYPE.

(i) COTTON GINNERIES, RICE MILLS, ETC.

490. Of factory industries, the most important and best established are the cotton ginneries, rice mills and sugar refineries which are springing up in increasing numbers throughout the country. These draw a large part of their labour from the villages in their neighbourhood and are a valuable agency for part-time employment. We regard their multiplication within economic limits as one solution of the problem of spare time employment in rural areas.

In addition to the industries mentioned, we have, in the course of our enquiry, received numerous suggestions for the establishment of new industries, amongst which were mentioned implement-making, paper-making from bamboo pulp, fruit and vegetable-canning and the manufacture of essences and oils from local plants. We shall not attempt to express an opinion on the merits of these. Some of them have already been considered by the Indian Industrial Commission. In the case of all of them, intimate knowledge of the locality in which it is proposed to establish the industry and of the markets to which it is intended to send the finished product is required before any opinion as to the chances of success can be expressed. We shall, therefore, content ourselves with referring to a few of the more striking suggestions received. The economics of any proposal require to be carefully worked out. We are concerned mainly with possible developments which may offer increased employment to the rural population.

(ii) MANUFACTURE OF AGRICULTURAL IMPLEMENTS.

491. The suggestion that the local manufacture of agricultural implements might be greatly extended seems, on the whole, to offer considerable promise. India is a land of great distances and the cost of transporting implements from factories to destinations many hundreds of miles away adds materially to the local sale price. It undoubtedly limits the scope of the activities of the few implement-manufacturing firms that now exist in India and is one of the reasons why the number of improved implements sold annually is disappointingly small. We consider that there is room for many more implement firms throughout the country, if internal supply is to prove equal to meeting the increased demand which, we are confident, will arise in the near future. The establishment of these firms must be left to private enterprise. But the engineering sections of the agricultural departments can give valuable help in the matter. Their early environment makes youths of the rural classes particularly suitable for training in implement manufacture and they should be encouraged by the grant of stipends to attend engineering schools, railway workshops and the workshops of the

agricultural departments with a view to employment in implement factories or, if they have adequate capital, to start such factories themselves. Government should recognise the obligation to assist private enterprise to equip itself to take over, and greatly extend, the manufacturing work which is now being done by the engineering branches of the agricultural departments because there is no one else to do it.

(iii) PAPER MANUFACTURE.

492. Various witnesses have suggested to us the possible commercial exploitation of the bamboo as material for paper manufacture. We had an opportunity of seeing the process of making paper from bamboo pulp in actual operation at the Forest Research Institute at Dehra Dun. While the development of this industry might give employment to the rural population living on the outskirts of forests, we do not consider that it holds out much prospect of employment for any considerable section of the rural community. Bamboo plantations of any extent are generally remote from areas of fixed cultivation. To work in them the cultivator would in some cases have to travel far from his home and settle in a locality with few, if any, amenities. It is only to those already accustomed to work in the forests that this class of employment would appeal.

(iv) MISCELLANEOUS.

493. Of other developments which may be anticipated, the manufacture of oilcake may assume importance both as a fertiliser and also for cattle feeding, if the habit of stall feeding of cattle becomes more general than it is at present. We have suggested in paragraphs 87 and 91, Chapter IV, that the possibilities of extending the oil and bone-crushing industries should be investigated. Factories of this kind would naturally be located in rural areas where the supply of raw material is available, and this would give employment to some of the rural population in the neighbourhood. It has yet to be seen whether the preservation of fruits by drying, canning and making into jam holds out much prospect either of employment to the agricultural community or of profit to the promoters. The local demand for such factory products is, at present, small and, if it increased, competition from similar highly organised industries in other countries would be serious. We make recommendations in our chapter on Horticulture and Plantations for a thorough investigation into the possibility of developing such an industry in the case of fruit.

VILLAGE INDUSTRIES.

(i) THE VILLAGE ARTISAN.

494. Apart from employment in factories situated in its neighbourhood, the rural population can employ its spare time in certain village and domestic industries. These, in many cases, cannot be sharply distinguished from industries of the ordinary factory type. The practical distinction lies in their smaller size and in their type of organisation. This is best described as at present being part and parcel of the self-sufficing economy of the village. The description of the typical village in our chapter on The Village included an account of the

village craftsmen still serving the village on a basis of status rather than of individual competition. We also indicated, in that chapter, the tendencies favouring a termination of the self-sufficing economy of the village. We refer to these village artisans not because they can contribute to any extent to the question of part-time employment but because they occupy a very important position in the village community and because casual labour may occasionally be available for agriculturists or for their children. The survival of such village industries in the changing circumstances of the times thus seems to us to depend on a change of attitude on the part of the village artisans. Instead of standing in local isolation, they must, if they hope to survive the struggle of competition, modernise their own methods of work by adopting power-driven machinery, as they are already beginning to do in certain parts of the country. These artisans can also be trained to effect repairs, to stock and fit spare parts and to handle successfully the improved types of machinery which are bound sooner or later to be introduced. It should be to the interest of the large manufacturers of machinery to take long views and to establish a net-work of agents throughout the area served by their business who can get into touch with village artisans. Government should also provide, when required, suitable courses in their technological institutes, in the railway workshops, and in the engineering workshops and on the farms of the agricultural departments.

(ii) THE HANDLOOM, POTTERY AND ROPE-MAKING INDUSTRIES.

495. The handloom industry of India is still of great importance in the national economy and has, up to the present, shown remarkable vitality in the face of competition with factory products. It is likely to remain the principal form of village industry and there is no immediate reason to fear its decline. The pottery industry meets the local demand for common utensils at moderate prices. Attention is being devoted in some provinces, notably Burma, to improving the technique of the potter and to introducing the higher embellishments of his art. It is felt that, apart from the ordinary pottery of the village, there is considerable room for the expansion of a trade in ornamental pottery by improvements in designs or in methods of glazing. It is an industry in which instruction in the making of new articles, such as insulators for telegraph poles, might prove of great value to the worker.

Wherever clay of the right texture is to be found, bricks as well as pottery are very generally made. Both the pottery and brick-making industries would benefit much from the introduction of modern methods. Improvement in the quality of bricks would also facilitate the construction of better houses.

Evidence has been given that, in certain districts, rope-making which, in the past, was almost universal in villages, is declining. We see no reason why this should be so, since fibre of a high quality is everywhere abundant and demand is spread throughout the country. There would seem here to be an opportunity for introducing rope-making machinery of a simple type.

(iii) Sericulture.

496. Sericulture and Indian silk are seriously threatened by economic considerations. In various parts of India where the industry has been long established, much attention has been paid by Government to the improvement of strains of silk worms and the treatment of cocoons. Where silk worms can be reared, a valuable subsidiary industry is available—the more so as it provides what is essentially a spare-time occupation. To the cultivator it affords a useful addition to income with a comparatively small expenditure of time and labour on the crop which feeds the worm. While, in certain areas and amongst certain classes, there are religious prejudices against the processes the industry involves, there are large areas of the country where these religious prejudices do not exist and the mulberry, or some alternative source of food for the worm, is to be found. Its value in the village economy must not, however, blind organisers to the competition which is already confronting the industry from artificial silk. The subjoined figures will show how quickly the imports of artificial silk have grown.

Imports of artificial silk

		1921-22	1922-23	1923-24
Yarn ..	Quantity lbs. ..	70,600	224,900	406,000
	Value Rs. (lakhs) ..	4·54	13·40	19·55
Piece goods of cotton and artificial silk.	Quantity yds. ..	560,000	1,547,000	8,555,000
	Value Rs. (lakhs) ..	7·56	19·73	104·09

		1924-25	1925-26	1926-27
Yarn ..	Quantity lbs. .	1,171,000	2,671,000	5,776,000
	Value Rs. (lakhs) .	42·40	74·72	102·64
Piece goods of cotton and artificial silk.	Quantity yds. .	17,020,000	15,362,000	41,978,000
	Value Rs. (lakhs) .	176·23	137·83	308·74

Unfortunately, there are no figures available for the total production of natural silk in India, but it has been stated in evidence that, up to the present, the demand for natural silk has not declined. This is probably because artificial silk has not yet exploited the luxury market which, regardless of expense, demands the natural article. If, however, the use of artificial silk continues to increase at its present rate, there must, we think, be a serious risk that the demand for the natural article will begin to weaken.

As regards external demand, we were informed by the Indian Trade Commissioner in London that there is a ready sale for hand woven articles especially for those produced in Bihar. The export figures do not distinguish these highly specialised silks from the ordinary article, but, as the sub-joined figures show, the export of manufactured silk goods show no tendency to expand whilst that of raw silk is definitely on the decline.

Value of exports of silk

Year	Raw silk	Manufactured silk
	Rs. (lakhs).	Rs. (lakhs).
1921-22	26·29	2·96
1922-23	38·17	2·43
1923-24 . .	50·21	4·27
1924-25	38·07	2·95
1925-26	35·75	3·01
1926-27	32·40	2·68

(*iv*) POULTRY REARING.

497. There are undoubtedly opportunities for the development of a poultry industry in India. In some parts of the country, there is a growing local demand for eggs and other poultry products. There is also, in large towns and cities, an unsatisfied demand for high class eggs and poultry. There would seem also to be possibilities in drying or preserving eggs for export and of manufacturing dried albumen. But the amount of produce disposed of by the village poultry keeper is, as a rule, small, and if markets other than those for local consumption are to be fully exploited, it will be necessary to organise the collection, transport and sale of poultry and eggs. This is a direction in which producers' co-operative sale societies have achieved marked success in other countries, and we would suggest that co-operative departments in India should explore the possibilities of establishing such societies in suitable tracts.

We are glad to note that the departments of agriculture in most provinces are now devoting some attention to poultry questions. In the United Provinces, in particular, Government have, during the past six years, interested themselves in the development of the poultry industry. Mrs. A. K. Fawkes, Secretary of the United Provinces Poultry Association which receives a substantial annual grant from Government, is doing valuable pioneer work by no means confined to the United Provinces. Religious prejudices against the keeping of poultry exist in certain parts of the country and among certain classes of the community, but Mrs. Fawkes was able to offer some evidence that these prejudices are not incapable of being overcome. While these and other limitations to the rapid expansion of a poultry industry must not be overlooked, there are grounds for hoping that a gradual development of the industry where local conditions are favourable will take place. What is chiefly required is a steady interest on the part of Government and the carrying out of a carefully planned programme of experiments, the results of which should be made readily available to all those who intend to take up poultry rearing. It is most necessary that, in these experiments, failures should be carefully recorded and their causes patiently analysed. The progress of the industry has suffered in the past from the abrupt discontinuance of experiments before their results were fully known, and from the failure to record such results as had been secured.

(v) Lac.

(a) General.

498. The lac insect is found on a considerable number of trees throughout India, but of these only half a dozen are of any commercial importance. These, however, are of such common varieties that, over large areas from the Punjab to Assam, in parts of Bombay and the Central Provinces, and in the hilly tracts of Burma, the cultivation of lac is a village industry affording additional income to the poorer classes. Caste prejudices restrain many from sharing in the work, and the people engaged are mostly illiterate, untrained, unorganised and lacking in the technical knowledge required for the expansion of the industry. Within the country, lac is used for decorating toys, metalware and lacquerwork generally; its use as a dye has declined, but it is in great demand overseas for gramophone records, electric implements, varnish, etc. For these purposes, the world's demand is chiefly met from India which has practically a monopoly of output. The evidence given before us indicated that while a synthetic product was being manufactured in increasing quantities, the natural material could hold its own in the market provided the price were kept within reasonable limits. It was further stated that the output could be increased several fold if suitable assistance were forthcoming.

The provinces differ somewhat as to the machinery through which this assistance should be afforded. In Assam, the proposal to hand over the subject to the Forest Department had been made and rejected, and it is left neglected between the Industries and Agricultural departments. In the Central Provinces, only the Forest Department appears to be doing any work and that is limited to the propagation and cultivation of lac in government forests as a purely departmental operation; the department encourages cultivators to propagate lac by purchasing brood lac, but otherwise nothing is done for cultivation on privately owned trees. At one time, one forest division alone yielded a revenue of three lakhs. The Agricultural Department is not taking part in this work. In the Punjab, the subject is dealt with in the entomological section of the Agricultural Department and an assistant is being trained to undertake experimental work. In one tehsil alone, the output was valued at four lakhs, and it was said that this could be increased fivefold, if knowledge of cultivation and of the proper treatment of pests could be widely diffused. In Bombay, the Agricultural Department is striving to increase cultivation in Sind and the Deccan. In Bengal, where the industry is of considerable importance, nothing has yet been done but proposals for expansion are under discussion.

The premier province, however, so far as lac is concerned, is Bihar and Orissa; the value of the exports from this province sometimes runs into crores of rupees, and for this reason the main work on this subject in India is concentrated at the Lac Research Institute at Ranchi.

The chief obstacles in the way of the development of this industry are said to be the great fluctuations in prices, the excessive number of middlemen between the cultivator and the Calcutta market, the

competition from the synthetic article, the absence of any standardised product, and the liability to loss from pests.

The fluctuations in prices are not by any means always due to the yield of the crop; there appears to be considerable speculation in Calcutta and the profits from this are rather apt to distract attention from the permanent interests of the industry. The effects of such fluctuations on the cultivator are bad; when prices are low, he refrains from collecting the lac, the natural enemies of the lac insect flourish unchecked and the subsequent production is poor in quantity and quality. When prices rise, little lac is obtainable at first and it takes time to increase production.

These defects, as well as those arising from the excessive number of middlemen, can only be overcome by organisation, and we would suggest that, in view of the helplessness of the actual cultivator, Government should attempt to bring together the various interests somewhat on the lines of the Indian Central Cotton Committee.

The other three obstacles, danger from the synthetic article, the absence of a standardised product and the liability to pests, call for research with a view to the regular production of a good standard article in steady quantity.

(*b*) RESEARCH AND ORGANISATION.

499. Research was at first carried on chiefly by the Imperial Entomologist; the lac insects were studied and the most valuable varieties cultivated; the best methods of propagation were investigated, and a number of students were trained in lac culture. The fact that the Pusa Bulletin on this subject is now in its fourth edition affords testimony to the value of the work done and of the interest it aroused. In 1921, the Government of India initiated an inquiry which led to the formation of the Indian Lac Association for Research in the same year. This is financed by a cess on exports of four annas a *maund* on lac and two annas a *maund* on lac-refuse. The Association is managed by a committee which was intended to represent all branches of the trade, but, owing to the difficulty, if not impossibility, of securing actual cultivators as members, the committee is chiefly composed of Calcutta merchants. The income from the cess imposed by the Indian Lac Cess Act, 1921, after deducting cost of collection, is paid to this committee. No officer of Government is a member of the committee, and no report on expenditure is presented to Government. The Association has constructed a Research Institute with staff buildings at Ranchi; a Director and Bio-chemist was appointed in 1923, and with the strengthening of the staff in 1925 and 1926, the Institute may now be said to be in full working. The chief defect in the arrangement described is that, owing to the illiteracy and ignorance of the growers and minor middlemen, representation on the committee has been limited to the bigger merchants, who are not in a position to attend to the troubles of the village cultivator. Although much of the work of the Institute is being carried on in close conjunction with the Forest Department and in areas under the control of that department, neither it nor the Government of Bihar and Orissa is

represented on the committee. The Director of the Institute holds no permanent post and is controlled in her research work by a committee whose members may not possess the qualifications required for this difficult task. Moreover, the committee, with the best will in the world, is not in a position to undertake the improvement of the lot of the growers, scattered as they are in numerous villages. The appointment of a Scientific Advisory Board consisting of a forest officer, an entomologist and an agricultural chemist has been suggested, but this would not help the cultivator. A further suggestion has been made that each of the chief local governments interested in lac culture should be represented on the committee.

From our point of view, the chief interest is that of the cultivator, and, in consideration of the value of the industry, its importance in providing subsidiary employment throughout such a large area and the pressing need for measures to save it from destruction by the synthetic article, we are of opinion that the Association should be reconstituted and strengthened by the addition of nominees of the Government of India and of the Government of Bihar and Orissa, and of an official to represent the interests of the cultivators. The Imperial Entomologist and the Chief Conservator of Forests of Bihar and Orissa would be suitable nominees for the first two posts. It is doubtful if any satisfactory representative of the growers could be found, and we accordingly recommend that the chairman of the Association should be the Commissioner of Chota Nagpur. The Institute is situated in his division and it would be his particular responsibility to bring to the notice of the Association the best methods of promoting the interests of the growers. He would also attempt to keep in view the wishes of other provinces where lac-growing is important and to protect the staff of the Institute from difficulties arising from the fact that most of the members of the association reside some distance away in Calcutta.

We also recommend that inquiry should be made, under the general supervision of the chairman, into the economics of lac-growing.

RURAL INDUSTRIES: GENERAL CONCLUSIONS.

500. We deal with the possibilities of developing fruit and vegetable production for the market in our chapter on Horticulture and Plantations.

Before we proceed to consider the possibilities for the employment of an agriculturist away from his village, it may be convenient to review the position with reference to rural industries. In our opinion, what is most required to stimulate their development is new ideas; in silk weaving, for example, the supply of attractive patterns; in the pottery industry, new lines of development such as the making of insulators for telegraph poles; in carpentry, patterns of simple articles of furniture and of suitable containers for the marketing of village products. Next in importance we place careful and thorough instruction in modern processes. Government art and technological schools are already doing good work in this field, and existing provincial facilities in these respects should be developed for those rural industries which a local government may select as promising. As an example, reference may be made to Burma.

In that province, the local Government have selected silk, lac and pottery as the principal rural industries. With the widening of the villager's outlook through improved communications and education, we anticipate that gradually a new range of wants will be created. It is on the satisfaction of these that village industries can rely most securely for support, as the formidable difficulties of transport and marketing are thereby obviated. But markets external to the locality should not be neglected, and, for the capture of these and the maintenance of a connection once secured, the best advice obtainable is needed on the commercial side. However attractive the articles may be, sale in the long run will depend on uniformity of the product and on the promptitude and regularity with which market orders are complied with. When a foreign dealer makes a direct arrangement for his supplies, these essentials can, perhaps, be assured. But where this is not done, the villager stands in great need of instruction and constant supervision in both respects. This assistance will best be given by the co-operative and industries departments to artisans organised on the co-operative basis which we suggest in the succeeding paragraph.

But even with the aid of new ideas and assistance in training and marketing, the contribution which rural industries can make, in reducing the heavy pressure on the land, is infinitesimal and in the nature of things they cannot, as a rule, hope for ever to survive the increasing competition of organised industry. In some cases, we are afraid that an altogether exaggerated importance is attached to their development, whereas sound reflection would show that their possible expansion is strictly limited. The position may be summed up as follows: in villages generally, some increase in demand for local products may be looked for as new ideas of the values of life develop. In villages favourably situated for the establishment of small industries such as rice and sugar mills, cotton ginneries and presses, part of the agricultural population may find seasonal work as unskilled labourers. In the villages, many of the smaller cultivators find employment in carting for their more prosperous neighbours and some may hire out their own labour to them. Where caste prejudices are not a difficulty, a few may find employment as assistants to the local artisans. Near large towns poultry can be kept or vegetables, fruit and flowers can be cultivated. The women and girls of the family can fill their leisure moments with the spinning of various fibres and also with the making of lace and embroidery, a cottage industry to which the Madras Department of Industries has paid special attention. In certain areas, lac cultivation and silk can be taken up and near forests employment can be obtained by the cultivators in their spare time in various ways. But the possibility of spare-time or subsidiary occupations depends very largely on the location of the village and, as a general principle, it may be laid down that the chief solution of the problems of the cultivator is intensification or diversification of his agriculture. Corporate action for the improvement of his village would, of course, give him something to do; but this awaits the awakening of a public health conscience and the revival of the corporate spirit in

the village. To put it briefly, the possibilities of improving the conditions of the rural population by the establishment of rural industries are extremely limited.

CO-OPERATIVE SOCIETIES FOR VILLAGE INDUSTRIES.

501. The difficulty of providing sufficient capital at reasonable rates of interest for carrying on village industries can be met by the organisation of co-operative societies for the purpose. In the case of skilled artisans, the bulk of the profit earned by the sale of their products is apt to go at present into the pockets of middlemen who supply them, at a very high rate of interest, with the capital required and who, as a rule, also insist upon the finished product being sold through themselves. Some of these village artisans are financed at present by the ordinary village co-operative credit society but societies have also been formed for special classes of village artisans. Mention may be made of weavers' societies which now exist in several provinces. These supply their members not only with the credit required but, where they are well developed, also purchase for them the requisite raw material and, in some cases, arrange for the sale of their finished products. We believe that development on these lines is essential, if the artisans are to reap a reasonable profit from their labour and if rural industries are to be placed in a position to survive the competition to which they are increasingly exposed. We, therefore, suggest that the question of organising village artisans on a co-operative basis for purposes of credit, of purchase of raw material, and of marketing, should receive the attention of both the departments of co-operation and industries in every province. Where artisans are thus organised co-operatively, Government might, where special needs exist, make advances to the societies for the purchase of improved machinery.

NATURE OF SPARE-TIME OCCUPATION.

502. We now pass to the questions arising from the sale by the cultivator of the labour surplus to that required for the cultivation of his holding. We have already referred to the work in local mills or ginneries. This is a valuable outlet for his labour. As the economic relations between industry and agriculture grow closer, the number and variety of these primary processing factories in rural areas may be expected to increase greatly and seasonal employment in them may come to be an important factor in the cultivator's economy. Seventy-five per cent of the labour employed in the fifteen large sugar mills situated in Bihar and Orissa is agricultural.

These occupations can be carried on without change of residence. But, in several parts of the country, the cultivator is accustomed, when there is no work to be done on his own holding, to travel considerable distances to sell his labour. Very often he is accompanied by his family. The work may be agricultural or it may be employment in a factory, or general labour. Every year there are considerable movements of the population from North Bihar and the Orissa division to rural Bengal and to Calcutta; from the upland districts of the Madras Presidency to the Kistna and Godavari deltas; in Burma, from Upper to Lower

Burma and from the rural parts of the Bombay Presidency to the mills of Bombay city and Ahmedabad.

ADVANTAGES OF SEASONAL MIGRATION OF LABOUR FROM RURAL TO URBAN AREAS.

503. The advantages and disadvantages of the transfer of the rural population to urban areas and factory conditions are well known and are common to all countries. There is the risk of disease from the crowded and insanitary conditions in which the labourer must too often live, and there are the temptations of a large city without the restraining influence of public opinion which village life imposes. It cannot be doubted that the objections which have been urged by some witnesses to this seasonal migration to large cities is due to personal knowledge of these dangers and that the disfavour with which the prospect of any transfer of factories to rural areas is viewed in certain quarters has a similar origin. We have every sympathy with the desire to protect the countryman but we consider that due weight should be given to the advantages which undoubtedly accrue from such seasonal migration of labour. In many cases, it is the only alternative to semi-starvation or at least scarcity. Interference by Government with the economic demand which annually attracts large supplies of labour from one part of India to another would, in our opinion, be impracticable and undesirable. Apart from the fact that it provides the migrant with subsistence for part of the year and enables him to return to his village with a small cash reserve, this annual migration is, we consider, of great value in introducing new ideas into the country-side. We entirely agree with the author of the Census Report of 1921 that "It would be difficult to overestimate the economic and educative effect of this habit of migration." The life of the city should quicken the minds and enlarge the outlook of a far greater number of labourers than it corrupts. The true solution, in our opinion, is not to attempt to interfere with seasonal migration but to use every endeavour to ensure that the housing and general social surroundings of the countryman in the city are tolerable and decent.

There are indications that, as an industrial spirit develops, the tendency will be to multiply the number of small local factories dealing with the produce of a limited area rather than to increase factories in the cities. From the point of view of the agriculturist, this will be all to the good, as accessible and steady markets for his produce and an outturn for his labour will be assured without the disadvantages of leaving his home.

In the linking up of the cultivator and the cultivator's produce with these localised factories, the co-operative movement can play an important part. This movement must ultimately, if the rural population is to reap the full benefit of it, advance from the supply of short and long-term credit to the organisation of the purchase and sale of commodities and produce.

DEPARTMENT OF INDUSTRIES. (i) POLICY.

504. Departments of industries have been constituted in Madras, Bombay, Bengal, Bihar and Orissa, the Punjab and the United Provinces, and amongst their functions is that of the supervision of rural industries. Madras and Bihar and Orissa have passed State Aid to Industries

Acts and the Punjab an Industrial Loans Act. Under these Acts, assistance, subject to certain conditions, can be given from provincial revenues to private enterprise for starting new industries. The intention of these Acts is to help the development of industries generally. Other things being equal, we hope that particular attention will be paid to the development of agricultural industries. In some provinces, technical institutes exist for the training of artisans and it is on this education, general or particular, that we lay the greatest emphasis. As we have already indicated, it is our view that only the adoption of the co-operative principle by the smaller rural industries can enable them to hold their own in the intensive competition of modern times.

We do not consider that Government can usefully seek to influence the location of large scale industries in rural areas, though the possibilities of industrial development should be taken into account in the layout of roads or railways or in the elaboration of a hydro-electric scheme. Removal of existing industrial concerns to rural areas and the establishment of new concerns in those areas rather than in the vicinity of large towns will necessarily be dictated by such considerations as the availability of raw material and suitable labour and the adequacy of transport to markets. It is in the interests of the agricultural population that there should be as many prosperous industries based on the processing of agricultural products as economic conditions will allow, and we are convinced that it would be a mistake to fetter their development by any policy of control in regard to their location. Government may, however, do much to assist the mutual adjustment between the larger industries and agriculture by their policy in respect of communications and the development of power; by fostering the supply of skilled managers and technicians and by the collection of information as to marketing both in India and abroad. Further, when there is a risk of manufacturing power exceeding the supply of raw material available in any locality, Government can assist by conducting an economic survey of an industry, and, if necessary, sounding a note of warning. For this and other reasons, it seems desirable that before evolving a policy for industrial development in rural areas, Government should make a careful survey of economic possibilities. This, we understand, is proposed in Madras.

We hope that, with an improvement in the facilities for technical education and the growth of a class of technicians who have gained experience of the application to business of scientific processes through a period of employment in large scale industries, capacity may increase among private individuals to organise the smaller industries successfully. But for a long time to come, Government will have to be prepared to make suggestions for the development of the smaller industries, to give advice in some detail in regard to matters of organisation and management and, perhaps, in some instances to make themselves responsible for running a pioneer enterprise. Close collaboration between the departments of industries and the co-operative departments is necessary if the workman is to get the best training in his craft and be in a position to market his products most favourably.

(ii) PERSONNEL.

505. If a Department of Industries is to achieve any success in the promotion and assistance of rural industries in the ways we have indicated above, its Director must possess considerable power of organisation and also a close understanding of, and sympathy with, rural needs. He must also be of a status which would secure that his views carry weight with the business community. The power of organisation which we regard as one of the essential qualifications for the directorship of industries might be obtained if the Director were recruited from the business world. It must, however, be recognised that the salary which a local Government is in a position to offer is not such as to attract a man who has been a success in business. We are, therefore, strongly of opinion that the Director of Industries should be an experienced administrator.* We found few, if any, indications during our enquiry that the departments of industries were exercising any appreciable influence on rural development, and, unless they are strengthened and their efficiency increased, it would seem that, so far as the interests of the cultivator are concerned, there is little justification for their continued existence.

AGRICULTURAL LABOUR.

506. We propose to conclude this chapter with a review of the general labour situation as it affects cultivation in India. The facts are simple. In no province, except possibly in Assam, is there any indication of a serious general shortage of labour. The shortage in such tracts as the forest areas of Kanara and the semi-forest tracts of the same district, and in Dharwar and Belgaum, is due rather to the existence of factors unfavourable to development, such as malaria, than to a real dearth of labour. Where these difficulties are being overcome, it is found that no special measures are required to attract cultivators to such tracts, though the process of opening them up is a gradual one. Where land has gone out of cultivation, as in certain areas of western Bengal, the Central Provinces and the Punjab, it is again due to causes other than lack of labour; the spread of intense malaria in the first, of intractable weed in the second, and of alkali in the third case. Were these causes removed, it is certain that there would be an influx of population from contiguous districts more than adequate to ensure full cultivation. The experience of the Punjab canal colonies suggests that no serious difficulty will be found in attracting sufficient population to cultivate the new areas of land which will be progressively brought under irrigation on the

* Mr. Kamat is unable to agree in the view that the Director of Industries should necessarily be an experienced administrator. Experience has shown that mere administrative experience in government service has not yielded the expected results in the matter of industrial development; as the Indian Industrial Commission pointed out, the Director of Industries must be a man with special qualifications which, in addition to power of organisation, should include, "in the first place, a business sense, *i.e.*, the capacity of appreciating the technical features of industries in their bearing on commercial possibilities."

That Commission has suggested that, if a properly qualified industrialist or a suitable man from the business world is not forthcoming, then only the balance of advantage is in favour of the selection of the Director from any of the existing services. Mr. Kamat agrees with this view. Further, if the departments of industries have to be strengthened at all, he is inclined to think that better results are likely to be achieved by having a deputy director specially for the promotion of rural industries.

completion of the Sukkur Barrage and the construction of its subsidiary canals.

The evidence which we have received and our own observations indicate, indeed, that, in a belt stretching from the Madras Presidency, east and north through Bengal, Bihar and the United Provinces, the problem is definitely one of superfluity of agricultural labour. This is the case, even after allowance is made for the character of the Indian seasons which favours a short period of intense activity at seed time and again at harvest, causing at these times a demand for agricultural labourers for whom, during the remainder of the year, there is little or no occupation on the land. The Famine Commission of 1880 observed that "the numbers who have no other employment than agriculture are greatly in excess of what is really required for the thorough cultivation of the land." Since that date, the population has increased considerably, especially in Madras and Bengal and to an appreciable extent also in Bihar and Orissa. Although, since the census of 1891, the first in which urban and rural population were distinguished, the urban population has shown the higher proportionate rate of increase, by far the greater number has been added to the rural population, as the following figures show.

	Census of 1891	Census of 1921	Increase	
			Actual	Per cent
Urban ..	20,391,000	25,044,000	4,653,000	22·8
Rural ..	200,782,000	221,959,000	21,177,000	10·5

It seems clear that the increase in the population and its distribution makes the observations of the Famine Commission even more pertinent to-day than when they were made in 1880.

ADVANTAGES OF MOBILITY OF LABOUR.

507. The labour problem is, therefore, from the agricultural point of view, a simple one: to lessen the pressure on the land, more especially the extreme pressure which at present exists in Bihar (particularly North Bihar), in the deltaic areas of Bengal and Madras and in certain parts of the United Provinces. Our examination of the present facts and of the probable future relations between industry and agriculture has not led us to expect that large scale industry will develop in these areas to an extent likely to relieve materially the pressure on the land by offering to agriculturists the alternative of permanent industrial employment. Some development of industries concerned with the primary processing of agricultural products may be expected but, for the most part, these will be seasonal in character and will, therefore, only afford part-time occupations for a small number of agriculturists. The essential condition for relieving pressure on the land is, therefore, in our opinion, mobility and the question arises how far the free movement of the population is impeded by government regulations, defective communications, or its own inertia. We propose to give a

brief account of these factors before considering what measures can be suggested for relieving pressure on the land.

LEGISLATION AGAINST MOVEMENT OF LABOUR.

508. The movement of labour between province and province in India is entirely unrestricted by Government with the single exception of the movement of labour from certain provinces to eight districts in Assam. Under the Assam Labour and Emigration Act No. VI of 1901, as amended by Assam Acts XI of 1908 and VIII of 1909, the provinces of Madras, Bengal, the United Provinces, Bihar and Orissa and the Central Provinces can regulate or prohibit the migration of labourers to the tea gardens in Assam, which are all situated within the limits of the eight districts mentioned above. The power of prohibition has been exercised in respect of five divisions and two districts of the United Provinces, containing a population of 22 millions or half the total population of the provinces. The density of population in four of these divisions exceeds 450 to the square mile. In such conditions, we are unable to find any justification for the existing prohibition and we recommend that it be withdrawn without delay.

Elsewhere, control is exercised over aided recruitment.* We are informed that the Government of India are investigating the method of control. We recognise that abuses would arise if all control were withdrawn and we content ourselves with endorsing the ideal which has been set forward that "the abolition of all restrictions on the movement of labour throughout India should be attained" as early as possible, and we recommend that, pending abolition, all restrictions should be reduced to the minimum.

Communications by road, rail and river, though they are capable of much improvement, are already sufficiently good to secure for labour full mobility over long distances. Travelling in India is cheap and labour moves with ease each year between North Bihar and Calcutta, Orissa and Calcutta, Bombay city and the rural districts, from the uplands of the Madras Presidency to the rice lands of the Kistna and Godavari deltas and, more permanently, between Madras and Burma, and from the Chota Nagpur plateau to the tea gardens of Assam and of the Bengal Duars. It is local rather than long distance communications which are lacking.

FACTORS LIMITING MOVEMENT OF LABOUR.

509. The fact remains, however, that permanent migration within India does not take place to anything like the degree which might have been expected, when regard is had to the considerable extent to which seasonal migration takes place and to the gravity of the congestion of the rural population in certain parts of the country, notably those which are within comparatively easy reach of the sparsely inhabited valleys of Assam. This inertia is due, we think, to the combination of several factors. The most important of these is the widespread possession of, or interest in, a piece of land. According to

* No impediment exists anywhere in India to a labourer migrating on his own initiative and at his own expense.

the census of 1921, the total number of actual cultivators throughout British India was 79,583,180. Of this number, some seventy-four per cent owned or hired some land, and only twenty-two per cent were returned as farm servants and field labourers, the remaining four per cent being rent receivers, managers and agents. The plot of land may only be an acre or two in extent, or the interest in its produce only a share of a few coconut trees or plantains, or it may, though of considerable extent, be situated in a precarious tract. In many cases, too, the hirer of land is subject to conditions which make his status approach much more closely to that of a labourer than an independent cultivator. Very frequently also, the holding is so small that the cultivator must supplement his income by working as a labourer. Nevertheless, with all these drawbacks, the average man will not give up a certain livelihood for the risks of pioneering in Assam or even of transferring his family from the Deccan to unoccupied tracts in Kanara or Khandesh in the same presidency.

Secondly, there is the factor of indebtedness. Most cultivators are tied to their village by their relations with the village moneylender and trader, who for obvious reasons puts every obstacle he can in the way of their emigrating. Lastly, there is the important factor of ill-health. A population which suffers extensively from such enfeebling diseases as chronic malaria and hookworm cannot be expected to display that energy which would accept, and triumph over, the risks incidental to the pioneer.

The problem of migration within India is a particularly difficult one. The different peoples of India vary much as regards their capacity to make good emigrants. It seems, unfortunately, generally to be the case that those who possess in an especial degree the qualities of enterprise and hardihood are not those who stand most in need of assistance. Those very qualities have enabled the men of the Punjab, the North-West Frontier Province, Gujarat and the Deccan in large part to solve their own problems without government assistance. The men of the Tamil-speaking districts of the south of the Madras Presidency have also shown capacity to help themselves by emigrating in large numbers to Ceylon and British Malaya, and similar enterprise has been shown by men of the Telugu and Oriya-speaking districts in the north of that presidency in emigrating to Lower Burma. The provinces which most require relief in this respect are Bengal, Bihar and Orissa and parts of the United Provinces. In certain areas, migration is impeded by malaria or lack of water. Such conditions should be investigated and improved and definite schemes of colonisation introduced. In this connection, an experiment in Burma is worthy of mention. Under the aegis of the Co-operative Department, colonies for Burmans from congested districts have been established in areas which have been disafforested or on waste lands coming under irrigation for the first time. These colonies have been formed on a co-operative basis and are financed through their societies by the ordinary *taccavi* loans advanced by Government. The method seems worthy of consideration by other provinces.

510. Finally, we propose to consider what possibilities there may be of relieving the pressure of population on the land by emigration abroad. According to the figures available, there are some 2,282,000 Indians resident outside India but within the bounds of the British Empire. They are distributed approximately as follows:—

POSSIBILITIES OF OVERSEAS EMIGRATION.

Ceylon	820,000
British Malaya	660,000
Mauritius	274,000
Union of South Africa	161,000
Trinidad	126,000
British Guiana	125,000
Fiji Islands	61,000
East Africa	55,000

The number of Indians who are living in foreign countries outside the Empire is very small. It is believed not to exceed 100,000 in all.

Since 1917, emigration abroad has been strictly controlled. In March of that year, under the Defence of India (Consolidation) Rules, emigration was temporarily stopped except under general or special license; and now, under the provisions of the Emigration Act of 1922, which is an Act of the central Legislature regulating the emigration overseas of all assisted * labour within the limits of the Indian Empire, emigration abroad of unskilled labour is permitted only to Ceylon and British Malaya. A scheme of emigration to British Guiana has been approved, but has not yet come into operation; the conditions imposed are more stringent than those imposed in the case of Ceylon and British Malaya and have proved too onerous from the point of view of employers of labour in that colony. Emigration of skilled labour is controlled by the local Government within whose jurisdiction the port of embarkation is situated. This, in practice, means the Government of Bombay who permit emigration only through specially authorised agents and on the terms and conditions of agreements approved by them which must be entered into between the employer and each individual emigrating. The amount of such emigration is negligible.

* Where a labourer is in a position to pay his own way, no impediment exists to his leaving India. But instances of such emigration, though they do occur, especially among the Punjabis and men of the North-West Frontier, are too few to produce any effect on the general situation in regard to emigration.

In view of these restrictions, emigration outside the limits of India has of recent years been unimportant as the following figures indicate:

Year	Ceylon			British Malaya		
	Arrivals	Departures	Net number remaining in Ceylon	Arrivals	Departures	Net number remaining in British Malaya
1922 ..	77,636	46,285	31,351	58,674	45,733	12,941
1923 ..	90,290	51,760	38,530	49,502	42,958	6,544
1924 ..	153,989	56,124	97,865	62,051	37,326	24,725
1925 ..	125,585	53,203	72,382	90,708	43,144	47,564
1926 ..	101,746	61,265	40,481	174,795	66,164	108,631
Total ..	549,246	268,637	280,609	435,730	235,325	200,405

Emigration to both these territories takes place practically entirely from the Madras Presidency. The net emigration of rather less than half a million in five years can have little direct effect on the labouring population of even the Madras Presidency. The indirect effects, on the other hand, are probably considerable, as the greater part of the emigrants come from one area—the Tamil-speaking districts on the east coast—and, as the late Sir George Paddison informed us, such of them as return bring back considerable savings and, what is even more important, new ideas and a higher standard of life. They also, during their period of absence, send considerable remittances to their homes.

We are well aware of the political difficulties which have occurred in recent years in regard to emigration and make dispassionate consideration of the matter from the point of view of the economic welfare of the population peculiarly hard of attainment Nevertheless, we feel that it is our duty to leave no possibility unexplored which might play a part, however small, in providing relief for congested areas, as the pressure on the land in these areas is already so serious that any increase of it must, in our opinion, be viewed with apprehension. Every possible avenue of escape to a better life should be thrown open freely to the labourer.*

We propose to confine our consideration of the possible outlets abroad for superfluous population to countries within the bounds of the British Empire and, further, to those areas which are situated within the tropical and sub-tropical zones. As regards Ceylon and British Malaya, we assume that, as emigration is freely permitted to these countries, the present annual amount of emigration satisfies the economic demand and cannot be advantageously increased; that is to say, that these countries will provide annually an outlet for not more than 140,000 persons.

* With regard to overseas emigration of Indian labour, Mr. Kamat wishes to make it clear that he strongly holds that, although every avenue of escape to a better life from the economic standpoint must be thrown open freely to the Indian labourer, as suggested by his colleagues, it should be clearly understood that every such avenue of emigration must be closely watched and emigration thereto controlled by the Government of India under the provisions of the Emigration Act, in view of the illiteracy of the emigrants and their ignorance regarding the general conditions of life and the treatment of Indians abroad.

Indeed, as regards Ceylon, a recent Madras Resolution (No. 1116, dated 17th May 1927) observes that "the gradual decrease (of emigration) seems to bear out the opinion of the Agent to the Government of India in Ceylon that Ceylon is slowly reaching saturation point in absorbing Indian labour on the estates."

Apart from Ceylon and British Malaya, the other areas which would seem to offer opportunities for Indian emigration are the British West Indies, *i.e.*, Trinidad and Jamaica, Mauritius, the Fiji Islands and British Guiana. The capacity of the West Indies and the Fiji Islands to absorb more Indian labour cannot, having regard to their total area and the number of the existing population, be large, while the result of a recent enquiry into conditions in Mauritius appears to indicate that that island is not at present ready to absorb further immigrants. The prospect, therefore, of any considerable emigration would appear to be confined to British Guiana. The room for the expansion of cultivation in that country is admittedly great. Out of a total area of 89,480 square miles, only 219 square miles are at present cultivated, and the present population numbers only 304,000 of whom, as we have seen, about 125,000 are immigrants from India. The total cultivable area has not yet been ascertained, but it is known that, in the strip between the sea and the mountains, about 300 miles in length and from 25 to 30 miles in breadth, there are some 3,000,000 acres of cultivable land. This land is generally suitable for growing sugarcane, cocoa, coffee and rice. We notice that Sir Cecil Rodwell, the Governor of British Guiana, speaking recently at the Royal Colonial Institute, estimated that the colony was capable of carrying a population of approximately 3,000,000. He also considered that the only source from which population could be drawn was India. As we have already stated, a scheme has been approved for Indian immigration into the colony, but has not yet been brought into operation because the terms are considered unremunerative by the planters. This scheme appears to us to be worthy of further exhaustive investigation, for the possibility of doubling the Indian population resident abroad is not to be lightly disregarded.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

511. The conclusions and recommendations in this chapter may be summarised as follows:—

(1) Industries located in rural areas are at present unimportant from the point of view of their demand on labour (paragraph 487).

