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THE LAND OF THE TWO RIVERS

A STUDY IN THE AGRICULTURAL PROSPERITY OF THE UPPER DOAB

BY

BALJIT SINGH, M.A., LL.B.

*Formerly Asstt. Professor of Economics, D. A. V. College,
Cawnpore*

WITH AN INTRODUCTION BY

DR. RADHA KAMAL MUKHERJEE, M.A., P.R.S., PH.D.

*Professor of Economics and Sociology, Lucknow University,
Lucknow.*

ALLAHABAD

THE INDIAN PRESS, LTD.

1940

Price Rs. 3.

Printed and published by K. Mittra, at
The Indian Press, Ltd.,
ALLAHABAD.

INTRODUCTION

It is a pleasure to introduce this monograph on the agricultural development of the Doab, which has been the result of first-hand investigation by its author, Professor Baljit Singh, M.A., formerly a pupil and now a lecturer in Economics in the D. A. V. College, Cawnpore, and which won for him the Lucknow University gold medal of the year. In the Doab holdings are the largest in the Province and the standard of farming is the highest. Climate, irrigation, caste habits and agricultural practices all have contributed towards a phenomenal progress in this part of India. All this have been accurately analysed and their mutual relations revealed in an attractive survey. Whether the bracing climate or the fertile soil, the phenomenal expansion of canal irrigation or the combination of dairy farming with agriculture, the endurance and thrift of the Jat cultivator or his large-sized, undivided holdings have played the more important role in the development of prosperity are uncertain. Each, however, has aided the other and the result is a rural atmosphere and a tradition in which all spell progress, and which are so strikingly different from those in the eastern portions of the province. Into this scene has recently been introduced the Ganges grid, which has distributed electricity in hundreds of towns and villages—a power that has stimulated not only the development of irrigation but also rural industrialisation, of which the social and educational effects are just beginning to be realised.

Yet, this region, which has reached the high watermark of agricultural prosperity, bristles with problems of deterioration. Soil erosion and consequent loss of moisture and fertility, deficient drainage, rise of the spring level and the falling in of the 'Kuchcha' wells, over-saturation and spread of 'reh,' endemic malaria, the exclusion of fallowing and the cultivation of legumes due to the introduction of

sugar-cane, the vogue of ratooning, and decline in numbers and breed of dairy cattle all these represent problems, which menace progress.

Mr. Baljit Singh has investigated into the subsidiary occupations of the cultivators in certain villages in Meerut. It has been found that there is more subsidiary employment among cultivators in Meerut than in Gorakhpur. Carting, dairying, leather curing, spinning and weaving form important by-occupations. It is significant that caste prejudices exclude all such occupations except cattle-breeding and carting. It appears that such castes as the Rajputs, Saiyads and Tagas, whose women do not work in the fields and who have most of their agricultural operations undertaken by hired labour, and whose costs of cultivation are greater, not only expend more on social ceremonies but also deny to themselves many non-agricultural subsidiary occupations. No wonder that these castes are now losing ground as compared with the Jats and especially the Mahajans. Between 1901 and 1931, the Vaish increased their area of land in a particular pargana from 6.0 per cent. to 11.0 per cent.

On the other hand such castes as the Chamars have hardly any proprietary status. They are mere tenants, whose holdings are the smallest, and credit is lowest and yet who pay the highest rents on the inferior lands. Economic, social, and agricultural problems are inter-laced in India. No planning can succeed, without a co-ordinated offensive on all fronts—social, economic and agricultural. This is the crux of Mr. Baljit Singh's careful regional and social analysis.

One of the most interesting parts of the book is the study of the gradual change with the increase of population from open ranch farming to dairy farming based on fodder cultivation in association with cereal growing. For large parts of India the development of mixed farming will be a most appropriate agricultural adjustment, which may combat the low level of prices of agricultural produce by a reduction of cereal production and also diminish the risks due to

uncertainty of rainfall. No doubt in planned agriculture improvement of milk marketing and transport and guarantee of minimum prices of dairy products will be exceedingly useful, as in the agricultural countries of West in the reorganization of dairying. It is an invaluable subsidiary occupation, as it not only increases the cultivator's income and improves his dietary but also contributes materially to replenish the fertility of the soil. Without any kind of planning or organisation the depression in agriculture has led in Meerut to the decline in the number of dairy cattle and the change of cows into cow-buffaloes. Forced sale of cattle, and their purchase in lieu of instalments of 'ghee' to creditors have become much more common while the band of peripatetic cattle-dealers makes the most out of the transactions.

The social structure of the agrarian population in the Upper Doab, the author's study reveals, is of great interest. The bulk of the small landlords is represented by the Jats, Tagas, Gujars, Mahesras, Mahajans. The last are non-agricultural money-lenders who have gained recently in great importance. In the whole Meerut Division non-agricultural castes increased the area held by them from 983,000 acres to 1,183,000 acres, between 1907 and 1925. Since the depression proprietorship has even come more in the hands of the money-lenders and tenants' cultivation has been substituted for cultivation by the agriculturist proprietor, the recent tenancy enactment will no doubt stabilise such tenants. But for a district where out of 16 lakhs of people 3.5 lakhs are depressed Hindus and the Chamars represent a population of 2.4 lakhs, the new legislation will not be of much benefit to the lower orders, for the Chamars hold mostly non-occupancy status, cultivate the smallest sized and inferior holdings or work as agricultural labourers. Since in the 'Sir' areas rack-renting and eviction will still continue a large proportion of the agricultural population will remain without adequate protection. Between 1891 and 1931 both the classes of the cultivating owners numbered

1,37,890 (Males) and cultivating tenants numbered 1,63,122 (Males) declined to 84,094 and 1,32,052 respectively, while agricultural labourers increased from 43,456 (Males) to 55,124 (Males). This is a disheartening situation even in the most prosperous district of the United Provinces and suggests that the reorganisation of agriculture and re-definition of rights of actual tillers of the soil will have to be considered in a more radical and comprehensive fashion. Planning needs to be preceded by factual survey and that is why a monograph like this fills an important gap in Indian economic literature.

It is hoped that the monograph will not only be useful to students of economics and agriculture but will also be an aid to the general public in appreciating the difficult agrarian and economic issues facing the country.

University of Lucknow,

March 26th, 1940.

RADHA KAMAL MUKERJEE.

CONTENTS

CHAPTER	PAGE
I. The Agricultural Characteristics of The Upper Doab	1
II. Canal Irrigation and Agriculture	22
III. The Size of Holdings	42
IV. Improvements of Crop Varieties and Seeds	59
V. Improvement of Manurial Economy	75
VI. Effects of Cane Cultivation	93
VII. Subsidiary Employment of Peasants	104
VIII. Relation between Dairy and Intensive Farming :	121
IX. Hydro-electric Development and Rural Industrialisation	137
X. Economic Condition of the Agriculturists	147
XI. Caste as a Factor in Rural Prosperity	162
XII. Climate as a Factor in Rural Prosperity	169

ILLUSTRATIONS

Graph showing relation between Cultivation and
Rainfall in Meerut District.

Graph representing the Average yield in pounds
per acre for the United Provinces of Wheat, Gram,
Juar, Bajra, Cotton, Rapeseed and Maize during
twelve years.

The Land of the Two Rivers

CHAPTER I

THE AGRICULTURAL CHARACTERISTICS OF THE UPPER DOAB

The Upper Ganges Valley, the region which for a long historical past can boast of a great civilisation, comprises one of the most fertile spots of the globe, born of the silt deposits of the mighty river. As the annual rainfall does not exceed 30 inches in the normal years, this is a region of dry farming. However, we find here the world's most elaborate system of canal irrigation, making it possible for a great part of the cultivated area to be devoted to rich and heavy crops like wheat and sugarcane. The small depth of the water-table has also stimulated the development of a system of alluvial well irrigation, providing an additional protection from deficiency and irregular distribution of rainfall which are recurrent.

Still the natural precipitation of water is the determining factor in agriculture in this region. The least deviations from the normal annual rainfall register their effects on the area cropped, and the yield also, responds to the amount and distribution of

the rains in the year. The moisture required by the Kharif crops is exceedingly great; and the extreme heat in the months during which these are raised makes it rather difficult to obtain a successful harvest with the aid of irrigation alone. Therefore, the success of the Kharif is linked with the natural water-supply during the rainy season, which as a rule is sufficient for its growth. Canals mainly protect Rabi areas and well-irrigation falls short of the needs of the Kharif. Consequently, the shrinkages in the Kharif area, though not violent on the whole, occur even with slight deficiencies of rains in the months of June, July and August. The Rabi, which enjoys a more or less greater security from the effects of a deficiency of rains due to the various methods of irrigation, is dependent for its success on the rainfall of the later part of the rainy season and that of the winter. So it offers a greater resistance to climatic conditions. Nevertheless, as a result of a dry and hot September, if the soil is too dry for sowing, the Rabi crop has to be restricted to areas irrigated either from canal, or from wells or from other sources, for it has to be sown after preliminary irrigations. So in years of extreme drought, when such conditions are invariably present, there are considerable shrinkages in both the area and the output of the Rabi crop. An excess of rains again hampers agricultural operations to such an extent that sowings are delayed with consequential shrinkages in both the cropped area and the produce. Thus there is an affinity between rainfall and agriculture which is more apparent in the case of the Kharif crops.

*Relation between Cultivation and Water-Supply,
Meerut District*

Year	Normal rainfall Inches	Total rainfall in the year Inches	Area under Kharif Acres	Area under Rabi Acres
1902-03	25·6	30·5	683,459	670,300
1903-04	25·5	22·8	650,586	691,649
1904-05	25·7	30·0	698,740	697,420
1905-06	27·48	16·29	672,292	660,478
1906-07	27·48	36·89	702,799	727,642
1907-08	27·48	12·71	717,486	469,457
1908-09	27·48	30·39	697,987	633,657
1909-10	27·48	36·11	698,019	708,031
1910-11	27·48	34·74	668,329	747,673
1911-12	27·48	23·58	569,516	911,278
1912-13	27·48	32·36	681,278	736,678
1913-14	27·48	19·18	677,395	539,315
1914-15	27·48	43·44	679,856	772,328
1915-16	28·06	20·46	655,366	733,550
1916-17	28·06	40·83	698,416	764,986
1917-18	28·21	35·22	685,977	801,866
1918-19	28·12	15·14	625,930	481,682
1919-20	28·12	24·16	687,031	624,687
1920-21	28·12	22·43	677,291	540,666
1921-22	28·12	31·87	662,203	765,871
1922-23	28·12	29·52	644,017	706,704
1923-24	28·09	35·32	663,881	759,943
1924-25	28·09	33·97	654,524	801,397
1925-26	28·09	31·09	648,851	683,465
1926-27	28·09	25·39	680,178	626,982
1927-28	28·09	31·55	667,885	749,118

Year	Normal rainfall. Inches	Total rainfall in the year Inches	Area under Kharif Acres	Area under Rabi Acres
1928-29	28·09	14·49	642,128	760,196
1929-30	28·09	18·44	681,513	576,499
1930-31	28·09	22·71	680,009	617,049
1931-32	28·09	26·11	652,939	762,089
1932-33	28·09	27·47	673,460	692,793
1933-34	28·09	47·93	666,966	787,983
1934-35	28·09	35·67	684,606	643,087
1935-36	28·09	27·00	699,080	708,319
1936-37	28·10	34·90	700,377	702,163

A study of successive drought years shows that the relationship is as close to-day as it was about 40 years ago. A graphical representation of the above table may be found useful in understanding the close dependence of agriculture on rainfall.