(2) The multiplication of industries of the ordinary commercial type, such as cotton ginneries, rice mills and sugar refineries, supplies one solution of the problem of spare-time employment in rural areas (paragraph 490).

(3) Of the suggestions made for the establishment of new industries, that of an increase in the number of implement firms throughout the country seems to offer, on the whole, considerable promise (paragraph 491).

(4) While the establishment of such implement firms must be left to private enterprise, Government can render valuable assistance in training staff (paragraph 491).

(5) Government can help to train the more progressive artisans to manage and repair improved types of machinery (paragraph 494).

(6) If the use of artificial silk continues to increase at the present rate, there is a serious risk that the demand for the natural article will begin to weaken (paragraph 496).

(7) There are opportunities for the development of a poultry industry which Government can further, principally by a carefully planned programme of experiments and a careful recording of the results (paragraph 497).

(8) (*i*) Government should try to bring together the various interests concerned in the production and sale of lac, with a view to forming a Committee on the lines of the Indian Central Cotton Committee. For this purpose the existing Indian Lac Association should be reconstituted and strengthened;

(*ii*) Research should be undertaken with the object of securing a regular output of good quality lac;

(*iii*) An enquiry should be made into the economics of the production of lac (paragraphs 498 and 499).

(9) The stimulus of new ideas, adequate instruction and the best advice obtainable on the commercial side are the chief needs of village industries (paragraph 500).

(10) The opportunities for improving the condition of the general mass of cultivators by the establishment of rural industries are strictly limited (paragraph 500).

(11) As a general principle, it may be laid down that the chief solution of the problems of the cultivator is intensification or diversification of his agriculture (paragraph 500).

(12) The question of organising village artisans on a co-operative basis should receive the attention of both the departments of co-operation and industries in every province. Government might in special cases make advances to artisan co-operative societies for the purchase of improved machinery (paragraph 501).

(13) There are indications that, as industrialism spreads, the tendency will be to multiply the number of small factories. This tendency will be to the cultivator's advantage (paragraph 503).

(14) The co-operative movement can play an important part in linking up the cultivator and the cultivator's produce with these localised factories (paragraph 503).

(15) Technical education and co-operative organisation are the only means by which the smaller industries can hold their own in the intensive competition of modern times (paragraph 504).

(16) Government may do much to assist the mutual adjustment between the larger industries and agriculture by its policy in respect to communications and the development of power; by technical education; and by the collection of marketing information (paragraph 504).

(17) In the case of the smaller industries, Government will have to be prepared, for a long time to come, to advise and make suggestions for development (paragraph 504).

(18) When a new industry is being started, Government may have to make itself responsible for it in its pioneer stage (paragraph 504).

(19) The Director of Industries should be an experienced administrator (paragraph 505).

(20) The labour problem is to-day the same from the agricultural point of view as it was when the Famine Commission reported in 1880, *viz.*, to lessen the pressure of population on the land (paragraph 506).

(21) All restrictions on the free movement of labour in India should be reduced to the minimum, and should be abolished as soon as possible (paragraph 509).

(22) To encourage migration, health conditions should be improved in certain areas and definite schemes of colonisation must be introduced. The method adopted in Burma of establishing colonies under the aegis of the Co-operative Department is worthy of consideration by other provinces (paragraph 509).

(23) Consideration of the possibilities of emigration abroad is confined to the tropical and sub-tropical parts of the British Empire (paragraph 510).

(24) Apart from Ceylon and British Malaya, British Guiana alone offers scope for emigration on any considerable scale and the scheme now under consideration for promoting emigration to that colony is worthy of further exhaustive investigation (paragraph 510).

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CHAPTER XVII

HORTICULTURE AND PLANTATIONS

INTRODUCTORY.

512. In view of the fact that the overwhelming majority of the people of India depend chiefly, if not entirely, on a vegetarian diet, the cultivation of fruit and vegetables possesses much importance. In one form or another, vegetables appear almost daily in the Indian home, and fruit is a popular addition wherever it can be obtained free or at small cost. The area returned as uncultivated is an important source of wild fruits and berries; the edges of fields and of irrigation channels are frequently used for growing vegetables for household use, and, wherever there is a well or other assured supply of water, it is usual to find a small plot given up to growing vegetables. The recorded figures of area ignore these sources and refer rather to production for sale than to the supply of the household, and yet innumerable cultivators possess small plots for the needs of the family and it is not possible to estimate the total area of land so employed

No accurate estimate can be framed of the proportion of the total produce which is consumed outside the producer's home; it varies with the particular item; but the chief consumer is either the producer or his immediate neighbour. This chapter is, in the main, concerned with the prospects of improving the crops grown for the market We assume that the relatively small number of market growers could be much more easily influenced by the advice and guidance of agricultural departments than could the growers for family consumption and that any improvements effected by the former would influence the cultivation of fruit and vegetables by the latter. For these reasons we consider that, in the ordered development of horticulture, attention should first be given to the cultivators growing for the market

It is of importance to note that, in spite of the almost universal consumption of spices and condiments, of dried and fresh fruits, and of vegetables, very little appears to have been done in any systematic manner to improve the quality of indigenous plants by selection, crossing and cultivation. On the other hand, the introduction of varieties from overseas has yielded results of great value and importance, and some of these exotics, such as the potato, tomato, cauliflower and Jaffa orange are now found over a large area, especially in the north.

The chief essentials for intensive cultivation are a rich deep soil, plenty of manure and an assured and controlled water supply. The most perishable products are, of course, grown near the chief markets and so the main areas of fruit and vegetable production are in the immediate vicinity of the cities and large towns. The more hardy fruits, such as the mango, date, wild apricot and *ber* are found growing over a wider area; others again, such as the apple and peach

require special localities, while in the case of some fruits, such as cherries and raspberries, the conditions necessary for their successful cultivation are found so far away from transport facilities as to preclude their production on an economic scale.

SCOPE OF THE CHAPTER.

513. The cultivation of fruit and vegetables for the market has, as yet, been but little developed in India. Out of 256,991,000 acres cropped in 1925-26 in British India, 5,173,000 acres were returned as under fruit and vegetables, including root crops, and 1,369,000 acres under condiments and spices, of which chillies constitute by far the largest element. The total area under fruit and garden crops which thus amounted to a total of 6,542,000 acres, has remained practically stationary for a number of years. In 1920-21, the acreage was 6,506,000 and in 1913-14, 6,400,000. But if horticulture can, on its present acreage, claim but a small share of importance in a general review of cultivation, it, nevertheless, possesses great possibilities for the future. If the demand for fruit and vegetables could be stimulated and adequate transportation and marketing facilities were available, there is no reason why the production of these commodities by intensive methods should not be undertaken by an increasing number of cultivators. All experience suggests that, where favourable markets can be developed, the substitution, in part or in whole, of horticultural crops for the existing field crops would materially advance the prosperity of the cultivator. Such a change would have other beneficial effects. It would necessitate in most parts of the country a development of well irrigation, it would promote the use of municipal and village sewage as manure, and, ultimately, it might well lead to the multiplication of factories for processing surplus produce, and so to the provision of alternative occupations for the rural population.

We propose in this chapter to consider the prospects of horticultural development and the ways in which Government can best assist that development. We propose also to review, briefly, the position of plantations and the planting community in India.

FRUIT CULTURE. (i) PRODUCTION.

514. India possesses such a wide range of climate and soils, that there is no fruit of the temperate, sub-tropical or tropical zones which cannot be grown.

In the course of our enquiry, many witnesses, both official and non-official, referred to the potentialities of fruit production but, outside the North-West Frontier Province, only one witness from the Punjab spoke from actual experience of it as a means of livelihood. We are aware that there are areas where the income of a number of cultivators is derived mainly from fruit—notably round Peshawar in the North-West Frontier Province and Quetta in Baluchistan, in the Kangra and Kulu valleys of the Punjab, in the Kumaon Hills in the United Provinces, in those parts of the Central Provinces and Assam in which oranges and other citrus fruits are extensively grown, and in the Konkan district of Bombay from which mangoes are largely exported. But even in these natural fruit growing districts, there is as yet no widespread cultivation of fruit on scientific lines. In other areas, where various commercial fruits would undoubtedly do well, such as the Nilgiri and Anamalai Hills in Madras

and parts of the Deccan, little or no cultivation of fruit for the market is attempted. Lack of any tradition of horticulture amongst ordinary cultivators, the amount of capital and the length of time required to bring the crop to bearing, coupled with the lack of expert advice and the difficulty of obtaining satisfactory varieties of proved suitability to local conditions, are amongst the factors which tend to check the spread of fruit culture and market gardening. The extent to which the absence of transport facilities to markets, both internal and external, and the difficulties which attend the marketing of perishable produce hinder the expansion of fruit-growing as an industry are dealt with later.

While there can be no question that there is much scope for the small cultivator who endeavours to supplement his income by growing cheap and hardy fruit for local sale, there are serious obstacles to be overcome by the grower who proposes to specialise in fruit-growing for the larger and more fastidious urban markets. The amount of capital required has already been mentioned and this is, perhaps, the greatest single obstacle, especially as it appears from the information given to us that, in order to be successful, the small cultivator must rely on his orchard, once it has come into bearing, as his main source of income. In addition, the ordinary cultivator lacks the skill required in selecting varieties, planting, pruning and spraying which the successful production of high grade fruit for the market demands. Moreover, he does not, as a rule, live on his holding and the protection of small areas of fruit would be difficult even where the holding was in one compact block and quite impracticable if, as is so frequently the case, it consisted of a number of separate plots. The conditions, therefore, for the successful production of fruit for the market are that the grower, in addition to the possession of capital and acquired skill in the management of fruit trees, should have his holding in a compact block and be prepared to live on it in order to protect his crop during the ripening season. Further, supplies of water and manure must be readily available and a connection with a satisfactory market must be established.

These considerations for the most part apply with equal force both to the man of small means who is contemplating the purchase or renting of land with a view to fruit or vegetable growing, and to the established small holder who decides to turn from ordinary tillage to the intensive cultivation of orchard or garden crops.

On the assumption that a small market grower possesses a holding of from three to six acres, it may be estimated that not more than two-thirds of this area would be under fruit trees. The balance, held in reserve for new plantations, would be used for growing vegetables and other food crops. The immediate planting of even two to four acres would involve the possession of more capital than the grower is likely to possess. A small part of the necessary capital might be borrowed; but, in our view, the beginner should limit his borrowing. The difficulties presented both by lack of capital and want of experience should be surmounted by planting up this fruit area gradually. In the meantime, and until the fruit trees come into bearing, the market gardener must earn a livelihood by growing other crops on his spare land. Some of

the agricultural departments are already in a position to offer facilities for instruction and expert advice, but local experience of the industry and facilities for transport and marketing would have to be developed to a greater extent than they are at present before the capital required for the general development of a tract for fruit-growing could be lent by co-operative societies to small cultivators without undue risk of failure. Although, as we have noted, all the fruits of the temperate, sub-tropical and tropical zones can be grown in one part or another of India, yet there is one limitation which the commercial grower would have to observe; in the case of certain fruits such as grapes, peaches, figs and plums, he must select those varieties which ripen before the monsoon breaks in his locality. Dates cannot be grown at all except in regions of very light rainfall.

(*ii*) TRANSPORT.

515. It is to the larger urban centres that the commercial fruit grower has, in the main, to look for a market for his produce. The difficulties arising from transport to these centres are undoubtedly very serious, especially in the case of such varieties of the more perishable fruits as can only be grown in certain localities far away from these centres. The difficulties arise chiefly before the rail-head is reached. Some of the best natural fruit areas are in the valleys of the Himalayas and in the hill country of Assam. In many of these areas, roads either do not exist or are so bad as to lead to delays, high transport charges and damage to produce which render the trade unprofitable. The alternatives of pack transport or porterage are slow and expensive and are ill-suited to the carrying of perishable produce. Even in localities which are much closer to urban markets, difficulties in obtaining adequate transport were advanced in evidence before us as a reason for not growing fruits for which the soil and climate were well suited. Where these difficulties obtain, greater attention to picking and packing would undoubtedly do much to lessen losses from bruising or rotting in transit. We have already pointed out in our chapter on Communications and Marketing, paragraph 345, the importance of suitable containers as an element in the successful marketing of both fruit and vegetables.

Once the rail-head is reached, transport presents less difficulty. It has been proved that even such a perishable fruit as the peach, if properly packed and not disturbed *en route*, can be safely sent by ordinary passenger train from the North-West Frontier Province to Calcutta and Bombay. As stated in Chapter XI, paragraph 314, ice-cooled vans for the carriage of the more delicate kinds of fruits have already been brought into use, chiefly on the North-Western Railway. We have given, in the same paragraph, our conclusions regarding the further development of cold storage facilities on the railways for perishable agricultural produce.

It appears from the report of the committee appointed in 1925 to investigate the conditions of the mango industry in the Konkan that improvements are required in the arrangements for loading, transport, and unloading of fruit conveyed by coastal shipping.

(iii) Marketing.

516. The marketing of fruit falls into two main divisions; that of fresh, and that of dried and preserved, fruit.

As we have mentioned, it is only those orchardists whose land is near the larger centres of population, who find any local demand for fresh fruit. The producer, even when he is a small man, seldom does his own marketing. He either sells his crop on the trees to a local man who has established business relations with firms in Simla, Calcutta, Bombay, or other large centres of population, or he consigns the fruit to a commission agent in those centres. We were informed that the former is the usual procedure in the North-West Frontier Province. Where it is followed, the cultivator at least knows with whom he is dealing. Business relations between the local buyer and the firm which sells to the consumer are said to be good. In the Konkan, however, where this system is in force, the relations between the local buyer of the crop and his agents in Bombay are not so satisfactory. Nor, to judge from the evidence before us, does a grower who consigns direct to a commission agent commonly obtain a price satisfactory to himself. The agent has his difficulties; he is dealing with a perishable commodity; cold storage facilities at both Calcutta and Bombay are very limited and do not exist at all elsewhere; gluts are of frequent occurrence and prices are chaotic. When the wholesale trade is in the hands of a small number of middlemen operating at a distance from the place of production, and when the grower is commonly without alternative markets, the margins of profit exacted by intermediaries are apt to be wider than are justified by the services they render.

The establishment of retail shops, wherever a demand for fruit exists, by the upcountry grower or the local purchaser of the crop, direct sale to hotels, clubs and institutions, and to private clients, co-operative collection and sale, may provide satisfactory markets in particular cases. Any important increase in the general internal demand for fresh fruit and vegetables would no doubt lead to a development of marketing facilities on the lines of those existing for other sorts of produce. Regulated markets such as we recommend in paragraph 329, Chapter XI, when these are situated in areas in which fruit is grown to meet a local demand, should prove of much benefit to the wholesale vendor. The provincial marketing officers whose appointment is also recommended in that chapter should be able to advise as to the most suitable localities for the establishment of such markets for both fruit and vegetables. They should also be able to advise on the prospects of developing an export trade in fresh fruit and as to grading and packing. The development of such a trade would necessitate provision of cold storage on steamers and it would not be possible to arrange for this unless there was a reasonable assurance of a steady trade bringing in a profitable return. The more immediate hope of expansion would, therefore, seem to lie in the home markets, combined with the exploration of the demand in markets abroad for specially choice fruits, such as mangoes of good quality.

In these circumstances, it appears to us that the development of horticulture in India must in the main rest upon the internal demand for fresh produce. But, wherever fruit is grown on a commercial scale for marketing in its fresh state, there is always the risk that abnormally heavy crops

may glut the market and leave the grower with unsalable produce. Facilities for the disposal of fruit surplus to the demand for fresh produce and domestic requirements thus become of great importance in the production of fruit on a commercial scale. For this purpose, a market among consumers in India generally is required. The demand from those who have adopted a western style of living must for long be comparatively small and the keen competition of well-known brands of imported preserved fruits and jams will have to be overcome. It will, therefore, be necessary to study the tastes of the mass of consumers in India and it is probable that the readiest means of dealing with surplus produce would be the drying of fruits suitable for this treatment. There is already a large home trade in dried fruit and the import into the country is also considerable. The climate of most parts of India is obviously very suitable for this method of preserving fruit which is, indeed, indigenous to the East.

We desire to make it clear that we are not here referring to the drying, and the preservation generally, of fruit in the home, but to the prospects of finding an extensive market which would justify the adoption of preserving processes on a commercial scale. The demand for local domestic needs is too small, too uncertain, and too scattered to absorb a surplus of fruit from commercial orchards. It is only when it proves possible by means of factory industries to cater for popular needs formerly satisfied by home-made preserves that the surplus of a fruit industry can be satisfactorily dealt with.

Although, at the present time, the market in India for jams and preserved fruits, prepared to suit those who have adopted a western style of living, is very restricted, we think that it would be worth while to try to meet the demands of this market also, as it is one which, taking the country as a whole, should show steady expansion. An attempt might also be made to place such products on the foreign market. For both purposes, it would seem desirable to make a trial on a moderate scale with a product such as mango pulp ; the mango is one of the most widely distributed fruits ; there are already three factories in existence in one of the principal centres of production, the Konkan ; it is an article for which the Bombay Mango Marketing Committee of 1925 considered there was likely to be a great demand in almost all the principal towns of India ; and finally, and most important, there is already a small export of mango pulp to Europe and America. It is clear from the Committee's report, however, that great improvements in technique are required before the canning business can be placed on a sound footing and we recommend the suggestions made by the Committee to the careful consideration of local governments. These recommendations have a wider application than to the Bombay Presidency and to the mango, and we recommend that all local governments should make themselves familiar with their terms.

The best advertisement for Indian jams and preserved fruits will be the development, on a considerable scale, of one or two special lines rather than a number of small attempts. The Government of India are fully alive to the opportunities afforded by European commercial fairs and exhibitions Indian products, including foodstuffs, were exhibited at

the British Industries Fair held in London in February and March last and at the Fair held in France at Lyons immediately afterwards. An exhibition at the Budapest Industrial Exhibition to be held at the end of April and early in May is also being arranged.

The potential demand of the home market is, however, so much greater than any development of export trade conceivable in the near future, that we consider it would be wise if the main efforts of government officers were directed towards opening up the home market. The demand for fruit comes from the comparatively well-to-do classes and it is, therefore, specially important that the fresh fruit should be of good and uniform quality and that the dried fruits, preserves and jams should be sent out in good containers of attractive design. For it will become increasingly possible, for those who are able to pay, to obtain fresh fruit from Australia and America and the home preserved fruit industry will have to meet an established import of high grade products. It is necessary, therefore, that the home product should be able to undersell the imported product and yet be of high quality. In order to permit of this, the establishment of comparatively large factories would seem to be required. For this, substantial capital and skilled organisation on the manufacturing side and also on that of salesmanship will be essential.

A Fruit Preserving Institute started by the Madras Government at Conoor in the Nilgiris, after a chequered career, was closed in 1925. It is true that the products made at this institute were mainly jams and jellies and thus the available market was a limited one. But its history shows how essential it is that all ventures in regard to fruit preservation should only be embarked upon after the carrying out of most thorough and comprehensive surveys, technical and commercial. The choice of site will be important, and one accessible to supplies from both the hills and the plains should offer advantages in cheapness of production.

VEGETABLES.

517. The evidence we received showed that there is undoubtedly an increasing demand for high class vegetables in the large cities and towns and that a man with land in their vicinity who has capital at his back and is possessed of business capacity can make large profits. A witness from the Punjab stated that he was able to realise about Rs. 35,000 in one year from the sale of vegetables grown on a sullage farm close to Rawalpindi, the net cultivated area of which was sixteen acres. Another witness from the Burdwan district of Bengal, who had a holding of fifty acres, stated that he and his fellow cultivators had begun to grow such European vegetables as cauliflowers and cabbages. They were also growing potatoes which were displacing pulses. The information before us is not sufficient to enable us to decide how far instances of this kind may be regarded as typical, but they suggest that the provincial marketing officers should make it their duty to ascertain what the possibilities of a substantial expansion of the existing vegetable production are, and, also, whether there are any openings for preserved vegetables for consumption in this country or for export. We consider investigations into the possibilities of home markets to be especially important because vegetables, to a much greater extent than fruit, may be regarded as having

a potential market among the bulk of the population and, in these circumstances, the prospects of market gardening are more hopeful than those of fruit culture.

As in the case of fruit, transport is an obstacle to the extension of the growing of vegetables for marketing in a fresh state. Existing areas of vegetable production are either close to the big cities and towns, or have a good railway connection with them. Market gardens round Poona, for instance, supply Bombay. From stations on the East Indian Railway along the Ganges bank in Bihar, large quantities of market garden produce are despatched to the Calcutta market 400 miles away.

As we have suggested in paragraph 516, where vegetables and fruit are grown on a large scale, the question of establishing regulated markets and of improving marketing conditions generally, including transport and the provision of cold storage, should be examined.

THE AGRICULTURAL DEPARTMENTS AND HORTICULTURE.

518. Long before the present agricultural departments came into existence, horticultural societies and Government gardens in various parts of India were doing valuable work on fruit, vegetables and flowers both in experimenting with the acclimatisation of exotics and in improving indigenous varieties. The agricultural departments themselves have not hitherto done much work on either fruit or vegetables. An exception to this general statement is the special attention which has been paid for a number of years to the production of improved varieties of fruit at Tarnab farm by the Agricultural Officer of the North-West Frontier Province, the work of Mr. and Mrs. Howard at Quetta and the improvements effected by several agricultural departments in the cultivation of the potato.

We found, however, in the course of our enquiry, full recognition by the directors of agriculture of the potential importance of fruit and vegetable production. The Punjab Government have now two fruit specialists at work and intend to appoint a vegetable specialist in 1929. Horticulture in the United Provinces has been in charge of a deputy director since 1922 and training in horticulture is to be given at the Cawnpore Agricultural College. Much valuable horticultural work has been accomplished in the government gardens at Saharanpur and elsewhere. The garden at Saharanpur dates back to the early years of the nineteenth century. These gardens have been instrumental in introducing apples, pears, peaches and the potato industry into the Kumaon hills and have distributed improved varieties of many fruit trees and vegetables on an extensive scale throughout the province. In Bihar and Orissa, where work on the improvement of vegetables is specially important in view of the large amount of produce grown for the supply of the Calcutta market, special attention is being devoted to them at the Sabour farm by the botanical section. Bengal proposes to appoint a horticulturist as soon as funds are available. It is proposed to strengthen the horticultural section of the Central Provinces Agricultural Department, as soon as possible, by the appointment of a special officer to replace the officer who was brought under reduction as a measure of

retrenchment in 1923. Madras already has a horticulturist and stations in the Nilgiris. In Assam, the Agricultural Department is devoting such attention as its limited resources permit to promoting the supply of improved varieties of fruit and vegetables to the public. In Burma, horticulture is receiving attention on five farms. At the Hmawbi farm near Rangoon, an area of thirty acres is devoted to it and classes in horticulture are being arranged. In the grounds of the Poona Agricultural College, an area has been set aside for the experimental cultivation of fruit and the horticulturist is teaching inexpensive methods of drying fruit and making chutneys and jams. Methods of preserving fruit and vegetables inexpensively, and at the same time efficiently and in an attractive manner, would form an admirable subject for a short course at agricultural colleges.

We have thought it desirable to set out, in some detail, the attitude of the agricultural departments towards horticulture, as we observed a tendency in some witnesses to criticise the departments for lack of interest in this subject. We consider that the departments are now fully alive to the possibilities of horticulture.

There is, however, much important research work to be done, notably in selecting and classifying suitable root stocks. The aggregate number of fruit trees in the country is very large and an improvement in quality alone, quite apart from an increase in number, would confer great benefits on the people. In this connection, it may be mentioned that wild olives are common all over the north-west of India and that experimental grafting on to their stocks of Italian and Spanish cultivated varieties has proved successful. But, as we indicate in the succeeding paragraph, even more urgent than the need for research is the need to ascertain what the economic possibilities of increased fruit and vegetable production may be in order that the agricultural departments may know to what extent the development of their horticultural sections is justified in the interest of the small cultivator.

519. Owing to the difficulties described in the preceding paragraphs, we consider that investigations into transport and markets must form an essential part of any policy of active encouragement of either fruit or vegetable production and we suggest that the provincial marketing officers should undertake these. In making them, regard should be had to any expedients for stimulating demand which may suggest themselves as practicable for Government to employ. It is particularly important, for the reasons we have already given, that the possibilities of the home market for preserved and dried fruits and vegetables should be explored.

General conclusions.

If these investigations show that there is scope for development, there is, we think, a great opportunity for the larger landholders to popularise the growing of both fruit and vegetables. As one witness put it to us "Every gentleman should make it a principle to grow his own fruit and vegetables" and, we would add, to show his smaller neighbours how to dispose profitably of a surplus.

While the economic possibilities of increased production are thus being worked out, we suggest that the agricultural departments should conduct

experiments designed to ascertain the varieties of fruit and vegetables best suited to the various conditions of soil and climate. The information so obtained should be recorded in a form which will enable those intending to start fruit and vegetable production to profit by it. Should it become evident that there will be a large demand for young fruit trees and for seeds of improved varieties of vegetables, the agricultural departments should take steps to ensure that reliable stocks are obtainable by the public. Selection is especially necessary in the case of fruit trees. At present, too many indifferent varieties of each species are grown. The possibilities of introducing profitable exotics should also repay investigation.

Nurserymen and seedsmen are making their appearance in India, but, as a class, they are not, as yet, fitted to make their own selections of fruit trees and vegetable seeds. The agricultural departments should use every means in their power to encourage and strengthen private enterprise in this direction.

PLANTATIONS: GENERAL.

520. A chapter on specialised agriculture would not be complete without some reference to the crops grown by the planting community. The three main planters' crops are tea, coffee and rubber but sugarcane is important in Bihar as are spices in the south of India. The area under indigo in Bihar, where it was formerly the principal planters' crop, is now negligible. The total area under tea, coffee, rubber and indigo, in 1925-26, was 1,169,000 acres of which 982,000 acres were in British India. The area under spices is not recorded separately. A little cinchona is also grown by planters. The value of their crops is out of all proportion to their acreage. In 1926-27, the value of the total exports, including spices, amounted to Rs. 34·59 crores or about 18 per cent of the value of all agricultural products exported. By far the greater part of this was accounted for by tea, the value of the exports of which amounted to Rs. 29·06 crores. The principal spices are pepper, chillies, ginger, cardamoms and arecanuts. There is also a small production of cinnamon, nutmeg, and cloves. With the exception of chillies, which are grown extensively in various parts of India as an ordinary garden crop, spices require for the most part a moist climate and some of them a considerable elevation. These conditions are found most extensively in the Madras Presidency; there are numerous plantations maintained both by Europeans and Indians along the Malabar coast and on the Anamalai and Nilgiri Hills; and the production and marketing of tea, coffee and spices form an important element in the agriculture and trade of that province.

THE IMPORTANCE OF PLANTATIONS TO INDIA.

521. From the outset of our enquiry, we have recognised the important place which plantations occupy in the general and agricultural economy of the country. We heard evidence from the two principal associations of planters and merchants, namely, the Indian Tea Association in Calcutta and the United Planters' Association of Southern India, and also inspected the experimental station of the Indian Tea Association at Toklai during our visit to Assam. Both associations maintain close relations with the Imperial and provincial agricultural departments and expressed

themselves as satisfied with the assistance they receive from them. Until 1924, indeed, the planting community in south India depended entirely on the Madras Agricultural Department for scientific supervision and advice. The planting districts in south India constituted the separate charge of a deputy director of agriculture under the Director of Agriculture, Madras. The United Planters' Association has now its own scientific organisation to the cost of which the Government of Madras and the administration of Coorg contribute. The scientific work done by the two associations is valuable both in itself and as an example of what organised private effort can accomplish. We consider it desirable that its importance should be recognised, and the continuance of the co-operation between the agricultural departments and the scientific officers of the associations secured, by the representation of the latter on the Council of Agricultural Research. The nomination of a scientific representative of the associations on the Council might be made by the two associations jointly.

The ranks of the planting community have been increasingly filled, of recent years, by Indians of standing and we think that this is a career which young Indians, with capital at their command and possessed of the requisite scientific and business knowledge, would do well to consider. Except in Bihar and Orissa, plantations are generally situated in remote districts of India and, in addition to the economic benefit they confer on the community generally by the introduction of valuable crops, their presence is in many ways, direct and indirect, of great service to the population in their vicinity. Communications are improved, local agricultural practice is favourably influenced by a good example, the wages paid to labour raise the general standard of living in the district, and, in many instances, educational and medical facilities are provided. Further, when, as is often the case, local labour is insufficient to meet requirements, plantations play a part in relieving congestion in distant areas by the immigrant labour which they attract. Owing partly to their remote situation and partly to the fact that Indian interests have not in the past been largely associated with the planting industry, the benefit which India owes to the planting community has not, we think, been adequately realised by the general public.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

522. The conclusions and recommendations in this chapter may be summarised as follows:—

(1) The evidence received suggests that fruit growing can seldom be profitably combined with ordinary cultivation by the small cultivator (paragraph 514).

(2) The small cultivator is faced with serious financial and other difficulties in turning from ordinary tillage to the intensive cultivation of orchard and garden crops (paragraph 514).

(3) Difficulties in regard to the transport of fruit, especially before rail-head is reached, are serious (paragraph 515).

(4) More careful picking and packing and the use of suitable containers would reduce losses in transit (paragraph 515).

(5) Suitable marketing arrangements are generally lacking (paragraph 516).

(6) The possibilities of developing an export trade deserve investigation (paragraph 516).

(7) Where vegetables and fruit are grown on a large scale, the question of establishing regulated markets and of improving marketing conditions generally, including transport and the provision of cold storage, should be examined (paragraph 517).

(8) The development of both the fruit and vegetable industries on a large scale is dependent on the development of the home market and on the existence of a demand for fruit and vegetables in a preserved form (paragraphs 516 and 517).

(9) There is much important work to be done by the agricultural departments, notably in selecting and classifying suitable root stocks (paragraph 518).

(10) In view of the transport and marketing difficulties enumerated above, investigations into transport and marketing should form an essential part of any policy of active encouragement of either fruit or vegetable production (paragraph 519).

(11) The provincial marketing officers, whose appointment has been recommended, should undertake these investigations (paragraph 519).

(12) If these investigations show that there is scope for development, the larger landholders have a great opportunity to popularise the growing of fruit and vegetables (paragraph 519).

(13) While the economic possibilities are being worked out, the agricultural departments can usefully undertake experimental work (paragraph 519).

(14) The information obtained by the marketing officers and by the agricultural departments should be recorded in a form which will enable those intending to start fruit and vegetable production to profit by it (paragraph 519).

(15) Agricultural departments should encourage and strengthen private enterprise in establishing nurseries for orchard stock and the production of vegetable seeds (paragraph 519).

(16) The importance to the community of the 'planters' crops is not generally realised (paragraph 521).

(17) The value of the scientific work done by the Indian Tea Association and the United Planters' Association of Southern India should be recognised, and co-operation between these associations and the agricultural departments secured, by arrangements for their joint representation on the Council of Agricultural Research (paragraph 521).

CHAPTER XVIII

STATISTICS

SCOPE OF THE CHAPTER.

523. We propose to consider, in this chapter, statistics relating to cultivation and crops; such trade statistics as have an immediate bearing on agricultural production; statistics relating to livestock and implements; vital statistics, and the statistics necessary to an accurate presentment of subjects relating to rural welfare.

HISTORICAL.

524. The Indian Famine Commission of 1880 in their Report dealt at some length with agricultural statistics, and showed what amount of information could at the time be collected from the existing data, and what were the defects in the data and in the method of preparing them; they then proceeded to recommend the appointment of a Director of Agriculture in each province who would directly control the special statistical officers (whose appointment was also recommended) and would be the adviser to Government in all matters relating to agriculture and statistics. It would be his duty to warn Government of the agricultural outlook and to prepare forecasts for its guidance. They further reviewed the existing system of statistics in some detail and made recommendations for improvement. Their Report may be regarded as the starting point of the present agricultural statistics in India. It was dealt with in a despatch from the Secretary of State in 1882. A statistical conference was convened by the Government of India in the following year, as a result of which it was decided to combine the information collected by the provinces into all-India returns, and the compilation of these returns began in 1884. Statistical information of much the same character as is collected to-day had, indeed, been recorded since 1866 by the provinces separately and published by them in provincial land revenue returns and administration reports, but it was clear that for the purposes of a general statistical account of the whole of India, greater uniformity in the methods adopted by the provinces and a higher standard of accuracy were required. The problems involved in securing uniformity in the returns from the different provinces were serious. Then, as now, the only primary collecting agency was the subordinate staff of the provincial revenue departments. The revenue systems in the provinces are not, however, themselves uniform and the requirements of statistics have had to be subordinated to administrative considerations. Although much progress towards uniformity has been achieved, the accuracy and completeness of the statistics are still influenced by administrative considerations. The defects in the statistical information available for the greater part of Bengal and Bihar and Orissa, where the land revenue has been permanently fixed, are very largely due to the fact that, no regular village staff is maintained in such tracts. Further, the area of land cultivated by

each individual, as distinct from the size of the unit for payment of land revenue, and the amount of his indebtedness, are both subjects of much importance from the point of view of rural welfare. Although information on both points exists in numerous settlement reports, it has not been periodically collected in statistical form. The statistics are, in short, a compromise between what is ideally desirable and what is actually obtainable.

At first, the duty of compiling and publishing agricultural statistics was entrusted to the Department of Revenue and Agriculture of the Government of India. In 1895, a statistical bureau was established to deal with the statistical work of the departments generally. In 1905, this bureau was merged in the new Commercial Intelligence Department. A separate Department of Statistics was created in 1914 but the independence then achieved was lost in 1922 when the department was again amalgamated with the Commercial Intelligence Department.

PUBLICATIONS.

525. It will be convenient at this stage to give a list of the statistical publications of the Government of India dealing with :—

(*a*) cultivation and crops ;
(*b*) livestock and implements ;
(*c*) vital statistics ; and
(*d*) economic data.

The *Agricultural Statistics of India* are published annually in two volumes, the first of which relates to British India and the second to certain Indian States. For each province or State figures are given of the total area, classified as cultivated (area sown and current fallows), uncultivated (culturable waste and area not available for cultivation) and forests ; the area and crops irrigated ; the total area under crops and under each important crop ; the numbers of livestock, ploughs and carts ; the incidence of the land revenue assessment ; the harvest prices of certain important crops ; and the average yield of the principal crops in each province. We consider that the date of publication of these volumes might be expedited with advantage. At present, an interval of at least eighteen months elapses between the end of the agricultural year (June) and publication. Up till 1920-21, the figures in the Tables in these volumes were given separately for each district. This practice was dropped mainly on the ground that it largely increased the cost of publication. The district figures are, however, of such great value in all agricultural and economic enquiries that we are of opinion that a reversion to the former practice is highly desirable.

A report is also published quinquennially on the average yield per acre, in each province, of the principal crops in India, seventeen in number. The latest issue of this publication is that for the year 1921-22. In addition, there is published annually in the *Indian Trade Journal*, about one year after the year to which it relates, a provisional issue of Volume I of the Agricultural Statistics and full particulars relating to the tea, coffee and rubber industries. A crop atlas has also been published.

This contains sixteen maps showing the distribution, area and production of each of the principal crops.

In addition to these definitive statistics, crop forecasts for all India are also published for the eleven crops shown in Appendix VIII. The *Estimates of Area and Yield of the Principal Crops in India* which include all the crops for which forecasts are issued and also tea, coffee, rubber and certain other crops are issued annually. This report contains final figures of area and yield for nine preceding years, and figures, which are liable to revision, for the year prior to publication, which takes place some six to nine months after the crops of this last year have been harvested. The figures for this year are, in effect, a preliminary issue of information which is later embodied with corrections in some of the Tables of the Agricultural Statistics. The *Estimates of Area and Yield* also contain information regarding rainfall in India and the yield of certain important crops in foreign countries, which is not subsequently embodied in the Agricultural Statistics. The only suggestions that we have to make in regard to the form and contents of this volume are that the figures of area and yield should be given separately for British India and the Indian States and that indigo should be omitted as it can no longer be regarded as one of the principal crops of India.

The provincial crop forecasts, as well as those for the whole of India, are published in the *Indian Trade Journal*, a publication which is issued weekly by the Department of Commercial Intelligence and Statistics. The provincial forecasts are also published locally by the provincial authorities concerned except in the smaller provinces and in Indian States. The information on which these forecasts are based, with the exception of that for jute forecasts, is collected by the revenue departments, but, except in Burma and the Central Provinces, the forecasts themselves are prepared by the agricultural departments. Provided that the agricultural departments of Burma and the Central Provinces obtain the statistical assistance we recommend in paragraph 538 for the agricultural departments generally, we think it would be advantageous if, in these two provinces also, the forecasts were to be prepared by the agricultural departments. In Burma, however, we think that the rice forecast should continue to be prepared by the Commissioner of Settlements and Land Records.

Detailed particulars respectingall-India forecasts will be found in Appendix VIII. The forecasts, in addition to the usual estimates of area and outturn of the crop to which they relate, give an account of the weather conditions affecting its growth and of the state of the crop in foreign countries. The *Indian Trade Journal* also publishes, weekly, a statement of the amount of cotton pressed in the different provinces compiled from information which the pressing factories are required to supply under the provisions of the Cotton Ginning and Pressing Act of 1925.

The use of the *Indian Trade Journal* as the sole medium for the publication of forecasts is not satisfactory. The former practice of publishing them in leaflet form should be revived. A delay in the publication of a

forecast by even a few days in order to conform with the publishing date of a weekly journal is obviously undesirable. Moreover, a leaflet can be sold at an anna or less whilst the Trade Journal costs four annas. This difference in price greatly curtails circulation. Arrangements should also be made for the issue of forecasts in the vernacular and for their supply to cultivators through such agencies as post offices, village libraries, co-operative societies and agricultural associations.

The *Agricultural Statistics of India* contain particulars regarding livestock, ploughs and carts which are incorporated from the report on the census of livestock, ploughs and carts. This census has been held quinquennially since 1919-20 and the report includes comparative figures for foreign countries.

Much statistical material of great interest to the agricultural investigator is also contained in the provincial season and crop reports and in the reports of the agricultural and veterinary departments which are all published annually. In the latter are gathered together the reports on the work of the experimental, seed, cattle breeding and other farms and on the various activities of the departments. The information contained in these provincial reports is condensed and the salient features of it are commented upon by the Agricultural Adviser to the Government of India in the *Review of Agricultural Operations* to which are appended Tables of statistics. Statistical information likely to be of interest to the general reader is also published from time to time in the *Agricultural Journal of India*.

With the exception we make above in regard to forecasts, we consider that the present arrangements secure sufficiently wide publicity for agricultural statistics. Whether, as interest in statistical matters increases, the publication of a journal entirely devoted to statistical subjects of which agricultural statistics would form a section, would be useful, is a matter which, we think, may well be left for decision by the Central Bureau of Statistics the creation of which we recommend in paragraph 539.

The annual provincial reports of the irrigation and forest departments and the annual review on *Irrigation in India* also contain much statistical material which the agricultural investigator will need to consult. We have emphasised, in our chapter on Irrigation, the importance of ordinary wells. It would be convenient if the annual provincial reports on irrigation and also the annual all-India review included in future the total number of ordinary wells divided into three classes : (*a*) the wells in actual use with the total area irrigated by them, (*b*) the wells in working order but not used and (*c*) abandoned wells. If the recommendations which we make in Chapter VIII for the creation of a Minor Forests Division in each province is accepted, statistics regarding the work of this division should be shown separately in each provincial forest return and in the all-India return ; these returns should include a statement of the total area actually under timber, State and privately owned forests being shown separately. This information should be incorporated in the Agricultural Statistics.

In the course of our investigations, we have discovered various discrepancies between the figures given in the departmental returns and those given in the *Agricultural Statistics of India*. Care should be taken to avoid these and, where any figure given in the latter volumes is a provisional figure, this should be explained in a footnote.

Information regarding births, deaths and the general health of the population is published annually by each department of public health. The Public Health Commissioner with the Government of India also publishes an annual report in which this information is collected and presented on an all-India basis.

Of the various publications which contain statistics of interest to the student of rural welfare, special mention may be made of the annual provincial and all-India reports on education, the annual provincial reports on the progress of the co-operative movement and the annual general reports on the administration of each province. The value of the reports on education would be much enhanced if the figures relating to rural and urban areas could be shown separately and if a uniform system of classification of schools could be adopted in all provinces. We recommend that an attempt should be made to do this.

Finally, the *Statistical Abstract for British India*, which is published annually by the Department of Commercial Intelligence and Statistics, summarises much of the information regarding crops, livestock, trade in agricultural products, and the state of the population which is contained in the reports enumerated above.