The increase in the irrigation facilities has not averted the shrinkages of cropping in years of abnormal or sub-normal rainfall, as is clear from a comparative study of rainfall, irrigation, and crops in Meerut District extending over three decades.

Year	Rainfall	Irrigation and crops			
	Percentage of deficiency in rainfall	Area irri- gated from canals Acres	Available wells masonry and non-masonry	Percentage to the cultivable area of :	
				The Kharif	The Rabi.
1905-06	40·7	363,018	21,576	50·4	49·5
1907-08	53·7	340,564	23,350	53·9	35·3
1913-14	30·2	231,853	24,320	50·9	40·3
1918-19	46·2	363,502	25,607	47·9	36·9
1928-29	49·1	394,437	27,627	49·2	58·2
1929-30	34·4	382,798	28,405	52·2	44·2

It seems that the advantages conferred by increased facilities of irrigation have been reduced by an agricultural expansion experienced both extensively and intensively. The deterioration of the soil fertility, the extension of the margin of cultivation to inferior lands and the increased percentages of the double-cropped area have all been features in the recent history of the Upper Ganges Doab and are no less responsible for its increasing dependence on climatic conditions. It is also significant that nearly every drought year in the above table exhibits comparatively larger shrinkages in the Rabi area than in the Kharif, though nearly two-thirds of the former and a little more than one-third only of the latter are normally irrigated. As a rule, the acreage of the Rabi far exceeds that of the Kharif but in all the drought years considered above (leaving aside 1928-29), *i.e.*, where the deficiency in the annual rainfall is more than 30 per cent, the figures are reversed though both suffer from shrinkages. During the past 40 years fluctuations in the Kharif area have not been so violent, the minimum acreage being 569,516 (1911-12) while the maximum figure was 717,486 (1907-08), as in the case of the Rabi crop for which the highest record is 911,278 acres in 1911-12 whereas it was so low as 469,457 acres in the year 1907-08. These extreme shrinkages of the Rabi crop in the years of severe drought are, no doubt, the results of the failure of rains in the months of September and October. The Upper Ganges Valley is the meeting-place of the two monsoon currents (one rising in the Bay of Bengal and the other in the Arabian Sea) and may be well compared to a tract at

the frail end of, a distributary channel. Whenever, therefore, monsoons are weak, this part invariably suffers from deficient rainfall, ceasing much earlier than usual as the two currents hardly penetrate so far in such a year. Thus the rains in a year of deficient monsoon doubly register their effects due to the current retreating earlier; and in case the percentage of deficiency is considerable, they altogether fail, as a rule, in the later part of the season on whose precipitation the sowing of the Rabi depends.

Rainfall in Meerut District in the Drought years.

Year	July and August			September and October		
	Normal Inches	Actual Inches	Percentage of deficiency	Normal Inches	Actual Inches	Percentage of deficiency
1907	17.97	11.33	36.9	5.24	0.02	99.6
1913	17.97	10.41	42.1	5.24	0.80	84.7
1918	17.97	7.45	58.6	5.24	0.30	94.3
1929	19.48*	12.42*	36.2	5.47	1.46	73.3

The deficiency of rainfall in the later part of the season is far greater than that of the earlier months. The seed in such years cannot germinate without a preliminary irrigation in the month of November when the Rabi crop is usually sown. This demand for artificial aid is successfully met when the deficiency in rains is not considerable with the result that in such years the Rabi area does not show the same amount of shrinkage as the Kharif. But when nearly the whole

* Figures are for April to August.

area marked for the Rabi crop is thirsting for irrigation in cases of extreme drought, the canal water-supply cannot fully meet the situation, and large areas are left uncultivated. Thus a tendency of the dominance of the Rabi over the Kharif which the canal irrigation has set in motion presents a difficulty of an overwhelming nature in a year of extreme drought which is aggravated partially by the inelasticity of the canal water-supply and partially by the adverse effects of the system of canals on well irrigation through years of its development in a region where the meteorological conditions do not favour the growth of enormous quantities of the Rabi crops. The crop further suffers by being sown late and so when it matures conditions are not favourable and the grains simply shrivel rather than ripen under the hot westerly winds in March and April and consequently it is threshed light. Had the canal irrigation instead of resulting in a discontinuation of the well water-supply supplemented it, preliminary irrigation might be done in large parts and within a favourable time to admit of large sowings, even in the years of drought, under Rabi crops, with which is now inter-linked the prosperity of the peasants. Unfortunately well irrigation seems to have been ignored, a large number of wells having declined in this portion of the valley.

*Number of available masonry and non-masonry wells
in Meerut Division*

Year	1906-07	1911-12	1921-22	1927-28	1932-33	1936-37
Available wells	114,519	68,233	72,354	73,437	78,912	78,352

The practice of burdening the soil successively with rich and heavy crops without paying much attention to the maintenance of the soil fertility, the high percentages of the double-cropped area throughout the past, the development of a system of irrigation which meant the extinction, unemployment and under-employment of thousands of wells, and the introduction and extension of new crops and varieties without any limit for which climatic conditions are not favourable, have all contributed towards the exhaustion of the soil to such an extent that even though the standard of cultivation here is far superior to that of any other part of the valley, it offers the least resistance to effects of an unfavourable rainfall. In the eastern districts of the valley which, no doubt, enjoy a more abundant rainfall, even a relatively greater deficiency of rainfall has caused less shrinkages in the cropped area in successive famine years.

Percentage of deficiency of the total rainfall from the normal during famine years				Percentage of difference between the normal net cultivated area and area cropped during famine years			
The Ganges Valley :	Upper	1907-08	1913-14	1918-19	1907-08	1913-14	1918-19
Muzaffarnagar		-13.7	-6.6	-15.7	-13.4	-4.4	-16.4
Meerut	...	-53.7	-30.2	-46.2	-14.9	-16.4	-23.4
The eastern portion :							
Gorakhpur	...	-21.9	-0.6	-5.8	-1.0	-13.0	-1.9

Rainfall in the eastern districts is more abundant and regular than in the Upper Ganges Doab;

but the greater agricultural security which these districts enjoy has been fortified by a network of wells reinforced phenomenally at every famine year. Every famine there leaves behind a fresh array of defence so that the eastern districts offer far greater resistance to the next. A comparison of the variations of the percentages of the irrigated to the estimated irrigable area in the two contrasted regions in successive famine years is indicative of this tendency.

Percentage of irrigated to the estimated irrigable area.

		1907-08	1911-12	1918-19
The Upper Ganges Doab :				
Meerut	...	80.9	57.8	81.4
The Indo-Gangetic Plain				
East :				
Azamgarh	...	89.2	71.8	83.2

The nature of the irrigation facilities accounts for the greater resistance of the eastern districts as contrasted with the Upper Valley in addition to the more favourable conditions of a greater harmony between crop and rotation on the one hand and soil and climate on the other which they enjoy. The agricultural contrasts may be summarised in the following table :—

Statement showing the agricultural characteristics of the Upper Doab in contrast with the Eastern portions of the United Provinces.

Districts	Normal rainfall Inches	Percentage to total area of:		Percentage to culturable area of the normal cultivated area	Percentage of double-cropping to net cultivated area	Percentage of gross cultivated area which is normally irrigated	Percentage of the total irrigable area, per well	
		Culturable	Normal cropped area					
The Upper Doab:								
Muzaffarnagar	...	29·67	86·6	71·1	82·1	18·6	47·2	27·3
Meerut	...	28·09	87·8	75·8	86·3	24·5	47·2	25·3
The Eastern Valley:								
Basti	...	47·67	89·9	70·5	78·4	33·2	31·2	10·4
Gorakhpur	...	48·15	88·0	71·1	70·7	35·6	27·4	7·6

Though irrigation facilities in the Upper Doab are not lacking, its greater liability to famines is marked, as we have already seen, due to its less abundant and more irregular rainfall. The Kharif, as a rule, gets sufficient water throughout the whole course of the Ganges, but the Rabi is not anywhere so much endangered as in this portion and still this is the crop which enables the cultivator to pay his revenue and meet other monetary obligations. It enables a relatively higher density of population to be maintained. On the other hand this very preponderance of the Rabi over the Kharif which is not to be met in the eastern parts presents a problem of grave anxiety in the years of drought, particularly due to its dependence on the inelastic canal irrigation, wells being already too limited in number to meet the emergency. The average area per well in the eastern districts can be easily irrigated independently of any other source, which is not possible in the Upper Doab where the high average infallibly points out that however urgent or extreme the demand may be, the whole of the irrigable area cannot be watered by wells alone. The canal water cannot moisten the whole irrigable portion; neither can it meet the emergency caused by irregular rains within an adequate time. The Upper Ganges Doab stands most urgently in need of a system of irrigation which may contract and expand with the requirements of the Rabi crops within the shortest time so that inadequate irrigation may not end in late sowing and poor harvesting. Canal water has never met and cannot possibly meet this sudden demand, however

much it might aid in man's fight against a deficient rainfall. Perhaps batteries of tube wells worked with hydro-electric power are better safeguards against the abrupt termination of the monsoon which causes violent shrinkages in the Rabi crops and is a menace to the agricultural prosperity of the Upper Doab. To sum up, the decreasing resistance which the present irrigation works (though the world's greatest canal system) now offer against the fluctuations of the rainfall, presents an alarming situation which requires the most urgent attention. The problem is further complicated by the fact that this portion lying at the meeting point of the two chief rain currents has been liable to deficiency and irregularity of rainfall more than any other part of India except the arid tract further west.

Dr. Mukerjee in a recent study of rainfall records has concluded that every sun spot minimum each year is accompanied by a serious drought, while other droughts have closely followed the sun spot maxima. To whatever cause it might be due we find the following facts about the district :—

*The years of deficiency of the annual rains in the
Meerut District*

Of more than 30%	Of 20 to 30%	Of 10 to 20%	Of less than 10%,
1905-06	1915-16	1903-04	1926-27
1907-08	1920-21	1911-12	1931-32
1913-14	...	1919-20	1932-33
1918-19	...	1930-31	1935-36
1928-29	...	...	...
1929-30	...	..	...

Of the last 35 years, sixteen have been of deficient rainfall, six of which have suffered from extreme types of it, whereas another seven years have witnessed more than 30% of the normal rains. Broadly speaking, the cultivator has to depend in two years out of three more on artificial manipulation than on natural precipitation invariably suffering once in every set of six years from a severe drought, which makes it incumbent on him to raise his crops with the aid of artificial water-supply alone.

After the hot summers the soil surface is a dreary sun-burnt waste and so when the rain, as usual, comes in heavily much of the water runs off the surface toward the drainage lines carrying the most valuable soil ingredients, leaving every year the soil poorer than before. This soil erosion sometimes leads to water-logging particularly when, in the construction of railways, roads and canals the natural system of drainage is disturbed. Uncontrolled drainage due to the peculiarity of our rainfall brings about a loss of moisture as well as a loss in fertility. Ravines along the left bank of the Jamuna, the formation of swamps, the deterioration of the Ganges Khadir and the coming up of the saline efflorescence have all been associated either with the water-run-off or the water-logging. In the areas where water-run-off is a marked evil, a gradual depletion of the sub-soil water takes place for it cannot possibly be replenished under running water with the same amount which the preceding crop utilizes out of it during days of insufficient or no rains. However, the evil can be controlled by a planned system of regulating the rainfall after it

reaches the soil. The rise of the spring level in the canal tracts which has occasioned the falling-in of the non-masonry wells, over-saturation and the spread of "reh" in depressions can all be minimised to a great extent by the opening up of the natural drainage lines. Similarly in the other tracts, particularly in the south-western portions of the Upper Doab, where the fall in the water-level has been marked, a controlled and systematic surface drainage will not only stop the loss of the fertile soil caused by water-run-off but time would be given for the water to soak into the soil. Further the replacing of a system which allows the rains to fall on a baked and compact surface by ploughing the surface after the Rabi harvest will add much to the sub-soil water-supply.

After the rainfall, no sooner the fields become cultivable than the cultivator hurriedly runs his plough from field to field, day and night, working to his full capacity. His energies are further taxed if all his fields are ready for ploughing at the same time, and in many cases he is hardly able to finish his operations on every field when another fall of rains hampers him or the total drying up of a field renders it too hard to be broken, and finally occasions the postponement of the ploughing to the next rains. Some fields thus do not enjoy a full advantage of the rains and sowings are delayed and the surface tilth also is not up to the mark. Very recently it was complained by the Agricultural Department that tillage is deteriorating in quality in the Meerut District. No doubt, many acres of land in the Upper Doab now remain under-cultivated. Country plough was satis-

factory up till the 19th century, when the double-cropped area was almost insignificant, when millets and pulses which are sown broadcast after one or two ploughings were the chief crops of the region and, finally, when fallowing was practised to a far greater extent. But now nearly one-fourth of the area is cropped twice whereas the Rabi dominates over the Kharif, requiring every inch to be thoroughly ploughed. The necessity of a vigorous, unremitting and continuous stirring of the soil for growing the Rabi crops amidst a myriad water-thieves points out clearly that improvements must take place before the soil can be properly tilled and the seed sown at the proper time, for the country plough takes an excessive amount of time, a waste which must not be allowed to the detriment of the agricultural progress. More pressing needs have arisen and a new balance must be struck in agricultural practices and crops on the one hand and soil fertility and population density on the other. However, we do not advocate the use of machines and tractors, for such measures will displace labour from agriculture, swelling up the number of the unemployed, finally ending in a general decline of the standard of living. A few minor improvements will supplement our country tools and implements much to the benefit of our peasantry. Such improvements are already taking place but a far greater popularity is required. Originally the pure *bhaichara* tenure of the self-cultivating Jat and Gujar clans gave to every cultivator a strip from every soil block, and as different types of soil take different periods to become cultivable, an emergent call for a

post-haste cultivation never arose. But now conditions have altogether changed and so a modified treatment of the soil has become incumbent.

Further the peculiar distribution of the rains in the region has given it two contrasted agricultural seasons, *viz.*, the Kharif and the Rabi. The various crops under each have been arranged in order of importance in the Meerut District in the following table :—

1936-37

	Kharif Crops		Rabi Crops	
	Food Crops	Area in Acres	Non-food crops	Area in Acres
Juar	...	108,383	Sugarcane	174,445
Maize	...	96,954	Cotton	51,971
Bajra	...	48,457	Hemp	5,850
Rice	...	22,215	Indigo	202
Sawan	...	4,052	Til	8
Mandua	...	34	Linseed	2
Kodon	...	...	Arend	Not avail- able
Arhar	...	Not avail- able	Mungphali	"
Urd	...	"		
Mung	...	"		
Moth	...	"		
Lubia	...	"		
Guar	...	"		
			Food Crops	Area in Acres
			Wheat	339,251
			Gram	191,893
			Barley	41,207
			Potatoes	2,40
			Peas	Not avail- able
			Oats	"
			Lentil etc.	"
			Non-food crops	Area in Acres
			Tobacco	3060
			Rape or Mustard	2954
			Safflower	Not avail- able

The areas under the various crops have changed from time to time adjusting themselves to the factors of irrigation, population density and soil fertility. The development of canal irrigation has added thousands of acres of the Rabi crop with the result that whereas up till 1860 there was a preponderance of the Kharif over the Rabi, a gradual shifting took place after that time and now the scales are completely reversed. Wheat occupies the largest part of the cultivated area (nearly one-third of the net cropped area). An ever-increasing density of population could only have been maintained by growing more paying crops or by having resort to an extension of the double-cropped area, for almost all of the cultivable area was under cultivation even in the Mughal days and consequently agricultural expansion was practically limited in that direction. Very little increase has taken place since then in the net area cropped. Mr. Moreland gives the following figures :—

The Upper Doab

District	Area in Akbar's time (in thousands of bighas)	Present area
Meerut	... 2310	2600
Saharanpur & Muzaffarnagar	... 3428	3640
Bulandshahr	... 1271	2100
Aligarh	... 2311	2970
Etah	... 911	963

But the increase of population occasioned an expansion of the gross cultivated area and a gradual replacement of the ordinary low-grade crops, mainly, millets and pulses, by richer crops of wheat and

barley. The density of population throughout the Upper Doab seems to determine the extent of the double cropping as well as the area under wheat and barley.

*Population density and crops in the Upper Doab
(1931)*

District		Rural density per sq. mile	Percentage to cultivable area of double cropped	Area under wheat and barley Acres.
Meerut	...	579	21.1	411,293
Bulandshahr	...	517	21.6	352,530
Aligarh	...	508	17.3	327,828
Muzaffarnagar	...	469	15.3	286,556
Agra	...	416	8.1	173,448
Muttra	...	373	7.3	143,393

As the family increases, a greater margin of profit from the holding is required to support it and consequently the density of population exercises a considerable influence on the proportion of the more paying crops. But the effects of the system of irrigation, the condition of the soil fertility and other allied factors cannot be excluded from a study of this problem. The following are interesting facts:—

1. Percentage of increase of population from 1865 to 1931 32.2
2. Percentage of increase of the net cultivated area from 1860 to 1931 5
3. Percentage of the increase of the double-cropped area from 1860 to 1931 460.7
4. Percentage of the increase of the area under wheat from 1860 to 1931 29.2
5. Percentage of the increase of the area under sugarcane from 1860 to 1931 92.9

The increased density of population, no doubt, occasioned higher percentages of the increase in the double-cropped area and that of the more paying crops; but to ignore the effects of the canal irrigation in that direction would be to leave a vital factor out of consideration. A population cannot go on increasing perpetually. The soil fertility operates as a brake and after a certain limit has been reached neither an improvement in the outturn of the paying crops nor an extension of the double-cropped area is practicable. Quite on the other hand, the soil becomes too exhausted to admit of even the same amounts of double cropping or of the same percentage of the more paying crops. Consequently, though density has a potent influence in determining crops, it is rather crops that thin out ultimately the recklessly multiplying race of man. Such limits seem to have already been overstepped in many parts of the Upper Doab. Thus, the Baghput Tehsil recorded the highest rural density in the district (density in Meerut Tehsil being highest owing to the presence of Meerut City) both in 1921 and 1931. But the more important fact is that whereas this tehsil showed the largest increase in 1921, it showed the smallest in 1931. The pressure of the population on the soil demanded an outlet leading to increased emigration to Delhi. In the district, as a whole, the net cultivated area declined by more than one per cent and the double-cropped area also by nearly the same amount during the past decade. There are also signs of the decrease of the area as well as the produce of wheat and other money crops, leaving out sugarcane which is an exceptional case.

The increase of population tends to decrease the period and amount of fallowing and, no doubt, the soil to-day cannot yield the same amount of crop as it did previously. Population is thus outreaching the means of subsistence, occasioning a keener struggle for existence and a tendency towards a lower standard of living. Any further increase in the number of men will now be dependent on the development of subsidiary and cottage industries rather than on intensive farming as the limit in this direction too has been reached.

CHAPTER II

CANAL IRRIGATION AND AGRICULTURE

The mainstay of agricultural prosperity in a precarious region like that of the Upper Doab has been undoubtedly the development of irrigation works; and though these are not without blemishes, yet the defects pale into insignificance in view of their lasting achievements. The paucity of irrigation facilities in the beginning of the nineteenth century in the district caused cultivation to decline gradually to such an extent that in the year 1817 it was pointed out by Mr. Guthrie, the Collector, that it was worse than in the Mughal days. However, the development of canals has been effective in enhancing the security of crops and the safety of domesticated stocks. It has added much in man's fight against periodical droughts in the region. The increase of the irrigated area is, generally speaking, an increase in rural prosperity and hence the following figures are of special importance :—

Year.		Irrigated area in acres.	Percentage of the irrigated area to the net cultivated.
1836	...	232,869	27
1860	...	580,005	55
1901	...	607,647	60
1913-14	...	566,954	56
1932-33	...	540,312	49
1936-37	...	518,275	49

The details of the irrigation sources are as follows :—

Area irrigated during the year 1936-37 from Government canals	...	...	318,066 Acres.
Area irrigated during the year 1936-37 from wells	...	...	196,253 „
Area irrigated during the year 1936-37 from other sources	...	...	3,956 „
Total			518,275 Acres.