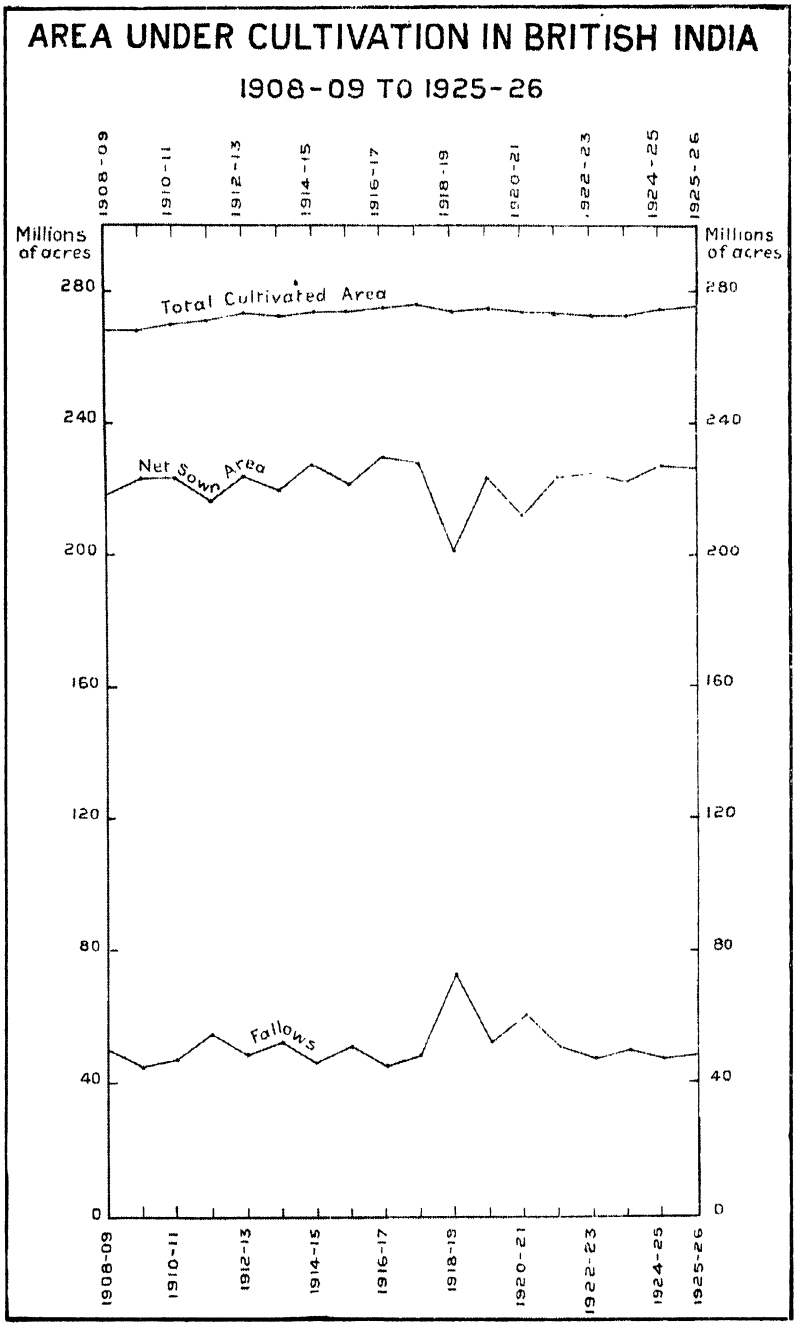
In the four succeeding paragraphs, the primary statistics relating to cultivation and crops, livestock, vital statistics and rural development will be examined in greater detail.

CULTIVATION AND CROP STATISTICS (ORDINARY).

(i) CLASSIFICATION OF AREA.

526. Hitherto, the area of each province, as given in the *Agricultural Statistics of India*, has been divided into land cultivated and uncultivated and forests. The cultivated area is subdivided into the net area actually sown and current fallows. The maximum period for which land left uncultivated is treated as fallow varies according to local laws and customs, from two years in the Punjab to ten years in Bombay. After the expiry of these varying periods, the land, if still left uncultivated, is included, for statistical purposes, under the head of culturable waste.

The uncultivated area is divided into "culturable waste other than fallow" and land "not available for cultivation." This division of the uncultivated area is to a large extent arbitrary. In Burma, it is admitted that it is based mainly on guess work and this is also probably true to a large extent of other provinces. In our chapter on Forests, we have recommended that a reclassification of forest areas should be undertaken with a view to deciding what proportion of forest lands could more profitably be put to some other purpose. We regard it also as important that the classification both of culturable waste and land not available



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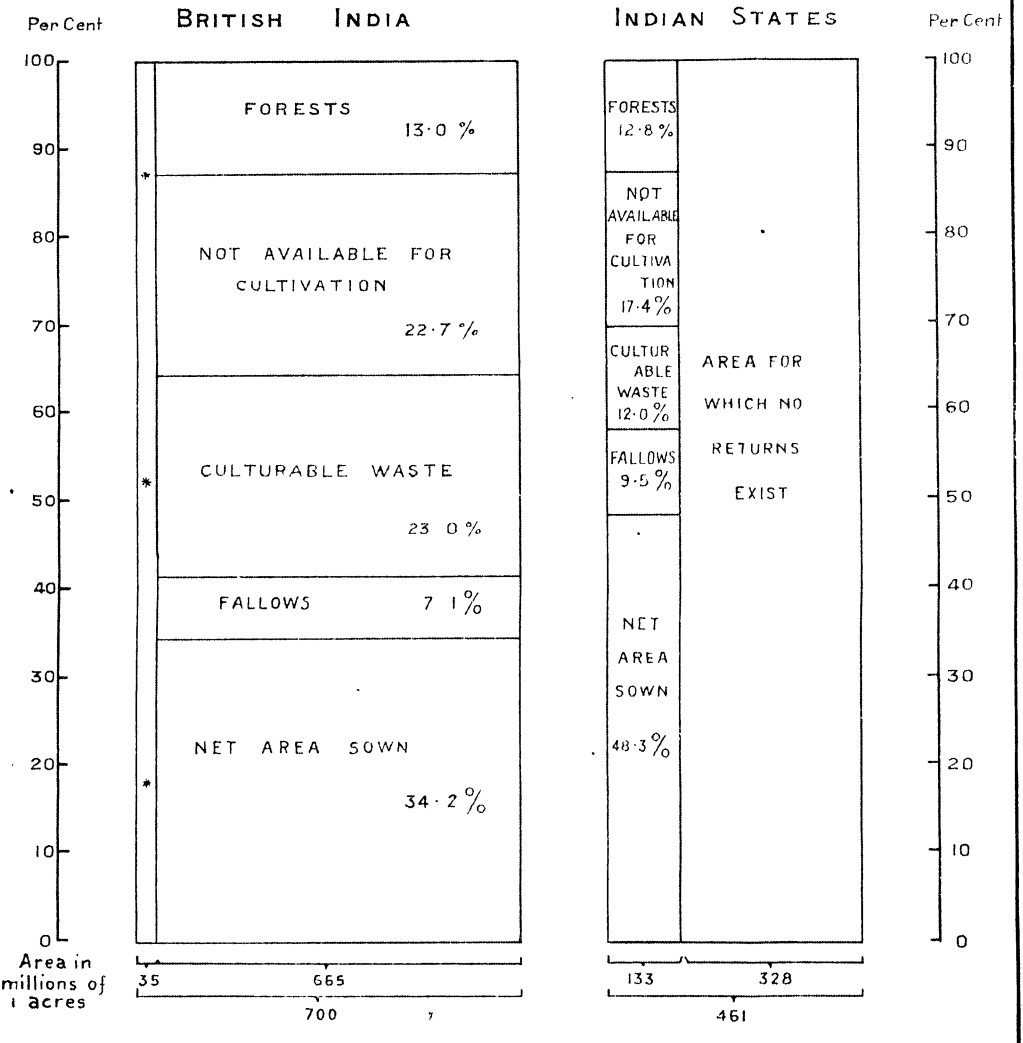
CLASSIFICATION OF AREA IN BRITISH INDIA AND IN INDIAN STATES IN 1924 – 25.



* Represents the area of British Baluchistan for which Agricultural Statistics are not collected.

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for cultivation should be carefully re-examined. It is pointed out in the introductory note to the *Agricultural Statistics of India* that most of the barren and unculturable lands of British India lie in the hilly tract of Burma and of southern India and in the dry and desert regions of north-western India and that, of the culturable waste other than fallow, exactly one-half is contributed by the undeveloped provinces of Burma and Assam. None the less, it is difficult to believe that the whole of the vast area now classed as "not available for cultivation" amounting, as it does, to 150 million acres or twenty-two-and-a-half per cent of the total area of British India is either not available or not suitable for cultivation. An improvement in the classification under this head would be the division of land "not available for cultivation" into land which is barren and unculturable and land covered by buildings, water and roads, or otherwise appropriated for uses other than agricultural. It is certain that much of the slightly larger area classed as "culturable waste other than fallow", amounting to 152 million acres or nearly twenty-three per cent of the total area of British India, could, in no conceivable circumstances, be brought under tillage. In many parts of India, the pressure of the rural population on the cultivated land is steadily increasing and both Government and the public should be in a position to know, with greater exactitude than they do at present, the area of land in each province which is in reality suitable for new cultivation. Even if regard is had to the explanation in the introductory note to the volume of Agricultural Statistics to which reference has been made above, the statement repeated annually in a volume which issues under the imprimatur of the Government of India that very nearly one-quarter of the total area of British India is culturable but not cultivated is calculated to give rise to misconceptions which it would be well to avoid.

(a) Statistics of crop areas.

527. It is generally agreed that the annual figures of areas sown with the various crops are, on the whole, accurate and that they compare in this respect very favourably with those published for any other country in the world. There are difficulties even here, however, mainly arising from the absence of a subordinate revenue staff in permanently settled tracts. In Madras, there are village officers in these tracts who act as a reporting agency, but in Bengal and Bihar and Orissa, where no such officers are available, reliance has to be placed mainly on reports from the police. Wherever possible, assistance is obtained from officers of the Revenue Department such as *khas mahal* tahsildars, and circle officers, and from district agricultural officers and non-official agricultural correspondents. The information thus collected is forwarded through the subdivisional officers to the district officer who has discretion to reject or amend reports in the light of his own knowledge or experience. These reports are admittedly often mere guesses and are, not infrequently, demonstrably absurd guesses. We have considered whether any steps could be taken to obtain more accurate information and to this end we communicated with the governments of Bengal and Bihar and Orissa where the difficulty arises in the most acute form. Whilst admitting the unsatisfactory

character of the information obtained, both governments took the view that no improvement could be effected without incurring expenditure which would not be justified by the results to be obtained. We appreciate the difficulty of effecting improvements and we think that the cost of employing a special statistical agency would probably not be justifiable in the circumstances. But we see no sufficient reason why the methods employed in collecting the statistics of jute production which we explain in paragraph 531 should not be gradually extended to other crops in the permanently settled areas of these provinces and also in those of Assam. The system of report by presidents of *panchayats*, where these are available, is far preferable to reliance on the police as a primary reporting agency. The evidence we received from the Director of Land Records and Survey in Bihar and Orissa also indicates that closer touch between his department and the Agricultural Department would be productive of good results.

The other great difficulty in arriving at correct crop areas arises from the practice of sowing mixed crops. Food and non-food crops such as wheat and linseed may be sown together or a minor crop such as castor may be interspersed with the main crop. Separation in the returns is effected by the subordinate staff in accordance with formulæ which are prescribed by the provincial authorities but which differ in different provinces and according to the type of mixture. We were informed that errors arising from this source are not such as to invalidate the statistics of the area of a crop as a whole. We accept this view and the only suggestion we have to make is that, where this is not already done, the correctness of these formulæ should be tested from time to time by actual field trials of the main types of mixtures found in a district. The trials should be conducted by the agency which does the ordinary crop-cutting experiments.

(*iii*) THE NORMAL YIELD.

528. The two factors, other than area, necessary for estimating the yield of a crop, namely, the standard or normal yield and the estimate of condition, are admittedly susceptible of considerable improvement.

The estimate of normal yield is based on crop-cutting experiments made over a number of years compared with such other information as may be available from trade statistics, settlement investigations and the like. Reliance on crop-cutting experiments, the methods adopted in carrying them out, and the agency employed in conducting them have all been the subjects of criticism in the past. It is now, however, generally agreed that no satisfactory alternative basis for calculating the standard yield is available. The Board of Agriculture, after a very thorough examination of the point in 1919 and 1924, expressed the view that " while every effort should be made to take the fullest advantage of trade statistics, it is not possible to obtain from such statistics the figures for the total production from which to calculate the standard outturn per acre and crop-cutting experiments must remain the basis of such standards." The agency which carries out these experiments is still almost entirely

the subordinate revenue staff. As long ago as 1915, the Government of India expressed the view that they should, as far as possible, be conducted by expert officers of the Agricultural Department. Except in the Punjab and the Central Provinces, however, and there only to a very limited extent, the agricultural departments, owing to paucity of staff, have so far found it impossible to spare men to carry out crop-cutting experiments. The time for making them coincides with the busiest season of the year for the agricultural departments. It may be accepted, therefore, that extra staff and consequently extra expenditure will be required if the agricultural departments are to undertake this work. In these circumstances, it becomes a question of relative urgency between improvement in statistics and other agricultural improvements. We are of opinion that it is desirable to move with caution in this matter. For reasons which we mention in paragraph 538, we consider that the departments of agriculture require strengthening by the appointment of an expert statistical officer at headquarters and we are of opinion that his appointment should in all cases precede any change in the present system. It would be a part of his duty, after examining the statistical position, and estimating the extent to which the standard yields are likely to be erroneous, to advise as to the measures required to render the system effective. It has been suggested that the additional staff required to carry out crop-cutting experiments could be used as demonstrators of agricultural improvements. The suggestion is an ingenious one, but it is our view that the question of employing staff engaged primarily for one set of duties on another set of duties should not be adopted without careful consideration, especially when the secondary function is of such critical importance as is the demonstration of agricultural improvements.

As regards the methods at present in use, criticism has in the main taken two forms. The practice of selecting by the eye 'average' crops for the crop-cutting experiment, is condemned by statisticians. The recasting of the standard yield every five years on miscellaneous data such as are used in the Punjab is also considered to be statistically faulty. To strike a balance between the results of crop cutting experiments annually made and the yields fixed in previous returns or for the purposes of land revenue assessments, is held to import into the new standard the personal factor which is unavoidable in estimating the annual condition of crops but which it is desirable to eliminate in pure statistics. The Board of Agriculture in 1924 condemned, for similar reasons, any attempt to correct the standard yield from trade statistics. From the point of view of what is immediately practicable, we think that attention should be paid to this last criticism and that no change in the standard yield should be made unless it is based on data supplied by crop-cutting experiments. The selection by the eye of average fields for these experiments is no doubt indefensible in statistical theory but it has to be recollected that the correct method of selecting fields mechanical y so as to give a statistically random distribution can only give proper results if a sufficient number of such selections can be made within a definite area. We consider, therefore,

that the recommendation made by the Board of Agriculture in 1919 and in 1924 in favour of such mechanical selection should be qualified by the proviso that, before random selection of villages and fields for crop-cutting experiments is introduced, the means to carry out far more numerous experiments must be provided.

(*iv*) THE CONDITION ESTIMATE.

529. The third factor in estimating the yield of a crop is the condition estimate (anna valuation), or the relating of the crop reported on to the standard yield per acre. This estimate is framed, in the first instance, by the village accountant, or an official of similar standing, in all temporarily settled tracts and in the permanently settled areas by subordinate district officials. The estimate is a visual one and, of all the three factors which enter into the estimate of crop yield, is that which is the most difficult to arrive at satisfactorily. But we consider that it is easy to take an exaggerated view of the degree of the consequent inaccuracy. Granted that the village accountant is a pessimist in such matters, his pessimism is a constant factor and it is not difficult for the district officers and the provincial authorities, through whom his estimate passes before it reaches the Department of Commercial Intelligence and Statistics, to correct it. The Board of Agriculture in 1919 recommended that all attempts to teach the primary reporting authority to form an exact mental picture of a normal crop should be abandoned and with this we agree. For the same reason, we refrain from suggesting that the present varying methods of indicating the condition of a crop should be replaced by a uniform notation. At present, in Madras, Bombay, Bengal and Assam, 12 annas denote a normal crop; in the United Provinces, the Punjab and North-West Frontier Province, 16 annas; in the Central Provinces and Berar, 13·3 annas; in Bihar and Orissa, 12 to 14 annas*; whilst, in Burma, the American notation of 100 points is employed. We have no doubt that it is better to allow the village accountant to continue to use the notation with which he is familiar and to leave it to higher authority to convert his results into the American notation.

CROP STATISTICS (SPECIAL).
(*i*) TEA, COFFEE AND RUBBER.

530. Statistics of planters' crops—tea, coffee and rubber production—and of jute are obtained in a different way.

In the case of tea, coffee and rubber, statements of production are obtained by district officers from the managers of the estates and, where no reports are received, estimates are made by these officers. Before accepting these estimates, the Department of Commercial Intelligence and Statistics makes a further and often successful attempt to obtain the actual results by direct correspondence with the non-reporting estates. As regards tea, the Indian Tea Association stated in their evidence before us that the government statistics did not always give results which agreed with the Association's own figures and that the Association

*12 annas in 12 districts.
13 „ „ 7 „
14 „ „ 2 „

considered its own figures to be the more accurate. The membership of the Association represents 71·8 per cent of the total area under tea in India. Legislation to provide for compulsory returns from planters was suggested some years ago by the Association which still adheres to this suggestion. We have no reason to suppose that the returns issued by Government are so defective as to be a cause of embarrassment either to them or to the trade. We would, therefore, leave the tea interests, which are strongly organised both in India and in London, themselves to move for legislation. If they press for legislation, there appears no strong reason why their request should not be granted.

The figures for coffee are, we were informed, defective in that no returns are obtained from plantations of less than ten acres. An endeavour should be made to obtain particulars from these smaller plantations.

(ii) JUTE.

531. Jute is the only crop for the publication of the estimate of yield of which the Department of Commercial Intelligence and Statistics is not responsible. The Director of Agriculture, Bengal, issues the estimates for the jute crop not only in Bengal but also in Bihar and Orissa and Assam. The primary reporting agency on which he relies are the presidents of *panchayats*. The circle officer in areas where the Village Self-Government Act is in force and the police officers of *thanas* to which the Village Chaukidari Act still applies, pass on to the presidents of *panchayats* schedules supplied by the Director of Agriculture to which are attached simple instructions for filling them up. On completion, the circle officer of the area checks the returns of the *panchayats* which then pass through the subdivisional officer to the district officer who forwards them to the Director of Agriculture. Police officers pass the completed forms direct to the subdivisional officer without attempting to check them. Officers of the Agricultural Department assist the district officers wherever possible in checking the returns. Theoretically, this system should produce satisfactory results especially as the Director of Agriculture has a valuable counter check in that the imports of jute into Calcutta in an ordinary year are accurately known. But he receives no direct assistance from the trade. Nevertheless, both the jute interests in India and in London are dissatisfied with the resulting departmental forecasts. The first forecast is issued in the middle of July and the second, and final, forecast in the second half of September. We were informed that long before the middle of July, the jute firms in Calcutta are able from private sources to frame their estimates of what the yield is going to be. If the government forecast, when it is published, proves very divergent from the estimates of yield formed by the trade it causes the market to become speculative. Representatives of the Jute Importers' Association, Dundee, who gave evidence before us in England, complained in particular of the inaccuracy of the estimates for the years from 1924 to 1926. The representatives of the London Jute Association, on the other hand, considered that, taking the difficulties into account, the departmental forecast was a very fair one. We are inclined to think that the trade interests in Calcutta have the remedy largely in their own hands. They have their own private sources of information and there is already in existence

a Jute Forecasts Joint Committee of the Bengal Chamber of Commerce. There appears to be no good reason why, if the jute interests are anxious to stop speculation, they should not collaborate with the Government of Bengal in the issue of forecasts in the same way as the rice trade does in Rangoon, where the final rice forecast is made at an annual conference presided over by the Settlement Commissioner and attended by the leading rice merchants. Indeed, action in this direction would naturally follow from the suggestion we ourselves make, in Chapter III, that all jute interests from the crop to the factory should be organised on the lines which have proved so successful in the case of cotton and which, *inter alia*, have effected considerable improvement in Indian cotton statistics.

We regret the decision of Government in 1923, to abolish, as a measure of retrenchment, the staff of jute clerks whose duty it was to check the estimates of the village *panchayats* and to carry out crop-cutting experiments. We regret equally that the trade took strong exception to the proposal of the Government that it should bear the cost of this staff. We consider that the matter was capable of adjustment and that it was unfortunate that the trade and Government were unable to come to a mutual understanding in a matter of common interest. The fact that the cultivator has an interest as important as that of the jute trade in the accuracy of these estimates should always be kept in mind. As the Director of Agriculture for Bengal observed, there is a very definite tendency for the jute cultivator to organise himself at the present time and we cordially associate ourselves with the Director's opinion that, if societies for co-operative sale succeed, there would seem to be no reason why, ultimately, representatives of producers, manufacturers and consumers should not arrange matters between themselves for the good of all concerned.

(iii) Cotton.

532. The improvement in cotton statistics which has been effected by the efforts of the Indian Central Cotton Committee deserves mention here, not only for its own sake but because it furnishes an example of the statistical benefits to be obtained from a thorough organisation of all interests connected with a particular crop. As a result of the enactment of the Cotton Ginning and Pressing Factories Act of 1925, returns of the cotton baled in cotton pressing factories throughout British India are now published weekly in the *Gazette of India*. Monthly returns of the cotton consumed in Indian mills are similarly published and, as the Committee have been able to make arrangements in the principal cotton growing provinces for voluntary returns of the unbaled cotton received by spinning mills, statistics of the commercial crop of Indian cotton are now available in a fairly complete form. Recently also, partly at the instance of the Committee, the rail-borne trade returns for cotton have been partially revived. These returns, which were formerly compiled not only for agricultural produce including livestock but also for manufactured articles and treasure were discontinued from 1921 as a measure of economy, except in the Central Provinces. The question of reviving them for

products other than cotton is discussed in the following paragraph. Used in combination with the weekly statistics of cotton pressed, the figures for cotton provide a most valuable independent check on the quantity of cotton produced in a province or a particular trade block as estimated by the agricultural or other department responsible for the preparation of forecasts. The cotton statistics should, in future, be as nearly accurate as it is possible for statistics of Indian crop production to be.

TRADE STATISTICS.

533. The monthly *Accounts relating to the Sea-borne Trade and Navigation of India*, the *Annual Statement of the Sea-borne Trade of British India with the British Empire and Foreign Countries* and the annual *Review of the Trade of India* give, in great detail, information regarding both the quantity and value of exports and imports of agricultural products, machinery, fertilisers and the like; the respective shares enjoyed by the Empire and the principal foreign States in this trade; and the proportions of the trade which is handled by the various ports in British India.

A general review of trade statistics does not fall within the scope of our enquiry but we are constrained to comment on the situation created by the discontinuance of the annual returns of rail and river-borne trade. For the purposes of these returns, each province was divided into five or six trade blocks and India, as a whole, including Indian States, into eighteen blocks. The provincial returns were published by the local governments and the consolidated return for all India was compiled and issued by the Department of Statistics.

Owing to the discontinuance of the returns, information regarding the movements of agricultural produce within India is now altogether lacking. This information would have been of very great value to us in our enquiries. We have pointed out in our chapter on Communications and Marketing, and elsewhere in this Report, that it is most important, in the interests of the cultivator, that the marketing of his surplus produce should receive expert attention. No analysis of the marketing situation in a particular province, or in India as a whole, which has any pretensions to completeness can be made in the absence of data in regard to the relative importance of external and internal markets. This information is of little use if it is obtained by special enquiry for a single year. A comparison of returns over a number of years is required in order that any change in marketing tendencies may be detected and the knowledge used in the cultivator's interests. Apart from the need of such information if the marketing question is to be studied intelligently, statistics of inter-provincial trade movements have at least two other important uses. They enable each province to ascertain how far it is dependent on other provinces in respect of food stuffs and they show the rate at which that dependence is increasing or diminishing. This information should be of vital importance in the event of failure of crops on a large scale. Further, as we have pointed out with reference to cotton, they furnish a valuable independent check on the present method of compiling statistics of agricultural production from the factors of

areas sown, standard outturn and condition estimate. We, therefore, strongly support the Resolution, passed by the Board of Agriculture in 1924, that they should be revived forthwith in their entirety and not for cotton only. As it is, a gap of several years will have intervened and this gap will seriously diminish the value of the returns for some time to come.

The revival of the returns after a lengthy interval would furnish a convenient opportunity for considering whether their form might not be remodelled with advantage. A committee, which met in Madras shortly before they were abolished, recommended the substitution of the district for the trade block and the restriction of the commodities selected for inclusion to those of economic importance. These suggestions appear to us to deserve examination. The omission of statistics of road-borne trade from the returns undoubtedly detracts somewhat from their usefulness, especially in the case of a crop such as cotton, but it is difficult to see how this can be rectified so far as internal road-borne trade is concerned. The cost of satisfactory arrangements for collecting statistics of this class of trade would be prohibitive. Transfrontier road trade presents an easier problem. Statistics of trade on the main roads crossing the frontiers of India were formerly collected and we consider that this practice should be revived, provided that reasonable accuracy can be secured without undue expense. The present practice of merely recording such merchandise as passes through railway stations adjacent to land frontier routes does not appear to us satisfactory, especially as these figures are not incorporated in the all-India trade statistics but are only published in the *Indian Trade Journal* and eventually appear as a separate Table in the *Review of the Trade of India*.

LIVESTOCK STATISTICS.

534. As was the case with crop statistics, the collection of statistics in their present form for livestock and implements was the outcome of the Indian Famine Commission of 1880. It was long, however, before these statistics were collected in such a way as to give anything resembling an accurate picture of the general position in regard to livestock and implements. Even in the temporarily settled tracts which possessed the necessary organisation for the purpose, the censuses in some cases took three or four years to complete. In the permanently settled provinces, estimates only were made and it was not until 1912-13 and 1913-14 that cattle censuses were taken in Bengal and Bihar and Orissa respectively. The lack of uniformity both in the methods adopted and in the time at which the census was taken caused the Government of India some concern and, in 1916, they arranged that the census should be held at intervals of five years and between December and April in all provinces except Burma and the Central Provinces, where an annual census was, and continues to be, taken. The first census under this arrangement was held in 1919-20. Returns were obtained not only from all provinces in British India but also from some Indian States. The second quinquennial census was taken in 1924-25 in most provinces.

but, in the Punjab, it was put forward to 1922-23, two years before the end of the quinquennial period and, in Bengal, owing to financial stringency, it was postponed till February, 1926. Such tests as we have been able to make of the figures of livestock have convinced us that the earliest material available for a satisfactory comparison of the cattle position, past and present, over British India as a whole is provided by the first quinquennial census of 1919-20. The value for comparative purposes of the figures collected at the second census, that of 1924-25, is diminished by the fact that the census was not held in the same year in all provinces.

In our chapter on Animal Husbandry, we have discussed the trustworthiness of the census figures for cattle and have there expressed the view that, whilst the methods adopted in taking the census make it inevitable that errors should be numerous, it is probable that these tend to cancel out and that the figures are sufficiently accurate to enable valuable deductions to be drawn from the differences they reveal in the cattle position as between province and province. This also holds good as regards sheep and goats. For the special classes of livestock, horses, mules, donkeys and camels, the census returns are probably less satisfactory. The numbers are relatively small and faulty methods of enumeration tend, therefore, to produce wide divergencies from the actual facts. We have been at pains to make clear in our chapter on Animal Husbandry that we regard the improvement of livestock as one of the most crucial agricultural problems with which this country is faced. We have, therefore, devoted special attention to the question whether that improvement would, in any way, be facilitated if more accurate general statistics of livestock were available. We have come to the conclusion that it would not. What those in charge of breeding operations specially wish to know is the number of improved cattle or other livestock which result from their work. Methods of enumeration which are all that is possible in a general census cannot help them to obtain this information. It can only be secured by the maintenance of records of the improved sires distributed and by inspections of qualified stockmen. The inaccuracies under the present system are due to the somewhat perfunctory manner in which the enumeration is often made and supervised. The only way in which greater accuracy could be obtained would be by the employment of a special staff under close supervision. Heavy expenditure on the enumeration of cattle, a large proportion of which are uneconomic, cannot be justified.

One cause of inaccuracy and one defect in method could, however, be removed without incurring additional expense. At certain seasons of the year, inter-provincial movements of cattle of some importance take place. If arrangements were made to take the cattle census simultaneously in all provinces, errors arising from double enumeration would be avoided. Reference to the defect in method has already been made in our chapter on Animal Husbandry. We have there pointed out that the methods of classifying the different kinds of livestock are not uniform in all provinces and that the village accountant in the Punjab is required to

enumerate them under twenty different heads whereas the village accountant in Madras has to fill up eight columns only. The number of bulls returned in one province may thus refer to a different description of animal from that in an adjacent province. We recommend that, in the next quinquennial census, an effort should be made to secure uniformity of classification and that, to this end, the heads under which the returns should be made should be settled at the next Cattle Conference held under the recommendations we make in paragraph 211, Chapter VII.

VITAL STATISTICS.

535. Under the heading "vital statistics" are comprised the returns of births and deaths occurring annually among the community, the causes of death, the nature and the incidence of the diseases from which the community suffers, the numbers and descriptions of institutions available for the treatment of disease, the extent of the preventive measures taken against small-pox and cholera, and the strength and distribution of the medical and health services. The statistics of disease and of the causes of death are liable to inaccuracies which are due, in the main, to the same influences which adversely affect the accuracy of agricultural statistics. We are confident that the public health officers are alive to the need for improvement and the only suggestion we have to make is that the statistics under the various heads should always be shown separately for rural and urban areas. At present, this separation is only effected in the case of deaths. We think also that the number and distribution of institutions for the treatment of disease and the strength and distribution of the medical and health services, including trained midwives, should be shown separately for urban and rural districts. We consider it very important that the extent to which rural areas still lack these essential services, and the progress which is made in supplying them, should be stated clearly in the returns. There is also much useful work to be done in correlating the data of the incidence of disease and the death-rate in rural areas with those relating to the agricultural conditions which prevail in those areas and with changes in those conditions arising from such causes as the extension of irrigation, improvements in the drainage of deltaic tracts, and the like. Similarly, the correlation of the statistical data relating to health conditions with changes in diet and with the conditions under which the staple foods consumed in the tract under consideration are grown, whether, for example, they come from irrigated or 'dry' land, should in time yield information of the greatest value.* Guidance will doubtless be required from the Institute of Human Nutrition, the establishment of which we recommend in our chapter on The Village, but readiness on the part of provincial statisticians, both public and private, to sift local data should immensely facilitate the work of that Institute. We desire to draw the attention in particular of local authorities to the value of co-operating in such work. Private bodies may also render

* *Vide* Evidence: Vol. I, Pt. II, pp 95-116; Vol. III, pp 731-746.

valuable assistance. Thus, the Indian Tea Association informed us that they had completed, at their own expense, a malaria survey of Assam and the Duars.

RURAL WELFARE.

536. Rural welfare is a subject which is so wide in scope that it is very desirable that the study of it should be facilitated as far as possible by statistical treatment. The provincial departments of education and co-operation supply valuable statistical tables with their annual reports but there remains a large group of subjects on which, with very few exceptions, little light has so far been thrown by the collection and study of the relevant statistical data. These subjects are most conveniently stated under one title, the economic survey of the village. Outside the Punjab, apart from a few special studies there has been little attempt to survey village by village, such problems as indebtedness, mortgage debt and the fragmentation of individual holdings. Yet a clear understanding of these problems, for which statistical treatment is indispensable, is essential to the framing of an ordered programme of rural development. Much of the information required has been obtained, but it lies buried in settlement reports and other official papers. What is required is some organisation which will extract and collate this information and, where necessary, bring it up to date. In regard to indebtedness, particularly, we entirely agree with the recommendation of the Indian Economic Enquiry Committee of 1925 that intensive enquiries should be made into the extent of indebtedness of various classes and tracts, the causes of indebtedness, the sources of loans and the rates of interest, and that the results of these enquiries should be published. We think, however, that this is eminently a field for investigation by private agency rather than by government departments. It is very necessary, however, that private investigations should be conducted on some general plan so that the statistics compiled shall be in such a form as will permit comparisons to be made. University organisations and semi-official bodies of the type of the Punjab Board of Economic Enquiry, the constitution and functions of which have been described in our chapter on The Village, are eminently fitted to provide the careful editorial supervision required for work of this character. Provided Government are satisfied that the investigators are statistically competent and that the arrangements for editing their work are satisfactory, we think that assistance from provincial revenues towards work of this character, would be fully justified. The art of interpreting statistical data has made great advances of recent years and it is important that investigator should be properly trained in modern methods.

PURPOSES FOR WHICH GOVERNMENT STATISTICS ARE COLLECTED.

537. Before considering whether improvements are possible in the present arrangements for collecting and recording agricultural statistics, it will be convenient to state the objects with which, in our opinion, such statistics should be collected.

In the view of the Director General of Commercial Intelligence and Statistics, "they are primarily meant for the information of Government, for no Government can afford to be ignorant of its agricultural resources, and, secondarily, they are meant for the information of the trade and the public." We accept this statement and would only add, what is no doubt implicit in the use of the word "public," that the fact that the producer needs information quite as much as the trader must be recognised. The information which Government, the producer and the trader desire to obtain from statistics is different in each case. Government are primarily interested in obtaining definitive information regarding the agricultural resources of the country in order that they may know whether these resources are increasing or diminishing and whether any changes are occurring which require action on their part; they are interested only in a secondary degree with stocks held by traders and the estimates of production for a particular crop or year. The producer is more immediately concerned with the stocks of his products which are held by traders, the state of demand for those products both in home and foreign markets, and the probable trend of prices. The trader, while equally interested with the cultivator in the question of the stocks held, the probable demand for, and the trend of prices of, the particular commodity or commodities in which he trades, is in a position to form a shrewd idea from his own trading what the position in these respects is, and seeks especially to know, in advance of the harvest of each crop, what the production is likely to be.

It is at once the interest and the duty of Government to place fully at the disposal of producers, traders and general public alike, all the statistical information which they consider necessary to collect for the purposes of administration, and to see that such information is, so far as possible, published at such times and in such a manner as will be of maximum benefit to all concerned. But the producer, the trader and the general public have also a very definite part to play in the collection of such information. The trader and the cultivator can and should assist Government in supplying the information which each needs. A frank interchange of information will ultimately benefit both, though it may check that speculation from which no one concerned with a commodity such as jute seems to be entirely averse. No doubt, in this country, collaboration has its special difficulties. The illiteracy of the average producer and the interposition of a number of middlemen between him and the substantial trader who is possessed of the education and the vision to appreciate the advantages of organising information; the size of the country; the small and scattered units on which crops are for the most part grown; the deep-seated disinclination of the cultivator to admit that his crops are even normal, and the absence of standardised weights and measures are all formidable difficulties. But we see no reason why, with time, patience and organisation, these difficulties should not be overcome for all important crops as, within the last six years, they have been largely overcome for cotton. What we desire to impress on all concerned is that Government have available neither the men nor the money to provide the whole of the organisation required. Government

can bring the interested parties together and make suggestions of principle and can, by introducing legislation, strengthen the hands of an intelligent majority, who see the advantages of full and complete information, against the opposition of the less far sighted producers and traders.

The local authorities and the general public have also very definite duties to perform. It is impracticable for Government to supply satisfactory statistics of education, health and general economic conditions unless those concerned with local administration play their part in supplying accurately and promptly the data required and unless the efforts of both are supplemented by a spirit of intelligent co-operation among the general public.

PROVINCIAL STATISTICAL ORGANISATION.

538. Except in Madras, no agricultural department has as yet a statistical section. This is a state of affairs which, in our opinion, calls for immediate action. The directors of agriculture are well aware of the need for statistical assistance and the Board of Agriculture, since 1919, has repeatedly pressed for the appointment of at least one statistical assistant to each department of agriculture. We consider that these appointments should be made with as little delay as possible. It is essential that the candidates selected should be trained in modern methods of handling statistical material and this training can, in our view, best be provided by attaching them for a suitable period to the central statistical organisation. The main concern of these officers will be with the compilation of crop forecasts, with statistics of agricultural production, with the technique and supervision of crop-cutting experiments and with the collection of statistics regarding prices. No change in the duties of the Land Records Department will be occasioned by their appointment.

All agricultural departments in India stand also in need of statistical assistance in another direction. Agricultural experiment in many western countries has in recent years derived the greatest benefit from the mathematical guidance which is given by an expert statistician. The importance of the " lay out " of experiments in such a way as to extract the utmost information and reduce experimental error to a minimum has been increasingly recognised but the extent to which guidance in this respect can enhance the value of the experimental work of research officers and deputy directors of agriculture has yet to be realised in India. It is specially required by the latter class of officers for it is on them that the bulk of the work involved in carrying out experiments in field conditions falls. We consider that it will ultimately be desirable that each province should have its own expert for this work. This, however, is a development for the future and, in present conditions, it will be sufficient if a specialist is attached to the Imperial Agricultural Research Institute, and if the manner in which his advice can best be made available to the provincial departments of agriculture is determined by the Council of Agricultural Research. We consider it essential that the officer appointed to Pusa for this work should possess the highest qualifications

in view of the fact that the application of mathematics to agriculture introduces an entirely new factor into scientific agriculture in India. Instruction in this branch of agricultural science could be usefully included in the post-graduate courses at Pusa which we have recommended for all recruits to the new superior provincial services, but it can only be given if an officer with the qualifications we indicate above is available.

We do not recommend that any additional subordinate statistical staff should be engaged or that any changes should be made in the present arrangements for dealing with agricultural statistics until a statistical assistant has been appointed to each provincial agricultural department. Otherwise, there is a serious risk that money may not be spent to the best purpose. One of the duties of this officer will, indeed, be to see that the limited funds which will be available for statistical purposes are put to the best use. Ample material on which to base proposals for improvement which involve little or no expenditure exists in the exhaustive reviews of agricultural statistics made by the Board of Agriculture at its meetings in 1919, 1924 and 1925. The possibility of obtaining funds for the strengthening of the superior statistical staff by amalgamating subordinate staff is one that should not be lost sight of.

We have directed our attention chiefly to the statistical requirements of the agricultural departments. We have, however, had occasion to notice, in our enquiries regarding indebtedness and the health of the rural population, the absence of any general statistical organisation at the headquarters of each province. We are aware of the competing claims on such funds as are available which are made by all "nation-building" departments and also of the scepticism which provincial legislatures may feel towards the necessity for, and the value of, statistical work in such matters. We would draw attention, nevertheless, to the increasing importance which is being attached all over the world to statistical research as an aid to the formulation of social policies. We consider that the efforts of Government to promote rural welfare would be greatly assisted by the appointment of a well qualified statistical officer to provincial headquarters to whom would be entrusted the duty of studying all aspects of the economic and social progress of the province. Such an officer would be a valuable correspondent for central workers in the fields of medical research and human and animal nutrition and in him the educational, co-operative, health and other social workers within the province itself should find a most useful guide. He should be of the status of an officer of the new superior provincial services and should receive pay on the scale decided upon for those officers. We do not think that the appointment of such a statistical officer at provincial headquarters should occasion much additional expenditure. He should be a centre round which voluntary workers in the field of economic and social statistics would gather rather than the head of a purely official organisation. In general, we envisage him as acting as director of a bureau of statistical information with a small staff of subordinate officials working under him. For, one of the advantages to be derived from the appointment of such an officer would be that one single

authority would be responsible for co-ordinating and publishing all provincial statistics other than those of crop forecasts and agricultural production. Eventually, indeed, it might be found advantageous to include agricultural statistics in the work of such a bureau and an intimate connection between its work and that of the statistical section of the provincial agricultural departments should be established from the outset. The wider the field a statistical officer, who is a man of insight, is called upon to survey, the more opportunities he has for making those discoveries from the correlation of data derived from widely different sources which are the aim, and frequently the achievement, of all modern statistical work.

The suggestions we have made for the organisation both of agricultural and of other statistics are designed to secure the broadest basis of development with the least possible expenditure. We have carefully considered the recommendations of the majority report of the recent Indian Economic Enquiry Committee which contemplate a total expenditure by provincial governments, collectively, which is estimated at the large sum of Rs. 15·31 lakhs for initial outlay and Rs. 28·40 lakhs for recurring annual expenditure, and we are unable to support the Committee's scheme. We hold strongly that officers of real statistical ability should first be appointed and that subsequent development should come as the result of their recommendations and should be for clearly defined objects which are shown to be both essential and practicable. We are opposed to general censuses of production or large schemes of economic investigation into the condition of the population undertaken with the mistaken notion that the mere accumulation of facts will of itself serve a useful purpose.

CENTRAL STATISTICAL ORGANISATION.

539. At present, the statistical work of the Government of India is carried out by the Department of Commercial Intelligence and Statistics. At the head of this department is an officer with the designation of Director General. Agricultural statistics are dealt with in a separate section of the department, under a part time superintendent with a staff of eight clerks, only five of whom are, however, exclusively engaged on the compilation of agricultural statistics.

If, as the result of our recommendations, a Council of Agricultural Research is created, it is clear that it will require statistical information of a character which the existing section concerned with agricultural statistics will be unable to provide. The Institutes of Human and Animal Nutrition will also require special statistical assistance, as will the Central Bureau of Information for irrigation and hydro-electric questions.