It is abundantly clear that irrigation in the district is chiefly canal irrigation. The introduction of canal-water has been associated with many of its own merits and demerits. From an economic point of view the most interesting co-relation is the one between agricultural expansion and canal development. The extension of canals as a rule always increases the area under cultivation. For instance, it was observed by Sir H. Elliot, not very long after the East Jumna canal was opened, that it had caused all the waste in neighbourhood to be reclaimed. A comparative study of the agricultural conditions by Mr. Colvin for the years 1835 to 1860 is corroborative of our statement and the figures given in his memorandum are as follows :—

		Percentage of increase in the cultivated area.	Percentage of increase in irrigated area.
<i>Irrigated by West Canal.</i>			
Baghput	...	23·0	316·9
Barot	...	19·0	137·0
Kotana	...	34·5	194·1
Chuprowlie	...	16·0	230·8
Lonee	...	18·4	238·9
Barnawa	...	28·0	138·3

		Percentage of increase in the cultivated area.	Percentage of increase in irrigated area.
<i>Irrigated by Centre Canal.</i>			
Meerut	...	12·0	138·2
Jallalabad	...	10·5	154·3
Sardhanna	...	29·2	124·4
Dasnah	...	29·1	74·5
<i>Irrigated by East Canal.</i>			
Pooth	...	15·5	142·0
Gurhmookhtesur	...	47·0	185·5
Hastinapur	...	22·7	299·5
Kithore	...	25·1	105·7
<i>Between Centre and East.</i>			
Haupper	...	20·2	106·9
Sarawah	...	21·2	72·5

But such an agricultural expansion is limited by nature and the limits are defined by the sources of irrigation. Thus the cultivated area in 1860 was 1,043,515 acres and to the present day it has marked a very slight increase. The net area cropped in 1936-37 was 1,090,795 acres only. This has been so owing to the fact that in this district there has been a very narrow margin for the cultivated area to expand as a limit in that direction was nearly approached even in the Mughal days. But, undoubtedly, there would have been a greater agricultural expansion within this narrow margin if the irrigated area in the district had progressively increased. However, canal irrigation suffers from inelasticity and its expansion ratio is bound to be low. Consequently, whereas canal districts show an expansion too limited both in

extensive agriculture and irrigation, the increase of irrigation facilities has been comparatively far greater and continuous in the non-canal districts. In brief, canal irrigation is rigid and defined as regards its expansion in contrast with well-water supply which is progressive. This has meant a greater increase in the net cultivated area of the eastern districts of the province, which depend mainly for their irrigation on wells, than in the western districts, where canal irrigation dominates. In a comparison of the agricultural expansion of the two regions we are apt to forget that the eastern districts had extensive areas, previously lying uncultivated, to bring under plough; whereas the western districts had no such easy opportunities of expansion and thus we far outweigh the defects and limitations of canal irrigation in this respect. In any case a comparison of the agricultural expansion of the two regions is interesting:—

Percentage of increase of the total net cropped area

Non-Canal Districts.

Canal Districts.

1891—1924			1926—37			1891—1924			1926—37		
Benares	...	14·3	1·6	Meerut	...	1·6	0·4				
Azamgarh	...	10·2	5·9	Saharanpur	...	2·0	3·4				
Jaunpur	...	2·4	2·1	Muzaffarnagar	...	5·5	4·3				
Gorakhpur	...	4·4	1·1	Bulandshahr	...	4·1	0·3				
Basti	...	4·9	0·5								

Another most important effect of the canal irrigation has been the improvement of cultivation by facilitating the growth of the more valuable staples.

The whole of the Upper Doab has a greater proportion of its cultivated area under rich commercial crops like wheat and sugarcane. The tendency of growing for the market as contrasted with growing mainly for home consumption and a gradual commercialisation of agricultural produce are well marked in Meerut. A game in prices has been substituted for a gamble in rains, so proverbial of the agricultural industry. There can be no real doubt that this commercialisation of agriculture has been good in the interest of the cultivators. It has increased the surplus with them for the trend of prices has been such that the incident of rent measured in terms of the quantity of grains falls less heavily when it is reckoned in wheat and gram than in millets and pulses. However the history of the *Great Depression* has a different story.

Tracing the effects of canals on particular crops, we may safely conclude from historical records that in Akbar's time wheat used to be imported from Bengal and it was scarcely possible to grow sufficient quantities of wheat, maize, sugarcane and cotton to meet the whole demand. But now in the district wheat occupies the first place, the area under it being now more than 33 per cent of the net area cropped. Sugarcane occupies another 15 per cent of the net cultivated area. One essential preliminary condition of this phenomenal change has been the existence of the enormous facilities of canal irrigation. Though canal irrigation does not directly necessitate the growing of commercial crops, yet the absence of canal-water supply may be a sufficient cause to hamper and

retard the progress of rich crops in any region, unless it enjoys the benefits of a more heavy and less uncertain rainfall and does not depend on artificial irrigation for the success of its crops. Well irrigation dependent on human or cattle power offers limited facilities in this direction. The view is amply supported by the fact that the increase of cane-cultivation in the eastern parganas of the district was noticeable immediately after replacement of well irrigation by canal-water in that portion during the early days of our century. We admit that sugarcane used to be and is still grown without irrigation in certain "Khadir" tracts of the district. So far back as 1835, sugarcane was grown in the vicinity of Hastanapur on unirrigated "*bhur*" land and even to-day it is so grown in the villages on the banks of the rivers. But elsewhere, five or six waterings, each four to six inches deep, according to the nature of soil and tillage, are required to mature a sugarcane crop. Shah-jahanpur results show that generally 80,000 gallons (4 inches) per acre, given from five to six times, give the best results; but on lighter soils this may have to be more frequent. The real limitation of irrigation sources other than canals, *e.g.*, wells and tanks lies in the insufficient output of water and in the unduly long periods required to irrigate from these. The irrigation of a "Kachcha" well hardly enables a farmer to water an acre of land within a time to give him an opportunity to hoe the field. The work requires a number of days and the portion irrigated in the beginning runs too dry before one is able to irrigate the whole acre. Even in the case of masonry wells

where bullock power is invariably used to lift water from the subsoil by means of a " Charas " or leather bag and a pulley, it has been estimated that the output of water varies from 20,000 gallons to 30,000 gallons per day according to weather and soil. It will take three days at least to irrigate an acre of sugarcane and by that time the part irrigated on the first day is ready to be hoed. Thus a cultivator in normal cases cannot expect to mature a sugarcane crop of more than an acre with well irrigation. But this too requires four bullocks and as, generally the cultivators have only a pair which is in some cases reduced only to a single animal, they are not able to sow and mature sugarcane even to the extent of an acre per holding under well irrigation. Canal-water, on the other hand, knows no limitations in this direction at least and thus facilitates the progress of commercial agriculture and intensive farming which are eventually introduced and seek expansion under an increased pressure of population on soil.

The growing of rich crops has increased the drought-resisting powers of our cultivators and tenants, for rich crops leave a greater margin of profits to the grower both in terms of the grain itself as well as in prices. To give an example, in the pargana of Barnawa it was found in the dry year of 1869 that the cultivators of the North Section in which canals were absent sold their sugar mills to the cultivators of the South area which was mainly watered by canals. This speaks for the prosperity of canal-irrigated villages. But we should not forget that

years of depression in areas of commercial crops are far more threatening than years of drought and the recent fall of the agricultural prices, we fear, has so adversely affected the prosperity of the district that it will take more time to recover than it took even after the famine of 1896.

Again, canal irrigation is inelastic and herein lies the superiority of well-water over canal-water supply. It may be laid down as a dictum that elasticity of water-supply ensures steadiness in the outturn of crops and its inelasticity exposes a region to the baneful effects of drought. If farmers in the Meerut District openly prayed for a continuance of famine in 1896, as was observed by the Settlement Officer in 1901, it was not because of any extra advantages conferred by canal-water supply; for a source of irrigation, which cannot increase its supply to adjust itself to the larger requirements of a drought year, cannot ensure the steadiness of agricultural outturns. In the past canal irrigation has not expanded and contracted to the same amount as well irrigation even in this district, where the latter is largely discouraged by the canal-water supply. The following figures are of special importance as showing how illogical and unintelligible the argument is that canals confer an additional security against famine as compared with well-water supply, unless it is made applicable to a region which offers little opportunities for the multiplication of wells. In any case, this district and perhaps the whole of the Upper valley, leaving aside a few portions in Muttra and Agra, do not comprise such a tract.

*Comparative figures for well and canal irrigation in
Meerut District.*

Year.	Deficiency or increase in rainfall.		Area irrigated	
	Inches.	Acres.	by wells.	by canals.
1913-14	... —8·30	231,853		329,236
1914-15	... 15·96	157,713		310,176
1915-16	... —7·60	198,383		323,156
1916-17	... 12·77	153,568		293,034
1917-18	... 7·1	153,984		316,995
1918-19	... —12·98	201,583		363,502
1919-20	... —3·96	173,470		358,912
1920-21	... —5·69	221,968		348,114
1921-22	... 3·75	153,264		302,853
1922-23	... 1·43	155,910		305,273
1923-24	... 7·23	60,864		182,059
1924-25	... 5·88	132,652		235,954
1925-26	... 3·00	183,073		333,869
1926-27	... —2·70	174,917		334,106
1927-28	... 3·46	154,797		314,280
1928-29	... —3·60	226,629		394,437
1929-30	... —9·65	204,916		382,798
1930-31	... —5·38	191,447		373,844
1931-32	... —1·98	181,926		341,228
1932-33	... —0·62	196,003		339,757
1933-34	... 19·83	154,547		299,564
1934-35	... 7·57	185,440		338,492
1936-37	... 6·80	196,253		318,066

The above table indicates without any ambiguity that canal irrigation has not been so responsive to the needs of the season as well irrigation has been. A study of rainfall deficiency and the area under rabi crops manifests the inadequacy of canal-water to meet the full demand of a drought year in much more vivid terms, and further strengthens our contention

that canal irrigation being inelastic is not so good a defence against drought as well irrigation. Arranging the years in order of deficiency in rainfall we get the following table :—

Years.	Deficiency in rainfall.		Area under rabi crops.
		Inches.	Acres.
1918-19	...	—12·98	481,682
1929-30	...	—9·65	576,499
1913-14	...	—8·30	539,315
1915-16	...	—7·60	733,550
1920-21	...	—5·69	540,666
1930-31	...	—5·38	617,049
1919-20	...	—3·96	624,687
1928-29	...	—3·60	760,196
1926-27	...	—2·70	626,982
1931-32	...	—1·98	762,089
1935-36	...	—1·09	708,319
1932-33	...	—0·62	692,793

Nowhere will one find a better example of the dependence of agriculture on rainfall. The area under the rabi crops varies inversely with rainfall deficiency and is closely inter-related with the amount of rain in the months of September and October. The implication seems to be that the irrigation sources fall short of the demand in such years. Consequently the extension of the rabi crops beyond the immediate means of the cultivator in this region of precarious rainfall may prove a disaster in the event of a serious drought owing mainly to the fact that the canal-water supply is too limited in its expansion.

Even in normal years canal-water is uncertain. A cultivator usually does not know the time when he is going to receive the water and the supply may be

shut off when he stands most in need of it. The evil is great and frequent at the tail end of the distributaries. At other times the supply may be excessive. The increase of masonry wells from 9,053 in 1860 to more than 21,700 in 1936-37 speaks of the shrewdness of the cultivators of the district, who thus guard themselves against the continuing uncertainties of the canal-water supply.

Generally the ignorant cultivator, to tide over the period of unknown length during which canal-water may not be available, applies more water than is necessary to mature the crops. The waste has been estimated from 30 to 50%. The waste may also be attributed to the fact that canal irrigation, for which a cultivator pays not by the amount of water he uses but by the area he irrigates, does not call for strenuous human effort to the same extent as is required in lifting every gallon of water from a well. He has no incentive to economise water and there is a definite tendency for the standard of cultivation to deteriorate. Fields are not so well divided into compartments, neither are the channels which lead water to the field well kept. Bursts are frequent. Irrigation is not uniform and results in poor tilth as the cultivator, under the security of canal water, does not attend to cultivation with the same enthusiasm for retaining moisture in the soil as is evinced in well-irrigated villages. One of the commonest complaints is that in sugarcane cultivation hoeing is neglected in canal-irrigated villages where the water-supply is easy with the result that the soil deteriorates, as the available plant food is not fully utilised.

Deficient drainage is a great menace in canal-irrigated villages. Underground accumulation of unused irrigation-water generally results in water-logging and formation of swamps. The water level rises and in the event of excess of rains whole crops, particularly *kharif*, are destroyed and thus the canal-irrigated village suffers most from the abnormalities of weather. Several villages have sustained loss from interruption of the natural drainage by the canal banks or by some of the distributary channels. As early as 1860 we find that in several canal villages whole autumn crops were simply lost by being flooded with rains, there being no outlet for water. The villages of Alipore and Mudarapoor are good illustrations. Another considerable area adjacent to the canal banks has been rendered swampy and unfit for cultivation by percolation from the canal. Village Kulunjun in Sardhana affords a good example of such a type of loss. Moreover the smaller channels, "guls" and "colabas," which finally conduct water to the fields, are generally found to contain anopheline larvæ. (Note by Dr. A. C. Banerjee on "The Rural Malarial Problem in the U.P., with special reference to the Agricultural population" reproduced in Vol. VII, page 201 of Royal Commissions on Agriculture.) The spleen indices prove that canal irrigation is associated with a high malarial index :—

Non-Canal Districts.		Spleen Ratio.	Canal Districts.		Spleen Ratio.
Jaunpur	...	3% (1914)	Saharanpur	...	78·8% (1909)
Sultanpur	...	·62%	Kirthal (District		18%
Benares	...	·57%	Meerut)		

Underground water is likely to bring to the surface deposits of mineral matter which form infertile salty tracts. In fact, inadequate drainage results in the land becoming saturated by the saline efflorescence known as "Reh." The area most affected by it are the low-lying lands of the Hindan and the Ganges river bed near Hastinapur. In Pooth and Garhmuktesar, the "Khadir" land, which prior to the year 1860 was one of the most fertile tracts, had become almost barren by the year 1900. This can only be explained as a result of the rise of water level due to the Anupshahr Branch which was opened in 1860. The "Reh" in the parganas of Dasna and Jalalabad can only be ascribed to saturation caused by canal. The evil is caused in two ways, *viz.*, by excessive irrigation and by the general influence of the canal on the water level. But the greatest evil is caused when we interfere with and incidentally undermine the independence of the cultivator by affording him an easy water-supply. Canal irrigation tends to drive out well irrigation owing to our faulty system of canal-water distribution. As far back as 1901 it was estimated that a transfer from wells to canals was taking place and within a period of forty years immediately preceding that date well irrigation had declined by 65,500 acres.

Decline of wells.

Similarly, during the last two or three decades there has been a large shrinkage of well irrigation in the Upper Doab as a whole. The following figures about Meerut Division indicate this tendency:—

Year	1906-07	1911-12	1921-22	1927-28	1936-37
Number of wells available— masonry and non-masonry ...	114,519	68,233	72,354	73,437	78,352

The outstanding cause seems to be the rapid development of canal irrigation in this region during the nineteenth century which was extended to those tracts particularly, where wells were extensively used. In the Meerut District the best well tracts were on the watersheds, and when canals were introduced and driven through the watersheds of the district alone, it was quite clear that as they traversed those tracts which were most fully irrigated by wells a definite decrease in the number of these wells would take place, leaving those tracts in which the loose and broken condition of the surface was an impediment to wells as destitute as ever.

Besides, a canal has a tendency to raise the spring level and this makes the wells, particularly those of a temporary nature, fall rapidly and thus reduce the people to utter dependence on canals. It was observed by Mr. Porter in 1860 that in most villages canal-water had only supplanted the "Kachcha" wells. Similarly, it was found by Mr. Forbes that the average duration of such wells had decreased by more than one-half. In Dasna, for instance, "Kachcha" wells were found in close proximity to the canal but in the course of its development they gradually fell in and had become extinct by the year 1901, when Mr. Gillan even doubted whether they could be made. The influence of canal irrigation on wells during the period

of its rapid development may be noted from the following figures :—.

Year.	Available " Kachcha "	Available masonry
	wells.	wells.
1860	... 8,427	9,053
1901	... 3,205	10,878

Prior to 1860 there must have been many more wells, specially those of temporary character. However, within this period of nearly 40 years 5,222 " Kachcha " wells declined. Only 1825 masonry wells were added to the figures of 1860. Such conditions at once reveal that the decline in the number of wells during those four decades had largely been the result of the increase of canal irrigation. But canals alone cannot be the only cause, for even in the pargana of Barnawa, which may be said to be a memorial of the country as it was before the advent of the canals, (*i.e.*, where water was very deep, and the "Kachcha" well capacity was unimpaired) though there was a marked increase in well irrigation, yet the "Kachcha" wells had phenomenally decreased. A corresponding decline was marked in the number of temporary wells in Hapur and Sarawa where well irrigation exceeded the canal-irrigated area. It can be accounted for by the fact that masonry wells tend to replace non-masonry ones. To sum up, we may say that during this period of canal development the decline has been mainly in the direction of non-masonry wells either due to a rise in the water level in the canal-irrigated tracts or due to the increase of masonry wells, which the landlords found to be more remunerative than the

temporary wells, in the non-canal villages. But in the district, as a whole, the masonry wells remained almost stationary and the slight increase had been chiefly in the non-canal tracts.

This experience of nearly half a century clearly shows that canal irrigation to the detriment of well irrigation is an evil. During the present century the need for a closer association between wells and canals spurred the construction of both the masonry and the non-masonry wells, the latter gaining ground where they could still be remunerative. It is significant that the needs of the rich and heavy crops of sugarcane and wheat, which canal irrigation encouraged, could only be met by increasing numbers of masonry wells both in the canal-irrigated tracts where the water-supply is now in general inadequate and uncertain and also in the non-canal tracts, as non-masonry wells, being of low capacity, fall short of the great output of water required for such crops. Thus to guard against the drawbacks of canal irrigation the system has been greatly supplemented by the construction of masonry wells with the result that they have shown a phenomenal rise in their numbers during the present century.

Available masonry wells in the Meerut District.

Year	1901	1906	1911	1921	1930	1933	1937
Number of wells ...	10,878	12,766	15,270	17,736	20,331	21,096	21,772

But as they have replaced the non-masonry wells in the non-canal tracts the number of temporary wells though greater than that of 1901 shows a tendency to decline.

Number of non-masonry wells in the Meerut District.

Year	1905	1908	1911	1922	1929	1933	1937	
Available wells	...	7,069	9,636	7,908	7,685	7,716	6,937	6,347

It appears, however, that the greater evil of the unemployment of wells has cropped up especially in the canal-irrigated villages. The distributary channels which carry the canal-water to the fields have in many cases occupied the channels originally carrying water from the wells and on actual observation it has been found that the canal patrols in such cases do not discriminate between a field irrigated by a well and one by a canal and the cultivator does not often apply for a correction of entry, though the canal regulations afford him such opportunities. The cultivator knows well what the results of his contention will be before the canal authorities, who are anxious about the revenue collection. The cultivator has, therefore, no incentive to use his well, for in any case he will have to pay the canal-water rates. There are, in practice, no deductions made in the water rates for a farmer who supplements his canal irrigation by well-water. He has practically no inducement to use his well and had the distribution of water and the rates been charged by volume, no doubt the farmer would have effected every economy in using canal-water, taking at the same time more out of the sub-soil. Moreover it has been observed that in canal villages the various requisites essential to lift water from wells are not kept. As under the present rules of supply, canal irrigation is taken to mean and implies a discontinuation of the well-water supply, cultivators in

the canal villages sell everything required for raising water from a well and the wells are left uncared for with the result that without a lot of expenditure they cannot be put to immediate use. Consequently, even in times of extreme drought and scarcity of canal-water, thousands of acres suffer for lack of irrigation though wells may be found with plentiful water on a large number of fields. The following figures speak of the unemployment of masonry wells :—

*Difference between available and actually used
masonry wells.*

Years with deficient rainfall.	Number of unemploy- ed.	Years with slight varia- tions from the normal rainfall.	Number of unemploy- ed.	Years with excessive rainfall.	Number of unemployed.
1907-08	2,254	1908-09	4,042	1906-07	4,034
1913-14	3,116	1911-12	4,498	1909-10	4,647
1918-19	3,788	1921-22	5,113	1914-15	4,192
1920-21	3,979	1922-23	5,751	1916-17	4,649
1928-29	5,232	1925-26	5,887	1923-24	7,454
1929-30	5,286	1932-33	5,730	1927-28	6,231
1930-31	5,826	1935-36	7,059	1933-34	7,058
				1934-35	6,874
				1936-37	7,704

Even out of those which are used an overwhelming majority is not employed to its full capacity as we shall hereinafter indicate. Now, assuming that from a non-masonry well we can irrigate on the average 4 acres of land whereas from a masonry one nearly 12

acres are irrigated, we can compute for the purpose of our calculation non-masonry wells in terms of masonry ones in the ratio of 3 : 1. So calculating, we get the following figures which give an idea of the irrigated area per well in the Meerut District :—

Years of deficient rainfall.		Area irrigated from wells.	Wells actually used.		Irrigated area per masonry well.
		Acres.	Masonry	Non-Masonry.	Acres.
1907-08	...	218,509	11,460	8,739	15·2
1913-14	...	329,236	12,966	7,182	21·4
1918-19	...	201,583	13,568	7,037	12·7
1920-21	...	221,968	13,757	6,836	13·8
1928-29	...	226,629	14,679	6,883	13·3
1929-30	...	204,916	15,045	7,263	11·1
1930-31	...	191,447	14,800	7,038	11·1

We have taken the figures of the years of deficient rainfall as it is in these years alone that wells are most extensively employed. Here we clearly find that the area irrigated per well has constantly declined and as there are no signs of the capacity of wells being reduced due to the lack of water, the conclusion becomes irresistible that even those cultivators who irrigate from wells do not employ them to their full capacity. As there is no reason for such an under-employment of wells in the non-canal villages, there is a great probability that well irrigation in canal villages is declining rapidly. In some cases this decline is real when the cultivators have no incentive to use wells but in a great number of cases it is merely

apparent. The shrewd cultivators irrigate their fields from wells in scarcity but when once they have taken canal-water it is not even recorded as it means a shrinkage in the Government revenue. Still the fact cannot be denied that, though the decline is not so steep, there has emerged the problem of under-employment of wells and the only solution seems to lie in a distribution of canal-water by volume.