Again, although the general tendency towards provincial self-sufficiency must be recognised in the statistical as in other fields and while we have, therefore, laid the main emphasis on provincial development, it cannot be doubted that there are important statistical services which can only be provided by a central agency. Facility of comparison between provincial statistics is essential to their full utility and the

uniformity necessary for comparison is most easily secured, if machinery for co-ordination exists. There are many investigations which have a general as well as a local aspect; for example, the statistical treatment of the relation between weather conditions and the yield of crops.*

We, therefore, think that general considerations are all in favour of reconstituting the Department of Statistics as a separate department. A possible alternative would be to recognise that statistics are required for two quite different purposes, primarily for information and secondarily for correlation with a view to obtaining fresh light on agricultural, health and economic problems. To meet the first of these requirements, arrangements might continue as at present. For the second, an expert statistician might be appointed and placed in control of a small but highly skilled subordinate staff. We believe, however, that any separation of ordinary statistics from what may be termed research statistics would be unsound as well as expensive. Ordinary statistics are the material on which the expert works and the more familiar he is with their origin the better. We, therefore, prefer an organisation separate from that of the Department of Commercial Intelligence which would deal with both classes of statistics. Care should be taken to safeguard the head of the new department from all avoidable routine work by the establishment, within his office, of sections dealing with the various sets of ordinary statistics each under the control of a competent superintendent. As in the case of the provincial organisation, we contemplate that provision should be made for higher statistical enquiry on modest lines and we are unable to agree with the proposal of the majority of the Indian Economic Enquiry Committee that a large central organisation should be created at an estimated initial outlay of Rs. 16·56 lakhs and a recurring annual expenditure of Rs. 29·15 lakhs. All that would be required at first would be the engagement of a statistician of recognised competence who, with his staff, would be appointed and paid by the Government of India. He would be placed in control of the existing statistical staff and would be responsible for suggesting increases of staff as and when such increases were demonstrably justified by the work to be done. As regards the qualifications required of the statistician himself, we would stress the need of obtaining a man of first rate ability and of making, therefore, the pay and conditions of service in the appointment such as would attract an outstanding man. He might be styled the Director of the Central Bureau of Statistical Information. It would, in our view, be useless to engage any but a first class statistician for the duties we have in mind. The officer selected must be of sufficient standing to make his advice acceptable not only to the provincial statistical officers but also to the business world and the informed public. One of his most important duties would be to establish close touch with these very important non-official sections of

* See, for instance, the evidence of Mr. J. H. Field, M.A., B.Sc., late Director General of Observatories (Vol I, Pt. I, pages 193-208) and the Article on "Crop and Weather Data in India and their Statistical Treatment," by Mr. S. M. Jacob, I.C.S., in Vol. XXII, Part IV, of the *Agricultural Journal of India*.

the community and we trust that provision will be made in the central statistical organisation for boards which would advise on the publication of statistics and their periodical revision, and that representative leading economists, scientists and business men will find a place on these boards as well as officials of the departments interested. In this way, we trust that a school of statistical interpretation might develop in this country which would have little or no formal connection with Government but would, nevertheless, have access to, and be thoroughly familiar with, official statistical material of all kinds. In fact, there would, we trust, gather round the Central Bureau of Statistical Information the beginnings of a Royal Statistical Society for India.

The whole basis of statistics in India urgently requires broadening. It should rest not on the work of a few government officials, however able, but on the support of the informed public, and, through them, on the recognition by the legislatures and by the general public that modern statistical methods are in a position to make an indispensable contribution to the successful development alike of scientific agriculture and of social administration.

RELATIONS WITH THE STATISTICAL BRANCH OF THE INTERNATIONAL INSTITUTE AT ROME.

540. It has been suggested to us in evidence that establishment of closer relations with the International Institute at Rome might be productive of particularly valuable results in the statistical field. We deal with this question from a general point of view in Chapter XX, paragraph 578, and there recommend that relations between India and the Institute should be as close as possible and that officers on leave or duty in Europe should take every opportunity of visiting the Institute and acquainting themselves with those branches of its activities which may have a special bearing on their own duties. In this recommendation, we include statistical officers and other officers interested in statistical methods. We agree with the conclusion of the Board of Agriculture in 1925 that statistical information of value to India over and above that made available in its publications is to be found in the archives of the Institute. But we do not consider it necessary for the purpose of utilising this material, any more than we have held it to be necessary on general grounds, that there should be a whole-time representative of India on the Permanent Committee of the Institute. There are so many important directions in which improvements can be effected in Indian statistics, and, given money and men who have been properly trained, the ways in which these improvements can be made are so well known, that the money which would be required to meet the cost of a permanent representative at Rome can be better spent in India. We desire, however, to make it clear that we are in favour of the attendance from time to time of representatives from India for special questions.

We are also informed that the Institute is organising a world census of agricultural production to be made in 1931 and that it has been suggested that India should participate in it. We agree with this suggestion provided its acceptance involves no large expenditure. We cannot

accept the view that, even if the cost of collecting the information were considerable, participation would necessarily still be worth while. This, however, is a matter in which the Government of India will look for authoritative advice from the Director of the Central Bureau of Statistical Information whose appointment we recommend in paragraph 539.

CONCLUDING OBSERVATIONS.

541. In advising concentration on a moderate programme of official improvement, as compared with comprehensive and costly enlargement of the statistical services such as that contemplated in the majority report of the Indian Economic Enquiry Committee, we do not wish to underrate the assistance that unofficial agencies can give. As interest in statistical methods, promoted by the activities of bodies such as the Board of Economic Enquiry in the Punjab, increases, there is every reason to hope that substantial landholders, commercial firms and groups of cultivators associated co-operatively for the furtherance of their interests in a particular crop, such as cotton or jute, will be able to render valuable assistance. We agree with the Indian Cotton Committee of 1919 that sufficient use has not hitherto been made of such non-official agencies. But nothing is to be gained by ignoring the fact that, in the present stage of development in this country, no extensive use can be made of a system of paid reporters of agricultural information such as obtains in the rural statistical organisation of Great Britain and the United States of America. It is for this reason that we have forborne to compare the Indian system of collecting agricultural statistics with the systems obtaining in other countries.

Until a reliable voluntary reporting system can be built up, we also consider that the establishment of a government agency separate from the revenue agency, for the collection of statistics, would impose an unjustifiable burden on the public purse. Even if far greater accuracy were thereby obtained, we have grave doubts whether its attainment would be worth the cost, but, in fact, we see no likelihood that substantially greater accuracy would be achieved in this way. Indeed, it is quite possible that the immediate result would be to make returns less, rather than more, accurate. For the agency employed would need to be literate and the number of literates required would make it necessary to employ many who were entirely unversed in agricultural matters. We think that solid progress is far more likely to be achieved by the adoption of the policy advocated by many of the witnesses who appeared before us, and which we ourselves recommend in paragraph 538 above, namely, to strengthen the staff which checks and interprets the data collected by the primary reporters.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

542. The conclusions and recommendations in this chapter may be summarised as follows:—

(1) The date of publication of the *Agricultural Statistics of India* should be expedited (paragraph 525).

(2) Separate figures for each district should again be given in the *Agricultural Statistics of India* (paragraph 525).

(3) It would be advantageous if forecasts of yield in the Central Provinces and in Burma (with the exception of the rice forecast in the latter province) were prepared by the Agricultural Department as in other provinces, provided that the statistical assistance recommended in paragraph 538 is given (paragraph 525).

(4) The practice of issuing forecasts in leaflet form should be revived. The forecasts should be translated into the vernaculars (paragraph 525).

(5) Fuller information regarding wells should be given in the irrigation reports (paragraph 525).

(6) In the forest reports, statistics for the proposed new Minor Forests Division should be shown separately; the areas actually under timber should be given and public and private ownership distinguished (paragraph 525).

(7) Discrepancies between the figures given in departmental returns and those given in the *Agricultural Statistics of India* should be reconciled (paragraph 525).

(8) In the reports on education, figures relating to urban and rural areas should, if possible, be shown separately and a uniform classification of school should be adopted (paragraph 525).

(9) The classification of uncultivated lands into culturable waste and not available for cultivation requires examination (paragraph 526).

(10) In the permanently settled areas of Bengal, Bihar and Orissa and Assam, an attempt should be made to extend to other crops the method now in use in collecting the statistics of jute production (paragraph 527).

(11) The correctness of the formulæ used in arriving at the areas under mixed crops should be tested from time to time by actual field trials of the main types of mixtures found in a district (paragraph 527).

(12) The formation at the headquarters of each provincial agricultural department of a statistical branch which is recommended in paragraph 538 should precede any attempt to transfer all crop-cutting experiments from the revenue to the agricultural departments or to improve the technique of the experiments (paragraph 528).

(13) Changes in the figures of standard yield of crops should be made only on data supplied by crop-cutting experiments (paragraph 528).

(14) Before a system of random selection of villages and fields for crop-cutting experiments is introduced, the means to carry out far more numerous experiments must be provided (paragraph 528).

(15) No attempt should be made to teach the primary reporting authority to form an exact mental picture of a "normal" crop (paragraph 529).

(16) It should be left to the tea trade to move for legislation with a view to improve the statistics of tea production. If a request to this effect is made, it should, if possible, be granted (paragraph 530).

(17) The statistics of coffee are susceptible of improvement (paragraph 530).

(18) The jute trade should collaborate with Government in the improvement of the jute crop statistics (paragraph 531).

(19) As an ultimate solution of the difficulties in compiling satisfactory statistics of the jute crop, the possible collaboration of all jute interests, from the cultivator to the trader, manufacturer and exporter, should be kept in view (paragraph 531).

(20) The statistics relating to the production and consumption of the cotton crop should, in future, furnish a model for statistics relating to other crops (paragraph 532).

(21) The statistics of inland trade (rail and river-borne) should be revived forthwith for all commodities of economic importance and not only for cotton. Advantage should be taken of the gap in their publication to reconsider their form and contents (paragraph 533).

(22) Statistics should be collected of the trade on the main roads crossing the frontiers of India (paragraph 533).

(23) While the statistics of livestock for the different provinces are now sufficiently uniform to permit of useful comparisons, considerable improvements are possible without resort to the costly expedient of engaging special staff (paragraph 534).

(24) The quinquennial census of livestock should be taken simultaneously throughout India (paragraph 534).

(25) An effort should be made to secure uniformity of classification in the next cattle census and the heads under which returns should be made should, therefore, be settled by the next Cattle Conference (paragraph 534).

(26) All vital and health statistics should be shown separately for rural and urban areas (paragraph 535).

(27) Vital statistics for rural areas should include particulars of the strength and distribution of the medical and health services, including trained midwives (paragraph 535).

(28) There is a wide field of useful work for private individuals and associations in correlating vital statistics and health data with those relating to agricultural and irrigation conditions (paragraph 535).

(29) Similarly, there is a wide scope for private individuals and associations working on a common plan under the aegis of university organisations or of bodies of a semi-official type such as the Punjab Board of Economic Enquiry, to prosecute research into such socio-economic problems as indebtedness, mortgage debt and fragmentation of holdings (paragraph 536).

(30) The object of statistics collected by government agency should be, primarily, the supply of the information required by Government

to discharge its functions and, secondarily, the supply of information required by the producers and the general public. In present circumstances in India, the latter object is of special importance (paragraph 537).

(31) Each agricultural department should be strengthened by the appointment of a statistical assistant. The appointment of this officer should precede any changes in present arrangements for statistical work (paragraph 538).

(32) The application of mathematics to agriculture has introduced an entirely new factor into scientific agriculture and a specialist with the highest qualifications in this branch of agricultural science should, therefore, be attached to the Imperial Agricultural Research Institute (paragraph 538).

(33) It is desirable that a statistical officer should be appointed at the headquarters of each provincial government who would control all government statistical work other than that connected with agricultural statistics and, as director of a bureau of statistical information, would be an adviser to non-official workers (paragraph 538).

(34) The present statistical organisation of the Government of India should be strengthened by the appointment of a statistician of first rate ability as head of a separate Department of Statistics (paragraph 539).

(35) The appointment of this officer should precede any changes in the present arrangements for statistical work, but it is hoped that, as a result of his appointment, a Bureau of Statistical Information would be created with the administration of which leading economists, scientists and business men would be closely associated (paragraph 539).

(36) Every opportunity should be taken to utilise the statistical experience of the International Institute of Agriculture at Rome, but the expense of a whole-time representative in India on the Permanent Committee of the Institute would not be justified by statistical considerations (paragraph 540).

(37) As a primary agency for the collection of agricultural statistics in temporarily settled areas, there is no practicable alternative to the subordinate officials of the revenue departments (paragraph 541).

(38) More use should be made of non-official agencies in the collection of agricultural statistics but, in the present stage of development, no extensive use can be made of a system of paid reporters (paragraph 541).

CHAPTER XIX

THE AGRICULTURAL SERVICES

SCOPE OF THE CHAPTER.

543. We propose to consider in this chapter the recruitment, organisation, pay and conditions of service of the personnel of the agricultural departments with special reference to the increased responsibilities which will be imposed upon them if the recommendations we have made in this Report are accepted. In the course of this review, we shall have occasion to deal from the service point of view with some matters which have already received mention in Chapters II, III and XV. Questions affecting the recruitment, organisation, pay and conditions of service of the veterinary personnel have already received full treatment in Chapter IX and we do not propose in this chapter to recapitulate the conclusions there arrived at.

THE INDIAN AGRICULTURAL SERVICE.

544. The Indian Agricultural Service was constituted in 1906 as an all-India service; an officer recruited to it was liable to serve in any part of India, was appointed and could only be dismissed by the Secretary of State in Council, by whom his pay, pension and other conditions of service were regulated. Although, in recruiting candidates for the service, the qualifications required for administrative posts were distinguished from those required for research and teaching posts, all officers once recruited were borne on the same cadre and received the same basic rates of pay. Recruitment for the Indian Agricultural Service ceased in 1924 in consequence of the general decision taken, on the recommendation of the Royal Commission on the Superior Civil Services in India, not to recruit further for such of the all-India services as were administering subjects, of which agriculture was one, which had been transferred, under the Constitutional Reforms of 1919, to the control of the Governors of provinces acting with their Ministers.

The Indian Agricultural Service will thus gradually disappear but, before it does so, it has still an important part to play in directing the agricultural development which will, we trust, result from the recommendations in this Report. For this reason, and also to enable the recommendations we have to make in regard to the future organisation of the agricultural departments to be more readily understood, it will be convenient to give some account of its antecedents and present distribution.

The service has been filled mainly by direct recruitment. When recruitment ceased in 1924, only 22 out of 109 effective posts were held by officers who had been promoted from the lower ranks of the department. There was no competitive examination for admission to the Indian Agricultural Service. Appointments to it were made by the Secretary of State in Council, on the advice, in the case of direct recruitment, of an *ad hoc* selection committee sitting in London and, in that of promotion from the lower ranks, of the Government of India.

Preference both for administrative and for research and teaching posts was given to "distinguished graduates of universities in the British Empire." In making appointments to administrative posts, weight was attached to the possession of a university degree in honours in science, or the diploma of a recognised school of agriculture, or other similar distinction, and also to practical experience in farming. Candidates for research and teaching posts were required to possess a university degree or other similar qualification in the special science concerned and preference was ordinarily given to those who had spent a period of two years in research work under a scientist of established reputation and had studied science from an agricultural point of view. Candidates had, as a rule, to be between the ages of 23 and 30.

In the eighteen years which elapsed between the foundation of the service and the cessation of recruitment for it, many officers combining high academic qualifications with considerable practical experience were recruited and, from the point of view of efficiency, the arrangements we have described above, on the whole, worked well.

When recruitment for the service ceased in 1924, its sanctioned strength was 157. The posts were distributed as shown below :—

Class of post	Under Government of India	Under provincial governments
Administrative	5	79
Teaching and Research	14	59
Total ..	19	138

The service was, however, considerably under strength and the number of effective posts was, as already mentioned, 109. This has since fallen to 93. The officers holding these posts are distributed as shown below :—

Class of post	Under Government of India	Under provincial governments
Administrative	1	46
Teaching and Research	9	32
On deputation	2	3
Total ..	12	81

There are, in addition, twenty-five officers holding permanent appointments outside the cadre. Four of these are serving under the Government of India at Pusa and its sub-stations, two from Pusa are on deputation and nineteen are under provincial governments. There are also three officers serving under provincial governments on short-term contracts. Most, if not all, of the permanent officers will receive appointments in due course in the new superior provincial services. The present position is thus that the duties of the higher branches of the service in the provinces are being performed by ninety-seven* permanent officers of whom fifty-one are holding administrative and forty-six research and teaching posts. This may be regarded as the minimum strength required for the existing work. The distribution of these posts in the provinces is shown in the following Table :—

Province	Administrative	Teaching and Research	Total
Assam	1	1	2
Bengal	3	5	8
Bihar and Orissa	5	..	5
Bombay	2	8	10
Burma	10	3	13
Central Provinces	7	4	11
Madras	10	7	17
North-West Frontier Province	1	..	1
Punjab	8	12	20
United Provinces	4	6	10
Total ..	51	46	97

THE PROVINCIAL SERVICES.

545. Although, prior to 1920, there were, in all the major provinces, a certain number of special posts, the incumbents of which formed a group intermediate as regards duties, status and pay between the Indian Agricultural Service and the subordinate agricultural services, Bombay and the Central Provinces were the only two provinces which had a regular Provincial Service. As a result of the recommendations of the Public Services Commission of 1915, commonly known as the Islington Commission, such services were constituted in all provinces, after 1920, partly by absorption of special posts, partly by the promotion of officers of the upper subordinate services and partly by direct recruitment. Those recruited from the subordinate services are usually graduates or holders of diplomas of an agricultural college in India. Those appointed direct are usually graduates in science of an Indian university but, in a few cases, they have received special training abroad. Selected officers of the provincial services are sent from time to time for post-graduate courses

*Namely, 81 officers of the Indian Agricultural Service, *plus* 19 officers holding permanent appointments outside the cadre *less* three who are at present holding extra provincial appointments.

at Pusa. Members of these services hold both administrative and research and teaching posts. Their principal administrative work is the supervision of demonstration and propaganda under the general control of deputy directors. Typical appointments on the research and teaching side are those of assistant professors in agricultural colleges and assistants to research officers. In the present depleted state of the Indian Agricultural Service, some officers of the provincial services officiate more or less continuously in professorial or research appointments. In all provinces except Burma, the minimum pay of this service is Rs. 250 per mensem and the maximum Rs. 750 per mensem. In Burma, the minimum and maximum are Rs. 300 and 800 respectively.

The following Table shows the present strength of the provincial services :—

Province	Administrative	Research and Teaching	Total
Assam	3	..	3
Bengal	9	4	13
Bihar and Orissa	7	5	12
Bombay	6	18	24
Burma	6	5	11
Central Provinces	9	7	16
Madras	12	15	27
Punjab	14	16	30
United Provinces	12	9	21
Total ..	78	79	157

There are, in addition, eleven officers holding permanent or temporary posts outside the cadre.

SUBORDINATE SERVICES.

546. Below the provincial services in all provinces come subordinate services, the designations of which are as various as their rates of pay. In most provinces, the qualification for the upper grade of the subordinate services is the possession of the degree or diploma of an agricultural college. This is the qualification required for the Upper Subordinate Service in Madras, the Upper Division in the Central Provinces, "A" Class agricultural assistants in the Punjab and graduate assistants in Bombay. Scales of pay differ greatly but, in no province, is the minimum starting pay of the upper grade less than Rs. 60 or the maximum more than Rs. 300 per mensem. The upper subordinate services provide managers and assistant managers of farms, demonstrators of agricultural improvements, and laboratory and teaching assistants at the colleges; it also renders general help in the work of the department under the orders of the deputy or assistant directors of agriculture. In most provinces, the lower grade of the subordinate services consists mainly of those who

hold the certificate that they have passed the two years' course of an agricultural college. In Madras and the Central Provinces, this grade is designated Lower Subordinate Service and Lower Division, respectively; in the Punjab, " B " Class agricultural assistants, and, in Bombay non-graduate fieldmen. It provides overseers for the smaller farms and for demonstration plots, and also sub-assistants on the research side of the colleges. The rates of pay vary greatly but nowhere is the minimum less than Rs. 30 or the maximum more than Rs. 180 per mensem.

Below the two grades, details regarding which have been given above, come a large class of subordinates variously known as *mukaddams* in the Punjab, *kamdars* and *jamadars* in the Central Provinces, ploughmen, *mukaddams* and *kamgars* in Bombay, fieldmen in Burma, fieldmen and demonstrators in Bengal and Assam, *sardars* and *mistris* in Bihar and Orissa. This class is recruited for the most part from the sons of cultivators who are literate, but have had no secondary education. They have, however, undergone a course of special training. Their rates of pay vary from a minimum of Rs. 15 per mensem to a maximum of Rs. 60.

All posts in the subordinate agricultural services, like those in the Indian Agricultural and the provincial agricultural services, are permanent and pensionable. Temporary fieldmen are frequently engaged from time to time for some specific duty such as a demonstration in a particular district or group of villages.

DIRECTORSHIPS OF AGRICULTURE AND PRINCIPALSHIPS OF AGRICULTURAL COLLEGES.

547. For convenience of reference, we propose throughout the remainder of this chapter to designate appointments in the new superior provincial agricultural services, which will ultimately take over the duties of the Indian Agricultural Service in their entirety, as Class I appointments and appointments in the existing provincial agricultural services as Class II appointments.

Before discussing questions connected with the new superior provincial services, it is necessary to examine the position of the directors of agriculture and the principals of the agricultural colleges. The directorship of agriculture must obviously be a selection post outside the cadre of Class I appointments. In paragraph 477, Chapter XV, we have stated our view that the post of principal of an agricultural college is second only in importance to that of Director of Agriculture. In these circumstances, we consider that it also should be scheduled as a selection post outside the cadre of Class I officers. We have also stated in the same paragraph that the incumbent should continue to be selected as a rule from the Agricultural Service, but that, in the event of a suitable officer not being available from that service, the selection of an officer from the Educational Service should be considered.

The Director of Agriculture should be an officer combining administrative capacity with high scientific qualifications. As the functions and activities of the agricultural departments extend and their staff is expanded, an increasing measure of decentralisation will become necessary. The administrative responsibilities of the

directors are certain to grow and much of the technical work at present in their hands must pass to the charge of officers subordinate to them. We cannot too strongly state our conviction that the directorship of agriculture is one of the key posts in rural development and that agricultural advance must in a very great degree depend upon the suitability of the officer appointed. It may happen that the administrative capacity we postulate as an essential qualification for a Director of Agriculture may not be forthcoming in the Agricultural Department of a particular province, when a vacancy in the appointment occurs. In such circumstances, we think that the local Government should, in the first instance, turn to the Agricultural Department of another province and, failing that, to the Indian Civil Service.

In paragraph 477, Chapter XV, we have stated the qualifications which, in our view, should be possessed by the principal of an agricultural college. We need not repeat them here but we would again emphasise that there is no appointment, except that of Director of Agriculture, the holder of which has greater opportunities for influencing the course of agricultural development in his province. If the principal fails to take advantage of these opportunities, and if, in consequence, the efficiency of the college is lowered, agricultural progress in the province must suffer a set back from which it may take years fully to recover.

If our recommendation is accepted and the posts of Director of Agriculture and principal of an agricultural college are scheduled as selection posts outside the cadre, the rates of pay attaching to them will require to be specially fixed. The directors of agriculture in all provinces except Assam are at present on a scale of Rs. 2,000--50—2,250. In view of the greatly increased responsibilities which will be placed upon them as the departmental organisation develops in the way we recommend that it should, we do not consider this scale of pay sufficient. Moreover, pay and status are closely connected and we recommend that the head of the Agricultural Department should be on an equality with the heads of other important departments such as those of Public Instruction and Forests.

The principals of agricultural colleges receive pay on the time scale of the Indian Agricultural Service with a special pay of Rs. 150 per mensem. The principals of the Nagpur and Poona colleges are the only principals who have reached the selection grade of the service, the pay of which is Rs. 1,250—50—1,500. The other principals are still in the ordinary grade, the maximum of which is Rs. 1,250. The ordinary time scale of the Indian Agricultural Service is not, in our opinion, commensurate with the responsibility of a post which we regard as of such importance as that of principal of a college. We would, therefore, suggest that the scale should be Rs. 1,500—50—2,000. The special pay of Rs. 150 per mensem would be abolished. We should explain that we have omitted all reference to overseas pay in the above discussion. We assume that this would continue to be given, as at present, to those officers who are eligible for it. The posts of Director of Agriculture and Principal of a college would continue to be pensionable under the ordinary rules.

The Director of Agriculture should be eligible for the higher rate of additional pension.

It may be that, in some of the larger provinces, the additional responsibilities which will fall on the Director of Agriculture as the result of the acceptance of our recommendations will render it desirable that the Director should be given the assistance of a joint director. If this proves advisable, we consider that it will be sufficient if the joint director is on the time scale of the Indian Agricultural or of the new superior provincial agricultural services and is given suitable special pay in recognition of his increased responsibility.

THE NEW SUPERIOR PROVINCIAL SERVICES. (CLASS I). (i) GENERAL.

548. Although recruitment for the Indian Agricultural Service ceased in 1924, no province has, as yet, constituted a new Superior Provincial Service to take its place. The only indications of provincial views on this subject are furnished by the proceedings of the Conference of provincial representatives which was held at Delhi in November, 1927, to consider the constitution of the transferred services in each province. The Conference, however, came to no definite conclusions and, in these circumstances, we offer the following suggestions as to the manner in which the agricultural services should be recruited and organised and the terms and conditions of service which should be offered. We recognise, however, that the financial circumstances of the provinces differ widely and that a scale of organisation which one province is in a position to adopt immediately may only be a distant ideal to another. We revert to this point in paragraph 557.

It will be evident that, in several directions, our recommendations involve an increase in the present staff on the administrative, teaching and research sides. The precise extent of that increase must depend upon the relative importance assumed by different problems in different provinces and we, therefore, made no attempt to set out in tabular form the additional staff which would be required in each province if full effect is given to our recommendations. On the administrative side, we have recommended that three officers of the standing of deputy director of agriculture should undertake special duties under the general supervision of the Director in regard to the control and distribution of improved varieties of seed, demonstration and propaganda and marketing. We have also recommended that the engineering section of each agricultural department should be completely reorganised and greatly strengthened and should be made an integral part of the department. On the teaching side, we have recommended that the staff of the colleges should be strengthened to enable thorough instruction in agricultural economics to be given. On the research side, we have emphasised the great importance of developing the research organisation in all provinces. On the statistical side, we have urged the appointment forthwith of a competent statistician. The additional staff we have proposed represents, in our view, no more than the minimum additional requirements of each province.

549. As we have seen, the qualifications for admission to the Indian Agricultural Service were of a general character. Preference both for administrative and for research and teaching posts was given to distinguished graduates of universities in the British Empire. The only distinction made between the two classes of posts was that, for research and teaching posts, a university degree or similar qualification in the special science concerned was insisted on and preference was ordinarily given to those who had spent a period of two years in research work under a scientist of established reputation and had studied the science from an agricultural point of view.

(ii) QUALIFICATIONS AND RECRUITMENT.
(a) RESEARCH POSTS.

So long as the provincial agricultural departments were developing their organisation and mapping out the local problems of special importance, the policy of recruiting an "all round" type of officer, with a moderate degree of specialisation where research and teaching posts were in question, was undoubtedly a sound one. The achievements of the agricultural departments in the fields both of administrative organisation and of research lend support to this view. We consider, however, that the time has now come when the problems of agricultural research in this country demand a more specialised type of officer. In such branches of science as plant genetics and the investigation of plant disease, the conditions are now passing, if, indeed, they have not already passed, in which success comes rapidly because the field of research is virgin ground. Agricultural research in India now requires men who combine scientific knowledge and technique of the first order with the vision and creative power essential to the opening up of new and original lines of work.

The conditions most congenial to such research workers are generally to be found in universities, for residence in a university offers opportunities of contact with minds of similar calibre engaged in other lines of research. It is under this stimulus that agricultural research workers are likely to do their best work. Moreover, the research worker is apt to feel hampered by official rules and regulations and there is always a danger that the value of his work may be seriously affected by the unwillingness of impatient administrators to realise that definite results cannot be produced within any definite period of time. But, while the ultimate goal may be the establishment of agricultural as well as of other research centres at the universities, we recognise that the time is not yet ripe for this. The only course open, in present conditions, is to continue and strengthen the existing organisation and to fortify the position of the agricultural college as the centre of research work in the province. It will, therefore, be necessary to continue to recruit agricultural research workers into government service and the possible sources of recruitment and the terms of engagement require consideration. We are convinced that the field of recruitment for the Superior Provincial Service in any province ought not to be restricted to the province itself or to India. The best man should be selected, wherever he can be found. As regards qualifications, we consider

that more importance should be attached to the record of the candidate in the field of research in which the appointment is being made than to his academic distinctions, but an honours degree in science at a university of repute or its equivalent should be regarded as an essential qualification.

As regards terms of engagement, we have considered whether appointments of research workers might not be filled by recruitment on short-term agreements on special terms to be decided in each case. We do not recommend this course to which local governments, so far as their opinion can be gauged from the proceedings of the Conference at Delhi in November, 1927, would also appear to be opposed. Its adoption would mean, in many cases, that valuable experience gained by an officer during his period of service would be lost to India at the end of it. In this connection, it is of interest to note that the chain of research stations which it is under contemplation to set up in the Crown Colonies, and on the organisation of which much time and thought has been expended, will be staffed by a corps of research workers constituted as a regular service. Again, as we have pointed out, research is now entering on a stage at which speedy results are not to be anticipated. Team work inspired by men of insight is indicated as most likely to be fruitful. In such circumstances, engagement for five or ten years, even if the engagement may be freely renewable at the option of either party, does not appear to us to be so satisfactory a course as the constitution of a regular service. At the same time, special arrangements will be necessary if research workers of the requisite calibre are to be recruited. The basic pay which might be sufficient to attract the right type of administrative or teaching officer is not, in our opinion, sufficient to secure the first class research worker. The latter will, in any case, have undergone a more prolonged period of training. It is also desirable that he should have been given time to show his quality before appointment in some such way as the production of a thesis on some practical piece of research. He will, therefore, on entry to the service be considerably older than the administrative officer and his age will ordinarily be between 25 and 30. Due allowance for age on entry can, and should be, made by fixing his starting pay at a suitable point in the time scale. But, to attract the first class man, something more than this will probably be required. We consider that this can best be given in the form of special pay personal to himself, the amount of which would be fixed with reference to his special qualifications.

The fact that there is an increasing demand from private organisations for first class men has also to be faced. What has been done on a small scale by the Indian Tea Association is being done on a much larger scale by such combines as Imperial Chemical Industries, Ltd. And, again, during the period of formation of the new Colonial Scientific Service, competition for the best men likely to be attracted to government service may be expected to be specially keen. This may lead to a dearth of suitable candidates for the agricultural services in India. We are, therefore, of opinion that provincial governments would do well to institute a system of scholarships for their candidates similar to

that which the Imperial Agricultural Conference which met in London in October, 1927, recommended should be instituted for the new Colonial Scientific Service. These scholarships would be awarded to graduates selected as possessing the kind of qualifications required and should be of sufficient value to maintain the scholar whilst he is obtaining the post-graduate qualifications we have indicated above as essential. The possibility that a scholar may prove undesirable must be faced and, in such circumstances, the scholarship should be terminated and the expense incurred written off without hesitation. This course is obviously preferable to that of appointing to a research appointment a candidate unlikely to prove a success in it. A wider field of selection would be available if provinces were to pool their requirements. We would, therefore, suggest the constitution of a scholarship fund consisting of contributions from provincial governments, augmented by a grant from the funds at the disposal of the Council of Agricultural Research. As special machinery will be required to award the scholarships, to arrange for post-graduate courses of study at suitable centres for the holders of scholarships and to watch their progress, we consider it desirable that the scheme should be administered by a sub-committee of the Council.

In organising their research departments, provincial governments should realise that there are two quite distinct types of research worker. The true research worker is of the type we have described above. There is, however, another type of worker, who is often regarded as a research worker, although this term as applied to him is somewhat of a misnomer. Men of this type are not capable of original research, though they may be most efficient in carrying on work on plant selection, plant breeding, the investigation of disease and experiments in other directions on well established lines. Work of this character is an essential part of the work of a research station, but does not demand talents of a high order. It is most important that there should be no confusion between the two types when the creation or filling of an appointment on the research side is under consideration. If a botanist or mycologist of the first type is required, it is waste of money to recruit a man of the second type, which is naturally far more plentiful, and useless to hope that, if he is paid sufficiently highly and given lavish apparatus and equipment, he will eventually become a true research worker. Where what is required is routine work in any particular branch of research, this should be provided for by the creation of an appointment in Class II.

This leads us to the consideration of the question whether research posts in Class I should ever be filled by promotion from Class II. We cannot too strongly state our view that promotion to Class I appointments should never be regarded as a matter of " seniority tempered by selection." Research posts in Class II will ordinarily be filled by passed students of the agricultural colleges and by graduates in science from the Indian universities. Among these there should be found a proportion of individuals who are endowed with the qualifications of the true research worker and, in such cases, promotion should certainly be allowed.

(b) Teaching posts.

550. In paragraph 479, Chapter XV, we have discussed the combination of research and teaching in the agricultural colleges. We have there expressed the view that the combination of research with teaching is of mutual benefit to both. We have also expressed our entire approval of the existing system under which, at all the agricultural colleges, the heads of sections, while largely engaged in research work, also give instruction in their special subjects, and have associated with them lecturers, who, while dealing with most of the routine of instruction, engage also to a limited extent in research work. The lecturers are ordinarily members of the Provincial Agricultural Service. In a few instances, officers have been recruited to the Indian Agricultural Service solely or primarily for teaching work and the professorships of agriculture at the colleges have usually been held by officers of that service. If India is to achieve a greater measure of self-sufficiency in the matter of higher agricultural training, it is essential that the standard of teaching in the agricultural colleges should be a high one. For, on the quality of the instruction in the fundamental agricultural sciences which students have received in the agricultural colleges will depend the use they are able to make of the post-graduate facilities which we have recommended should be provided at Pusa. We are, therefore, of opinion that the teaching side of the agricultural colleges should be strengthened and that the professorships in agriculture and agricultural economics and also, where the professorships in botany and chemistry are held by research officers, the senior lecturerships in these subjects should invariably be filled by officers of the Indian Agricultural Service or by Class I officers of the new provincial services. We would explain that we do not contemplate that the special pay we recommend in the preceding paragraph should be attached to any posts in the colleges, the duties of which are solely or primarily teaching duties. We do not consider that there would be any justification for differentiation in the matter of pay between posts of this kind and the administrative appointments which we now proceed to discuss.

(c) Administrative posts.

551. Sufficient indication has been given in earlier chapters of this Report of the multifarious duties which fall to the lot of the district officers of the agricultural departments and of the necessity for securing competent officers for this branch of work. The qualities required in an administrative officer are, however, more likely to develop as the result of experience and opportunity in lower administrative posts than they are in the case of research workers. We contemplate, therefore, that a considerable number of the vacancies in Class I appointments on the administrative side will be normally filled by the promotion of Class II officers. Where resort is made to direct recruitment, we consider that a high standard of qualification should be demanded. The possession of a university degree with honours in science or the diploma of a recognised college of agriculture or other like distinction should be insisted on and the candidate should, in addition, have had practical experience of agriculture. Where he has undergone his previous training in a provincial agricultural college or an Indian

university, a post-graduate course should be made an essential qualification. The arrangements for this course would be on the same lines as those we have suggested in the case of research posts and, in the event of a dearth of suitable candidates, it may be necessary to introduce a similar system of scholarships for post-graduate study. The post-graduate course should, in no circumstances, be regarded as a substitute for the practical experience which we hold to be essential.

(*iii*) PROBATIONARY PERIOD.

552. All officers appointed to Class I posts, whether directly recruited or promoted, should be placed on probation for a period sufficient to determine their fitness for their duties. This period can hardly, we think, be less than two years. Confirmation should unhesitatingly be refused when a probationer has failed to justify his selection.

RELATIONS BETWEEN THE THREE BRANCHES OF THE SERVICE.

553. We consider that it will make for efficiency if, during the earlier years of service, interchange is freely allowed between the administrative and the research and teaching branches of the service. Officers will ordinarily remain throughout their service in the branch to which they were first appointed. But instances will occur in which an officer appointed to the administrative or teaching branch shows an aptitude for research work. Again, the professorship of agriculture in an agricultural college is an appointment which should invariably be held by an officer who has had a considerable period of district experience. There will also be instances in which it will have to be recognised that an officer recruited for research work is not fulfilling the promise of his academic career. In such cases, interchange will be much facilitated by the existence of a common cadre with a common basic scale of pay. The research officer who is transferred to an administrative or teaching post would relinquish his claim to any special pay of which he might have been in receipt but might, perhaps, be allowed, as a concession, to retain it until it was absorbed in due course by the increments on the basic scale. A concession of this kind would facilitate a transfer desirable in the best interests of the department and the advantages would far more than counterbalance the small additional expenditure involved.

SPECIAL POSTS OUTSIDE THE CADRE.

554. We consider that all higher appointments, other than those of directors of agriculture and principals of agricultural colleges, might be included in the cadre of the new superior provincial agricultural services. There may, however, be occasions when it might be necessary to make special arrangements to deal with specific problems. These occasions are most likely to occur on the research side but may possibly arise in regard to teaching and administrative appointments. Appointments on short-term contracts should, in our view, be made for strictly limited periods and for strictly defined objects.

PAY AND PENSION.

555. We have suggested in paragraph 549 above that special personal pay might be granted to officers holding particular research appointments in the new superior provincial agricultural services. This allowance would be in addition to the basic scale of pay of the service, an important consideration in fixing which must undoubtedly be the rates of pay fixed for other provincial services. We assume that it will be necessary to have a common basic scale of pay for all officers and that the only differentiation permissible will be the grant of overseas pay in sterling to officers of non-Indian domicile. Subject to the reservation we have made above in regard to special allowances for research posts, we consider that the basic time scale now in force for the Indian Agricultural Service (Rs. 350 to Rs. 1,250 per mensem) should be sufficient for Class I appointments. There should also be a minimum of two selection posts on Rs. 1,200—50—1,500 for each province.* If the service is to continue at its present level of efficiency, we are of opinion that no reduction in this scale is practicable. We further suggest that officers of the Indian Agricultural Service and future Class I officers should be placed as far as possible on an age for age equality of pay with services of a like standing such as the Educational and Forest services. We would also suggest that, when the age of an officer appointed to a Superior Provincial Agricultural Service exceeds the normal age of entry and this connotes the possession of higher qualifications or of experience likely to be of value, allowance should be made for this in fixing the point at which he enters the time scale. In addition to the special pay we have suggested for officers filling research posts, it may be found desirable to grant special pay to holders of administrative posts for which exceptional qualifications are required. Posts of this character would be the deputy directorships for demonstration and propaganda work and for marketing investigations. We consider, however, that as a rule, any special experience required by officers of the administrative branch should be obtained by them during study leave. All Class I appointments should be pensionable under the ordinary rules.

SAFEGUARDS FOR RECRUITMENT, DISCIPLINE AND CONDITIONS OF SERVICE

556. As it is essential for the future of agricultural development that the Superior Provincial Agricultural Service in each province should contain competent administrators and teachers and research workers of distinction, it is of the first importance that the manner in which it is recruited should be such as to ensure that vacancies are filled by the best candidates and that satisfactory provision is made in regard to the protection and discipline of members of the service.

The Indian Agricultural Service as a general organisation for agricultural development in India has ceased to exist. Each Superior Provincial Service when it comes into being will be an independent service

* So long as officers of the Indian Agricultural Service continue in service, this recommendation will necessarily be subject to such special arrangements as may be required to secure the rights in regard to selection posts which have been reserved to them.

responsible to the provincial Government which it serves for promoting the interests of the cultivators. For the recruitment of members of that service the provincial governments will be entirely responsible. We have the fullest confidence that they will desire that their agricultural services should be maintained at the highest possible level of efficiency. This, however, will only be possible if the officers in Class I of those services are the best men that can be obtained, and they cannot be obtained unless they have full confidence in the system under which they are recruited and they are assured that proper provision exists for the administration of the service. The only object of direct recruitment from abroad is to obtain men of outstanding merit. Unless recruits from abroad are well above the average in ability and professional attainments, the principal object of obtaining such officers from abroad will be frustrated. Such men are ordinarily in a position to choose the employment the conditions of which appeal to them most. Other things being equal, they will take service under that Government which can offer them the fullest security that the conditions of their service will be adequately safeguarded. In these circumstances, we regard it as of the greatest importance that, before recruitment for Class I appointments commences, effect should be given to the recommendations of the Royal Commission on the Superior Civil Services in India that local governments and local legislatures should take immediate steps to pass Public Services Acts regulating both the new and the existing provincial services. The Commission considered that these Acts might be expected, *inter alia*, to secure selection over the widest possible field on merits and qualifications and to reduce the risks of political interference, to lay down procedure for punishment and appeals and to provide satisfactory conditions in regard to such matters as pensions, promotions and leave.*

No province has, as yet, proposed legislation of this character. A central Public Service Commission has, however, been appointed, as recommended by the Royal Commission, to advise the Government of India regarding recruitment of all-India services and central services in India and also conditions of service generally. We would urge upon all provincial governments the necessity of legislation, if the conditions of service in their new superior agricultural services are to inspire confidence. Pending the passing of such legislation, it is open to local governments to make use of the central Public Service Commission and we think that it is desirable that they should do so. That there must be some authority regulating service questions which is external to provincial governments if the evils of the intrusion of political influences are to be avoided seems to us self evident. To quote from the Report of the Royal Commission : " Wherever democratic institutions exist, experience has shown that, to secure an efficient Civil Service, it is essential to protect it as far as possible from political or personal influences and to give it that position of stability and security which is vital to its successful working as the impartial and efficient instrument by which Governments of whatever political complexion may give effect

* Paragraph 16 of the Report on the Superior Civil Services in India.

to their policies. In countries where this principle has been neglected, and where the 'spoils system' has taken its place, an inefficient and disorganised civil service has been the inevitable result and corruption has been rampant." It should be needless for us to point out that any invasion of research and technical services by political influences would be specially disastrous.

RELATIONS BETWEEN PROVINCIAL AGRICULTURAL SERVICES.

557. It is, we think, inevitable that there should be some degree of dissimilarity between provinces in the conditions of service attaching to their superior agricultural services and also in the efficiency of those services. Where ability to spend varies so much, the wealthier provinces will, from the outset, have a larger number of Class I officers in their service than other provinces the financial position of which is not so satisfactory. And there can be little doubt that eventually, if not in the near future, the rates of pay of the provincial services will cease to be uniform and will vary in accordance with the resources of the province and also with the importance attached by local governments to attracting candidates with the highest possible qualifications to their agricultural departments. We trust, however, that a convention of friendliness and mutual help in agricultural administration and research will grow up between the different provinces and will be fostered by the Council of Agricultural Research. While we would most strongly deprecate any attempts by one local Government to attract promising officers from another province by the offer of better terms than the Government of the province in which they are serving is able to give, there should be regular provision for the interchange of officers to deal with special problems. Only in this way can the major inconveniences which arise from the existence of nine separate and comparatively small Class I agricultural services in this country be avoided. Where help is required in dealing with a research problem of more than local importance, a province may reasonably look to the research fund, the creation of which we have recommended in Chapter III, for financial assistance in meeting the cost of borrowing expert officers in this way. It would be for the provinces to agree amongst themselves as to the extent to which loans of this character could be allowed and the conditions which should be attached to them. The point we wish to stress is the desirability of avoiding the sacrifice of the public welfare that would be involved if a province were compelled to obtain an expert from outside India to deal with a special problem because another province refused to lend an officer who, so far as his own work was concerned, could well be spared for a limited period.