CHAPTER III

THE SIZE OF HOLDINGS

The loss of the equilibrium of occupations in the economic organisation of the country, coupled with the ever-increasing pressure of population, has been responsible for swelling the number dependent on agriculture for their livelihood; and finally, the operation of inheritance and succession laws, administered by the English judges with their own notions of property and individual rights, has occasioned the progressive partition of land into numbers beyond limit and thus brought in its trail our acutest economic problem—the undesirable sub-division of the holding. Owing to the discontinuation of the joint-family system there is nothing to prevent the growth of population causing greater land morcellement. The growing poverty of our cultivators and proprietors has been another additional factor in the dismemberment of a holding. But these factors have been prevalent none the less, throughout the greater part of the Ganges Valley and still we find a disparity between the size of holdings of different agricultural regions. In the eastern districts of the United Provinces cultivators have carried sub-division of holdings to excess whereas in the western districts land morcellement has not gone so far. The following figures taken from Mr. Shyam Behari Misra's Report on the proposed consolidation of

agricultural holdings and prevention of their minute sub-division (May 31, 1924) materially substantiate our statement :—

Average area in acres per

District.	<i>Cultivator</i>		<i>Plough</i>
	Intensive.	Ordinary.	
Meerut	... 2·8	10·2	10·4
Bulandshahr	... 7·8	18·83	16·17
Aligarh	... 1·0	16·3	10·39
Muttra	... 1·8	11·12	11·47
Fatehpur	... 2·0	7·0	7·0
Jalaun	... 1·5	8·72	10·46
Gorakhpore	... 1·3	4·3	4·88
Basti	... 1·0	3·1	3·1

A detailed analysis will show that though, as population increases in a tract, it is likely to set in motion a strong tendency for holdings to become reduced, yet to explain regional differentiation between sizes of holdings by densities of population alone would be touching only the fringe of problem. No doubt a crude co-relation exists between rural density and size of holding but with no measure of precision can we relate them as cause and effect. Rural density might increase through a swelling of the numbers of the landless proletariat—the agricultural labourers, and no doubt this would increase the burden on land and adversely affect the rural prosperity, but certainly it would have no immediate effect on the size of holdings. Or, again, there may be a

corresponding rise in the standard of cultivation, increasing the demand for labour on the same holding and thus expansion of numbers may be maintained by intensive agriculture without affecting to any appreciable extent the size of holdings. The success of the large-size holdings itself checks the sub-division of holdings, for the smaller uneconomic enterprises will not long remain in the field against the healthy competition with larger holdings. Here is, however, a vicious circle, for when once very small-size holdings come to stay, the standard of cultivation falls and the joint-family system is gradually disintegrated and thus any person may become a tenant (as with poor farming it costs little to establish a farm), cultivating a plot of land brought in by slicing off a holding. It is virtually the number of cultivators and not any other section of the rural population which accounts for the sub-division of agricultural holdings and as the high standard of cultivation and the prevalence of the joint-family system prevent an unlimited entrance into this class, an increase in rural density does not necessarily mean a greater proportion of this class, provided these two barriers exist. The immediate cause of the excessive sub-division of holdings is thus a lowering of the standard of farming, or of social life as represented by the lapse of communal institutions. Consequently, in the light of the above analysis, we may maintain that the history of the agricultural progress of a region and the social institutions of its cultivating tribes are by far the most important factors in determining the rate of division of holdings into undesirable fragments.

Thus, in the eastern districts, the lack of any outlet has caused a serious overcrowding of agriculture and in the absence of a high standard of cultivation the proportion of population following farming as their main occupation actually has increased. The agricultural progress of these districts has been a record of the extension of the area under cultivation without any corresponding improvement in the art of cultivation and consequently there has been perhaps little increase in the demand of labour per acre. The expansion of agriculture to inferior soils was not sufficient to provide enough land to the increased number of farmers and hence the existing agricultural holdings were put to a process of gradual sub-division. The smaller the holding, the lower the standard of cultivation, and the easier it is to practise farming. The operation of this vicious circle leads not only to the greater proportionate increase of cultivators and tenants but also accelerates the sub-division of holdings and finally occasions a vast amount of agricultural idleness in these districts.

But the agricultural progress in the Upper Ganges Doab has been synchronous with the rise in the standards of farming and thus the high costs of agricultural equipment have been instrumental in limiting the numbers of cultivators and tenants. With intensive agriculture, on the other hand, more labour is required on every holding and hence the institution of the joint-family system is preserved as an economic expediency. Consequently an increase in rural density in many of the western districts has not meant more of the agricultural holdings. We give the

following figures about Meerut District in support of our contention :—

Actual Workers.

		1891 Males.	1931 Males.
Non-cultivating owners	...	11,512	6,038
Cultivating owners	...	137,890	84,094
Non-cultivating tenants	...	nil	1,512
Cultivating tenants	...	163,122	132,052
Agricultural labourers	...	43,456	55,124

In the last 40 years, though the population of the district has increased by more than 16 per cent, the number of cultivators and tenants has actually gone down. The theory, that in the absence of any outlet for the agricultural population any addition in its number must necessarily mean more farmers and consequently an increased number of holdings, does not hold good at least in the case of this district.

We have indicated above that the average holding is larger in the western districts due to a high standard of cultivation than in the eastern where the equipment of a farmer can be had at a nominal price. The size of a holding measures the standard of cultivation and is a resultant of the agricultural progress of a people and a region. It may be that within the same tract, with a poor standard of living and farming with poor equipment, the minimum may be much below the maximum and still the one may be as economic as the other. Between the maximum and the minimum there are a thousand gradations, which rise and fall with a high and low standard of living.

and farming, with rich and poor equipment; and finally the size of a holding varies with the institutions and status of the cultivating class. Below are given certain facts and figures about the size of holdings in the Meerut District. We produce the following from the Rent-Rate Report of Pargana Hastinapur Tehsil Muwana (1931):—

“ ‘ The minimum economic holding ’ in this part of the provinces has been calculated to be 4·6 acres for an occupancy tenant, 5·5 acres for a statutory tenant and the average size of holding in the Meerut Division has been put at 8 to 10½ acres by the United Provinces Banking Inquiry Committee Report. The average size of holding in this tract works out at 12·3 acres (all cultivators) and 11·3 acres (tenants only) On a broad view the holdings are decidedly more substantial and less un-economic than in such an irrigated district as, say, Budaun. Taken over all classes of agriculturists’ holdings the largest are those held by Jats (16 acres). Probably more than any other caste, the Jats co-operate and work as a family under the head of the family. Only 13% of the cultivators sub-let and the average size of a sub-tenant’s holding is 2·4 acres.”

Generally speaking, one may say that the majority of the holdings in Meerut District are larger—the following being the different sizes of holdings:—

Statement showing different sizes of holdings of the Agriculturist Class.

Tahsil Pergana.	Less than 5 acres.		Between 5 and 10 acres.		Between 10 and 20 acres.		Between 20 and 50 acres.		Over 50 acres.	
	Percentage of cultivators.	Percentage of cultivated area.	Percentage of cultivators.	Percentage of cultivated area.	Percentage of cultivators.	Percentage of cultivated area.	Percentage of cultivators.	Percentage of cultivated area.	Percentage of cultivators.	Percentage of cultivated area.
Hapur Garhmuktesar	26	7.9	37.6	25.3	26.3	33.5	8.8	23.4	1.3	9.9
Puth	37.1	12.1	31.9	25.3	23.0	34.1	7.7	26.8	1.3	1.9
Muwana hastinapur...	19.5	4.7	32.8	20.0	32.8	37.0	13.8	32.4	1.1	5.9

The figures have been taken from the Rent-Rate Reports of 1931-32.

As regards the non-agriculturists, the figures are quite different. Thus in Pargana Puth, the holdings of the non-agriculturists average only 2·3 acres whereas those of the Jats average 16 acres. Similar odds throughout the district can only be accounted for by the fact that the cultivation of the agricultural class as contrasted with that of the non-agricultural is on a higher standard. The cultivators of the former class have better equipment and, consequently, to work with it profitably, they jealously maintain the large size of their holdings and thus even to-day coparcenary is prevalent among them. The non-agriculturists, however, have inferior equipment, ekeing a poor living out of their fragmented plots. It is in conformity with the law of proportions that the sizes of the holdings of the agriculturists and the non-agriculturists, of the proprietary cultivators and of the tenants, and ultimately of the tenants and the sub-tenants, should show such great disparity. The following figures indicate some of these variations :—

Statement showing sizes of holdings in some of the parganas of Meerut District.

Caste Groups.	ALL CIRCLES.				BHUR CIRCLE ONLY.			
	Proprietary cultiva- tion included		Proprietary cultiva- tion excluded		Proprietary cultiva- tion included		Proprietary cultiva- tion excluded	
	Hapur Bighas.	Sarawa Big.	Kithor Big.	Sarawa Big.	Hapur Bighas.	Sarawa Big.	Kithor Big.	Sarawa Big.
1. Brahman, Rajput Mussalman.	19.5	30.1	14.5	19.8	26.1	12.8	26.0	31.4
							18.0	21.3
								23.2
								13.0
2. Sayani, Mali, Dhimar, Kachchi, Baghban.	12.2	13.6	5.25	11.1	11.7	5.0	19.0	21.5
							5.0	15.0
								5.0
								5.6
3. Jat ...	21.0	22.8	18.0	20.5	22.3	15.0	21.1	26.0
							18.0	26.4
								24.3
								15.0
4. Others ...	16.5	22.0	11.0	17.1	20.8	9.4	18.8	25.8
							10.3	19.9
								24.0
								10.0
5. Total agriculturists ...	19.2	26.1	12.5	19.8	22.1	10.5	22.2	29.8
							13.0	22.3
								23.5
								11.25
6. Non-agriculturists ...	2.3	3.3	3.0	3.3	4.6	1.5	1.1	5.3
							0.9	4.0
								8.7
								1.25

The figures have been compiled from the Rent-Rate Reports of Tahsil Hapur and Muwana (1931 and 1932).

The following general conclusions emerge from the above comparison :—

1. The size of a holding varies according to character of the soil and of irrigation facilities. Thus holdings in the Bhur Circle are larger owing to the difficult and precarious cultivation than in the up-land tracts with more fertile soil and ample sources of irrigation. At a particular standard of farming and with similar equipment more land is required to remunerate the expenses of running a farm in a precarious and less fertile portion than in an irrigated and a more fertile tract.
2. The holding of a tenant is smaller in the case of the agriculturists, and larger in the case of the non-agriculturists, than the average holding as worked out with the proprietary cultivation included. It is so because the holdings of the landlords of the agriculturist class are larger as they have better equipment and thus an area which will suffice a tenant is insufficient to be in conformity with their standard of cultivation. As regards the proprietors of the non-agriculturist class a majority of them follow agriculture as a subsidiary source of income to some other principal occupation. Hence they maintain very poor equipment even as compared with the

tenants of that very class and consequently the size of their holdings diminishes.

3. The average size of holdings of Jats is the largest owing to their high standard of farming, greater skill, prevalence of the joint-family system and a greater proportion of their cultivated area being held in permanent rights, either proprietary or occupancy.
4. Non-agriculturists everywhere have the smallest holding because many of them are mere allotment-holders—village artisans and menials, agricultural and other labourers, etc., who cultivate a field or two with very poor equipment. With the skill they have attained and the working capital at their disposal their holdings are sufficiently large for having the maximum production. Any attempt to increase the size of their holdings for raising their standard of life will miserably fail both as regards the fulfilment of its ultimate object as well as in its immediate purpose unless there is a corresponding rise in their standard of cultivation and a better equipment at their disposal. It should be clear to every worker in the field that the small size of a holding is the effect and not a cause of poverty, of poor farming and of low standard of living.