We deal with the relations between the provincial services and the research and administrative posts under the Government of India in paragraph 563 below.

RELATIONS WITH EMPIRE SERVICES.

558. In our chapter on Irrigation, we have welcomed the possibility of the establishment in India of an all-Empire station for research into irrigation problems.

Whether such a station is established or not, we desire to place on record our sense of the importance to India and the Empire of a close connection between agricultural research services in India and the corresponding services overseas, more particularly those which are working in tropical and sub-tropical regions. The problems in many cases are fundamentally the same, and, the more they are studied from different points of view and under different conditions of soil and cultivation, the more likelihood there is of solutions being found. There should be free interchange, not only of published information, but also of views and surmises before the stage of publication is reached. Communications of the latter kind may be of very great value, but they can scarcely take place unless the workers on the same class of problem have established some degree of personal touch with each other. The creation of a chain of Empire research stations would furnish a unique opportunity for establishing personal relations of this character, as it would greatly facilitate arrangements for interchange of visits between research workers in India and those in other parts of the Empire, the direct and, even more, the indirect results of which, should be of the greatest value to both. Whilst research workers in India could learn much from work in progress in other parts of the Empire, there are many directions in which Indian experience could help Empire research workers. There is, for example, the sugarcane breeding station at Coimbatore. It is at present the only station within the Empire at which cane breeding is done on a large scale and the possibilities of utilising it as an all-Empire station appear worthy of consideration. Again, should it be decided not to establish an all-Empire station for irrigation research, advantage could still be taken of the unique opportunities which exist in India for studying irrigation problems with the advice of experienced irrigation engineers.

STUDY LEAVE AND EXCHANGE OF OFFICERS BETWEEN EMPIRE AND INDIAN RESEARCH STATIONS.

559. We contemplate that a large proportion of the administrative posts in Class I will always be filled by promotion from Class II and that some of the research posts in Class I may be similarly filled. An increasing proportion of the direct recruits to both the administrative and research branches of Class I will doubtless be obtained from among students who have taken a post-graduate course at Pusa. We consider that opportunities for study abroad are of great importance for officers whose previous training has been confined to India. Even where a course of study at some British or foreign university has preceded appointment, the efficiency of an officer is likely to be much increased if he is given similar opportunities. We are not in favour of the grant of post-graduate scholarships to enable an officer to obtain the wider professional knowledge we have in view. The post-graduate scholarships we have recommended in paragraph 549 above are for the different purpose of enabling an officer to qualify himself for appointment to a Class I post. Once he has actually been appointed to the department, any further training required can, in our view, which is supported by the evidence of witnesses best qualified by experience to speak on this point, most advantageously be given after he has been in the public service for a few years. His senior officers will then have had sufficient time to

gauge his capacity and the direction in which his special abilities lie, and the officer himself will be sufficiently familiar with Indian agricultural conditions to define the aim of his advanced studies. We, therefore, recommend that officers, especially those holding research appointments, should be encouraged to take advantage of the study leave rules which appear to us to provide all the facilities required in this connection.

The requirements of the research worker and the administrative officer in respect of study abroad will be somewhat different. The former will need somewhat extended periods of study in order not only to acquaint himself generally with the methods of research followed in other centres but also to obtain guidance in regard to details. We anticipate that this study will often take a research worker to one of the Empire research stations and we trust that this will lead to the development, in course of time, of a system of exchange of research workers for definite periods. The advantages of an interchange of visits to which we have already referred would then be obtained on a very much larger scale. We regard it as most desirable that the Indian research system should be linked up with the Empire plans for research in tropical and sub-tropical regions which are in process of formulation.

On the administrative side, the main objects of visits abroad will be to obtain a knowledge of practical improvements in agricultural practice and of the most modern methods of conveying the proved results of research to the cultivator. For this purpose, a wider range of travel with a stay of comparatively short duration at important centres is indicated. Much assistance as regards the arrangement of an itinerary might be obtained from the International Institute of Agriculture at Rome, and we trust that, when the programme of his visits takes an officer to Europe, he will take the opportunity of paying a visit to the Institute, if it possesses information bearing upon his own line of work. We attach much importance to keeping agricultural departments in India in close touch with the work of the Institute and this end will be achieved more satisfactorily, in our opinion, by frequent visits of officers while on leave or duty in Europe than by the permanent residence at the Institute of an officer of the Indian Agricultural Service either on the active or the retired list. Programmes of work in England should always be arranged through the office of the High Commissioner for India, as that office is in the best position to advise regarding the centres which should be visited for the purposes of any particular enquiry.

Before we leave the subject of the facilities which should, in our view, be provided for post-graduate work, we would suggest the provision of one or two travelling scholarships for each province, to be held for one or two years by graduates or holders of diplomas of agricultural colleges whose intention it is to become managers of estates or to farm their own land. The award of the scholarships and the approval of the itinerary would, we hope, rest with the sub-committee of the Council of Agricultural Research which we recommend should be set up for the administration of the scholarship scheme referred to in paragraph 549

above. We have no doubt that the sub-committee would bear in mind the special advantages which the class of students to which we now refer would derive from travel within India. The endowment of such scholarships seems a very suitable object for private munificence.

PROVINCIAL AGRICULTURAL SERVICES (CLASS II).
(*i*) DUTIES.

560. We do not anticipate any substantial change in the nature of the duties which fall to the existing provincial agricultural services. As advisers to the agricultural associations, taluka development associations, co-operative Better Farming societies and the other organisations through which we trust the desire for agricultural improvement will find expression in ever increasing measure, they will continue to act as liaison officers between the expert officers in Class I and the individual landholder and cultivator. Within the official organisation, they will, as now, continue to control, under the general supervision of the deputy director, the numerous demonstrators and the managers and overseers of the departmental farms.

On the research side, they will assist the Class I officer by making experiments, observations and tests which, though of a routine character, are none the less essential, if discoveries are to be properly verified. Elsewhere in this Report, we have emphasised the importance of the verification of an agricultural improvement before it is recommended to cultivators. As assistant professors or lecturers they will also assist Class I research and teaching officers in the work of demonstrating and teaching. Here also, while the nature of their duties will remain much as at present, those duties will grow rapidly in importance as the agricultural colleges expand to meet the demands, not only of an enlarged government staff, but also the private demand for trained men, which has already arisen to a limited extent in one or two provinces and will undoubtedly increase, as the movement for agricultural development becomes more pronounced.

This enumeration of their duties is sufficient in itself to show how largely the success or failure of any policy of agricultural development and the speed and soundness of that development must depend upon the quality of the provincial agricultural services.

(*ii*) RECRUITMENT AND CONDITIONS OF SERVICE.

561. We see no reason to suggest any change in the system under which members of these services are recruited. Vacancies in administrative posts in Class II should ordinarily be filled by promotion from the upper grades of the subordinate services. Promotion should be strictly by selection on grounds of merit and no weight should be attached to seniority. The object should be to advance, as rapidly as their record justified, graduates of the agricultural colleges who would be required to enter the subordinate service in order that they might gain detailed practical experience and prove their capacity. As soon as experience has been gained and capacity proved, an officer should be promoted to Class II in the first vacancy which presents itself. When direct appointment to Class II posts are made, these will doubtless be, as at present, from science graduates who have received their training at a

university, either in India or abroad. We contemplate that direct appointments will, as a rule, be for research and teaching duties. Promotion from the lower grade to Class II and direct appointments should receive very careful attention from the authorities concerned for, as we have pointed out, the success of the whole official organisation depends, in no small measure, on the efficiency of this branch of the agricultural services. Pending the constitution of Public Services Commissions in the provinces, we are of opinion that promotions and direct appointments to Class II posts should be made on the recommendation of a strong selection committee.

In Class II as in Class I, there will be a well marked division between the administrative and the research and teaching sides. As a consequence, officers will naturally tend to stay on the side to which their qualifications have led to their being appointed. But, in Class II as in Class I, we think that interchange between the three branches should be freely allowed in the early years of service and even at later periods should this appear desirable. The arrangements in regard to probation should be the same as those for Class I officers.

THE LOWER GRADES OF THE AGRICULTURAL SERVICES.

562. In paragraph 546, we have described the general composition and the existing rates of pay of the lower grades of the agricultural services. It is the men of these grades who carry out all the detailed work of the department, the management of the smaller farms, the cultivation of the departmental demonstration plots and the supervision of those demonstration plots the cultivation of which is done by the cultivator himself, the selection, multiplication and distribution of seed, the management of livestock, etc. This is all work which is done under control, but it is work which demands high qualities of skill and intelligence for its successful performance. All provincial agricultural departments will depend largely for their success on encouraging a spirit of team work amongst the officers of all ranks and a conviction that good work will be rewarded by promotion. The upper grades of the subordinate services are recruited from graduates and holders of diplomas of the agricultural colleges, a proportion of whom are promoted in the normal course to Class II of the provincial agricultural services. Designations are not unimportant, and we think it very desirable that the designation of the upper grade of the subordinate services should not be such as to cause graduates or holders of diplomas of the agricultural colleges, who will normally be posted to it on first appointment, to regard service in it as in any sense derogatory, or to cause persons who are unfamiliar with the organisation of Indian services to conclude that the agricultural colleges are giving a training which equips their graduates only for subordinate positions. We, therefore, recommend that in all provinces the two higher grades of the subordinate services should be designated Agricultural Assistants, Class I and Class II.

We would emphasise the importance of careful selection of agricultural assistants on first appointment and the need for a period of probation with a strict review of the record of the probationer before

he is confirmed. Careful selection is specially essential for Class I agricultural assistants as it is from their ranks that the provincial agricultural services will be largely filled.

THE CENTRAL AGRICULTURAL RESEARCH SERVICE.

(*i*) THE SUPERIOR STAFF: ORGANISATION, RECRUITMENT AND DURATION OF APPOINTMENTS.

563. As we have stated in paragraph 59, Chapter III, we contemplate that, whilst Pusa in relation to other research institutions in India will be no more than *primus inter pares*, it will set the standard for all research institutions in India. We also hope that it will become the centre for post-graduate study to which the passed students of the provincial agricultural colleges will come to qualify themselves for appointment to Class I of the provincial agricultural services and for the highest posts in the agricultural services throughout the country. It is clear that if Pusa is to achieve these aims, a Director and staff of the highest calibre will be required.

In addition to the Agricultural Adviser to the Government of India, there are at present in residence at Pusa nine officers holding what are known as Class I appointments in the Imperial Department of Agriculture in India, of whom eight are members of the Indian Agricultural Service. Six of these are heads of the sections into which the work of the Institute is divided, Bacteriology, Botany, Chemistry, Cultivation and Cattle breeding (which are in charge of the Imperial Agriculturist), Entomology and Mycology. The remaining three officers occupy less important positions. The Imperial Agronomist is at present on deputation and the temporary vacancy has not been filled.

The Physiological Chemist and the Imperial Dairy Expert, whose headquarters are at Bangalore, are also heads of their respective sections. The Physiological Chemist is a member of the Indian Agricultural Service. The Imperial Dairy Expert holds a special post outside the cadre of that service. The references to Pusa in the subsequent discussion should be read as including its sub-stations.

The number and character of the posts which will be required in future cannot be estimated with any certainty as both will depend partly on the extent to which the services of the staff at Pusa again become in request among the provinces and the directions in which the provincial departments find themselves most in need of assistance from a central organisation; partly on the extent to which Pusa expands as a centre of post-graduate study; and partly on the outcome of our recommendations in regard to dairying and animal nutrition. In considering the strength of the staff at Pusa, it should be borne in mind that Pusa is not an ordinary research institute, as the term is used in other countries, but a group of institutes. For plant breeding alone, which in Pusa is undertaken by the botanical section, there are in Great Britain three separate institutes, in England, Scotland and Wales; and for physiological work on plants, which in Pusa is also included in the botanical section, there is a special institute in London. The staffing of these institutes in England is also on a more generous scale than has, up to the present, been adopted at Pusa. In addition to the Director, there are three grades of superior

officers, all of whom have academical qualifications similar to those of the Director and the only difference between him and them is one of experience and seniority.

We now propose to consider the composition, recruitment, organisation and pay of the Central Agricultural Research Service. As regards the composition of the staff, the principal object to be aimed at, in our opinion, is the provision of specialists of high reputation, each in charge, at the outset, of one of the eight sections into which the work of the Institute is at present divided. Further division may become necessary at a later stage but this is a matter on which it will be desirable for the Government of India to obtain the advice of the Council of Agricultural Research. These specialists with the Director at their head would, each in his own sphere, supply any provincial department in need of it with authoritative advice and, partly through their own reputation and partly through their skill in teaching, would imbue the students who come under their influence with high ideals of science and service. Below these specialists would come junior officers whose main duty would be to assist the specialist officers in their research and teaching work to an extent which cannot be expected of the present Class II officers at Pusa, and to act for them in their absence. The number that may eventually be required must be determined by the number of students taking post-graduate courses at Pusa. But as a commencement, there should, in addition to the head of the section, be at least one Class I officer attached to each section. The relationship between heads of sections and these Class I officers would be very much the same as that between the incumbent of a Chair at a university and the lecturers on the subject for which the Chair was founded.

The alternative methods of filling appointments to the superior staff at Pusa are direct recruitment and selection from the Indian Agricultural Service, so long as that service continues to exist, or from the new superior provincial services. If Pusa is again to set the standard of agricultural research in India and is to become the recognised centre for post-graduate training in the agricultural sciences, it is necessary that its superior staff should consist of research workers and teachers of the highest calibre. The Director and the heads of sections will require to be most carefully selected. Whilst we have no desire to debar the appointment either as Director or as head of a section of any officer of exceptional merit already in service, we consider it necessary, in existing conditions, that these appointments should, in the main, be filled by direct recruitment from abroad. Other Class I officers should be recruited either directly or by selection from the Indian Agricultural Service or the superior provincial agricultural services.

It has to be recognised, however, that the number of research workers of the requisite calibre is limited and that, for a time at least, the manning of the chain of research stations which it is proposed to establish in the Crown Colonies will make a heavy demand upon that number. We trust that the form of organisation and the terms of remuneration

we suggest will tend to lessen the difficulty of recruiting suitable candidates.

In this connection, as in the case of recruitment to Class I appointments in the provinces, we have considered whether the superior appointments at Pusa might not be filled by recruitment on short-term agreements, on special terms to be decided in each case. Such an arrangement would have the advantage that the services of an officer whose work in this country belied the promise of his record before appointment could be dispensed with without difficulty. This advantage would be clearer in the case of appointments at Pusa than in that of research appointments in the provinces as it would not be possible to transfer a research officer at Pusa to a post in the administrative line. On the other hand, it is very doubtful if this course would make service at Pusa sufficiently attractive to the best type of research worker and it might mean, in some instances, as we have pointed out in paragraph 549, that valuable experience gained by an officer during a short engagement would be lost to India at the end of it. It would also prove more expensive as short-term agreements almost invariably mean higher rates of salary. We are, therefore, of opinion that officers directly recruited, together with officers of the Indian Agricultural Service or of Class I of the provincial services who are appointed to the Pusa staff, should be constituted into a Central Agricultural Research Service. It may, however, be necessary on occasion to engage an officer for a limited period for a definite piece of work or because an individual whose services it is specially desired to obtain is unwilling to accept a permanent engagement.

An important question which arises is whether any fixed period should be laid down for the tenure of an appointment at Pusa by officers of the Indian Agricultural Service and officers of Class I of the provincial services. The preferable course appears to us to be to appoint such officers to Pusa in the first instance for a limited period, which might suitably be fixed at three years, and to allow the officer so appointed to retain a lien on his substantive post for this period. At the end of it, he should either be confirmed in his appointment or should revert to his province. If he were confirmed, he would ordinarily remain in the Central Agricultural Research Service for the remainder of his service, unless he were offered an appointment in a province. We would express the hope that, from time to time, provincial appointments may be offered to officers serving at Pusa, as this would assist in securing that closer touch between Pusa and the provincial departments which we regard as so desirable from every point of view.

(*ii*) THE DIRECTOR OF THE PUSA INSTITUTE.

564. Sanction for the creation of a separate post of Director of the Pusa Institute was given in 1921 but financial considerations have hitherto prevented its being utilised. The pay which it is proposed to attach to the appointment is Rs. 2,000—50—2,250 per mensem *plus* overseas pay under the ordinary rules and free quarters. This, it may be noted, except as regards rent-free quarters, is the pay of a provincial Director

of Agriculture. In paragraph 59, Chapter III, we have stated the qualifications which we consider are required for an appointment, the importance of which will doubtless be greatly enhanced under our scheme. Moreover, status and pay are closely related. It will be essential for so important a post that the best man available should be obtained and it will be necessary to fix such a rate of pay as may be required to obtain his services. The appointment should not carry pension unless it is held by an officer of a pensionable service in which case he should continue to earn pension under the rules of his service and would also be eligible for additional pension at the higher rate. Appropriate provident fund arrangements should be made for officers not already in a pensionable service and these should include a substantial contribution from Government. We make this recommendation as the officer appointed will be of an age which will make it impossible to serve for full pension under the ordinary rules and a provident fund is, therefore, likely to be more attractive than pension. Where an officer is a subscriber to the British Universities Pension Scheme, his rights in that scheme should, if possible, be preserved. Where an officer is a member of a pensionable colonial service, a similar arrangement can be made under existing rules. In such cases, a provident fund might not be required or required only on a reduced scale.

(*iii*) THE SUPERIOR STAFF AT PUSA.

565. The heads of sections at Pusa, with the exception of the Imperial Dairy Expert are all, at present, members of the Indian Agricultural Service. They are in receipt of the time scale of pay of that service *plus* a Pusa allowance and overseas pay of £30 per mensem. The Pusa allowance is a graduated one rising from Rs. 200 by increments of Rs. 50 to Rs. 400 per mensem. The first increment is not admissible until an officer has completed fifteen years of service. The maximum of the time scale is Rs. 1,250 per mensem. We do not consider that a maximum of Rs. 1,650 per mensem *plus* overseas pay of £30 per mensem is adequate remuneration for men who, under the scheme of development that we envisage for Pusa, should not only be specialists of standing but also the teachers from whom the students who will be the research workers of to-morrow will draw their inspiration. We find it difficult to suggest an appropriate scale but we consider that a scale of Rs. 1,500-50-2,000 represents the minimum that is likely to attract men of the calibre that we regard as essential. Overseas pay would be admissible at the appropriate rate for this scale of salary but the present Pusa allowance would be absorbed. We cannot too strongly reiterate our conviction that Pusa requires the best men available and if this scale proves insufficient to secure them, we are of opinion that the Government of India should have no hesitation in raising it. As we contemplate that the officers directly recruited to these appointments in future will be specialists of standing in their own line of work and will, therefore, be men of some seniority, we consider it preferable that the appointments should not carry pension, unless held by officers of a pensionable service in which case they would continue to earn pension under the rules of their service and would be

eligible for additional pension at the lower rate. As in the case of the Director and for similar reasons, appropriate provident fund arrangements should be made for officers not in a pensionable service and these should include a substantial contribution from Government. The suggestions in regard to the British Universities Pension Scheme and colonial pensionable services made in the case of the Director apply equally to heads of sections.

For Class I posts at Pusa, other than those of heads of sections, we consider that the existing time scale of pay of the Indian Agricultural Service with Pusa allowance and overseas pay, where admissible, is sufficient but we would suggest that the Pusa allowance should be absorbed into pay and suitable adjustments in the time scale should be made accordingly. If it should prove necessary to offer a higher rate of remuneration in order to obtain a suitable man for a particular appointment, the preferable course would be to allot special pay to the holder of the post rather than to increase the basic pay. Where an officer is directly recruited to any of these posts, the point at which he enters the time scale should be determined in the light of his age, his previous experience and his general qualifications. If a probationary period of three years were prescribed for a direct recruit, it should prove sufficient to enable his real worth as a research worker to be tested. Under the recommendations we have made above, an officer directly recruited would be engaged on permanent terms. As officers of this class would ordinarily be recruited at a younger age than the heads of sections, the provident fund has not the same advantages over pensionable service as in the case of the heads of sections. In order to secure uniformity and to provide for the eventuality of their being promoted as heads of sections, we would, however, recommend that the provident fund and other arrangements regarding preservation of extra Indian pension rights which we have suggested for the Director of the Institute and the heads of sections should also apply to them.

Should officers of the Indian Agricultural Service or of Class I of the provincial services be appointed to any of these posts, that is to Class I posts at Pusa other than the headships of sections, they would enter the time scale of the Central Agricultural Research Service at the appropriate point and would continue to earn pension under the ordinary rules.

(*iv*) CLASS II OFFICERS AT PUSA: RECRUITMENT, STATUS AND PROSPECTS.

566. The superior staff at Pusa has the assistance of officers who are designated Class II officers in the Imperial Department of Agriculture. They are, as a rule, graduates or holders of diplomas of the agricultural colleges or graduates of universities who have distinguished themselves in science. Promotions to this class from lower grades are occasionally made on grounds of special merit. The number of Class II posts, at present, is eight.

We consider that this valuable class should be developed and its status raised. We think that the designation "Class II officers" might be abolished and that, in future, these officers might be known as

"lecturers, demonstrators in botany, mycology, entomology, etc." We would not exclude direct appointments to these posts of graduates of Indian universities or graduates and holders of diplomas of agricultural colleges provided, in the latter case, that the college course has been followed by a period of post-graduate training. We think, however, that it would be an advantage if appointments in this class were largely filled by junior Class I officers in the provinces who had shown promise in their academical careers and a capacity for good work after appointment to the service, and partly by Class II officers in the provinces who had done work of outstanding merit. Class I officers appointed from the provinces would often be men who had taken a post-graduate course at Pusa and in returning to the Institute as lecturers or demonstrators, they would have the advantages which intimate prior acquaintance with the work of the Institute would bring. We consider that an excellent means of forging an additional link between Pusa and the provincial services would be furnished if the tenure of these appointments, when held by officers of Class I or Class II of the provincial services, were limited to five years. An extension of this period should only be permitted in exceptional circumstances.

The present scale of pay of Class II officers rises from a minimum of Rs. 300 to a maximum of Rs. 800 per mensem or an increase of Rs. 50 per mensem over the scale of pay of the provincial agricultural services. The difference between the two scales does not appear sufficiently large to attract the best type of provincial officer to Pusa and would not be suitable for junior Class I officers. We, therefore, suggest that officers appointed to posts of this class from provincial departments should receive their provincial scale of pay *plus* a Pusa allowance of Rs. 150 per mensem. Officers directly recruited should receive pay on the scale of Class II officers in the provincial services with a similar allowance. In deciding the point at which they should enter that scale, due weight should be given to their age and qualifications at the time of appointment. Their appointments should be pensionable as there does not appear sufficient justification, in this instance, for a departure from the usual rules in this respect.

VISITS OF OFFICERS OF THE CENTRAL AGRICULTURAL RESEARCH SERVICE TO THE PROVINCES.

567. It is our hope that, as the result of the establishment of the Council of Agricultural Research, the Pusa staff will be brought into far closer relations with the provincial agricultural departments than now exist. We understand that one obstacle to the establishment of these relations has been the strict application of the rule governing the financial relations between the Imperial and provincial governments which has been quoted in paragraph 32, Chapter II. It has been held that, when an officer of the Government of India is called in to advise provincial governments on local problems, his salary and travelling allowances should be borne by provincial revenues. Our own view is that, where lengthy work is required on a problem which is beyond the capacity of the provincial department and it, therefore, turns to Pusa for assistance, the correct

course is to place an officer on special duty for a limited period, in which case all the expenditure involved would be borne by the local Government. But, in all other cases, in which an officer of the Central Agricultural Research Service visits a province, whether in the course of his ordinary work or to assist in dealing with a specific problem, the cost involved should be regarded as part of the normal expenditure of the Pusa Institute. Short visits to provinces cannot fail to enlarge the outlook of members of the Central Agricultural Research Service and to increase their experience and we should regard it as a matter for great regret if any obstacle were placed in their way. We recommend that, if necessary, the existing rules on this point should be amended accordingly.

RECRUITMENT FROM ABROAD.

568. We think that it will be generally agreed that no country offers wider scope or better promise for the application of science to the business of agricultural production than India. Our Report will have failed in its purpose if it has not shown how vast is the field of work which lies before the agricultural services in India and how essential it is that those who are called upon to deal with the many and complex problems which present themselves for solution should be thoroughly equipped with all the resources which the best agricultural training available can furnish. India does not, in present conditions, provide that training and the object of some of our most important recommendations is to place her in a far more self-sufficient position in this respect than she now is and to provide for her young men opportunities for higher training second to none in the Empire. To this end, we have recommended improvements in the teaching of agriculture and its allied sciences at every stage, in schools, colleges, and universities, and have devoted special attention to the agricultural colleges. Above all, we have proposed that Pusa should become a true centre of higher agricultural training. It is to fit Pusa for this function as well as for that of setting the standard of agricultural research throughout India that we have recommended that it should be manned by a staff of the highest calibre, capable not only of initiating and directing all branches of agricultural research but also of creating and sustaining an atmosphere of research in which Indian students may find inspiration and the opportunity to develop to the full their natural capacity for this class of work. The extent to which men with the qualifications we regard as essential for the proper performance of these most important duties are available in India is very limited and it is for this reason that we have proposed that the Director and heads of sections at Pusa should for the present be recruited in the manner suggested in paragraph 563. We have in mind the declared policy of the Government of India that the agricultural services, including the higher posts, shall be manned by Indians and that the object to be kept steadily in view is to reduce to a minimum the number of experts from abroad and to train up indigenous talent to supply the required standard of efficiency. We are also aware of the recommendations of the Royal Commission on the Public Services of 1915 and those of the Royal Commission on the Superior Civil Services which reported

in 1924. Whilst we endorse the policy laid down by these Royal Commissions, we recognise that the fulfilment of the policy of complete Indianisation must be dependent upon the provision in India of first-rate educational facilities and it is evident that the more efficient the teaching schools throughout India can be rendered, the sooner may this country be expected to become dependent on its own resources for recruitment to the higher branches of its agricultural staff.

It must be recognised that the demands of progressive agriculture require, during the transitional period, that the recruitment from abroad should not be confined to that of senior officers. Young officers recruited from abroad should possess the highest academical qualifications and should also have shown good practical capacity in the branch of science or practical agriculture for which they are being recruited. But, as the Public Services Commission of 1915 recommended, "every effort should be made to discover and recruit competent men in India wherever they may be found and the whole of the normal requirements of the staff should be met from India within a reasonable period of time."

We have pointed out the supreme importance to the agricultural development of India of the new superior provincial agricultural services and the necessity for recruiting the best men for these services wherever they are to be found. We have also made plain our conviction that the existing facilities for training officers are not such as to make the best of the material at present entering the agricultural colleges. We would add here that we think it probable that a substantial raising of the standard of scientific and agricultural teaching in India will attract as students to the agricultural colleges and to the agricultural services a greater number of young men of real promise than are at present forthcoming. But these improvements must take time to mature, and the advantages that may be expected to flow from them cannot, in the nature of things, be secured for some years to come. As the result of our tour, we have formed the general impression that the agricultural colleges, unless strengthened, are unlikely to provide enough officers of sufficiently high professional attainments, fully to supply the needs of the new superior provincial agricultural services. In these circumstances, we wish to record our considered opinion that the restriction of recruitment to a province or even to India cannot fail to tell seriously on efficiency at a time when the general awakening of interest in agricultural progress, of which the appointment of a Royal Commission on Agriculture in India is only one of many indications, makes efficiency specially desirable. We are convinced that, from the point of view of wider outlook and variety of experience, officers recruited abroad are in a position to make a valuable contribution to the development of Indian agriculture. We would, therefore, strongly endorse the hope expressed by the Royal Commission on the Superior Civil Services in India: "In this matter the discretion of local governments must be unfettered, but we express the hope that Ministers, on the one hand, will still seek to obtain the co-operation of Europeans in these technical departments and that qualified Europeans, on the other hand, may be no

less willing to take service under local governments than they were, in the past, to take service under the Secretary of State."

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

569. The conclusions and recommendations in this chapter may be summarised as follows :—

(1) The Director of Agriculture should be an officer combining administrative capacity with high scientific qualifications (paragraph 547).

(2) If an officer with the requisite qualifications is not forthcoming in the Agricultural Department of a particular province when a vacancy in the directorship occurs, the local Government should, in the first instance, turn to the Agricultural Department of another province or, failing that, to the Indian Civil Service (paragraph 547).

(3) The posts of directors of agriculture and principals of agricultural colleges should be scheduled as selection posts outside the cadre of Class I appointments (paragraph 547).

(4) In the matter of pay and status, the Director of Agriculture should be on an equality with the heads of other important departments such as those of Public Instruction and Forests (paragraph 547).

(5) The pay of principals of agricultural colleges should be Rs. 1,500—50—2,000. The special pay at present attaching to these posts should be abolished (paragraph 547).

(6) Should it prove advisable to appoint a joint director in any province, he should be on the ordinary time-scale with special pay in recognition of his increased responsibility (paragraph 547).

(7) The field of recruitment to the superior provincial agricultural services in any province should not be restricted to the province itself or to India (paragraph 549).

(8) The research, teaching and administrative branches of the superior provincial agricultural services should be on the same basic scale of pay, but in order to attract the first class research worker, it will probably be necessary to supplement the basic scale with special pay (paragraph 549).

(9) The recruitment of research workers on short-term agreements on special terms is not recommended (paragraph 549).

(10) A system of post-graduate research scholarships should be instituted, the scheme for which should be administered by a sub-committee of the Council of Agricultural Research (paragraph 549).

(11) Promotions to research posts in the superior provincial agricultural services from the provincial agricultural services should be permitted in cases of outstanding merit (paragraph 549).

(12) The teaching side of the agricultural colleges requires strengthening and the professorships and certain senior lectureships should invariably be filled in the future by officers of the Indian Agricultural Service or officers in Class I of the new provincial agricultural services (paragraph 550).

(13) A post-graduate course should be an essential qualification for direct recruitment to the administrative branch of the superior provincial agricultural services where the candidate has undergone his previous training in a provincial agricultural college or an Indian university (paragraph 551).

(14) This course should not be regarded as a substitute for the possession of practical experience (paragraph 551).

(15) All officers appointed to the superior provincial agricultural services should be on probation for a suitable period (paragraph 552).

(16) Interchange should be freely permitted between the administrative and the research and teaching branches in the earlier years of service (paragraph 553).

(17) The only special posts outside the cadre of the superior provincial agricultural services, other than those of the directors of agriculture and principals of agricultural colleges should be those created for strictly limited periods and strictly defined objects (paragraph 554).

(18) Subject to the reservation in regard to research posts in recommendation (8) above, the basic time-scale now in force for the Indian Agricultural Service is recommended for appointments in the new superior provincial agricultural services (paragraph 555).

(19) Officers of the Indian Agricultural Service and of the superior provincial agricultural services should be placed on an age for age equality with services of similar standing (paragraph 555).

(20) Allowances should be made for age, where this connotes higher qualifications or valuable experience, in fixing the point at which an officer enters the time-scale of a superior provincial agricultural service (paragraph 555).

(21) Effect should be given to the recommendation of the Royal Commission on the Superior Civil Services in India that Public Service Acts should be passed in each province (paragraph 556).

(22) The relations between the provincial agricultural services should be of the closest possible character and the interchange of officers to deal with special problems should be provided for (paragraph 557).

(23) The establishment of close relations between research workers in India and all Empire research stations should be encouraged by mutual visits and possibly also, in course of time, by a system of exchange of research workers for definite periods (paragraphs 558 and 559).

(24) Officers in all branches of the superior provincial agricultural services should be encouraged to avail themselves of the opportunities for study abroad afforded by the study leave rules (paragraph 559).

(25) Officers on study leave in Europe should take the opportunity to visit the International Institute of Agriculture at Rome if it

possesses information bearing upon their line of work (paragraph 559).

(26) Programmes of work in England should be arranged through the office of the High Commissioner for India (paragraph 559).

(27) Travelling scholarships should be instituted for graduates or holders of diplomas of agricultural colleges who intend to take up private work (paragraph 559).

(28) No changes in the methods of recruitment and the conditions of service of the provincial agricultural services are recommended (paragraph 561).

(29) Pending the constitution of Public Services Commissions in the provinces, promotions and direct appointments to posts in these services should be made on the recommendations of a strong selection committee (paragraph 561).

(30) Interchange between the three branches of the provincial agricultural services should be freely allowed in the early years of service and even at later periods should this appear desirable (paragraph 561).

(31) The higher grades of the subordinate agricultural services should be designated Agricultural Assistants Class I and Class II respectively (paragraph 562).

(32) The staff of the Pusa Research Institute and its sub-stations should be constituted a Central Agricultural Research Service (paragraph 563).

(33) As regards the composition of the staff at Pusa, the principal object to be aimed at should be the provision of specialists of high reputation each in charge at the outset of one of the eight sections into which the work of the Institute is at present divided (paragraph 563).

(34) In addition to the head of the section, there should be at least one Class I officer attached to each section at Pusa (paragraph 563).

(35) The Director and the heads of sections should be most carefully selected. While an officer of exceptional merit already in service should not be debarred from being appointed either as Director or the head of a section, it is necessary, in the existing conditions, that these appointments should in the main be filled by direct recruitment from abroad (paragraph 563).

(36) Other Class I officers at Pusa should be recruited either directly or by selection from the Indian Agricultural Service or the superior provincial agricultural services (paragraph 563).

(37) Recruitment for the Central Agricultural Research Service on short-term agreements is not recommended (paragraph 563).

(38) Officers of the Indian Agricultural Service or of the superior provincial agricultural services should be appointed to Pusa in the first instance for a term of three years (paragraph 563).

(39) The pay of the Director of Pusa should be such as will enable the best man available to be obtained (paragraph 564).

(40) A minimum scale of Rs. 1,500—50—2,000 is suggested for the heads of sections at Pusa (paragraph 565).

(41) The pay of other Class I posts in the Central Agricultural Service should be the existing time-scale of pay for the Indian Agricultural Service *plus* Pusa allowance, but the Pusa allowance should be absorbed into pay and suitable adjustments in the time-scale should be made accordingly (paragraph 565).

(42) Posts in the Central Agricultural Research Service, unless held by officers already in a pensionable service, should be on a provident fund basis with the exception of those at present designated Class II posts at Pusa which should remain on a pensionable basis (paragraphs 564, 565 and 566).

(43) The designation of the existing Class II officers at Pusa should be changed. These appointments should be largely filled by officers from the provincial services who would receive their provincial scale of pay with a Pusa allowance of Rs. 150 per mensem (paragraph 566).

(44) Officers directly recruited to these appointments should receive the pay of the Provincial Agricultural Service with a Pusa allowance of Rs. 150 per mensem (paragraph 566).

(45) The tenure of these appointments when filled by officers from the provinces should be limited to five years (paragraph 566).

(46) The cost of visits paid by the members of the Central Agricultural Research Service to the provinces, whether in the course of their ordinary work or to assist in dealing with a specific problem, should be regarded as part of the normal expenditure of the Pusa Institute (paragraph 567).

(47) Restriction of recruitment for the new superior provincial agricultural services to a province or even to India would tell seriously on efficiency. From the point of view of wider outlook and variety of experience, officers recruited from abroad can make a valuable contribution to the development of Indian agriculture and the hope expressed by the Royal Commission on the Superior Civil Services in India in regard to the continued co-operation of European officers is, therefore, strongly endorsed (paragraph 568).

CHAPTER XX

MISCELLANEOUS

570. In this chapter, we propose to discuss a few miscellaneous questions of some importance which do not fall naturally within the scope of previous chapters of our Report.

SCOPE OF THE CHAPTER.

571. A question which, in our opinion, deserves more attention than it has hitherto received is that of agricultural development in the minor provinces which remain under the direct control of the Government of India. Much the most important of these, though it is not the largest in area, is the North-West Frontier Province. The agricultural and other rural problems of this province have been examined with those of the nine major provinces of India in the previous chapters of this Report and it is, therefore, unnecessary to discuss them further here. It will be convenient to preface the recommendations regarding agricultural development in the other five provinces which are also under the direct control of the Government of India, Baluchistan, Ajmer-Merwara, the Andaman Islands, Coorg and Delhi with a brief description of the salient features of these tracts.

AGRICULTURAL DEVELOPMENT IN THE MINOR PROVINCES.

(i) DESCRIPTIVE.

(a) BALUCHISTAN.

Baluchistan is a country of barren mountains and arid deserts on the western border of India. Exclusive of the States of Kalat and Las Bela, it has an area of 54,228 square miles and a population of 420,650. Its rainfall varies from eleven inches in the mountains to about half that amount in the plains. The principal crops are wheat and *juar* which are grown on 54 and 21 per cent respectively of the total cultivated area of 336,000 acres, of which 129,000 are irrigated. Other crops are rice, barley, oilseeds, maize, melons and potatoes. Fruit for export is increasingly grown in the highlands. Cropping on the unirrigated land is of a most precarious nature.

(b) AJMER-MERWARA.

Ajmer-Merwara is a small enclave of British territory in Rajputana, of which the Agent to the Governor General in Rajputana is Chief Commissioner. Its area is 2,711 square miles and the population at the census of 1921 was just under half a million. The principal crops grown are maize, *juar*, cotton, barley, *bajra* and wheat. The area under cotton during the past thirty years has increased from 10,000 acres to over 45,000 acres. Sheep-breeding is of some importance and a considerable amount of wool is exported from Merwara. The rainfall is uncertain in quantity and very unequal in distribution. The annual average for the last twenty years has been 19·45 inches. Of the total cultivated area of 350,000 acres, 110,300 are protected by tanks and wells, but both these sources are dependent upon rainfall and, in periods of drought, both dry up.

(c) THE ANDAMAN ISLANDS.

The Andaman Islands in the Bay of Bengal, about 360 miles from Rangoon and 760 miles from Calcutta, are 2,508 square miles in extent. Some 2,250 square miles are still under virgin forest and the only tract which has been opened up is that which forms the penal settlement of Port Blair in the South Andaman Island. This settlement was established in 1858. In 1921, it was decided that it should be closed and the policy of the Government of India now is to convert the Andamans into a free settlement as soon as practicable. Of the total population of the Islands, which was returned at the census of 1921 as 17,814, the Port Blair settlement accounted for 15,675, and the two forest centres, one in the Middle and the other in the North Andaman Island, for 1,581. The small and rapidly dwindling aboriginal population numbered only 786, some of whom were included in the population of the forest centres.

As throughout the rest of the islands, the configuration of the Port Blair settlement is very hilly. Rice is grown where the narrow valleys open out sufficiently to permit of its cultivation. Sugarcane and maize are cultivated to some extent in the uplands and vegetables are raised both in the valleys and uplands. Plantains, pineapples and *papayas* do well. The government plantations of tea, coffee, rubber and coconuts have been handed over to private enterprise. The average rainfall is about 140 inches. There is a well defined dry period extending from mid-December to the end of April.

(d) COORG.

Coorg, bounded on the north and east by the Mysore State and on the south and west by the Malabar and South Kanara districts of Madras is, in the main, a province of hills and forests, subject to very heavy rainfall which varies from 45 inches in the north-east to nearly 250 inches in the south-west. Its area is 1,582 square miles and its population at the census of 1921 was about 164,000 of whom 121,000 were classed as cultivators. The main crops are rice and coffee which are grown on 82,000 and 40,000 acres respectively out of the total cultivated area of 136,000 acres. Spices, mostly cardamoms and pepper, are also grown and rubber and a little tea. The Resident in Mysore is the Chief Commissioner of Coorg.

(e) DELHI.

The small province of Delhi consists of an area of 593 square miles, taken, in 1912, partly from the Delhi district of the Punjab and partly from the Meerut district of the United Provinces. The province was formed for administrative reasons arising out of the establishment of the Imperial Capital.

This brief account will serve to show the obstacles which stand in the way of providing the minor provinces with suitable agricultural assistance. With the exception of Baluchistan, they are all small in area. They are very far apart and their agricultural problems are entirely different in character. The attention paid to agricultural development in all of them is very small indeed. Coorg has a Deputy Director of Land Records and Agriculture who, however, has received no special training in agriculture or its allied subjects There are two experimental farms in the province, one for oranges and one for rice and sugarcane, but, as no experimental work is in progress on the latter, the agricultural assistant who was in charge of it is now employed temporarily in the Revenue Department. In the Andaman Islands, there is an agricultural officer stationed at Port Blair, and, in Baluchistan, a subordinate agricultural officer in charge of the experimental fruit station at Quetta. The only farm in Ajmer-Merwara has been established by the District Board. Delhi has no agricultural or veterinary staff of its own and is dependent on the Punjab for agricultural and veterinary assistance. The Pusa staff gives the minor provinces what help it can. From 1911 to 1919, Mr. and Mrs. Howard were in charge of the experimental fruit station at Quetta for six months of the year and members of the Pusa staff have visited the Andaman Islands to investigate crop pests and diseases. But occasional visits by specialists are of little use in the absence of a resident agricultural officer familiar with the local problems and able to carry the suggestions of the expert into effect.

(*ii*) THE CASE FOR ASSISTANCE.

572. We are of opinion that all these provinces, with the exception of Delhi, should have a definite agricultural organisation. We are aware that the administration of none of them, with the exception of that of Coorg, pays its own way and that the cost of any steps taken to promote their agricultural development must, therefore, fall on central revenues from which assistance will also probably be necessary if any substantial progress is to be made in Coorg. But we are unable to regard this fact as a conclusive reason for inaction. Baluchistan is a frontier province which, on general grounds, cannot be expected to be self-supporting. Special attention to agricultural problems in the Andaman Islands is required now that the declared policy of the Government of India is to convert it into a free settlement. Ajmer-Merwara, in consideration of its long history of famines should, in our view, receive special consideration and might well be made a model, both in agricultural and veterinary matters, to the States of Rajputana by which it is surrounded. Delhi should not be deprived of the agricultural advice and assistance which would have been available if it had remained part of the Punjab.

We examined two witnesses from Baluchistan and Ajmer-Merwara and have perused memoranda in which the agricultural position in the Andaman Islands and Coorg has been clearly explained. The witnesses as well as the writers of the memoranda, in their desire to advance the solution of the local problems with which they are familiar, advocated the establishment of a research and administrative organisation similar to that which exists in the major provinces. Such a demand is entirely natural and has our sympathy, but it is obvious that, without sacrificing all sense of proportion in administration, it would not be possible to give the minor provinces a research and executive staff of agricultural officers with laboratories, equipment and experimental and demonstration farms on the scale considered appropriate for a major province.

(*iii*) POSSIBLE METHODS OF PROMOTING THE AGRICULTURAL DEVELOPMENT OF THE MINOR PROVINCES.

573. There appear to us to be three possible ways in which the agricultural development of the minor provinces could be assisted. The first is by the formation of a small separate agricultural service which would have its headquarters at some centre such as Pusa or Delhi where experimental work and the training of subordinate staff could be carried on. The objections to this course are that the soil and climate, and consequently the agricultural needs of the minor provinces, vary so widely that it would be impossible to select any one centre which would be suitable for all of them and that an officer whose experience had, for example, been gained in Coorg would be of little use in Baluchistan. There is also the further objection that the service would be too small to be efficient.

The second method is to place the agricultural development of each minor province in the charge of the Director of Agriculture of the nearest major province and to give that officer such additional staff as may be necessary for the purpose. This course is, *primâ facie*, attractive and, in the case of Coorg, Ajmer-Merwara and Delhi, is probably feasible. Indeed, it appears to us the only way in which suitable provision can be made for the agricultural needs of Delhi. We, therefore, consider that that province must continue to look to the Punjab Agricultural and Veterinary departments to supply its requirements in respect of agricultural and veterinary assistance. Distance and difficulties of communication would render the effective linking up of Baluchistan with the Bombay Agricultural Department difficult and the same objection applies to linking the Andamans with the Burma Agricultural Department. The position of Coorg and Ajmer-Merwara remains for consideration. On the whole, the advantages of placing Coorg under the Madras Agricultural Department and Ajmer-Merwara under the Agricultural Department of the Punjab or the United Provinces are open to question. The responsibilities of the directors of agriculture of those provinces are heavy and are certain to increase. Even if they were given additional staff, the tendency would inevitably be to subordinate the interests of the minor to those of the major province.

The third course, which is the one we recommend, is that each minor province, with the exception of Delhi, should build up an agricultural organisation of its own. For research, apart from such work as the aptitude of the officer in charge of the new provincial organisation may lead him to undertake, the minor provinces must rely on Pusa and on the research staff of the neighbouring major provinces whose problems in many directions are very much akin to their own. We consider it most desirable that Pusa should pay special attention to the needs of the minor provinces. The research organisation of the neighbouring major provinces should be able to do much to help them and we trust that assistance will be generously given. It would only be when visits from a provincial research officer were required that financial considérations would arise and suitable arrangements in regard to the cost involved would be necessary. The planting community of Coorg can look for assistance to the scientific staff of the United Planters' Association of Southern India which receives a subsidy from the Coorg Administration. It is the needs of the ordinary cultivator in that province that have to be considered.

As regards district work, we consider that the staff of a deputy director's circle in a major province would form a suitable unit for Baluchistan, Ajmer-Merwara, Coorg and the Andamans. The deputy director himself should be obtained on loan, preferably from the neighbouring major province, and should be given a special allowance in view of his increased responsibility. Subordinate staff should be recruited on his advice and might, in part at least, also be obtained on loan from the neighbouring province.

As these minor administrations would usually be unable to afford the pay of senior officers, the gazetted staff required should continue to be borne on the cadre of the province from which it is lent, so that officers could be reverted and replaced whenever their time-scale pay exceeded what the administration could afford. The Director of Agriculture and the Director of Veterinary Services of the neighbouring major province should be appointed advisers to the head of the minor province concerned and should be directed to visit the minor province once a year, or once in two years if this proved sufficient.

The lines of development are, we think, best left to be settled in the light of the local conditions but we would suggest that, as the funds available are bound to be limited, the first task should be to take up the major problems, and that all-round development should not be attempted until some progress has been made with their solution. In Baluchistan, the first problem to be attacked would be that of fruit culture and it would, therefore, be advisable that the first deputy director should have special experience of this branch of agriculture and that, before appointment, he should be given an opportunity of studying questions connected with the transport and marketing of fruit. We are informed that, in Ajmer-Merwara, there are three good markets for dairy produce but that the industry is poorly organised and that no attempt has been made to improve the dairy herds. In these conditions, a deputy director with

special experience of livestock or dairying, or preferably of both, would seem to be required. In the Andamans, experience of "planting" crops would seem the first consideration. For Coorg, an officer with all round agricultural experience would seem most suitable. We would impress upon the administration of Baluchistan that irrigation development in that province should, as far as possible, proceed simultaneously with agricultural development. In paragraph 294, Chapter X, we have made recommendations regarding the investigation of the possibilities of developing irrigation in Baluchistan.

(*ix*) Concluding remarks.

574. It is our hope that the new agricultural organisations we recommend should work in the closest collaboration with the local co-operative and educational authorities and that the recommendations we make in regard to co-operative, educational and also veterinary matters in the preceding chapters will also be held to apply, so far as practicable, to the minor provinces. In Coorg and in the Andaman Islands, it will also be desirable that cordial relations should be maintained with the Forest Department in the province.

Although we contemplate that the agricultural organisations of the minor provinces should be responsible to the heads of the local administrations, we would recommend that the Council of Agricultural Research should take a special interest in the agricultural development of these tracts. The small area of each of these tracts should make them especially suitable for trying out experiments, and, in this and in other ways, they might well become models from which the major provinces could copy. We trust that no effort will be spared by the Government of India to remove the reproach that, because of their insignificance, the claims of these small units to share in the benefits of the general advance which is being made, not only in agricultural science but in all matters affecting rural welfare, have not received a due measure of attention. In order that agricultural progress in the minor provinces may be on sound lines, it is, in our opinion, essential that increased attention should be paid to the development of education and co-operation.

Points of contact between agriculture in British India and in Indian States.

575. In the course of our investigations, we have had occasion to notice many points at which the agricultural and veterinary problems of British India require the co-operation of the Indian States for their solution. We have mentioned two instances—that of the adoption on a large scale, of the serum-simultaneous method of inoculating cattle in Mysore and that of the compulsory cultivation of cotton of an approved variety in the Rajpipla State—in which Indian States have adopted a more advanced policy than has so far been followed in British India.

Although, by our terms of reference, our enquiry has been limited to British India, the Indian States are so interspersed with British territory, their area is so large, amounting as it does to 711,000 square miles out of a total area for all India of 1,805,000 square miles, and their economy

is so predominantly agricultural, that it has not been possible entirely to omit all reference to them in our examination of the agricultural position in British India. In Chapter IV, we drew attention to the responsibilities of maritime States in the matter of excluding plant diseases and pests from the country. In Chapter IX, we have pointed out that no campaign for stamping out contagious diseases amongst livestock in British India can be successful unless the co-operation of the Indian States is secured. In Chapter X, we have shown that the development of irrigation is often dependent on agreements with Indian States as to the use of water. Further, in Chapter VII, we have discussed the great part the Indian States can play in the improvement of the cattle of India.

These are all matters of great moment to the agricultural prosperity of India as a whole and there are many other directions in which the co-operation of Indian States would prove of the greatest value. The desirability of such co-operation has been recognised in the constitution of the Indian Central Cotton Committee and of the Board of Agriculture. The main research station of the Indian Central Cotton Committee is situated in Indore. The Director of the Institute is also Agricultural Adviser to the Central India States and represents these States and the States of Rajputana on the Committee. The States of Hyderabad, Mysore, Baroda, Gwalior and Indore are also represented on the Committee. All these States with the exception of Indore, and also the States of Kashmir, Travancore and Patiala send representatives to the meetings of the Board of Agriculture. Thus, the foundations of an active policy of co-operation have already been laid. We have no doubt that the manner in which co-operation can be rendered more effective and, more especially, the manner in which Indian States can best be brought into the research organisation, the establishment of which we suggest in Chapter III, will receive early and careful consideration from the Government of India and the Rulers of the States. We are confident that it will become increasingly practicable to envisage the agricultural and veterinary problems of India as a whole, and to initiate measures for their solution which will be operative in all parts of the country.

EDUCATION IN THE PRINCIPLES AND AIMS OF LOCAL SELF-GOVERNMENT.

576. From the point of view of rural welfare generally, we welcome the foundation, in 1927, of a Local Self-Government Institute for the Bombay Presidency. The object of the Institute appears to us an admirable one. It is "to acquaint the people with the meaning and ideal of local self-government, its importance, its problems and the methods of dealing with these problems." The Institute will have local branches throughout the presidency and one of its main activities will be the organisation of district, divisional and provincial conferences. The district conferences will be held once or twice a year and will provide an opportunity for representatives of local bodies in the district to meet and discuss local problems and difficulties. They will send representatives to the divisional conferences which are to be held yearly for the discussion of questions of common interest to the division. The

Provincial Conference which is also to be held yearly will be organised on similar lines. We are glad to note that the district conferences will include representatives of village *panchayats*. The proposal to divide the agenda of all conferences into three sections, matters of urban interest, matters of rural interest and matters of joint interest, should prove of value in ensuring that rural problems receive due attention.

We understand that conferences of presidents and officers of local boards are occasionally held in other provinces but we see great value in establishing an organisation for the promotion of education in the principles of local self-government with a definite programme of work. We note that not only is the Minister for Local Self-Government president of the Institute but also that the Provincial Conference will include representatives nominated by him and that he will refer subjects to it for consideration, thus establishing a link between the provincial Government and the Institute. The scheme appears to us to hold out great promise of advantage to rural as well as to urban interests. It also provides a common meeting ground for both, and, by so doing, should do much to bring about an increasing sense of mutual interest and an increasing spirit of mutual help. We commend the principles of the Bombay scheme to the notice of other provincial governments and to the local self-governing bodies in their provinces.

METEOROLOGY AND AGRICULTURE.

577. We would invite attention to the need for working out a programme of research into meteorological problems, the solution of which may have a special bearing on agricultural practice. In this connection, we would emphasise the need of clearly defining where the responsibility lies for undertaking a particular piece of research. Such a definition should not present any difficulty. In recent years, the weather forecasts issued by meteorological departments have become much more useful to agriculturists, largely because wireless telegraphy has enabled information from distant stations on land and sea to be transmitted rapidly to offices issuing forecasts, and because the growing importance of aviation has caused much more attention to be concentrated on upper air observations. While studies which have as their object the increase of knowledge of the laws governing weather are of much general interest, agriculturists themselves can take no direct share as investigators. This is work for meteorologists. The investigations with which agriculturists are directly concerned are those which relate to the effect of weather on crops. In such studies, use must be made of meteorological data, instruments and methods of recording and interpreting observations, but work of this kind is investigation of a type for which agricultural departments should be responsible.

There are two directions in which we think that scientists interested in agriculture should undertake investigations of a meteorological nature. The first is statistical, the second biological. For many years past, the Meteorological Department has accumulated weather data. The revenue departments have concurrently collected statistics of the area sown and the yield of crops. Very little attempt has been made

to correlate the two sets of data ; two valuable studies published by Mr. S. M. Jacob, I.C.S. (retired) represent, so far as we are aware, the only instances of work of this kind. We are of opinion that much useful light could be thrown on agricultural questions, were investigators to follow the methods adopted by Mr. Jacob in India, and by others in countries such as England, Sweden and the United States ; and if our recommendations for strengthening the statistical organisation of agricultural departments are accepted, we hope that such correlation studies may receive early attention.

The second group of meteorological studies for which agricultural departments should make themselves responsible relates to the precise influence of weather conditions on the growing crop. This class of investigation is especially useful in connection with the introduction of new varieties, whether exotics or improved crops resulting from plant breeding. The influence of the climate on the ordinary crops of a particular district is known through the general experience of cultivators ; but it is very desirable that precise weather observations should have been made before new crops are introduced as, otherwise, much time is likely to be lost. For example, it is possible that, when the Sukkur Barrage has been completed, a pronounced effect will be produced on the climate of Sind. It appears likely that valuable strains of Egyptian cotton could then be successfully grown. The quality of the lint of cotton is much influenced by the humidity of the air during the ripening period. Humidity fluctuates widely not only from month to month but throughout the 24 hours. The prospects of Egyptian cotton in the newly irrigated areas in Sind could be estimated with much greater confidence if records of the air humidity in various parts of Sind already irrigated or marked out for irrigation were collected and carefully compared with the records of the air humidity in Upper and Lower Egypt. It is, in our opinion, very important that data bearing on this subject and on other climatic factors should be available when the time comes to provide suitable varieties for the newly irrigated land in Sind.

Where, as in Sind, climatic questions are of importance in developing new forms of agriculture, we are of opinion that agricultural departments which have not already established meteorological stations should, in consultation with the Meteorological Department, arrange for the establishment of meteorological stations of what is known as the " second order " on their experimental farms. To the instruments usually maintained on a " second order " station, soil thermometers and any other apparatus required for special investigation could be added as necessary.

With regard to research in agricultural meteorology generally, we would suggest that the Council of Agricultural Research, in consultation with the Director General of Observatories and the Director of the Central Bureau of Statistical Information, whose appointment we have recommended, should, as soon as possible, prepare a programme of work, settle the relative urgency of the various items in it, having regard to the men and money available, and make suggestions for the allocation of the work

between the different departments. We hope that the universities may take a part in the work to be done.

In addition to the contributions to the knowledge of the influence of weather conditions on growing crops which it is in the power of the meteorologist to make, there are, as we have indicated above, current specific services, such as short period forecasts and warnings of abnormal weather conditions, which it is part of the routine duties of the Meteorological Department, in this as in other countries, to render the agriculturist. We regard it as the business of the agricultural departments to keep the Meteorological Department informed of the needs of the rural community in these respects with a view to enabling that department to meet them to the fullest possible extent.

The headquarters of the Meteorological Department have very recently been moved from Simla to Poona and we understand that the intention is to expand the study of marine and aviation meteorology and to survey upper air conditions in south India. These studies should yield valuable additions to knowledge in regard to the conditions determining the south-west monsoon. In addition, the department will now be in a position to offer facilities for post-graduate students wishing to familiarise themselves with meteorological methods in order to undertake research on the relationships existing between weather and crops. We trust that some among the students graduating from the agricultural colleges will take advantage of these facilities. The point is one to which attention should be paid when the scheme for post-graduate scholarships and courses of study we have advocated in paragraph 549, Chapter XIX, is drawn up.

The transfer of the Meteorological Department to Poona and the expansion of its activities make the present a specially opportune time to undertake an examination of the action which should be taken to promote the investigation of the problems of agricultural meteorology and to decide which departments shall be responsible for the different branches of the work. Government will then be in a position to decide what increase of staff is required to ensure the satisfactory development of agricultural meteorology and in what departments it should be made.

One more point deserves mention here. The Meteorological Department has, as a matter of economy, considerably curtailed the distribution of its daily statement between the months of November and May. We consider that these statements are of sufficient use to the public to justify their being issued on the same scale as formerly.

THE INTERNATIONAL INSTITUTE OF AGRICULTURE AT ROME.

578. The International Institute of Agriculture at Rome was founded in 1905 "for the defence and representation of agriculture and agricultural interests throughout the world." Its main object is the collection, study and publication of statistical, technical and economic information in regard to agriculture and the provision of

facilities for the study of all questions bearing on agriculture. The two main ways in which these facilities are provided is by the publications of the Institute and by the maintenance of a well equipped library. So far as its staff and funds permit, the Institute also undertakes enquiries of a special character on behalf of its constituent countries.

The affairs of the Institute are controlled by a General Assembly and a Permanent Committee. The General Assembly consists of repesentatives of all the countries which have joined the Institute. It meets every two years and reviews the work and expenditure of the Institute. The number of representatives from each of the constituent countries varies from one to five in accordance with the subscription paid, which again depends on which of the five groups, into which the adhering States are divided, a particular State has joined. The Permanent Committee which, as the executive of the General Assembly, is the Governing Body of the Institute consists of such delegates of the constituent countries as are resident in Rome. Each of these countries is entitled to send one delegate to it but can, if it thinks desirable, be represented by the delegate of another State.

India joined the Institute in 1907. As a member of the second group of States, she pays an annual subscription of £ 800 and is entitled to send four representatives to the meetings of the General Assembly and to nominate a member of the Permanent Committee. Representatives were sent to the last three meetings of the General Assembly but for some years past the British representative on the Permanent Committee has also been in charge of the interests of India.

The Institute has collected much information of the greatest value to this country. To mention only one example, information in regard to legislation on agricultural subjects and on rural matters generally undertaken in other countries, from the experience of which India can profit, is more readily available at the Institute than elsewhere. The usefulness of the Institute to India has recently been greatly enhanced by the establishment of a separate Bureau of Tropical and Colonial Agriculture.

In these circumstances, we consider the continued adherence of India to the Institute most desirable and see no reason to suggest any change in the classification of this country for purposes of subscription, even if its continuance in the second group should involve the payment of a higher subscription than at present.

It has been suggested that this country would derive greater benefits from its connection with the Institute if it had its own representative on the Permanent Committee and also if a committee were formed in India to serve as a link between the Institute and the agricultural and allied departments in this country. We see no necessity for the appointment of such a committee as it appears to us that close touch between the Council of Agricultural Research and the Institute would secure the objects aimed at. Direct representation on the Permanent Committee would doubtless have advantages. The advantage to India would be that her representative would be in a position to study Indian problems in the light of the information available in the records of the Institute

and to pass on the results of his studies to his Government. The advantage to the Institute would be that its work would no longer be hampered by insufficient knowledge of Indian conditions and, on the statistical side, by unfamiliarity with the form in which Indian statistics are published and by failure to appreciate their limitations. We are, however, doubtful whether the advantage to India would be commensurate with the expenditure involved in the appointment of a direct representative on the Permanent Committee. No one representative would be in a position to deal with the vast quantity of technical information which the Institute has collected. The general interests of this country can, in our opinion, be satisfactorily looked after by the British representative on the Permanent Committee and by the deputation of representatives to meetings of the General Assembly. In these circumstances, we consider that the most satisfactory course from the point of view of this country is that which we have indicated in paragraph 559, Chapter XIX, namely, to encourage officers of the agricultural and allied departments to visit the Institute for the study of a specific subject, whilst on leave or duty in Europe. Should a representative of the Government of India be appointed in Rome for any other purpose, for example as Indian Trade Commissioner in Italy, there would, of course, be no objection to his nomination as representative of India on the Permanent Committee.

THE IMPERIAL INSTITUTE.

579. The Imperial Institute in London, which was founded as the Empire Memorial of the Jubilee of Queen Victoria, has been reorganised under the Imperial Institute Act of 1925 and placed under the control of the Department of Overseas Trade. The Parliamentary Secretary to that department is the Chairman of the Board of Governors which consists of the High Commissioners of the Dominions and India, representatives of the Colonial Office and other government departments and of the Crown Agents for the Colonies, with additional members representing scientific and commercial interests.

The principal functions of the Institute are to serve as a clearing house for information relating to the production and utilisation of the raw materials of the Empire and to carry out preliminary investigations of such materials in its laboratories. The work of the Institute is organised into two departments, the Plants and Animals Products Department and the Mineral Resources Department. Each of these departments has an Advisory Council. The Advisory Council for Plant and Animal Products, of which the Indian Trade Commissioner is a member, appoints a number of technical committees to deal with special subjects. The Indian Trade Commissioner is a member of four of these, the committees on Silk, Vegetable Fibres, Oils and Oil-seeds, and Essential Oils and Resins, and India is also represented on the committee on Timber and Tanning Materials. The Plants and Animals Products Department has an intelligence section which maintains a special service for dealing with enquiries relating to the sources, production, uses and marketing of raw materials, and for collecting and disseminating general and statistical information on these subjects. This service is available without

charge to government departments. The investigations section undertakes chemical and technical examination of Empire raw materials with a view to determining their composition and value and the possibility of utilising them in industry. Its close association with the users of raw materials enables the Institute to arrange for large scale trials of promising materials.

Mention should also be made of the public galleries maintained by the Institute, and of its publications. The galleries form a permanent exhibition illustrating the natural resources and scenery of the Dominions, India and the Colonies, and the life of the people. Of the publications, the most important is the quarterly bulletin which contains records of the investigations conducted at the Institute and also special articles, notes and abstracts chiefly relating to progress in tropical agriculture, the development of mineral resources and the industrial utilisation of all classes of raw materials.

Official enquiries from India are received by the Institute at present either through the Indian Trade Commissioner or direct from officers of the agricultural and forest departments. Of the seventy-one enquiries relating to India which were received in 1926, twenty-four were from government officials in India or England and forty-seven were un-official.

We have described the organisation and work of the Imperial Institute at some length as we consider that it is in a position to render valuable services to Indian agriculture by furnishing information regarding the commercial value of its products, by undertaking, if desired, the preliminary examination of raw materials and by investigating the industrial possibilities of such materials either through the appropriate technical committee or in association with manufacturers. We also consider it desirable that the facilities it offers in these directions should be more widely known. We would, therefore, suggest that the Government of India and provincial governments should take steps to give them wider publicity. One method of doing this would be by a larger distribution of the quarterly bulletin issued by the Institute.

The Government of India contribute £1,200 annually to the funds of the Institute. This does not include any subscription for the upkeep of the Indian gallery. The subscription for this purpose was withdrawn in 1923. The galleries of the Dominions and Crown Colonies have recently been reorganised and made most informative. We are strongly of opinion that the question of reorganising the Indian gallery on similar lines and of renewing the subscription for its maintenance should be considered. An adequate representation of the principal products of India in the galleries of the Institute would serve as an advertisement of the resources of this country which could not fail to exercise a valuable, if indirect, influence on the development of agriculture and rural industries.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

580. The conclusions and recommendations in this chapter may be summarised as follows :—

(1) Ajmer-Merwara, the Andaman Islands, Baluchistan and Coorg should have a definite agricultural organisation (paragraph 572).

(2) For district work the staff of a deputy director's circle in a major province would form a suitable unit for these provinces (paragraph 573).

(3) For research, the minor provinces should rely on Pusa and on the research staff of the neighbouring major province (paragraph 573).

(4) For assistance in agricultural and veterinary matters, the province of Delhi should continue to look to the Agricultural and Veterinary departments of the Punjab (paragraph 573).

(5) The Director of Agriculture and the Director of Veterinary Services of the neighbouring major province should be appointed advisers to the head of the minor province concerned (paragraph 573).

(6) The agricultural organisations in the minor provinces should work in the closest collaboration with the co-operative and educational authorities (paragraph 574).

(7) The Council of Agricultural Research should take a special interest in the agricultural development of the minor provinces (paragraph 574).

(8) In order that agricultural progress in the minor provinces should be on sound lines, it is essential that increased attention should be paid to the development of education and co-operation (paragraph 574).

(9) The foundations of an active policy of co-operation in agricultural and co-operative matters between the governments in British India and Indian States have already been laid through representation on the Indian Central Cotton Committee and the Board of Agriculture. It is hoped that the manner in which co-operation can be rendered more effective will receive early and careful consideration from the Government of India and the rulers of Indian States (paragraph 575).

(10) The scheme for the establishment of a Local Self-Government Institute for the Bombay Presidency is commended to the notice of other provincial governments and of local self-governing bodies in their provinces (paragraph 576).

(11) The present is a specially opportune time to undertake an examination of the action which should be taken to promote the investigation of the problems of agricultural meteorology and to decide which departments shall be responsible for the different branches of the work (paragraph 577).

(12) Where, as in Sind, climatic questions are of importance in developing new forms of agriculture, the agricultural departments should establish meteorological stations of the " second order " on their experimental farms (paragraph 577).

(13) The continued adherence of India to the International Institute of Agriculture at Rome is most desirable (paragraph 578).

(14) No change is called for in the existing arrangements under which the British representative on the Permanent Committee of the Institute is also in charge of the interests of India, nor is the establishment of a special committee in India to work in co-operation with the Institute recommended (paragraph 578).

(15) Officers of the agricultural and allied departments in India should be encouraged to visit the Institute whilst on leave or duty in Europe (paragraph 578).

(16) Wider publicity should be given in India to the facilities offered by the Imperial Institute (paragraph 579).

(17) The question of reorganising the Indian gallery at the Imperial Institute and of renewing the subscription for its maintenance should be considered (paragraph 579).

CHAPTER XXI

CONCLUSION

CONCLUSION.

581. We have been directed to examine and report on the present conditions of agriculture and rural economy in British India and to make recommendations for the improvement of agriculture and the promotion of the welfare and prosperity of the rural population.

The aim of the suggestions and recommendations we have made in the preceding chapters has been to bring about greater efficiency throughout the whole field of agricultural production and to render the business of farming more profitable to the cultivator. Throughout our Report, we have endeavoured to make plain our conviction that no substantial improvement in agriculture can be effected unless the cultivator has the will to achieve a better standard of living and the capacity, in terms of mental equipment and of physical health, to take advantage of the opportunities which science, wise laws and good administration may place at his disposal. Of all the factors making for prosperous agriculture, by far the most important is the outlook of the peasant himself.

This, in the main, is determined by his environment and it follows, therefore, that the success of all measures designed for the advancement of agriculture must depend upon the creation of conditions favourable to progress. If this conclusion be accepted, the improvement of village life in all directions assumes at once a new importance as the first and essential step in a comprehensive policy designed to promote the prosperity of the whole population and to enhance the national income at the source. The demand for a better life can, in our opinion, be stimulated only by a deliberate and concerted effort to improve the general conditions of the country-side, and we have no hesitation in affirming that the responsibility for initiating the steps required to effect this improvement rests with Government.

The realisation of this important truth has led, in recent years, to a large increase in expenditure on the departments concerned with rural welfare. None the less, we feel that its force is inadequately appreciated

by the Government of India and by local governments and that the necessity that the rural problem should be attacked as a whole, and at all points simultaneously, is still insufficiently present to their minds. We cannot but think that the failure to grasp the full significance of the proposition we have laid down in some measure explains the absence of any co-ordinated attempts to effect that change in the surroundings and in the psychology of the peasant without which there can be no hope of substantially raising his standard of living.

If the inertia of centuries is to be overcome, it is essential that all the resources at the disposal of the State should be brought to bear on the problem of rural uplift. What is required is an organised and sustained effort by all those departments whose activities touch the lives and the surroundings of the rural population.

It is, no doubt, the recognition of the need for co-ordination that has given rise in many quarters to the view that lasting progress is unlikely to be achieved unless, in all provinces, the activities of the various departments concerned are co-ordinated by development boards, advisory committees, or officers charged with the specific duty of securing combined action towards a given end. Development boards exist in some provinces, advisory committees in all. They are not without their value in bringing departments together and in interesting the leaders of public opinion in departmental activities. But there are definite limits to the extent to which governments may properly or usefully delegate the performance of their functions. The responsibility for framing policy, and for combining the activities of two or more departments in order to give effect to that policy, must remain that of Government and of Government alone.

It is no part of our duty to make recommendations regarding the internal organisation by which governments should seek to effect co-ordination. We would, however, point out that, in Indian conditions, a very special measure of responsibility in this direction falls upon the Viceroy and upon the Governors of provinces. Throughout our enquiry, we have been much impressed by the extent to which the Viceroy can, by the display of a personal interest in agricultural matters, forward the cause of India's premier industry. But the immediate responsibility of provincial Governors in this matter is the heavier, since the services most directly concerned with rural development are administered by provincial agency, and since it is they alone who provide a link between the reserved and the transferred departments. The responsibility of the Ministers in charge of the transferred departments, which include all those most directly concerned with rural welfare, is also a heavy one and they will need all the assistance that strong

secretariats with senior and experienced administrators at their head can give them.

But though we hold it to be the duty of governments to initiate a combined movement for the betterment of the rural population, we recognise that success on a large scale can be rendered permanent only if the sympathy, interest, and active support of the general public can be enlisted. So vast is the population and so extensive are the areas concerned, that no resources which could conceivably be commanded by the State would be adequate to the task in hand.

Our recommendations extend to so wide a field that it has not been possible for us to frame any exact estimate of the cost of such of our proposals as involve expenditure or to classify them in order of urgency. We would express the earnest hope that, as the funds necessary to carry out the policy of rural development we have attempted to outline become available, the various legislatures will be willing to place them at the disposal of the appropriate departments. We are confident that the members of those legislatures will play their part in creating a public opinion favourable to the advancement of a great endeavour. Our enquiry has convinced us that, given the opportunity, the cultivators of India will be found willing and able to apply in progressive degree the services of science and of organisation to the business of agricultural production.

ACKNOWLEDGMENTS TO STAFF.

582. We would express our sincere gratitude to Mr. F. Noyce, C.S.I., C.B.E., I.C.S., who, by the Chairman's request, was, early in 1927, attached on special duty to the Commission. Mr. Noyce has proved himself ever willing to place at our disposal his wide knowledge and experience of the subjects under review, and his services have proved a source of much strength to the Commission.

The preparation and arrangement of the large and diverse mass of material collected during our enquiry, in face of the difficulties and often the discomforts incidental to a travelling Commission, have involved a heavy strain upon our office, and we desire to record our high appreciation of the manner in which the staff of the Commission has discharged its arduous duties.

In particular, our grateful acknowledgments are due to our Joint Secretaries, Mr. J. A. Madan, of the Indian Civil Service, and Mr. F. W. H. Smith, of the India Office, for the zealous and efficient manner in which they have carried out their responsibilities, and to our Assistant Secretary Mr. J. C. McDougall, of the Indian Agricultural Service, for his valuable help.

All of which we submit for Your Majesty's gracious consideration.

(*Signed*) LINLITHGOW,
Chairman.

HENRY S. LAWRENCE.
THOMAS H. MIDDLETON.
J. MACKENNA.
H. CALVERT.
K. C. GAJAPATHI.
NAGENDRA N. GANGULEE.
L. K. HYDER.
B. S. KAMAT.

(*Signed*) J. A. MADAN
F. W. H. SMITH } Joint Secretaries.

Dated the 14th day of April 1928.

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APPENDICES

APPENDIX I

QUESTIONNAIRE

PART I

Question

1. Research.
2. Agricultural Education.
3. Demonstration and Propaganda.
4. Administration.
5. Finance.
6. Agricultural Indebtedness.
7. Fragmentation of Holdings.

PART II

8. Irrigation.
9. Soils.
10. Fertilisers.
11. Crops.
12. Cultivation.
13. Crop Protection, Internal and External.
14. Implements.

PART III

15. Veterinary.
16. Animal Husbandry.

PART IV

17. Agricultural Industries.
18. Agricultural Labour.
19. Forests.
20. Marketing.
21. Tariffs and Sea Freights.
22. Co-operation.
23. General Education.
24. Attracting Capital.
25. Welfare of Rural Population.
26. Statistics.

QUESTIONNAIRE

PART I

1. Research.

(*a*) Have you suggestions to advance for the better organisation, administration and financing of—

(*i*) All research affecting the welfare of the agriculturist, including research into the scientific value of the indigenous theory and traditional methods of agriculture,

(*ii*) Veterinary research ?

(*b*) If in cases known to you progress is not being made because of the want of skilled workers, or field or laboratory facilities for study or by reason of any other handicaps, please give particulars. [Suggestions of a general kind should be made under (*a*); answers under this heading should relate to specific subjects. The purpose is to secure a list of the problems met with by scientific investigators in the course of their work which are being held over because of lack of resources or deficient organisation.]

(*c*) Can you suggest any particular subject for research not at present being investigated to which attention might usefully be turned ?

2. Agricultural Education.

With reference to any form of agricultural education of which you may have experience, please state your views on the following :—

(*i*) Is the supply of teachers and institutions sufficient ?

(*ii*) Is there an urgent need for extension of teaching facilities in any district or districts known to you personally ?

(*iii*) Should teachers in rural areas be drawn from the agricultural classes ?

(*iv*) Are the attendances at existing institutions as numerous as you would expect in present circumstances; if not, state reasons. Can you suggest measures likely to stimulate the demand for instruction ?

(*v*) What are the main incentives which induce lads to study agriculture ?

(*vi*) Are pupils mainly drawn from the agricultural classes ?

(*vii*) Are there any modifications in existing courses of study which appear to be called for; if so, what are they ?

(*viii*) What are your views upon (*a*) nature study ; (*b*) school plots; (*c*) school farms ?

(*ix*) What are the careers of the majority of students who have studied agriculture ?

(*x*) How can agriculture be made attractive to middle class youths ?

(*xi*) Are there recent movements for improving the technical knowledge of students who have studied agriculture ?

(*xii*) How can adult education in rural tracts be popularised ?

(*xiii*) In suggesting any scheme for better educational facilities in rural areas, please give your views for (*a*) its administration and (*b*) its finance.

3. Demonstration and Propaganda.

(*a*) What are the measures which in your view have been successful in influencing and improving the practice of cultivators ?

(*b*) Can you make suggestions for increasing the effectiveness of field demonstrations ?

(*c*) Can you suggest methods whereby cultivators may be induced to adopt expert advice ?

(*d*) If you are aware of any striking instances of the success or the failure of demonstration and propaganda work, please give particulars and indicate the reasons for success or for failure.

4. Administration.

(*a*) Do you wish to suggest means towards the better co-ordination of the activities of the governments in India or to indicate directions in which the Government of India may usefully supplement the activities of the local governments ?

(*b*) Is it your opinion that the expert scientific knowledge required in the development of agriculture in the different provinces could be supplied to a greater extent than is the case at present by increasing the scientific staff of the Government of India ? If so, indicate the types of work which would benefit by pooling the services of experts, and suggest how that work should be controlled.

(*c*) Are you satisfied from the agricultural standpoint with the services afforded by—
(*i*) The Agricultural and Veterinary Services,
(*ii*) Railways and steamers,
(*iii*) Roads,
(*iv*) Meteorological Department,
(*v*) Posts, and
(*vi*) Telegraphs, including wireless ?
If not, please indicate directions in which you think these Services might be improved or extended.

5. Finance.

(*a*) What are your views as to the steps that should be taken for the better financing of agricultural operations and for the provision of short and long-term credit to cultivators ?
(*b*) Do you wish to suggest means whereby cultivators may be induced to make fuller use of the government system of *taccavi* ?

6. Agricultural Indebtedness.

(*a*) What in your opinion are :—
(*i*) the main causes of borrowing,
(*ii*) the sources of credit, and
(*iii*) the reasons preventing repayment.
(*b*) What measures in your opinion are necessary for lightening agriculture's burden of debt ? For example, should special measures be taken to deal with rural insolvency, to enforce the application of the Usurious Loans Act, or to facilitate the redemption of mortgages ?
(*c*) Should measures be taken to restrict or control the credit of cultivators such as limiting the right of mortgage and sale ? Should non-terminable mortgages be prohibited?

7. Fragmentation of Holdings.

(*a*) Do you wish to suggest means for reducing the loss in agricultural efficiency attendant upon the excessive subdivision of holdings ?
(*b*) What are the obstacles in the way of consolidation and how can they be overcome ?
(*c*) Do you consider legislation to be necessary to deal with minors, widows with life interest, persons legally incapable, alienation and dissentients, and to keep disputes out of the courts ?

PART II

8. Irrigation.

(*a*) Name any district or districts in which you advocate the adoption of new irrigation schemes, or suggest extensions or improvements in the existing systems or methods of irrigation by—
(*i*) Perennial and non-perennial canals,
(*ii*) Tanks and ponds,
(*iii*) Wells.
What are the obstacles in your district or province to the extension of irrigation by each of the above methods ?
(*b*) Are you satisfied with the existing methods of distributing canal water to cultivators? Describe the methods that have been employed to prevent wastage of water by evaporation and by absorption in the soil. What form of outlet for distribution to cultivators at the tail end do you regard as the most equitable and economical ? Have these methods and devices been successful, or do you wish to suggest improvements ?
(*N.B.*—Irrigation charges are *not* within the terms of reference of the Commission, and should not be commented upon.)

9. Soils.

(*a*) Have you suggestions to make—
(*i*) for the improvement of soils, whether by drainage or other means, not dealt with under other headings in this questionnaire.
(*ii*) for the reclamation of alkali (*usar*) or other uncultivable land,
(*iii*) for the prevention of the erosion of the surface soil by flood water ?
(*b*) Can you give instances of soils known to you which, within your recollection, have—
(*i*) undergone marked improvement,
(*ii*) suffered marked deterioration ?
If so, please give full particulars.
(*c*) What measures should Government take to encourage the reclamation of areas of cultivable land which have gone out of cultivation ?

10. Fertilisers.

(*a*) In your opinion, could greater use be profitably made of natural manures or artificial fertilisers? If so, please indicate the directions in which you think improvement possible.
(*b*) Can you suggest measures to prevent the fraudulent adulteration of fertilisers?
(*c*) What methods would you employ to popularise new and improved fertilisers?
(*d*) Mention any localities known to you in which a considerable increase in the use of manures has recently taken place.
(*e*) Has effect of manuring with phosphates, nitrates, sulphate of ammonia, and potash manures been sufficiently investigated? If so, what is the result of such investigation?
(*f*) What methods would you employ to discourage the practice of using cowdung as fuel?

11. Crops.

(*a*) Please give your views on—
(*i*) the improvement of existing crops,
(*ii*) the introduction of new crops including fodder crops,
(*iii*) the distribution of seeds,
(*iv*) the prevention of damage by wild animals.
(*b*) Can you suggest any heavy yielding food crops in replacement of the present crops?
(*c*) Any successful efforts in improving crops or substituting more profitable crops which have come under your own observation should be mentioned.

12. Cultivation.

Can you suggest improvements in—
(*i*) the existing system of tillage, or
(*ii*) the customary rotations or mixtures of the more important crops?

13. Crop Protection, Internal and External.

Please give your views on—
(*i*) The efficacy and sufficiency of existing measures for protection of crops from external infection, pests and diseases.
(*ii*) The desirability of adopting internal measures against infection.

14. Implements.

(*a*) Have you any suggestion for the improvement of existing, or the introduction of new, agricultural implements and machinery?
(*b*) What steps do you think may usefully be taken to hasten the adoption by the cultivator of improved implements?
(*c*) Are there any difficulties which manufacturers have to contend with in the production of agricultural implements or their distribution for sale throughout the country? If so, can you suggest means by which these difficulties may be removed?

PART III

15. Veterinary.

(*a*) Should the Civil Veterinary Department be under the Director of Agriculture or should it be independent?
(*b*) (*i*) Are dispensaries under the control of local (district) boards? Does this system work well?
(*ii*) Is the need for expansion being adequately met?
(*iii*) Would you advocate the transfer of control to provincial authority?
(*c*) (*i*) Do agriculturists make full use of the veterinary dispensaries? If not, can you suggest improvements to remedy this?
(*ii*) Is full use made of touring dispensaries?
(*d*) What are the obstacles met with in dealing with contagious diseases? Do you advocate legislation dealing with notification, segregation, disposal of diseased carcases, compulsory inoculation of contacts and prohibition of the movement of animals exposed to infection? Failing legislation, can you suggest other means of improving existing conditions?
(*e*) Is there any difficulty in securing sufficient serum to meet the demand?
(*f*) What are the obstacles in the way of popularising preventive inoculation? Is any fee charged, and, if so, does this act as a deterrent?
(*g*) Do you consider that the provision of further facilities for research into animal disease is desirable?

If so, do you advocate that such further facilities should take the form of—
(*i*) an extension of the Muktesar Institute, or
(*ii*) the setting up, or extension of, Provincial Veterinary Research Institutions ?
(*h*) Do you recommend that special investigations should be conducted by—
(*i*) officers of the Muktesar Institute, or
(*ii*) research officers in the provinces ?
(*i*) Do you recommend the appointment of a Superior Veterinary Officer with the Government of India ? What advantages do you expect would result from such an appointment ?

16. Animal Husbandry.

(*a*) Do you wish to make suggestions for—
(*i*) improving the breeds of livestock,
(*ii*) the betterment of the dairying industry,
(*iii*) improving existing practice in animal husbandry.
(*b*) Comment on the following as causes of injury to cattle in your district—
(*i*) Overstocking of common pastures,
(*ii*) Absence of enclosed pastures, such as grass borders in tilled fields,
(*iii*) Insufficiency of dry fodder such as the straw of cereals or the stems and leaves of pulses,
(*iv*) Absence of green fodders in dry seasons,
(*v*) Absence of mineral constituents in fodder and feeding stuffs.
(*c*) Please mention the months of the year in which fodder shortage is most marked in your district. For how many weeks does scarcity of fodder usually exist ? After this period of scarcity ends how many weeks elapse before young growing cattle begin to thrive ?
(*d*) Can you suggest any practicable methods of improving or supplementing the fodder supply that would be applicable to your district ?
(*e*) How can landowners be induced to take a keener practical interest in these matters ?