If we consider and compare the holdings of the tenants and those of the sub-tenants our contention is further strengthened. The average size of a sub-tenant's holding is 2·4 acres in pargana Hastinapur whereas the figure is 16 for the holding of a Jat. Similarly, in pargana Puth the holdings of the Jats average 14 acres whereas the average size of sublet holdings is 4 acres. These odds are the results of the different economic levels of the two classes and before adopting any special measure to equalise their holdings we should bring the two on the same economic level as regards farming practices and agricultural working capital; otherwise under-cultivation in one case will result in low profits, and over-cultivation in the other will occasion the operation of the Law of Diminishing Returns to a far greater extent. Total agricultural production will decline, causing a general lowering of the standard of living and, finally, with more human numbers, in combination with a decline in the standard of farming, there will be a greater sub-division of holdings until a new balance is reached.

In an appendix to this chapter we have given some more facts and figures about the size of holdings in a number of villages where we made detailed inquiries. The figures indicate that the holdings are effectively governed by tenures and castes. The reason is quite apparent. Certain castes have good bullocks and better implements and so the average area per cultivator exceeds that of a caste lower in the scale of agricultural enterprise. Similarly, tenants holding for life are, as a general rule, not so

well equipped as those holding in permanent rights and again these statutory tenants are on a higher level than non-occupancy tenants or sub-tenants. Hence these gradations of economic progress permeate throughout and effectively control the size of holding. Finally, the joint-family system, its prevalence, slackening or discontinuance, has a marked influence on the size of holding and here again the considerations of caste, tenure and agricultural progress enter into our discussion, for every one of these acts upon and is acted on by the other.

When we bear the fact in mind that the better the right to hold land the greater is the size of a holding it is at once clear that holdings in Meerut District are large because a greater proportion of land is held under more secured tenures.

Statement of holdings in Meerut District.

	1341 Fasli. Acres.	1343 Fasli. Acres.
Sir of landlords	... 384,487	376,637
Khudkasht	... 99,263	105,448
Rent-free land	... 6,960	6,937
Held by ex-proprietary tenants	... 53,449	55,639
Held by occupancy tenants	... 278,617	272,269
Held by tenants of not less than 12 years in 1333 Fasli	... 15,114	13,755
Held by statutory tenants	... 241,234	232,767
Held by heirs of statutory tenants	... 18,281	21,165
Held by non-occupancy tenants	... 41,585	48,904
Held by grove-holders	... 736	695

APPENDIX TO CHAPTER III

Average size of holdings according to caste and tenure in acres, Village Hazratpur of Pargana Hastinapur, Tahsil Muwana.

Caste.	Ex-proprietary tenant.	Occupancy tenant.	Statutory tenant.	Non-Occu- pancy tenant.
Taga	... 2·8	4·4	1·8	·26
Ahir		4·1	3·9	...
Gujar		3·5	1·3	·03
Brahman		2·0	...	2·3
Chamar		2·7	...	·09
Seikh		5·0	...	...

The tenants have been divided into exproprietary, occupancy, etc., according to the largest area held under a right, for the classification could not be absolute as many hold under various rights.

Statement showing the extent of Joint-Tenancies.

Percentage of holdings in more than one name under occupancy right	Taga	Ahir	Gujar	Brahman	Chamar	Seikh
	53	57	50	60	nil	100

On the whole the size of holdings is small. But the more important fact is that it continually diminishes as we pass from better cultivating castes to inferior castes. However, in the case of Seikh the size is the largest owing to all the holdings being in more than one name. Caste, thus, by determining the standard of cultivation, in combination with the extent of joint-tenancies, affects the size of a hold-

ing. Moreover non-occupancy tenants have very small holdings as compared with occupancy tenants. Similar tendencies are to be marked throughout the other villages which we have investigated.

Average size of holdings according to caste and tenure in Bighas—Village Pinhai of Pargana Hastinapur of Tahsil Muwana.

Caste.	Sir-holder.	Exproprie- tary tenant.	Occupancy tenant.	Statutory tenant.	Percentage of joint- tenancies in occupancy holdings.	
Jat	...	3.1	12.5	10.9	1.2	56
Gujar	...	...	...	15.6	5.2	33
Vaish	...	...	...	29.2	...	...
Brahman	...	...	...	4.1	...	50
Seikh	...	...	...	2.6	...	...

Average size of holdings according to caste and tenure in Bighas—Village Ataura of Pargana Hastinapur.

Caste.	Occupancy tenants.		Percentage of joint-tenancies in occupancy holdings.	Statutory tenants.	Percentage of joint-tenancies in statutory holdings.
Gujar	...	...	...	23.6	22
Chauhan	...	...	...	23.7	11
Sani	...	5.8	100	1.1	nil
Brahman	...	4.7	100	...	...
Barahi	...	9.8	100	11.6	nil

*Average size of holdings in Village Kuri Kamalpur
of Pargana Hastinapur in Bighas.*

Caste.	Sir-holder.		Occupancy tenant.	Statutory tenant.	Sub-tenant.
Gujar	...	...	10·2	6·4	...
Chauhan	...	1·3	3·2	1·3	5·1
Brahman	...	...	10·9	6·6	4·4
Vaish	...	...	4·6	...	·2
Gaddi	...	20·5	7·6	4·3	1·9
Chamar	...	...	11·4	4·1	2·2
Nai	...	38·7	...	...	...

Extent of joint-tenancies in Village Kuri Kamalpur.

Caste.	Percentage of joint-tenancies in	
	Occupancy holdings.	Statutory holdings.
Gujar	...	38
Chauhan	...	22
Brahman	...	50
Vaish	...	...
Gaddi	...	25
Chamar	...	33
Nai	...	7
	...	...

*Average size of holdings in Village Kherki Zadid of
Pargana Hastinapur in Bighas.*

Caste	Sir-holder	Cultivating owner.	Exproprietary tenant.	Occupancy tenant.	Statutory tenant.	Non-Occupancy tenant.	Sub-tenant,
Jat	... 18·8	...	6·9	...	...	...	...
Gujar	... 18·8	7·3	3·1	3·5	2·3	·9	2·5
Ahir	... 6·8	2·4	...	...	...	...	...
Vaish	... 11·5	4·0	...	...	...	·1	...
Brhman	... 2·7	1·5	...	3·5	...	·6	1·2
Kahar	...	...	...	·6	...	...	...
Sani	...	...	...	2·1	...	...	...

The holdings of the Jats are by far the largest and it is because they have the best equipment and moreover the land is held in permanent rights. The holdings of the *sir*-holders are in every case larger than those held in other rights simply because such holders maintain a better standard of farming and possess better agricultural capital.

*Size of holdings according to tenure and caste in
Bighas in Village Amarpur Garhi of Pargana
Jalalabad, Tahsil Ghaziabad.*

Caste.	Occupancy tenants.	Statutory tenants.	Non-occupancy tenants.	Sub- tenants.
Jat	... 14·8	4·4	0·9	...
Ahir	... 13·8	3·2	1·5	0·3
Taga	... ..	6·9	0·7	0·1
Brahman	... ..	3·6	0·5	...
Vaish	... ..	4·8	0·3	...
Khatri	... ..	13·0	...	...
Kahar	... 1·3	3·6	...	...
Dhobi	... ..	2·8	...	...
Chamar	... ..	6·9	0·8	...

*Village Saadatnagar Ikla Pargana Dasna of Tehsil
Ghaziabad.*

Caste.	Statutory tenants.	Non-occupancy tenants.	Sub- tenants.
Gujar	... 6·4	2·0	1·6
Brahman	... 8·7	16·0	...
Barhi	... 0·7	...	...
Gadaria	... 1·3	...	...
Chamar	... 4·3	..	1·2

CHAPTER IV

IMPROVEMENT OF CROP VARIETIES AND SEEDS

Twenty years ago the farmer was as ignorant or negligent of selection or change of seed as, even to-day, he is about his manurial business. However, the results obtained by the Agricultural Department clearly establish the fact that the so-called conservative peasant is not shy of taking up improvements only if suitable facilities are granted to him. Thus, within a decade or so the progress achieved with regard to the area under improved seeds in the Upper Ganges Doab has been undoubtedly beyond our expectation. The area under improved seeds in the various districts in the year 1933-34 has been as follows :—

	Saharanpur.	Muzaffarnagar	Meerut	Bulandshahr	Aligarh	Etah	Mainpuri	Muttra *
Wheat ...	11,906	17,457	18,506	46,891	21,880	17,813	11,347	2,246
Sugarcane...	55,670	96,110	151,463	42,731	8,454	14,143	4,607	478

Without fear of contradiction, one may assert that there is nothing inherently wrong with our cultivators; otherwise this sudden replacement of seed would have not been practicable at all. The root of our agricul-

* Sadabad and Muttra Tehsil only.

tural backwardness in matters of seed lies in the system or rather in the expediency, which exists even to-day, of disposing of the whole crop at the harvest time and of raising a new crop indebted with the debt of its own seed. Such conditions have been the consequences of our farmers' extreme indigence as in a majority of cases they do not possess surplus enough even to stock for seed of the next crop. The seed is generally supplied by a 'baniya,' 'mahajan' or some similar individual of the money-lending class at an apparently exorbitant rate of interest. These grain merchants receive many small lots at the harvest time and mix them up together. They stand no comparison to the seed merchants of the western countries. Our cultivators thus take the mixed grain and sow it and hence purity of seed and uniformity of quality cannot be maintained even after an effective introduction of improved varieties unless there is some other agency to fill up the place of the seed-merchants. State aid, by establishing seed-stores, has filled up a gap that private enterprise would never have done under the prevailing conditions, for our cultivators have not learnt to pay the premium on improved seeds. Quite on the other hand, the Indian peasant cannot even afford to pay for his seed when he requires it; and despite the improvements of more than a century, the British Government cannot boast that conditions have changed in that direction. The testimony recorded by Dr. Voelcker in the year 1895 that having saved no seed for himself for re-sowing, and having no money to purchase elsewhere, the cultivator generally borrowed it from the village

moneylender or grain merchant, seems almost repeated in the report of the Assistant Director, Agricultural Department, Western Circle, for the year 1930-31, namely, that 'there have been very little of cash sales as the average cultivator does not generally have money to pay for the seed at the sowing time.'

This customary practice of borrowing seed-grain presented its own difficulties in a propaganda for improved seeds. The Agricultural Department experienced marked failures to popularise improved varieties on a system of cash distribution, either when the price was charged on delivery or recovered at harvest plus the ordinary 'taccavi' rates of interest, *i.e.*, $7\frac{1}{2}\%$ per annum. It was only after the year 1922, when it was decided to issue seed to the cultivators on the grain 'sawai' system—the indigenous method of lending the seed, that the Government could achieve success either in the introduction of new varieties or in popularising improved seeds. Under 'sawai' system, to every maund of seed taken at sowing time the cultivator brings back at the harvest one, one-four maunds and this system in normal years enables him to obtain the seed practically without any interest, owing to the difference in the prices ruling at the two seasons. The 'sawai' system stands in vivid contrast to the minimum 'deorah' ($1\frac{1}{2}$) which the village moneylender charges. The great popularity of this system can be realised by the fact that out of the total wheat distributed in the Meerut district in year 1931-32 from Government seed-stores 249 maunds was given

on credit, 595 maunds in cash and 1609 maunds was distributed on 'sawai' system.