Part IV

17. Agricultural Industries.

(*a*) Can you give any estimate of the number of days of work done by an average cultivator on his holding during the year ? What does he do in the slack season ?
(*b*) Can you suggest means for encouraging the adoption of subsidiary industries ? Can you suggest any new subsidiary industries to occupy the spare time of the family which could be established with government aid ?
(*c*) What are the obstacles in the way of expansion of such industries as beekeeping, poultry rearing, fruit growing, sericulture, pisciculture, lac culture, rope-making, basket-making, etc ?
(*d*) Do you think that Government should do more to establish industries connected with the preparation of agricultural produce for consumption, such as oil-pressing, sugar-making, cotton-ginning, rice-hulling, utilisation of wheat straw for card-board, utilisation of cotton seed for felt, fodder, oil and fuel, utilisation of rice straw for paper, etc. ?
(*e*) Could subsidiary employment be found by encouraging industrial concerns to move to rural areas ? Can you suggest methods ?
(*f*) Do you recommend a more intensive study of each rural industry in its technical, commercial and financial aspects, with a view to, among other things, introduction of improved tools and appliances ?
(*g*) Can you suggest any other measures which might lead to greater rural employment ?
(*h*) Can you suggest means whereby the people could be induced to devote their spare time to improving the health conditions of their own environment ?

18. Agricultural Labour.

(*a*) What measures, if any, should be taken to attract agricultural labour from areas in which there is a surplus to—
(*i*) areas under cultivation in which there is a shortage of such labour ? and
(*ii*) areas in which large tracts of cultivable land remain uncultivated ?
Please distinguish between suggestions designed to relieve seasonal unemployment and proposals for the permanent migration of agricultural population.
(*b*) If there is any shortage of agricultural labour in your province, what are the causes thereof and how could they be removed ?
(*c*) Can you suggest measures designed to facilitate the occupation and development, by surplus agricultural labour, of areas not at present under cultivation ?

19. Forests.

(*a*) Do you consider that forest lands as such are at present being put to their fullest use for agricultural purposes? For instance, are grazing facilities granted to the extent compatible with the proper preservation of forest areas? If not, state the changes or developments in current practice which you consider advisable.

(*b*) Can you suggest means whereby the supply of firewood and fodder in rural areas may be increased?

(*c*) Has deterioration of forests led to soil erosion? What remedies would you suggest for erosion and damage from floods?

(*d*) Can you indicate any methods by which supply of moisture in the soil, the rainfall and supply of canal water can be increased and regulated by afforestation or by the increased protection of forests so as to benefit agriculture? Would the same methods be useful in preventing the destruction by erosion of agricultural land?

(*e*) Is there an opening for schemes of afforestation in the neighbourhood of villages?

(*f*) Are forests suffering deterioration from excessive grazing? Is soil erosion being thereby facilitated? Suggest remedies.

20. Marketing.

(*a*) Do you consider existing market facilities to be satisfactory? Please specify and criticise the markets to which you refer, and make suggestions for their improvement.

(*b*) Are you satisfied with the existing system of marketing and distribution? If not, please indicate the produce to which you refer and describe and criticise in detail the channels of marketing and distribution from the producer to the consumer in India (or exporter in the case of produce exported overseas). State the services rendered by each intermediary and whether such intermediary acts in the capacity of merchant or commission agent, and comment upon the efficiency of these services and the margins upon which such intermediaries operate. Please describe the method by which each transaction is financed, or in the case of barter, by which an exchange is effected.

(*c*) Do you wish to suggest steps whereby the quality, purity, grading or packing of agricultural produce may be improved, distinguishing where possible between produce destined for—

(*i*) Indian markets?

(*ii*) Export markets?

(*d*) Do you think that more effective steps might be taken to place at the disposal of cultivators, merchants and traders information as to market conditions, whether Indian or overseas; crop returns; complaints as to Indian produce from wheresoever originating; and agricultural and marketing news in general?

21. Tariffs and Sea Freights.

Do existing (*a*) customs duties, both import and export, and (*b*) sea freights adversely affect the prosperity of the Indian cultivator? If so, have you any recommendations to make?

22. Co-operation.

(*a*) What steps do you think should be taken to encourage the growth of the co-operative movement—

(*i*) by Government,

(*ii*) by non-official agencies?

(*b*) Have you any observations to make upon—

(*i*) Credit societies;

(*ii*) Purchase societies;

(*iii*) Societies formed for the sale of produce or stock;

(*iv*) Societies for effecting improvements—*e.g.*, the digging of wells and the construction of *bunds*, walls and fences, or the planting of hedges;

(*v*) Societies formed for the aggregation of fragmented holdings and their redistribution in plots of reasonable size;

(*vi*) Societies for the co-operative use of agricultural machinery;

(*vii*) Societies for joint farming;

(*viii*) Cattle breeding societies;

(*ix*) Societies formed for any purpose connected with agriculture or with the betterment of village life, but not specified above?

(*c*) Where co-operative schemes for joint improvement, such as co-operative irrigation or co-operative fencing or a co-operative consolidation of holdings scheme, cannot be given effect to owing to the unwillingness of a small minority to join, do you think legislation should be introduced in order to compel such persons to join for the common benefit of all?

(*d*) Do you consider that those societies of which you have personal knowledge have, in the main, achieved their object?

23. General Education.

(*a*) Do you wish to make observations upon existing systems of education in their bearing upon the agricultural efficiency of the people ? If you make suggestions, please distinguish, as far as possible, between—

(*i*) Higher or collegiate,

(*ii*) Middle school, and

(*iii*) Elementary school education.

(*b*) (*i*) Can you suggest any methods whereby rural education may improve the ability and culture of agriculturists of all grades while retaining their interest in the land ?

(*ii*) What is your experience of compulsory education in rural areas ?

(*iii*) What is the explanation of the small proportion of boys in rural primary schools who pass through the fourth class ?

24. Attracting Capital.

(*a*) What steps are necessary in order to induce a larger number of men of capital and enterprise to take to agriculture ?

(*b*) What are the factors tending to discourage owners of agricultural land from carrying out improvements ?

25. Welfare of Rural Population.

(*a*) Outside the subjects enumerated above, have you any suggestions to offer for improving hygiene in rural areas and for the promotion of the general well-being and prosperity of the rural population ?

(*b*) Are you, for instance, in favour of Government conducting economic surveys in typical villages with a view to ascertaining the economic position of the cultivators ? If so, what, in your opinion, should be the scope and methods of such enquiries ?

(*c*) If you have carried out anything in the nature of such intensive enquiry, please state the broad conclusions which you reached.

26. Statistics.

(*a*) Do you wish to make suggestions for the extension or improvement of the existing methods of—

(*i*) ascertaining areas under cultivation and crops ;

(*ii*) estimating the yield of agricultural produce ;

(*iii*) enumerating livestock and implements ;

(*iv*) collecting information on land tenure, the incidence of land revenue and the size of the agricultural population ;

(*v*) arranging and publishing agricultural statistics ?

(*b*) Have you any other suggestions to make under this heading ?

APPENDIX II

List of Witnesses Examined

Government of India

1. Bal Kishan, Mr., Registrar, Co-operative Societies, Ajmer-Merwara.
2. Clouston, Dr. D., M.A., D.Sc., C.I.E., I.A.S., Agricultural Adviser to the Government of India and Director of Agricultural Research Institute, Pusa.
3. Cowan, Dr. J. M., M.A., D.Sc., Officiating Director, Botanical Survey of India, Calcutta.
4. Cumming, Mr. J. W. N., Retired Extra-Assistant Commissioner in Baluchistan, Quetta.
5. Edwards, Dr. J. T., D.Sc.(London), M.R.C.V.S., I.V.S., Director, Imperial Institute of Veterinary Research, Muktesar.
6. Field, Mr. J. H., M.A., B.Sc., Director General of Observatories, Simla.
7. Fletcher, Mr. T. Bainbrigge, R.N., F.E.S., F.L.S., F.Z.S., I.A.S., Imperial Entomologist, Agricultural Research Institute, Pusa.
8. Graham, Lieut.-Colonel J. D., C.I.E., I.M.S., Public Health Commissioner with the Government of India.
9. Hardy, Mr. G. S., I.C.S., Member, Central Board of Revenue.
10. Harris, Mr. D. G., C.I.E., Dip. Ing., Zurich, M.I.E.(Ind.), Deputy Secretary to the Government of India, Department of Industries and Labour, Public Works Branch.
11. Harrison, Dr. W. H., D.Sc., I.A.S., Imperial Agricultural Chemist and Joint Director, Agricultural Research Institute, Pusa.
12. Henderson, Mr. G S , N.D.A., N.D.D., I.A.S., Imperial Agriculturist, Agricultural Research Institute, Pusa.
13. Hindley, Sir Clement, Kt., Chief Commissioner of Railways.
14. Jamiat Rai, Diwan Bahadur Diwan, C.I.E., Retired Extra-Assistant Commissioner, Quetta.
15. Joshi, Mr. N. V., M.Sc., L.Ag., Representative of the Imperial Agricultural Department (Pusa) Association, Pusa.
16. Marriott, Lieut.-Colonel A. S , Director of Farms, Master General of Supplies Branch.
17. McCarrison, Lieut.-Colonel R., C.I.E., M.D., D.Sc., LL.D., F.R.C.P., I.M.S., Pasteur Institute, Coonoor, S. India.
18. McRae, Dr. W., M.A., D.Sc., I.A.S., Officiating Imperial Mycologist, Agricultural Research Institute, Pusa.
19. Meek, Dr. D. B., M.A., D.Sc., O.B.E., Director General of Commercial Intelligence and Statistics, Calcutta.
20. Pascoe, Dr. E. H., M.A., Sc.D.(Cantab.), D.Sc.(Lond.), F.G.S., F.A.S.B., Director, Geological Survey of India, Calcutta.
21. Pitkeathly, Mr. J. S., C.I.E., C.V.O., C.B.E., D.S.O., Chief Controller, Indian Stores Department.
22. Richey, Mr. J. A., M.A., C.I.E., I.E.S., Educational Commissioner with the Government of India.
23. Rodger, Mr. A., O.B.E., I.F.S., Officiating Inspector General of Forests, Dehra Dun.
24. Sams, Mr. H. A., C.I.E., I.C.S., Deputy Director General of Posts and Telegraphs.
25. Sayer, Mr. M. W., B.A., I.A.S., Secretary, Sugar Bureau, Pusa.
26. Shaw, Dr. F. J. F., D.Sc., A.R.C.S., F.L.S., I.A.S., Officiating Imperial Economic Botanist, Agricultural Research Institute, Pusa.
27. Shuldham, Captain W. F. Q., I.A., Assistant Commissioner, Ajmer-Merwara.
28. Smith, Mr. W., Imperial Dairy Expert, Imperial Institute of Animal Husbandry and Dairying, Bangalore.

29. Venkatraman, Rao Bahadur T. S., B.A., I.A.S., Government Sugarcane Expert, Sugarcane Breeding Station, Coimbatore.
30. Walton, Mr. J. H., M.A., M.Sc., I.A.S., Imperial Agricultural Bacteriologist, Agricultural Research Institute, Pusa.
31. Ware, Mr. F., F.R.C.V.S., I.V.S., Officiating Director, Imperial Institute of Veterinary Research, Muktesar.
32. Warth, Mr. F. J., B.Sc., M.Sc., I.A.S., Physiological Chemist, Imperial Institute of Animal Husbandry and Dairying, Bangalore.

Bombay

33. Bhagwat, Mr. K. B., Representative, Irrigators' Central Committee, Deccan Canals.
34. Bruen, Mr. E. J., I.A.S., Livestock Expert.
35. Burns, Dr. William, D.Sc.(Edin.), I.A.S., Joint Director of Agriculture.
36. Burt, Mr. B.C., M.B.E., B.Sc., I.A.S., Secretary, Indian Central Cotton Committee.
37. Calvocoressi, Mr. Stephen, Head Manager, Ralli Brothers, Bombay.
38. Collins, Mr. G. F. S., O.B.E., I.C.S., Registrar, Co-operative Societies.
39. Desai, Rao Sahib Bhimbhai M., Deputy Director of Agriculture, Gujarat.
40. Desai, Rao Sahib Dadubhai Purshottamdas, F.R.H.S., M.L.C., Landholder, Nadiad
41. Desai, Rao Bahadur Govindbhai H., Naib Dewan, Baroda.
42. Devadhar, Mr. G. K., M.A., C.I.E., President, Bombay Provincial Co-operative Institute.
43. Edie, Mr. A. G., I.F.S., Chief Conservator of Forests.
44. Farbrother, Mr. E. S., M.R.C.V.S., I.V.S., Superintendent, Civil Veterinary Department.
45. Fotiadi, Mr. A., Manager, Ralli Brothers, Bombay.
46. Goheen, Mr. J. L., B.A., Principal, Sangli Industrial and Agricultural School, Sangli, and in charge, Kolhapur Farm School, Kolhapur.
47. Gordon, Mr. R. G., I.C.S., Collector, Nasik.
48. Gurjar, Mr. N. W., Secretary of Messrs. Kirloskar Brothers, Ltd.
49. Harrison, Mr. R. T., I.S.E., Secretary and Chief Engineer for Irrigation, Public Works Department.
50. Inglis, Mr. C. C., B.A.I., I.S.E., Executive Engineer, Special Irrigation Division.
51. Jenkins, Mr. W. J., M.A., B.Sc., I.A.S., Officiating Secretary of the Indian Central Cotton Committee.
52. Karmarkar, Mr., Secretary, Gadag Co-operative Cotton Sale Society, Dharwar.
53. Kay, Sir Joseph, Kt., Vice-President, Indian Central Cotton Committee.
54. Kembhavi, Mr. N. R., Managing Agent, The Bijapur Mahalaxmi Company.
55. Kirloskar, Mr. L. K., Chief Manager, Messrs. Kirloskar Brothers, Ltd.
56. Knight, Mr. H. F., B.A., I.C.S., Collector of West Khandesh.
57. Kothawala, Mr. Nariman R., President, The South Daskroi Taluka Development Association Ahmedabad.
58. Lory, Mr. F. B. P., M.A., I.E.S., Director of Public Instruction.
59. Lowsley, Mr. C. O., I.S.E., Superintending Engineer (On special duty).
60. Mann, Dr. Harold H., D.Sc., I.A.S., Director of Agriculture.
61. Maxwell, Mr. R. M., M.A., C.I.E., I.C.S., Collector of Kaira.
62. Mehta, Mr. J. K., Secretary, The Indian Merchants' Chamber.
63. Mehta, Sir Lalubhai Samaldas, Kt., C.I.E., Bombay.
64. Mehta, Mr. V. L., B.A., Managing Director, Bombay Provincial Co-operative Bank, Ltd., Bombay.
65. Melhuish, Lieut.-Colonel H. M. H., D.S.O., I.M.S., Director of Public Health.
66. Nagpurkar, Mr. S. D., M.Ag., of the Union Agency, Poona (Manures).

67. Naik, Rao Bahadur Bhimbhai R., President, District Local Board, Surat, and Member, Indian Central Cotton Committee.
68. Naik, Mr. V. H., M A., Bar.-at-Law, Collector of Bijapur.
69. Palmer, Ensign, representing the Salvation Army Social Work.
70. Patel, Mr. B. S., N.D.D., N.D.A., C.D.A.D., I.A.S., Professor of Agriculture, Agricultural College, Poona.
71. Patil, Rao Bahadur P. C., L. Ag., M.Sc., I.A S., Professor of Agricultural Economics and Acting Principal, Agricultural College, Poona.
72. Peck, Major C. E., representing the Salvation Army Social Work.
73. Ransing, Mr. B. R , B A., LL B., Honorary Secretary, Dhulia Taluka Agricultural Association and Member of the Divisional Board of Agriculture, North Central Division.
74. Rothfield, Mr. Otto, B.A , I.C.S. (Retired), Khairpur State.
75. Salimath, Mr. S S., B.Ag , Deputy Director of Agriculture, Southern Division.
76. Shirahatti, Rao Sahib G S., Managing Director, Hubli Co-operative Cotton Sale Society, Ltd.
77. Sule, Mr R G., L C.E., I.S.E., Executive Engineer.
78. Walchand Hirachand, Mr , President, Indian Merchants' Chamber.

Madras

79. Aitchison, Mr D A. D , M R.C.V.S., M.P S , I.V.S., Veterinary Adviser to the Government of Madras.
80. Anstead, Mr. Rudolph D., M A., C.I E., I.A.S., Director of Agriculture.
81. Bazl-ul lah, Khan Bahadur M., Sahib Bahadur, C.I.E., O.B.E., Director of Industries.
82. Champion, Mr. Herbert, M.A., I.E S , Principal, Teachers' College, Saidapet.
83. Deivasikhamani Mudaliyar, Rao Sahib K , Joint Registrar of Co-operative Societies.
84. Hood, Mr. H. M., I.C.S., Registrar of Co-operative Societies.
85. Hutchinson, Major-General F. H. G., C.I.E., I.M.S., Surgeon-General with the Government of Madras.
86 Keith, Mr. J. W , Representative of Messrs Parry & Co
87. Leach, Mr. A. G., I.C.S., Collector of North Arcot.
88. Macmichael, Mr. N., C S I , I C S , First Member, Board of Revenue.
89. Mullings, Mr. C. T., I.S.E., Chief Engineer for Irrigation.
90. Munro, Mr. D. G., B.Sc., I.A.S., General Scientific Officer, United Planters' Association of Southern India.
91. Narasimharaju, Rao Bahadur C. V. S , M.L.C., Landholder, Vizagapatam.
92. Paddison, Sir George, K.B E., C.S I., I C S., Commissioner of Labour.
93. Paul, Mr K. T , O B.E., B A., National Secretary, National Council of the Y.M.C.A.'s of India, Burma and Ceylon, Salem.
94. Raja of Kollengode, Raja Sir Vasudeva, Kt., C I E , Landholder, Malabar.
95. Rama Rao, Mr. N., Superintendent, Sericultural Department, Mysore Government.
96. Ramaswami Sivan, Rao Sahib M. R , B.A., I.A.S., Government Lecturing Chemist, Agricultural College, Coimbatore.
97. Ramdas, the Honourable Mr. V., Representative of the Madras Provincial Co-operative Union.
98. Ranganatha Mudaliyar, Mr. A., B.A., B.L., M.L.C., Madras.
99. Reddi Nayudu, Sir K. V., Kt., B.A., B.L., M.L.C., Landholder, Madras.
100. Russell, Major A. J. H., C.B.E., M.D , D.P.H., I.M.S., Director of Public Health.
101. Sivaswami, Mr. K. G., Representative of the Madras Provincial Co-operative Union
102. Subbarayan, Dr. P., M.L.C., Zamindar of Kumaramangalam.
103. Subramanya Mudaliyar, Mr. M. T., Proprietor of Uttamapalayam Estate.
104. Sutherland, Rev. W. S., B.D., United Free Church Mission, Chingleput.

105. Tireman, Mr. H., C.I.E., I.F.S., Chief Conservator of Forests.
106. Wood, Mr. C. E., Representative of Messrs. Parry & Co.

Bengal

107. Ahmed, Khan Bahadur Maulvi Emaduddin, B. L., Chairman, District Board, Rajshahi.
108. Ahmed, Khan Bahadur Maulvi Hemayat Uddin, Pleader, Barisal.
109. Ahmed, Khan Bahadur Maulvi Wasimuddin, Chairman, District Board, Pabna.
110. Bentley, Dr. C. A., M.B., D.P.H., D.T.M. & H., Director of Public Health.
111. Burrows, Mr. L., B.A., Collector of Faridpur.
112. Carpenter, Mr. P. H., Representative of the Indian Tea Association.
113. Chatterjee, Rai Bahadur Dr. G. C., Secretary, The Central Co-operative Anti-Malaria Society, Limited, Calcutta.
114. Chaudhuri, Mr. Prabhat Chandra, I.A.S , Deputy Director of Sericulture, Bengal, Berhampore (Murshidabad).
115. Crawford, Mr. T. C., Representative of the Indian Tea Association.
116. Das, Rai Bahadur A. N., B.E., I.S.E., Officiating Chief Engineer and Secretary to the Government of Bengal, Irrigation Department.
117. Finlayson, Mr. J. T., Representative of the Indian Jute Mills Association.
118. Finlow, Mr. R. S., B.Sc., F.I.C., I.A.S., Director of Agriculture.
119. Hutchinson, Mr. C. M., C I E., Late Imperial Agricultural Bacteriologist, Calcutta.
120. Kerr, Mr. P. J., M.R.C.V.S., I.V.S., Veterinary Adviser to the Government of Bengal.
121. Maurer, Mr. F. E., Manager, Fertiliser Department, Messrs. Shaw Wallace and Company, Calcutta.
122. McLean, Mr. K., B.Sc., I.A.S., Assistant Director of Agriculture.
123. Milligan, Mr. J. A., Representative of the Indian Tea Association.
124. Mitra, Rai Bahadur J. M., M.A., Registrar of Co-operative Societies.
125. Momen, Khan Bahadur M. A., Magistrate-Collector and late Officiating Director of Land Records and Surveys.
126. Morgan, Mr. G., M.L.C., Proprietor, Morgan Walker and Company, Calcutta.
127. Mukherjee, Mr. Nagendra Nath, B. L., Secretary, Ranaghat Central Co-operative Bank, Limited, Ranaghat.
128. Mullick, Rai Bahadur Kumud Nath, Ranaghat.
129. Oaten, Mr. E. F., M.A., I.E.S., M.L.C., Director of Public Instruction.
130. Peddie, Mr. James, M.A., I.C.S., Collector, Malda.
131. Ray, Sir P. C., Kt., D.Sc., University College of Science and Technology, Calcutta.
132. Roy, Mr. S. N., Representative of a Deputation from certain districts.
133. Shebbeare, Mr. E. O., I.F.S., Conservator of Forests.
134. Sime, Mr. J., Representative of the Indian Jute Mills Association.
135. Simpson, Mr. J. W. A., Representative of the Indian Jute Mills Association.
136. Soutar, Mr. W. J., Representative of the Indian Jute Mills Association.
137. West, Mr. M., M.A., I.E.S., Principal, Teachers' Training College, Dacca.

Assam

138. Barthakur, Srijut Laksheswar, I.A.S., Deputy Director of Agriculture.
139. Barua, Rai Bahadur K. L., B.L., Director of Agriculture and Industries and Registrar of Co-operative Societies.
140. Barua, Rai Sahib Narayan, Honorary Correspondent, Agricultural Department.
141. Chakravarty, Mr. Dijesh Chandra, M.A., B.L., Dewan, Gauripur Raj Estate.
142. Cunningham, Mr. J. R., M.A., C.I.E., Director of Public Instruction.
143. Harris, Mr. W., M.R.C.V.S., I.V.S., Superintendent, Civil Veterinary Department.

144. Lahiri, Mr. Mohendra Mohan, B.L., Pleader, Gauhati.
145. McKercher, Mr. W. G., General Manager, Amgoorie Tea Estates, Limited, and Vice-Chairman, Assam Branch of the Indian Tea Association.
146. Mitra, Dr. S. K., M.S., Ph.D., I.A.S., Economic Botanist.
147. Murison, Major T. D., D.P.H., I.M.S., Director of Public Health.
148. Ross, Dr. Halford, Assam Frontier Tea Company, Limited, Talup.
149. Scott, Mr. W. L., I.C.S., Director of Land Records.
150. Sema, Luzeku, Representing the Sema Nagas (a tribe of the Naga Hills)

Central Provinces

151. Allan, Mr. R. G., M.A., I.A.S., Principal, Agricultural College, Nagpur.
152. Amanat Ali, Mr., Landholder, Burhanpur, Khandwa.
153. Beckett, Mr. R. H., I.E.S., Officiating Director of Public Instruction.
154. Bhargava, Mr. Shyam Sundar, Managing Proprietor, Messrs. Chandrabhan Behari Lall, Jubbulpore.
155. Brahma, Rao Bahadur K. V., B.A., LL.B., M.B.E., President, Berar Co-operative Institute, Limited, Amraoti.
156. Burton, Mr. G. P., I.C.S., Deputy Commissioner, Raipur.
157. Chhotelal, Mr., Extra-Assistant Commissioner, Raipur.
158. Deshpande, Rao Bahadur M. G., Landholder, Nagpur.
159. Dokras, Mr. M. R., Pleader, Chandur, Amraoti.
160. Dubey, Mr. Ramcharan Lal, Retired Agricultural Assistant, Waraseoni, Balaghat.
161. Dwarkanath Singh, Rai Sahib Dadu, Talukdar, Seoni.
162. Irwin, Mr. C. J., C.I.E., I.C.S., Commissioner, Jubbulpore Division.
163. Khaparde, Mr. B. G., B.A., LL.B., M.L.C., Amraoti.
164. Korde, Rao Sahib T. S., M.L.C., Landlord, Murtizapur, Akola.
165. Pande, Mr. K. P., LL.B., M.L.C., Representing the Tahsil Agricultural Association, Sihora, Jubbulpore.
166. Pandeya, Mr. Purushottam Prasad, Malguzar, Balpur, Bilaspur.
167. Peterson, Mr. H. H., B.A., Secretary, Y. M. C. A., and President, The Empress Mills Co-operative Stores, Limited, Nagpur.
168. Plymen, Mr. F. J., A.C.G.I., I.A.S., Director of Agriculture.
169. Pochory, Mr. Kaluram, Representing the Agricultural Association, Gadarwara.
170. Pollard-Lowsley, Col. H.de L., C.M.G., C.I.E., D.S.O., Chief Engineer, Irrigation.
171. Powar, Rai Bahadur Tundi Lal, B.A., I.A.S., Deputy Director of Agriculture, Raipur.
172. Sahasrabudhe, Rao Sahib G. N., Pleader, Ellichpur, Amraoti.
173. Trivedi, Mr. C. M., I.C.S., Registrar of Co-operative Societies, Director of Industries, and Registrar, Joint Stock Companies.
174. Webb, Lieut.-Colonel H. G. Stiles, D.P.H., D.T.M. & H (Camb.), I.M.S., Officiating Director of Public Health.
175. Wilson, Mr. C. W., M.R.C.V.S., I.V.S., Veterinary Adviser to Government
176. Witt, Mr. D. O., I.F.S., Chief Conservator of Forests

United Provinces

177. Abdul Hameed Khan, Rao Sahib Rao, of Kairi, Landholder, Muzaffarnagar.
178. Adiram Singhal, Babu, Singhal Dairy Farm, Agra.
179. Ahmed, Syed Tofail, Retired Sub-Registrar, Aligarh.
180. Channer, Mr. F. F. R., I.F.S., Chief Conservator of Forests.
181. Chaudhury, Mukhtar Singh, M.L.A., Pleader, Meerut.
182. Chintamani, Mr. C. Y., Editor, "The Leader," Allahabad.

183. Clarke, Mr. G., F.I.C., F.C.S., H.L.S., C.I.E., M.L.C., I.A.S., Director of Agriculture.
184. Darley, Mr. B. D'O, C.I.E., I.S.E., Secretary to the Government of the United Provinces, Public Works Department, Irrigation Branch.
185. Deerr, Mr. Noel, Representing Indian Producers' Association, Cawnpore.
186. Dunn, Lieut.-Colonel. C. L., D.P.H., I.M.S., Director of Public Health.
187. Fawkes, Mrs. A. K., Secretary, United Provinces Poultry Association.
188. Fowler, Dr. Gilbert, Head of the Research Department, Government Technological Institute, Cawnpore.
189. Hickey, Captain S. G. M., M.R.C.V.S., I.V.S., Veterinary Adviser to the Government of the United Provinces.
190. Higginbottom, Mr. Sam, Principal, Allahabad Agricultural Institute.
191. Ishwar Sahai, Rai Bahadur Lala, Landlord, Man Bhawan, Fatehpur.
192. Jagannath Baksh Singh, Raja, Landholder, Rahwan, Rae Bareli.
193. Keventer, Mr. Edward, of Edward Keventer Ltd., Aligarh.
194. Keventer, Mr. Werner, of Edward Keventer Ltd., Aligarh.
195. Kirpal Singh, Sardar, Landholder, Sardar Nagar, Gorakhpur.
196. Kushal Pal Singh, Raja, M.L.C.
197. Lane, Mr. H. A., I.C.S., Revenue and Judicial Secretary to Government.
198. Mackenzie, Mr. A K., M.A., B.Sc., I.E.S., Director of Public Instruction and Deputy Secretary to the Government of the United Provinces, Education Department, Lucknow.
199. Malaviya, Pandit Madan Mohan, M.L.A , Vice-Chancellor of the Benares Hindu University.
200 Misra, The Honourable Mr. Shyam Bihari, Member, Council of State and Registrar, Co-operative Societies, Lucknow.
201. Mukherjee, Dr. Radhakamal, Ph.D., Professor and Head of the Department of Economics and Sociology, University of Lucknow.
202. Oakden, Mr. R., I.C.S., Commissioner, Meerut Division.
203. Pant, Pundit Govind Ballabh, M.L.C., Naini Tal.
204. Parr, Dr. A. E., Ph.D., M.A., B.Sc., M.S., I.A.S., Deputy Director of Agriculture.
205. Parr, Mr. C. H., B.Sc., I.A.S., Deputy Director of Agriculture, in charge of cattle breeding operations.
206. Ryan, Mr. J. G., Secretary, Indian Sugar Producers' Association.
207. Shakespear, Mr. A. B., C.I.E., Chairman, Indian Sugar Producers' Association.
208. Sukhbir Sinha, The Honourable Lala, Representing the United Provinces Zamindars' Association, Muzaffarnagar.
209. Vick, Mr. F. Howard, M.I. Mech. E., Agricultural Engineer to Government.

Punjab

210. Afzal Hussain, Mr. Mohammad, M.Sc. (Pb.)., M.A. (Cantab.), I.A.S., Entomologist to the Punjab Government, Agricultural College, Lyallpur.
211. Anderson, Sir George, Kt., M.A., C.I.E., Director of Public Instruction.
212. Battye, Lieut.-Colonel B. C., D.S.O., A.M., R.E., A.I.C.E., A.M.I.E.E., etc., Chief Engineer, Public Works Department, Hydro-Electric Branch.
213. Branford, Mr. R., M.R.C.V.S., I.V.S., Livestock Expert to the Government of the Punjab and Superintendent, Government Cattle Farm, Hissar.
214. Brayne, Mr. F. L., M.C., I.C.S., Deputy Commissioner, Gurgaon.
215. Brownlie, Mr. T. A. Miller, M.C.E., M.I.W.E., M.I.M. & C.E., Agricultural Engineer to Government of Punjab, and Principal, Agricultural College, Lyallpur.
216. Bunting, Mr. S. A., of Messrs. Duncan, Stratton & Company, Delhi.
217. Chopra, Rai Bahadur Lala Wazir Chand, B.A., M.I.C.E., M.I.E. (Ind.), F.R.S.A., Superintending Engineer, Lower Chenab East Circle, Lyallpur.
218. Cole, Colonel E. H., Coleyana Estate, Ltd., Okara, Montgomery.

219. Darling, Mr. M. L., I.C.S., Commissioner of Income Tax, Punjab and N. W. F. P., Lahore.
220. Fazl Ali, Khan Bahadur Chaudhri, M.B.E., President, Gujrat Central Co-operative Bank.
221. Forster, Colonel D. C. H., M.B., D.P.H., I.M.S., Director of Public Health.
222. Ghulam Hasan Khan, Mr., Honorary Secretary, The Mianwali Central Co-operative Bank, Ltd., Mianwali.
223. Gordon, Major R. E., R.E., M.C., Special Officer, North Western Railway.
224. Govan, Mr. R. E. Grant, of Govan Brothers, Ltd. Delhi.
225. Gulshan Rai, Lala, M.A., Professor, Sanatan Dharma College, Lahore.
226. Hardit Singh, S., of Messrs. Hardit Singh & Sons, Fruit Farmers and Nurserymen, Mona R. D.
227. King, Mr. C. M., C.S.I. C.I.E., I.C.S., Financial Commissioner.
228. Lalchand, Rao Bahadur Chaudhuri, President, State Council, Bharatpur.
229. Lander, Dr. P. E., M.A. (Cantab.), D.Sc. (London), A.I.E., I.A.S., Agricultural Chemist, Agricultural College, Lyallpur.
230. Mayes, Mr. W., F.C.H., I.F.S., Chief Conservator of Forests.
231. Mehdi Shah, Khan Bahadur Sayad Sir, K.C.I.E., O.B.E., Landlord, Gojra.
232. Milne, Mr. D., C.I.E., I.A.S., Director of Agriculture.
233. Mitchell, Mr. K. G., A.M.I.C.E., A.M.Inst.I., Secretary, Communications Board.
234. Myles, Mr. W. H., M.A., I.E.S., Professor of Economics, Punjab University, and Honorary Secretary, Board of Economic Enquiry.
235. Narainda Nath, Dewan Bahadur Raja, M.A., M.L.C., Lahore.
236. Nawaz Khan, Sardar Muhammad, I.A.R.O., M.L.A., of Kot-Fateh-Khan, Attock.
237. Quirke, Mr. T. F., M.R.C.V.S., I.V.S., Chief Superintendent, Civil Veterinary Department.
238. Sampuran Singh, Sardar, Barrister-at-Law, Honorary Secretary, Lyallpur Central Co-operative Bank, Ltd., Lyallpur.
239. Sangster, Mr. W. P., C.S.I., C.I.E., Chief Engineer, Irrigation Works.
240. Shiv Dev Singh, Mr., Honorary Magistrate, Shanwali, Sialkot.
241. Smith, Mr. J. B. G., Chief Engineer, Irrigation.
242. Strickland, Mr. C. F., I.C.S., Registrar of Co-operative Societies.
243. Taylor, Mr. W., I.V.S., Officiating Principal, Veterinary College.
244. Townsend, Mr. C. A. H., C.I.E., I.C.S., Commissioner, Jullundur Division, Punjab, and Ex-Director of Agriculture.
245. Trought, Mr. Trevor, M.A., Cotton Research Botanist, Lyallpur.
246. Ujjal Singh, Mr., M.A., M.L.C., Lahore.
247. Walton, Colonel C., D.S.O., R.E., Agent, North Western Railway
248. White, Mr. N., Chief Engineer of the Southern Canals and Secretary of the Irrigation Branch.
249. Wilsdon, Mr. B. H., M.A., B.Sc. (Oxon), I.E.S., Scientific Research Officer attached to the Irrigation Research Laboratory.
250. Wilson, Mr. W. R., I.C.S., Deputy Commissioner, Jhelum.

North-West Frontier Province

251. Abdul Matin Khan, Khan Sahib, Landholder, Takhti-Bai Mardan, Peshawar.
252. Abdul Rahim Khan, Khan Bahadur, M.B.E., Barrister-at-Law, Gul Imam.
253. Gilani, Syed Pir Kamal, L.Ag., Landholder, Jangal Khel, Kohat.
254. Khushal Khan, Mr., Landholder, Barikab (Mardan).
255. Mohammad Aslam Khan, Khan Sahib, Honorary Magistrate and Zamindar of Mardan.
256. Noel, Major E. W. C., C.I.E., D.S.O., Political Agent, Kurram.

257. Robertson-Brown, Mr. W., Agricultural Officer.
258. Sadullah Khan, Khan Bahadur, Assistant Commissioner and Landlord, Peshawar.
259. Walker, Mr. S., B.E., A.M.I.C.E., Secretary for Irrigation.
260. Wylie, Mr. F. V., I.C.S., Settlement Officer, Peshawar.

England

261. Adams, Professor W. G. S., M.A., All Souls College, Oxford, Chairman, National Council of Social Service, London.
262. Anderson, Mr. D. A., of Messrs. Caird (Dundee), Ltd.
263. Barber, Dr. C. A., C.I.E., D.Sc., Lecturer on Tropical Agriculture, School of Agriculture, Cambridge University.
264. Biffen, Sir Rowland, Kt., M.A., F.R.S., Director of Plant Breeding Institute, and Professor, Agricultural Botany, Cambridge University.
265. Brady, Capt. S. E. J., M.B.E., Board of Trade.
266. Buckpitt, Mr. E. J. W., J.P., Representing the Rope, Twine and Net Manufacturers' Association.
267. Butler, Dr. E. J., C.I.E., D.Sc., M.B., F.R.S., Imperial Bureau of Mycology, Kew, Surrey.
268. Buxton, Professor J. O. S., M.A., F.R.C.V.S., Professor of Comparative Pathology and Director of Animal Pathology, University of Cambridge.
269. Carmichael, Mr. L. T., Representative of Indian Tea Association, London.
270. Chadwick, Sir David, C.S.I., C.I.E., Secretary, Imperial Economic Committee.
271. Demetriadi, Sir Stephen, K.B.E., Representing the London Chamber of Commerce and Messrs. Ralli Bros.
272. Elliot, Major Walter, M.P., M.C., D.Sc., Under Secretary of State for Scotland.
273. Engledow, Mr. F. L., M.A., Director of Advanced Students and Lecturer, School of Agriculture, Cambridge University.
274. Faber, Mr. H., Agricultural Commissioner to the Danish Government.
275. Fagan, Sir Patrick, K.C.I.E., C.S.I., I.C.S. (Retired).
276. Floud, Sir Francis L.C., K.C.B., Permanent Secretary to the Ministry of Agriculture and Fisheries.
277. Foley, Mr. Edward A., Ph.D., Agricultural Commissioner of the United States of America.
278. Frost, Mr. J. E., Director, the British Oil and Cake Mills, Ltd.
279. Furse, Lieut.-General Sir William, K.C.B., D.S.O., Director, Imperial Institute, London.
280. Gaiger, Professor S. H., F.R.C.V.S., Professor of Veterinary Pathology, University of Liverpool.
281. Gebbie, Sir Frederick, Kt., C.I.E., *ex*-Inspector General of Irrigation with the Government of India.
282. Goodwyn, Mr. J. A., Director of Messrs. Ransomes, Sims and Jafferies.
283. Goulding, Dr. E. J., Secretary; Representative of the Advisory Committee on Vegetable Fibres, Imperial Institute.
284. Grantham, Mr. V. A., of Messrs. Forbes Forbes Campbell and Co., Ltd.
285. Greening, Mr. C. D., Manager, Agricultural Division of the Fertiliser Sales, Ltd.
286. Hall, Sir Daniel, K.C.B., M.A., F.R.S., Director, John Innes Horticultural Institute, Merton.
287. Henry, Mr. E., representing the London Jute Association.
288. Howard, Mr. Albert, C.I.E., M.A., I.A.S., Director, Institute of Plant Industry, Indore, and Agricultural Adviser to States in Central India.
289. Jarrett, Mr. A. E., of Jarrett Bros., London.
290. Jones, Mr. T., Secretary, Committee of Civil Research.
291. Julius, Mr. G. A., Chairman, Australian Commonwealth Council for Scientific and Industrial Research.

292. Keatinge, Mr. G. F., C.I.E., I.C.S. (retired).
293. Keen, Dr. B. A., D.Sc., F.Inst.P., Assistant Director, Rothamsted Experimental Station.
294. Knight, Mr. Jasper, representing Messrs. Jurgens, Ltd.
295. Lindsay, Mr. H. A. F., C.I.E., C.B.E., I.C.S., Indian Trade Commissioner, London.
296. Littlewood, Mr. James, representing the Oldham Master Cotton Spinners' Association.
297. MacPhail, Rev. Dr. E. M., C.I.E., C.B.E., M.L.A., *ex*-Vice-Chancellor of the University of Madras and *ex*-Principal of the Madras Christian College.
298. McFadyean, Sir John, M.D., B.Sc., M.R.C.V.S., LL.D., Principal, Royal Veterinary College, London.
299. McLeod, Major Norman, representing the Indian Tea Association (London).
300. Malcolm, Colonel G. A., D.S.O., Chairman, London Jute Association.
301. Nash, Mr. Vaughan, C.B., C.V.O., Vice-Chairman, Development Commission.
302. Ormsby Gore, The Right Hon. W. G. A., M.P., Under Secretary of State for the Colonies.
303. Orr, Dr. J. B., D.S.O., M.C., F.R.S E., Director, The Rowett Research Institute, Aberdeen.
304. Pelly, Mr. E. Godfrey, of Messrs. John Fowler and Co. (Leeds), Ltd.
305. Pfister, Mr. H. F., Manager of Messrs. Ralli Bros.
306. Prain, Lieut.-Colonel Sir David, C.M.G., C.I.E., F.R.S., *ex*-Superintendent of Cinchona Cultivation in Bengal, and Chairman of the Advisory Council for Plant and Animal products at the Imperial Institute, London.
307. Robson, Sir Herbert, K.B.E., of Messrs. Ross T. Smyth & Co., Ltd.
308. Rowland, Mr. G. E., Chairman of Agricultural and General Engineers, Ltd., Richard Garrett & Sons, Ltd., James and Fredk. Howard, Ltd., President of the Agricultural Engineers' Association, and Member of the Advisory Committee of the Department of Overseas Trade.
309. Russell, Sir John, Director of the Rothamsted Experimental Station.
310. Scott, Mr. G. Erskine, of Messrs. James Scott & Sons, Ltd. (representing the Jute Importers' Association, Dundee).
311. Shearer, Professor E., M.A., B.Sc., Professor of Agriculture, University of Edinburgh and Principal, Edinburgh and East of Scotland College of Agriculture.
312. Speyer, Mr. F. C. O., General Manager, Nitram. Ltd., and British Sulphate of Ammonia Federation, Ltd.
313. Steiner, Mr. E., Representing Messrs. Volkart Brothers, London
314. Swan, Mr. J., of Messrs. Steel Brothers & Co., Ltd.
315. Taylor, Mr. C. H., Wheat Department, Messrs. Ralli Brothers.
316. Walker, Sir Gilbert, C.S.I., M.A., Sc.D., F.R.S., Professor of Meteorology, Imperial College of Science and Technology.
317. Ward, Sir Thomas, Kt., C.I.E., M.V.O., *ex*-Inspector General of Irrigation with the Government of India.
318. Wigglesworth, Mr. Alfred, of Messrs. Wigglesworth & Co., Ltd.
319. Willson, Mr. L., Freights' Department, Messrs. Ralli Brothers.
320. Wilson, Mr. W. A., Agricultural Products' Representative of the Federal Government of Canada.
321. Wood, Professor T. B., C.B.E., M.A., Drapers Professor of Agriculture, School of Agriculture, University of Cambridge.

Sind

322. Abdur Rahman, Khan Bahadur Gulmahomed, Acting Deputy Director of Agriculture.
323. Aitchison, Mr. P. E., I.F.S., Conservator of Forests.

324. Bahadurkhan Khoso, Khan Bahadur Dilmuradkhan President, Jacobabad Municipality.
325. Bhutto, Khan Bahadur Shah Nawaz Khan, C.I.E., O.B.E., Landholder.
326. Dow, Mr. H., B.A., I.C.S., Revenue Officer, Lloyd Barrage and Canals Scheme.
327. Harrison, Mr. C.S.C., I.S.E., Chief Engineer, Lloyd Barrage and Canals Construction.
328. Hussain, Khan Bahadur Nabi Baksh Muhammad, M.A., LL.B., Manager, Encumbered Estates in Sind.
329. Inayatalikhan, Khan Bahadur Azimkhan, Assistant Registrar, Co-operative Societies.
330. Jeswani, Mr. T. K., Representing the Karachi Indian Merchants' Association.
331. Jerrom, Mr. J. H. G., I.C.V.D , Superintendent, Civil Veterinary Department, Sind and Rajputana.
332. Musto, Mr. A. A., C.I.E., M.Inst.C.E., I.S E , Superintending Engineer, Lloyd Barrage Circle.
333. Shahani, Mr. S. C., M A., Principal, D J. Sind College and Secretary, Sind Collegiate Board.
334. Shewakram, Rao Sahib Udharam, Zamindar, Guni, Hyderabad.

Burma

335. Aung, U. Tun, Representive of Co-operators from Lower Burma.
336. Bulkeley, Mr. J. P., M.A., I.E.S., Officiating Director of Public Instruction.
337. Charlton, Mr. J., M.Sc., F.I.C., I.A.S., Principal, Agricultural College, Mandalay.
338. Dan, Mr. Daniel Po, Barrister-at-Law, Tharrawaddy.
339. Dawson, Mr. L., Representing Dawson's Bank, Limited.
340. Dumont, Mr. J. L., B.Sc. (Edin.), Landholder.
341. Dun, U Aung, A.T.M., Rice Miller, Mandalay.
342. Dunn, Mr. C. W., C.I.E., I.C.S., Officiating Financial Commissioner (Transferred Subjects).
343. Edwards, Mr. E. L., Representing Messrs Steel Brothers & Co., Ltd.
344. Gale, U Maung, Representative of Agriculturists from Lower Burma.
345. Gale, U Yin, Representative of Co-operators from Upper Burma
346. Ghosh, Mr. C. C., B.A., F.E.S., Entomologist, Agricultural College, Mandalay.
347. Gyi, U Yin, Representive of Agriculturists from Upper Burma.
348. Han, U Po, Representative of Agriculturists from Lower Burma.
349. Hendry, Mr. D , M.C., I.A.S., Deputy Director of Agriculture, Southern Circle.
350. Hmaw, U Lu, Representive of Agriculturists from Upper Burma.
351. Hopwood, Mr. S. F., M.C., Officiating Chief Conservator of Forests.
352. Jevons, Professor H. Stanley, M.A., B.Sc., F.S.S. F.G.S., Professor of Economics, University of Rangoon.
353. Jolly, Major G. G., C.I.E., M.B , Ch B., D P.H., D.T.M.&H.,I.M.S., Officiating Director of Public Health.
354. Maung, U Ba, (*i*) Representative of Co-operators from Lower Burma.
355. Maung, U Ba, (*ii*) Representative of Co-operators from Lower Burma.
356. Maung, U Khin, B.A., M.L.A.
357. McKerral, Mr. A., M.A., B.Sc., I.A.S., Director of Agriculture.
358. Nelson, Mr. J. J., Representing Messrs. Steel Brothers & Co., Ltd.
359. Nyun, U, Representative of Co-operators from Upper Burma.
360. Pan, Mr. Saya, Representative of Agriculturists from Lower Burma.
361. Rippon, Captain S. R., M.R.C.V.S., I.V.S., Superintendent, Civil Veterinary Department, South-Eastern and South-Western Circles.
362. Robertson, Mr. H. F., B.Sc., I.A.S., Deputy Director of Agriculture, Myingyan Circle.

363. Romez, Mr., Representative of Co-operators from Lower Burma.
364. Sein, U, Manager, The Burma Provincial Co-operative Bank, Limited, Mandalay.
365. Shwe, U, Representative of Co-operators from Upper Burma.
366. Stuart, Mr. J. D., A.M.I C.E., M.I.E., Chief Engineer, Public Works Department (Irrigation).
367. Tin, U Po, Assistant Registrar, Co-operative Societies, Pegu East Division.
368. Tin, Thugyi U Ba, Representative of Agriculturists from Upper Burma.
369. Tun, U, Representative of Agriculturists from Lower Burma.
370. Tun, U Paw, A. T. M., M.L.C., Barrister-at-Law.

Bihar and Orissa

371. Atkins, Mr. C. G., The Dowlatpore Agricultural Concern, Rusera Ghat.
372. Bery, Mr. K. R., Superintending Engineer, Irrigation
373. Birbar Narayan Chandra, Babu, Dhir Narendra, Landholder, Garhamdhupui.
374. Blair, Mr. F R., M A , I.E S., Deputy Director of Public Instruction.
375. Dobbs, Mr. A. C., Dip-in-Agriculture (Cantab.), I.A.S., Director of Agriculture.
376. Durga Prasad, Rai Bahadur, M.A., Registrar of Co-operative Societies.
377. Ganga Vishnu, Babu, Planter, Muzaffarpur.
378. Ghose, Babu Tara Prasanna, Landholder, Ranchi.
379. Gurusahai Lal, Mr., M.L.C., Vakil
380. Henry, Mr. J., Cane Manager, Lohat Sugar Works.
381. Heycock, Mr. W. B., I.C.S., Commissioner.
382. Lambert, Mr. H., M A., I.E.S., Officiating Director of Public Instruction.
383. Lyall, Mr. J. H., B.A., Officiating Conservator of Forests.
384. Meyrick, Mr N., General Secretary, Bihar Planters' Association, Ltd., Motihari.
385. Muhammad Ahsan Khan, Moulvi Saiyid, Zamindar and Secretary of the Barh Agricultural Association, Barh.
386. Norris, Mrs. R. V., Director and Bio-Chemist, Lac Research Institute, Namkum.
387. Quinlan, Mr D., M.R.C.V.S., I.V.S., Director, Civil Veterinary Department.
388. Ross, Lieut. Colonel W. C., I.M.S., Director of Public Health.
389. Roy, Mr. N. K., Assistant Registrar of Co-operative Societies, Ranchi Circle.
390. Roy, Mr. S.. K., M.A., Principal, Gossner High School, Ranchi.
391. Sethi, Mr. D. R., M.A., B.Sc. (Edin) , I.A.S., Deputy Director of Agriculture.
392. Sinha, Babu Arikshan, Pleader, General Secretary, Bihar Provincial Kisan Sabha.
393. Sinha, Mr Devaki Prasad, M.A., M.L.C., Patna.
394. Sinha, Babu Mithila Saran, Advocate, Bankipore district, Patna.
395. Tuckey, Mr. A. D., I.C.S., Director of Land Records and Surveys.

APPENDIX III

Itinerary of the Royal Commission on Agriculture in India

Simla	October	11th to 18th, 1926.
Poona	October	21st " 31st
Bombay	November	1st " 6th.
Bangalore	"	8th " 11th
Coimbatore	"	12th " 17th.
Madras	"	18th " 27th.
Calcutta	"	29th " December 9th.
Shillong	December	11th " 17th.
Jorhat	"	18th " 19th.
Calcutta (Christmas Holidays)	"	21st ,, Jan. 3rd, 1927.
Dacca	January	4th " January 7th
Pusa	"	9th " 14th.
Raipur	"	16th " 19th.
Nagpur	"	20th " 28th
Hoshangabad	"	29th
Lucknow	"	30th " February 6th.
Benares	February	7th
Cawnpore	"	10th " 13th.
Agra	"	15th " 16th
Delhi	"	17th " 25th
Hissar	"	26th.
Lahore	"	28th " March 8th.
Lyallpur	March	10th " 13th.
Sukkur	"	14th " 16th.
Peshawar	"	18th " 21st.
Bombay	"	24th " April 8th.
(Left for England)	April	9th.
Karachi (Arrived from England)	October	23rd " 27th.
Rangoon	November	2nd " 8th.
Mandalay	"	9th " 11th.
Patna	"	21st " 26th.
Delhi	"	29th " December 7th
Mahableshwar	December	10th.

APPENDIX IV

Estimated cost of maintaining a pair of bullocks for one year by a ryot in various districts in British India

Province (Locality and agricultural conditions)	Roughage: Kind (*a*)	Roughage: Quantity lb. per day and days fed (*c*)	Value of roughage at local rates	Concentrates: Kind (*b*)	Concentrates: Quantity lb. per day and days fed (*c*)	Value of concentrates at local rates.	Total value of roughage and concentrates
MADRAS			Rs.			Rs.	Rs.
Tiruvalur (Plough Animals).	R	25 × 365	46	O Bran	1¼ × 180 3½ × 180	22	68
Tiruvalur (Cart Animals)	R	25 × 365	46	O Bran	2½ 7 × 365	91	137
Ramnad (Black Cotton Soil).	J	20 × 365	112	Cot. S.	6½ × 365	112	224
Madura	R	37 × 365	136	....	....	..	136
Coimbatore Central Farm.	J, B, R, and G. G	36 × 365	144	Gdnt. C., Cot. S., Gr, & R. B.	*	116	260
Pollachi ..	J, B, R, and G. G	29 × 365	91	Do. do.	*	124	215
Anakapalle ..	R	49 × 365	91	Gdnt. C. Gram .. R. B Salt	3 2 2 1/82	35	126
SIND							
Nawabshah (Flow area).	K	40 × 120 20 × 90	28	O	½ × 60	2	30
Nawabshah (Lift area).	K Grazing and G.F.	20-40 × 230 * × 135	30 ..	O	1 × 95	6	36
BOMBAY							
Dharwar (Mallad Rocky tract).	R G. G	32 × 180 * 180	36 34	Cot. S.	4 × 150	30	100
Dharwar (Black soil)	K W	19 × 365 20 × 365	60 72	Cot. S.	6 × 183	43	175
Dharwar (Intermediate).	J	40 × 183 20 × 182	68	Cot. S	6 × 250	60	128
East Khandesh (dry).	K G.G.	31 × 213 37 × 152	66 28	Cot S. or O.	6 × 243	45	139
West Khandesh (dry)	K, B, Gdnt. Fodder, Grass.	40 × 340	149	Cot. S.	4 × 121	19	168
BENGAL							
East (Dacca, Mymensingh, etc.).	R *plus* G. G. and Weeds.	2 × 180 *	45	Mus.	1 × 180	17	62
Central (Pabna and Nadia).	Do.	20 × 240 *	60	Mus	1 × 240	20	80
West (Burdwan and Bankura).	Do.	20 × 270 *	69	Mus.	1 × 91	7	76

* No information.

PROVINCE (Locality and agricultural conditions)	ROUGHAGE		Value of roughage at local rates	CONCENTRATES		Value of concentrates at local rates	Total value of roughage and concentrates
	Kind (*a*)	Quantity lb. per day and days fed (*c*)		Kind (*b*)	Quantity lb. per day and days fed (*c*)		
UNITED PROVINCES			Rs.			Rs.	Rs.
Meerut	J and W *plus* G G and Weeds.	20-40*	45	O, Gr Bhoosi, Chuni.	4-8 × 365	72	117
PUNJAB							
Gurgaon	K	52 × 121	84	Gr. and O	6 × 273	71	215
	W *plus* G G and G. F.	32 × 122	48	Ghi, Gur, and Flour	*	12	
Lyallpur	W	16 × 365	53	Gr & O	8 × 80	30	173
	G F.	1½ acre	90				
Montgomery	W	10-40 × 365	106	Gr. & O	6 × 91	31	234
	G. F.	*	97				
BURMA							
Lower Burma, Insein.	R	50 × 274	48	O	2 × 100	14	62
	G G.	80 × 91		R B.	2 × 100		
Upper Burma, Meiktila (dry).	J & Bean Chaff	* 153	45	Gdnt C, Ses	2 × 153	10	78
	G. G. and Weeds.	* × 212	23	....	....	..	
Upper Burma, Minbu (irrigated)	G G, J, S	120 × 323	91	Ses, R. B.	2 × 122	23	133
	Grazing	42	.	R. B.	* × 151	19	
BIHAR AND ORISSA							
Cuttack	R	16-20 × 365	56	R Dust, Cr. P.	6 × 150	42	98
Saran	GF, Bhusa	80 × 152	48	*	4 × 152	24	137
	R Bhusa, Cane Tops	40 × 213	53	*	* × 213	12	
CENTRAL PROVINCES							
Wheat and Cotton tract.	W	30-50 × 365	158	*	3-6 × 300	53	211
Rice tract	R	40 × 365	90	*	2 × 240	15	105
ASSAM							
Sibsagar	R	10 × 121	7	R. B.	4 × 121	8	15
Sylhet	R	16 × 152	19	R. B	4 × 152	9	28

(*a*) Symbols used :— J = Jowar Kadbi; B = Bajra Kadbi; M = Millet (unspecified) Kadbi; R = Rice straw; W = Wheat bhusa; G. G. = Green grass; G F = Green fodder; K = Kadbi (unspecified); S = Straw (unspecified).

(*b*) Symbols used :—O = Oilcake (unspecified); Cot. S. = Cotton Seed; Gdnt. C. = Groundnut cake, Gr. = Gram; R. B. = Rice bran; Mus. = Mustard cake; Ses. = Sesamum cake; Cr. P. = Crushed paddy.

(*c*) When the number of days for which feeding is specified is less than a year, the cattle spend the remaining days on grazings.

*No information

APPENDIX V

Forest Policy

(Circular No. 22-F., dated 19th October 1894)

RESOLUTION.—In Chapter VIII of his report on the improvement of Indian agriculture, Dr. Voelcker dwells at length upon the importance of so directing the policy of the Forest Department that it shall serve agricultural interests more directly than at present; and, in his "Review of Forest Administration" for 1892-93, the Inspector General of Forests discusses in some detail the principles which should underlie the management of State forest in British India. While agreeing, generally, with the principles thus enunciated by the Inspector General of Forests, the Government of India think that it will be convenient to state here the general policy which they desire should be followed in this matter; more especially as they are of opinion that an imperfect apprehension of that policy has, in some recent instances, been manifested.

2. The sole object with which State forests are administered is the public benefit. In some cases the public to be benefited are the whole body of tax-payers; in others, the people of the tract within which the forest is situated; but in almost all cases the constitution and preservation of a forest involve, in greater or less degree, the regulation of rights and the restriction of privileges of user in the forest area which may have previously been enjoyed by the inhabitants of its immediate neighbourhood. This regulation and restriction are justified only when the advantage to be gained by the public is great; and the cardinal principle to be observed is that the rights and privileges of individuals must be limited, otherwise than for their own benefit, only in such degree as is absolutely necessary to secure that advantage.

3. The forests of India, being State property, may be broadly classed under the following headings:—

(*a*) Forests the preservation of which is essential on climatic or physical grounds.
(*b*) Forests which afford a supply of valuable timbers for commercial purposes.
(*c*) Minor forests.
(*d*) Pasture lands.

It is not intended that any attempt should be made to class existing State forests under one or other of these four heads. Some forests may occupy intermediate positions, and parts of one and the same forest may fall under different heads. The classification is useful only as affording a basis for the indication of the broad policy which should govern the treatment of each class, respectively; and, in applying the general policy, the fullest consideration must be given to local circumstances.

4. The first class of forests are generally situated on hill slopes, where the preservation of such vegetation as exists, or the encouragement of further growth, is essential to the protection from the devastating action of hill torrents of the cultivated plains that lie below them. Here the interests to be protected are important beyond all comparison with the interests which it may be necessary to restrict; and, so long as there is a reasonable hope of the restriction being effectual, the lesser interests must not be allowed to stand in the way.

5. The second class of State forests include the great tracts from which our supply of the more valuable timbers—teak, sal, deodar and the like—is obtained. They are for the most part (though not always) essentially forest tracts, and encumbered by very limited rights of user; and, when this is the case, they should be managed on mainly commercial lines as valuable properties of, and sources of revenue to, the State. Even in these cases, however, customs of user will for the most part have sprung up on the margins of the forest; this user is often essential to the prosperity of the people who have enjoyed it; and the fact that its extent is limited in comparison with the area under forest renders it the more easy to continue it in full. The needs of communities dwelling on the margins of forest tracts consist mainly in small timber for building, wood for fuel, leaves for manure and for fodder, thorns for fencing, grass and grazing for their cattle and edible forest products for their own consumption. Every reasonable facility should be afforded to the people concerned for the full and easy satisfaction of these needs, if not free (as may be possible where a system of regular cuttings has been established), then at low and not at competitive rates. It should be distinctly understood that considerations of forest income are to be subordinated to that satisfaction.

There is reason to believe that the area which is suitable to the growth of valuable timber has been over-estimated, and that some of the tracts which have been reserved

for this purpose might have been managed with greater profit both to the public and to the State, if the efforts of the Forest Department had been directed to supplying the large demand of the agricultural and general population for small timber, rather than the limited demand of merchants for large timber. Even in tracts of which the conditions are suited to the growth of large timber, it should be carefully considered in each case whether it would not be better, both in the interests of the people and of the revenue, to work them with the object of supplying the requirements of the general, and in particular of the agricultural, population.

6. It should also be remembered that, subject to certain conditions to be referred to presently, the claims of cultivation are stronger than the claims of forest preservation. The pressure of the population upon the soil is one of the greatest difficulties that India has to face, and that application of the soil must generally be preferred which will support the largest numbers in proportion to the area. Accordingly, wherever an effective demand for culturable land exists and can only be supplied from forest areas, the land should ordinarily be relinquished without hesitation ; and if this principle applies to the valuable class of forests under consideration, it applies *a fortiori* to the less valuable classes which are presently to be discussed. When cultivation has been established, it will generally be advisable to disforest the newly-settled area. But it should be distinctly understood that there is nothing in the Forest Act, or in any rules or orders now in force, which limits the discretion of local governments, without previous reference to the Government of India (though, of course, always subject to the control of that Government) in diverting forest land to agricultural purposes even though that land may have been declared reserved forest under the Act.

7. Mention has been made of certain conditions to which the application of the principle laid down in the preceding paragraph should be subject. They have for their object the utilisation of the forest area to the greatest good of the community. In the first place, the honey-combing of a valuable forest by patches of cultivation should not be allowed ; as the only object it can serve is to substitute somewhat better land in patches for sufficiently good land in large blocks, while it renders the proper preservation of the remaining forest area almost impossible. The evil here is greater than the good. In the second place, the cultivation must be permanent. Where the physical conditions are such that the removal of the protection afforded by forest growth must result, after a longer or shorter period, in the sterilization or destruction of the soil, the case falls under the principle discussed in paragraph 4 of this Resolution. So, again, a system of shifting cultivation, which denudes a large area of the forest growth in order to place a small area under crops, costs more to the community than it is worth, and can only be permitted, under due regulation, where forest tribes depend on it for their sustenance. In the third place, the cultivation in question must not be merely nominal, and an excuse for the creation of pastoral or semi-pastoral villages, which do more harm to the forest than the good they reap from it. And, in the fourth place, cultivation must not be allowed so to extend as to encroach upon the minimum area of forest which is needed in order to supply the general forest needs of the country, of the reasonable forest requirements, present and prospective, of the neighbourhood in which it is situated. In many tracts, cultivation is practically impossible without the assistance of forests, and it must not be allowed to destroy that upon which its existence depends.

8. It has been stated above that the forests under consideration are generally, but not always, free from customs of user. When, as sometimes happens, they are so intermingled with permanent villages and cultivation that customary rights and privileges militate against their management as revenue-paying properties, the principles laid down at the end of paragraph 5 of this Resolution should be observed, and considerations of income should be made secondary to the full satisfaction of local needs. Such restrictions as may be necessary for the preservation of the forest, or for the better enjoyment of its benefits, should be imposed ; but no restriction should be placed upon reasonable local demands, merely in order to increase the State revenues.

9. The third class of forests include those tracts which, though true forests, produce only the inferior sorts of timber or the smaller growths of the better sorts. In some cases, the supply of fuel for manufactures, railways, and like purposes, is of such importance that these forests fall more properly under the second class, and must be mainly managed as commercial undertakings. But the forests now to be considered are those which are useful chiefly as supplying fuel and fodder or grazing for local consumption ; and these must be managed mainly in the interests of the population of the tract which supplies its forest requirements from this source. The first object to be aimed at is to preserve the wood and grass from destruction ; for user must not be exercised so as to annihilate its subject, and the people must be protected against their own improvidence. The second object should be to supply the produce of the forests to the greatest advantage and convenience of the people. To these two objects all considerations of revenue should ordinarily be subordinated.

10. It must not be supposed from the preceding remarks that it is the intention of the Government of India to forego all revenue from the large areas that are valuable chiefly for the fuel and fodder which they yield. Cases must be distinguished. Where the areas in question afford the only grazing and the only supply of fuel to villages which lie around or within them, the necessities of the inhabitants of these villages must be treated as paramount, and they should be satisfied at the most moderate rates and with as little direct official interference as possible. But where the villages of the tract have already ample pasture grounds attached to their cultivation and owned and managed by themselves, and where the Crown lands merely supplement these pastures, and afford grazing to a nomad pastoral population, or to the herds that shift from one portion of the country to another with the changes of the season, Government may justly expect to reap a fair income from its property. Even in such cases, however, the convenience and advantage of the graziers should be studiously considered, and the inhabitants of the locality, or those who habitually graze over it, should have a preferential claim at rates materially lower than might be obtained in the open market. It will often be advantageous to fix the grazing demand upon a village or a nomad community for a year or a term of years. The system, like every other, has difficulties that are peculiar to it; but it reduces the interference of petty officials to the lowest point, and minimises their opportunities for extortion and oppression. Where grazing fees are levied *per capita*, free passes are often given to a certain number of cattle. In such cases the cattle which are to graze free should include, not only the oxen which are actually employed on the plough, but also a reasonable number of milch cattle and calves. A cow or a buffalo is as much a necessity to a cultivator, using the word necessity in a reasonably wide sense, as is a plough-bullock; and in many parts the oxen are bred in the village.

11. In the portions of his report which are referred to in the preamble to this Resolution, Dr. Voelcker strongly recommends the formation of fuel and fodder preserves, and the Government of India have repeatedly urged the same policy upon local governments. The question whether any particular area can be made to support a greater number of cattle by preserving the grass and cutting it for fodder, or by permitting grazing upon it, is one that must be decided by the local circumstances of each case. But when it has been decided, the issues are by no means exhausted. It has been stated in paragraph 9 above that one main object towards which the management of these minor forests should be directed is the supply of fuel and fodder "to the greatest advantage and convenience of the people." In doing so, due regard must be had to their habits and wishes. It may be that strict preservation and periodical closures, or the total prohibition of grazing, will result in the largest yield both of fuel and of fodder in the form of hay. But that is of small avail if the people will not utilise the increased supply in the form in which it is offered them. The customs of generations alter slowly in India; and though much may and should be done to lead the people to their own profit, yet it must be done gently and gradually—always remembering that their contentment is no less important an object than is their material advantage. It must be remembered, moreover, that the object of excluding grazing from the preserves in question is the advantage of the neighbourhood; and that the realisation of a larger income than grazing would yield, by preserving the produce, only to sell it to the highest bidder for consumption in large towns at a distance from the preserve, is not always in accordance with the policy which the Government of India have inculcated. Here again circumstances must decide. It may be that the local supply of fuel or fodder, independently of the reserved area, is sufficient in ordinary years for the needs of the neighbourhood. In such a case the produce may legitimately be disposed of in such years to the greatest advantage, reserving it for local consumption only when the external supply runs short. Finally, the remarks regarding agency in paragraph 12, and the more general considerations that are discussed below in paragraph 13 of this Resolution, apply in full force to areas thus reserved for the supply of fuel and fodder.

12. The fourth class of forests referred to are pastures and grazing grounds proper, which are usually forests only in name. It is often convenient, indeed, to declare them forests under the Act, in order to obtain a statutory settlement of the rights which the State on the one hand, and private individuals or communities on the other, possess over them. But it by no means follows as a matter of course that these lands should be subjected to any strict system of conservation, or that they should be placed under the management of the Forest Department. The question of agency is purely one of economy and expediency; and the Government of India believe that in some cases where these lands are managed by the Forest Department, the expenditure on establishment exceeds the revenue that is, or at any rate the revenue that ought to be, realised from them.

The following remarks apply, not only to forest lands under the Act, whether administered by the Forest Department or not, but also to all Crown waste, even though not declared to be forest. Here the interests of the local community reach their maximum,

while those of the general public are of the slightest nature. It follows that the principles which have been already laid down for the management of minor forests apply, if possible, with even greater force to the management of grazing areas, pure and simple.

13. The difficulties which arise in connection with these areas are apt to present themselves in their most aggravated form where the tenure of land is *ryotwari*. In *zamindari* tracts, the Crown lands generally assume the second of the two forms indicated in paragraph 10 of this Resolution. But where the settlement is *ryotwari*, every survey number or field that is unoccupied or unassigned is in the possession and at the disposal of Government, and trespass upon it is *prima facie* forbidden. In some cultivated tracts, these unoccupied and waste lands are the only source available from which the grazing requirements of the resident population can be met. The Government of India are clearly of opinion that the intermixture of plots of government land which are used for grazing only, but upon which trespass is forbidden, with the cultivation of occupancy or proprietary holders, is apt to lead to extreme abuses and especially so when these plots are under the management of the Forest Department. The inferior subordinates of the Forest Department are perhaps as reliable as can be expected on the pay which we can afford to give; but their morality is no higher than that of the uneducated classes from which they are drawn; while the enormous areas over which they are scattered and the small number of the controlling staff render effective supervision most difficult. It is not right, in order to protect the grass or the grazing dues on plots of waste scattered over the face of a cultivated district, to put it into the power of an underling to pound, or threaten to pound, cattle on the plea that they have overstepped the boundary between their owner's field and the next. Still less right is it to permit the exercise of the power of compounding offences allowed by section 67 of the Forest Act to depend upon the mere report of a subordinate servant, or to expose him to the temptations which such a power holds out. Where the interests involved are sufficiently important, it may perhaps be necessary to accept the danger of extortion while minimising as far as possible the opportunities for it. But in the case under consideration the interests involved are trifling, while the opportunities are unlimited.

14. It is to be distinctly understood that the Government of India do not desire that grazing should be looked upon primarily as a source of income. But it by no means follows that all revenues from scattered government lands should be relinquished. It is, indeed, inadvisable that this should be done, as to do so would give the ryots an interest in opposing allotment and making things unpleasant for new occupants. But the objections to direct management which have just been pointed out are reduced to a minimum or altogether avoided, when the management is placed in the hands of the resident cultivators or of representatives from among them. It will generally be possible to lease or otherwise manage the unoccupied lands of a village through the agency of the community not, indeed, at the highest price which they are ready to pay to escape such evils as have just been alluded to; but at a moderate estimate of their value to them fixed in view of the fact that herds and flocks which cannot exist without grazing, are often a necessary condition of the successful conduct of that cultivation upon which the government land revenue is paid. In no case should fields that have been relinquished be let to outsiders at a reduced assessment for grazing purposes for then we might have speculators taking up such fields, mainly in order to make what they can out of trespassing cattle.

15. One more point of principle remains to be noticed. The procedure under Chapter IV of the Indian Forest Act,* whereby forests are declared to be protected, has been in certain cases regarded by the Government of India as a provisional and intermediate procedure designed to afford time for consideration and decision with the object of ultimately constituting so much of the area as it is intended to retain, a reserved forest under Chapter II, and of relinquishing the remainder altogether. The Act provides two distinct procedures. By the more strict one under Chapter II,* existing rights may be either settled, transferred or commuted and this procedure will ordinarily be applied to forests of the first and second classes indicated in paragraph 3 of this Resolution. By the second procedure under Chapter IV, rights are recorded and regulated and this procedure will often be properly followed where the rights to which the area is subject are extensive, and the forest is to be managed mainly in the interests of the local community. It will ordinarily be applied to forests of the third and fourth classes. This second procedure may indeed be provisional, and introductory to reservation under Chapter II, but there is in the Forest Act nothing repugnant to giving it a larger and even a permanent operation.

*The references here are to Act VII of 1878 as amended by Act V of 1890 and Act XII of 1891. The Act at present in force is Act XVI of 1927. Chapters II and IV of the Act of 1927 deal with reserved and protected forests respectively as did the corresponding chapters of the Act of 1878, and the statements made in the text remain unaffected.

As regards Government, the chief difference between the two procedures is that new rights may spring up in a protected but not in a reserved forest, and that the record-of-rights framed under Chapter II is conclusive while that framed under Chapter IV only carries a presumption of truth. It is believed that this presumption offers ample security where the object of regulating the right is to provide for their more beneficial exercise rather than to override them in the public interest. As regards the people the chief difference is that, speaking broadly, in a reserved forest everything is an offence that is not permitted, while, in a protected forest, nothing is an offence that is not prohibited. In theory it is possible so to frame the permission and the prohibition as to make the results identical in the two cases, but in practice it is almost impossible to do so. If it were not so, the distinction drawn by the legislature would be unnecessary and meaningless. It is only where the public interests involved are of sufficient importance to justify the stricter procedure and the more comprehensive definition of forest offences that the latter should be adopted.

The Governor General in Council desires, therefore, that with regard both to fuel and fodder preserves and to grazing areas pure and simple, and especially to such of them as lie in the midst of cultivated tracts, it may be considered in each case whether it is necessary to class them, or if already so classed, to retain them as forest areas; and if this question is decided in the affirmative, whether it would not be better to constitute them protected rather than reserved forests.

16. Such are the general principles which the Government of India desire should be observed in the administration of all State forests in British India. They are fully aware that the detailed application of these principles must depend upon an infinite variety of circumstances which will have to be duly weighed in each case by the local authorities to whose discretion the decision must be left. One of the dangers which it is most difficult to guard against is the fraudulent abuse of concessions for commercial purposes, and only local considerations can indicate how this can best be met. The Government of India recognise the fact that the easier treatment in the matter of forest produce which His Excellency in Council desires should be extended to the agricultural classes may, especially in the case of true forest areas, necessitate more careful supervision in order that the concession may be confined within its legitimate limits. But, on the other hand, they think that, in some provinces, it will render possible a considerable reduction of existing establishment, and they desire that this matter may be carefully considered with reference to what has been said above in paragraph 12. They know also in some provinces forest policy is already framed on the lines which they wish to see followed in all. But the Governor General in Council believes that local governments and administrations will be glad to receive the assurance now given them that the Supreme Government will cordially support them in recognising and providing for local requirements to the utmost point that is consistent with Imperial interests. Where working-plans or plans of operation are framed for forests the provisions necessary for this purpose should be embodied in them. The exercise of the rights that have been recorded at settlement will necessarily be provided for in these plans. Where further concessions are made by way of privilege and grace, it will be well to grant them for some such limited period as ten years, so that they may, if necessary, be revised from time to time as the circumstances on which they were moulded change.

APPENDIX VI

Estimated value of forest produce given away free or at reduced rates in 1925-26

Province	Timber	Fuel	Grass and Grazing	Bamboos and other minor produce	Total
	Rs.	Rs.	Rs.	Rs.	Rs.
Assam	39,285	54,385	19,784	2,00,432	3,13,836
Bengal	1,747	38,943	30,507	35,266	1,06,463
Bihar and Orissa	39,715	1,45,691	1,09,207	42,981	3,37,594
Bombay ..	90,192	2,04,816	6,35,165	95,292	10,25,465
Burma* . .	1,35,471	2,695	66,842	3,127	2,08,135
Central Provinces and Berar	18,023	67,690	11,82,629	27,787	12,96,129
Madras .	33,529	1,311	18,259	5,262	58,361
North-West Frontier Province	7,236	43,236	21,997	100	72,569
Punjab .	83,105	6,68,649	20,43,768	47,126	28,42,648
United Provinces .	95,713	1,20,056	3,11,358	63,152	5,90,279
Minor Administrations	3,194	2,636	97,764	4,985	1,08,579
Total ..	5,47,210	13,50,108	45,37,230	5,25,510	69,60,058

* Includes Federated Shan States.

APPENDIX VII

Area irrigated from wells in British India

	Acres (in 000's)
1900-01	9,343
1901-02	11,374
1902-03	11,569
1903-04	10,754
1904-05	9,499
1905-06	11,729
1906-07	10,949
1907-08	14,160
1908-09	12,496
1909-10	11,881
1910-11	10,214
1911-12	10,408
1912-13	12 351
1913-14	13,867
1914-15	12,556
1915 16	12,550
1916-17	12,033
1917-18	11,139
1918-19	14,216
1919-20	12,692
1920-21	14,242
1921-22	12,127
1922-23	11,439
1923-24	10,758
1924-25	10,570
1925-26	11,720

APPENDIX VIII

All-India Forecasts of Crops issued by the Department of Commercial Intelligence and Statistics

Crop	Forecast	Date prescribed for issue	Time of sowing	Time of harvesting
Rice ..	First .	October 20 ..	May-June* ..	September.*
	Second ..	December 20 ..	May-August* ..	December-January.*
	Final ..	February 20 ..	January-February	May-June.
Wheat ..	First ..	January 31 ..	October-December	March-May.
	Second ..	March 15 ..		
	Third ..	April 20 ..		
	Fourth ..	May 30 ..		
	Final .	August 10 ..		
Cotton ..	First ..	August 15 ..	March-August† ..	October-April†.
	Second ..	October 15 ..		
	Third ..	December 15 .		
	Final ..	February 15 ..		
	Supplementary ..	April 15 ..		
Linseed Rape and Mustard	First ..	January 1 ..	August-October.	January-April.
	Second ..	March 15 ..		
	Final ..	June 1 ..		
Sesamum ..	First ..	September 1 ..	May-July ..	October-December.
	Second ..	October 20 ..		
	Final ..	January 15 ..	January-February	May-July.
	Supplementary ..	April 20 ..		
Groundnut ..	First ..	August 20 ..	May-August‡ ..	November-January
	Second ..	October 20 ..		
	Final .	February 15 ..		
Castor-seed ..	(only one) ..	February 20 ..	May-July ..	January-February.‡
			September ..	March-April.
Indigo ..	First ..	October 15 ..	February-July§ ..	August-November.§
	Final ..	December 20 ..		
Sugarcane ..	First ..	August 20 ..	February-May ..	November-January¶
	Second ..	October 20 ..		
	Final ..	February 5 ..		
Jute ‖ ..	Preliminary ..	July 7-15 ..	March-May ..	August-September.
	Final ..	September 21 ..		

* In Madras, the first crop is sown between April and October and the second crop between September and March. The first crop is harvested between September and March and the second crop between January and May. The forecast is general for all three crops.

† In parts of southern India, sowing continues till December and harvesting till July or later.

‡ A summer variety is grown in Madras which is sown in February-March and harvested in July-August.

§ An irrigated variety is grown in Madras which is sown in December-January and harvested in March-April

¶ December-May in Madras.

‖ Issued by the Director of Agriculture, Bengal.

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GLOSSARY

Adatya	A commission agent or broker.
Anna	One-sixteenth of a rupee; equivalent to 1½*d.* at exchange rate of one and six pence to the rupee.
Aratdar	A seller of commodities on behalf of the growers and of middlemen, with godowns for hire for storage of goods
Bajra (or Bajri)	A small millet (*Pennisetum typhoideum*).
Batai	Cultivation on a produce sharing basis.
Bazaar	A market.
Bepari	A dealer or commission agent (according as to whether he buys with his own money or with money borrowed from an *aratdar* or financier).
Ber	Indian jujube (*Zizyphus jujuba*).
Berseem	Egyptian clover (*Trifolium alexandrinum*).
Bhil	An aboriginal tribe found mainly in the Bombay Presidency, Central India and Rajputana.
Bhusa	The husk or chaff of grain; the straw.
Brahmin	The priestly caste amongst the Hindus.
Bund	A dam, a field embankment.
Chilo	A stem-boring insect (*Chilo simplex*).
Chuni	Coarsely ground pulse.
Dai	A midwife.
Dal	A generic term for pulses.
Dalal	An agent or broker.
Damdupat	Literally "double the principal". An ancient Hindu provision of law under which a court, in passing a decree for principal and interest, cannot allow interest in excess of the principal when the claim is made.
Deodar	The Himalayan cedar (*Cedrus libani*).
Dhaincha	A leguminous fibre plant often grown for green manuring (*Sesbania aculeata*).
Dudshar	An improved variety of fine rice, grown mainly in Bengal.
Dumba	A breed of sheep, characterised by the development of masses of fat on the tail.
Emmolaera	An insect which attacks sugarcane.
Faria	A small dealer.
Fellaheen	Egyptian peasants.
Gowala	A herdsman or milkman.
Ghi	Clarified butter.
Gowshala	A cow-shed; a refuge home for cattle.
Gur	Unrefined Indian sugar; jaggery.
Indrasail	An improved variety of paddy, grown mainly in Bengal, Bihar and Orissa and Assam.
Jamabandi	An annual account of lands held in a village and the amount of land revenue due on them; or the essential portion of the record of rights in land wherein is entered the details as to ownership, the revenue assessed, area, etc.

Jamadar	An officer subordinate to the Agricultural Assistant, in the Central Provinces.
Jat	A cultivating class inhabiting north India.
Jhuming	Temporary cultivation in jungle clearings.
Juar	The large millet (*Andropogon sorghum*).
Kadbi	*Juar* straw.
Kala-azar	A malignant fever caused by an infection by a parasite (*Leishmania Donovani*).
Kallar	Saline efflorescence.
Kamdar	A fieldman.
Kamgar	A petty officer.
Kamia	An agricultural labourer, who enters into an agreement to perform labour.
Kamiauti	An agreement, written or oral, under which a person undertakes to perform labour for an advance of money or for a debt due or in lieu of interest on such debt.
Kankar	Nodules of limestone found in the soil.
Kans	A coarse, deep-rooted grass weed (*Saccharum spontaneum*).
Kapas	Cotton with seed still adhering ; unginned cotton.
Karnam	A village accountant.
Kataktara	A variety of rice, grown mainly in Bengal, Bihar and Orissa and Assam.
Kaukkyi	An improved variety of late maturing paddy grown in Burma.
Khandi	A measure of weight and capacity which varies according to the commodity and, in many cases, for the same commodity in different localities.
Khas Mahal	An estate owned and managed direct by Government
Kharif	The autumn harvest ; crops sown at the beginning of the rains and reaped from October to December.
Khot	A class of landholders found in the coastal districts of the Bombay Presidency, who hold villages and land on a special tenure.
Kulkarni	A hereditary village accountant.
Kumri	Temporary cultivation in jungle clearings.
Lac	A resinous incrustation formed on the bark of twigs of certain trees by the action of the lac-insect (*Coccus lacca.*)
Lakh	One hundred thousand.
Mahajan	A merchant ; a creditor.
Mamlatdar	A revenue officer in charge of a taluka (a revenue division of a district).
Mandi	A market.
Maund	A measure of weight varying in different localities and sometimes for different commodities. The standard (railway) maund is 82·284 lbs.
Mistry	A mechanic, carpenter, blacksmith, etc.
Mukaddam	A supervisor, a subordinate officer.
Nag	A varying measure of weight for cotton.
Namasudra	One of the depressed classes in Bengal.
Ngapi	Fish paste.
Nullah	A water course.

Paddy	..	.. Unhusked rice (*Oryza sativa*).
Panchayat	..	.. Literally, a committee of five. Used to describe an association of any number of persons instituted for objects of an administrative or judicial nature.
Papaya	..	.. A fruit (*Carica papaya*).
Pat, pattu	..	.. A breed of goats found in the Himalayas.
Patta	..	.. A document showing the area of land held under it and the revenue payable.
Patwari	..	.. A village accountant.
Phad	..	.. A system of irrigation under which a number of small holders join for the economic use of the water supply available, for the growing of irrigated crops on a regular plan.
Pinjrapole	..	.. A refuge home for cattle.
Podu	..	.. Temporary cultivation in jungle clearings.
Purdah	..	.. A veil, screen ; the practice of keeping women secluded
Rab	..	.. The burning of leaves and branches of trees on ground which is being prepared for a seed bed or for sowing generally.
Rabi	..	.. The spring harvest ; crops sown in the autumn and reaped at the end of the cold weather.
Ragi	.	.. An inferior kind of millet (*Eleusine coracana*).
Regur	..	.. Black cotton soil.
Reh	..	. Land impregnated with sodium salts and thereby rendered barren.
Roseum	..	.. A coarse short staple cotton (*Gossypium neglectum roseum*).
Ryot	..	.. A cultivator.
Sal	..	.. A forest tree (*Shorea robusta*).
Sann hemp	..	.. A leguminous fibre (*Crotalaria juncea*).
Sardar	..	.. A headman, a man sent out to recruit labour.
Seer	..	.. A weight (usually 2·057 lbs.)
Senji	..	.. A fodder crop (*Melilotus parviflora*).
Seva-Sadan	..	.. Literally " home of service ". A charitable organisation.
Sowcar	..	.. A moneylender.
Taccavi	..	.. An advance made by Government to cultivators for agricultural purposes.
Tahsil (Tehsil)	..	.. A local revenue division of a district.
Tahsildar	..	.. A revenue officer in charge of a tahsil.
Tal	..	.. An embankment.
Talati	..	.. A village accountant.
Taluka	..	.. A local revenue division of a district.
Tapedar	..	.. A village accountant in Sind.
Taungya	..	.. Temporary cultivation in jungle clearings.
Thana	..	.. A police station.
Tur	..	.. A pulse (*Cajanus indicus*).
Upacharak	..	.. A preacher.
Usar	..	.. Land impregnated with sodium salts and thereby rendered barren.
Zamindar	..	.. A landowner, a peasant-proprietor.
Zilladar	..	.. A canal officer.

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