Besides this limitation, the Agricultural Department had to win over the confidence of the cultivators before it could carry on a successful propaganda for the distribution of improved seeds and introduction of new varieties as the cultivators mocked at the wisdom of its officials in agricultural matters and thought them even ignorant of the elements of farming. However, demonstrations at cultivators' own fields pulled the people out of the depth of their false notions and they began to realise the importance of new varieties of seeds. Still, nowhere has a cultivator walked even a few miles to see a demonstration of improved varieties, and without a demonstration he has not taken up improvements. So we find in the khadir lands of Tehsil Muwana, for example, that many villages have extensive areas without a single acre of improved variety as the department has not yet penetrated so far. There is no doubt that the 'creation of a demand for improved seeds and implements and for approved fertilisers with the subsequent distribution of these is the natural outcome of demonstrations conducted by the departmental staff.' However, propaganda alone has never been sufficient to induce the cultivator to use the improved varieties unless at the same time he had favourable opportunities quite ready at hand to get the new seeds. Experience in the past has shown that cultivators will come only to certain distances to get seed or implements beyond which they will not travel, howsoever tempting the opportunities may be, and consequently

we advocate a policy of opening many seed-godowns throughout the whole region, one for every group of ten to fifteen villages instead of having big seed-stores at important centres only. In this respect the Government has not met fully the demand of the people. But there is no denying the fact that without a network of seed-godowns throughout a district, improvements can neither be rapid nor can they be steadily maintained. There was no seed-store in Meerut District in the year 1923-24 and the natural result was that the distribution of improved seed in the district from Bulandshahr which then served it was very meagre :—

Kind of seed	Cotton A. 19	Jaunpur Maize	Coimbatore 213	Co 204
Quantity distributed	5 Mds. 12 Srs.	1 Md.	54 Mds.	86 Mds.

As the Hapur seed-godown was built in the year 1924-25 the quantity distributed went up enormously as can be seen from the following figures :—

	Mds. Srs. Ch.				Mds. Srs. Ch.		
Cotton A. 19	10	27	8	Wheat Pusa 12	25	25	0
Jaunpur Maize	0	5	0	„ Muzaffar-			
Co 213	1,530	0	0	nagar.	10	12	8
Co 210 & 243	43	0	0	„ Pusa 4	4	0	0
Co 204 & 205	60	0	0				

Similarly, it has been reported that on the Baraut side 'sortha,' a 'desi' variety of sugarcane, was very popular in villages up till the year 1928. In the year 1928-29 one could pass through this rich sugarcane tract without seeing a single field of improved

Coimbatore varieties. But the establishment of a godown at Baraut meant their introduction in the year 1929-30. In the same year the distribution of wheat was about 75% more than in the previous year. It seems that a different story is corroborated if we analyse the progress of the distribution of improved seed during the last eight years in the Western Circle as a whole, *i.e.*, in the districts of Dehra Dun, Saharanpur, Muzaffarnagar, Meerut, Bulandshahr, Aligarh, Etah, Mainpuri, Farrukhabad and Muttra, all of which comprise the Upper Ganges Doab.

Year	No. of Seed-Stores	Seed distributed	Year	No. of Seed-Stores	Seed distributed.
1926	33	20,812 Mds.	1931	55	677,720 Mds.
1927	41	140,140 „	1932	44	535,342 „
1928	47	83,315 „	1933	39	1,323,881 „
1929	48	337,923 „	1934	38	1,689,646 „
			1935	44	1,801,259 „
1930	62	379,733 „	1936	43	1,849,704 „

Thus it appears that though seed-stores are declining in numbers the total seed distributed is increasing in quantity. It may, however, be remarked that various private farms which are scattered here and there in the districts, working under the guidance of the Agricultural Department, serve also as distributary agencies providing seed to the Government under their contracts. Consequently this decline in

the number of seed-stores is more apparent than real.

The following figures have been compiled to show the progress achieved in the area under improved seeds in Meerut District.

Percentage to total area of acreage under improved varieties

	Sugarcane	Wheat	Cotton	Maize	Gram	Barley
1925-26	·4	·3	·5	...	...	...
1926-27	10·3	·9	·4	...	..	...
1927-28	13·4	·7	·5	·04	·06	..
1928-29	17·4	·7	1·5	·16	·05	...
1929-30	12·7	1·8	2·3	·16	·13	...
1930-31	29·9	2·7	2·8	·16	·14	·03
1931-32	78·2	4·8	2·4	·15	·08	·02
1932-33	71·4	7·9	7·1	·15	·13	·06

It is deplorable that attention has been concentrated on commercial products alone and the cultivator today stands in the same position as he stood in the beginning of the century with regard to crops that form his staple food like Juar, Bajra and other millets and pulses. This one-sided development, we fear, has neither been in the best interests of the cultivators, nor will it carry us very far in matters of agricultural improvement. In the long run, as even to-day there is a tendency, the best efforts and the most fertile soils will be reserved for commercial crops which the cultivator must sell and for his own nutrition and for the feeding of his cattle he will have to depend on less fertile soils. It means that his food will be derived

from fields which lack in one or the other of the chemical components and according to the most recent theories it implies mal-nutrition and under-nourishment both for men and cattle. It is also notable that though improved varieties are undoubtedly high-yielding there has not been a consequential rise in rural prosperity. As we shall presently see, in the first place, with our own methods of cultivation, they have proved less drought-resisting than our indigenous varieties; secondly, with the inadequate supply of manure they have brought about an exhaustion of soil with far-reaching consequences; and, finally, the slump in prices of commercial crops has nullified any benefits of high yields which might have accrued. Sugarcane has received most attention, the percentage under improved canes being about 90 in Meerut Division. The figures for the Meerut District are :—

Year	Total Sugarcane Area	Under Improved Variety.
1925-26	142,466 Acres	600 Acres
1932-33	154,320 „	110,156 „

The yield as estimated by the Agricultural Department has been in the following proportion :—

1. Yield of improved variety 600 Mds. per acre.
2. Yield of the ratoon crop 450 Mds. per acre.
3. Yield of the ' desi ' variety 350 Mds. per acre.

Assuming 50 per cent to be the ratoon crop we have on the lowest estimate an average increase of

175 maunds per acre in the yield of the improved variety. But, on the other hand, it has increased the expenses of production in seed amounting to 60 maunds per acre. Cultivators in the case of indigenous variety do not spend anything on this item as they freely take from each other the upper sets of canes which they use for seed. Now these 60 maunds at the sowing time are generally equal to about 100 maunds as measured in terms of money at the harvest time. But since we should also add interest on the money invested in seed, which at the prevailing rate of credit for the average cultivator must in no case be less than 2% per month, we must also include this additional expenditure of nearly 5 rupees (assuming 60 maunds of cane at the rate of 7 annas per maund to be worth Rs. 26 annas 4). This extra amount can only be secured by selling 20 maunds of sugarcane at the harvest time. Thus the balance we reach is only 480 maunds as the yield of improved variety. With the same method of computation we come to the conclusion that 115 maunds per acre is the average increase from the yield of the improved variety taking into consideration 50% as the proportion of the ratoon. Efforts are now being made for the reduction of the cost of production. But as they are not popular still, we have not taken them into our consideration. Important steps have been taken in the following directions :—

1. Decreasing the amount of seed per acre by sowing the new varieties of cane in lines at least 3 feet apart or in trenches. This reduces the quantity by nearly half

of that which the average cultivator at present sows.

2. Inter-cultivation by country plough or by the new cultivators which reduces the enormous expenditure on hoeings and digging.
3. The trench system reduces the need for water which must mean a great reduction in irrigation charges where it is done by well.

Still, whatever the cultivator is gaining in the field he is losing in the market. Prices have become so unfavourable that the farmer has enjoyed no profit from modern improvements. 'An increase in the production automatically causes such a fall in prices that, whether it results from an increase in sown area or a better than usual yield, it brings no increase in sums received by the farmer!' Thus, in the United Provinces as a whole, in the year 1932, the prices of 'gur' went down from Rs. 4 to Rs. 1. 10as. a maund, a price unheard of before, mainly due to increased production besides other causes. In the year 1933-34 cultivators in Meerut District got only Rs. 2. 8as. per maund for their 'Gur' and prices for sugarcane which the cultivators received ranged from 3as. to 4as. 6p. only per maund during the main part of the season. These prices are below the actual costs of production even according to the official estimates. Increased yield per acre has so far been accompanied by a more than proportionate fall in the prices of sugarcane and unless it is stopped 'the constant suc-

cession of improvements may keep the farmer permanently underpaid.' It is satisfying to note that the Government, by fixing minimum prices of sugarcane to be given over to the cultivators by the various factories, has combated the evil to a certain extent.

Among cereals, wheat has shown the largest progress. The area under wheat in the district was 366,992 acres in 1932-33, out of which 29,350 acres were under improved varieties. The problem of improvement was to have in the same variety high yielding power, high grain quality, rapid growth, strong straw and a fair degree of rust-resistance. The new varieties are high-yielding in their capacities as seen from the results obtained at the Government farms under expert superintendence. But the cultivator has still to learn the art of obtaining similar results; and before he can grow a bumper crop out of these varieties he will have to modify his practices of irrigation and cultivation. Sometimes he has not been able to draw any benefit owing to the climatic conditions of the region. So Ch. Mukhtyar Singh stated before the Royal Commission on Indian Agriculture that "in some fields they (*i.e.*, Pusa 12 and Pusa 4) are very good, in some fields they are not; you cannot be sure that Pusa 12 will do well everywhere; it may fail miserably in many places. The main demerit of Pusa varieties is that they have a very brittle connexion between the ears and stalks; " they fall down very easily and have to be cut down early when they are not properly ripe. Under these circumstances the yield has not increased to any appreciable extent. As a result of inquiries made in several villages it may be

asserted that cultivators are getting 10 to 17 maunds per acre from the old varieties according to the conditions of soil and weather on irrigated land. The maximum yield is still higher than this. With improved varieties the results have been almost similar, and as the cultivator is still ignorant of the art of cultivation of improved varieties, the maximum has been much below then for the indigenous variety. To illustrate, we give below the yields obtained by Ch. Shiam Singh at his Pilokhari farm in Meerut in the year 1933-34 which are representative of the district :—

Yield from indigenous variety—17 maunds
20 seers per acre.

Yield of improved varieties—20 maunds per
acre.

It may be mentioned here that he had the advantage of expert supervision which the average cultivator cannot afford. Moreover there was the increase of expenditure in the seed item, as seed for improved varieties was obtained at a high price. From one maund to one maund and ten seers of grain is required for sowing an acre. Improved variety in the year 1933 could be obtained at sowing time at the rate of 10 seers per rupee whereas the price of ' desi ' wheat was 16 seers per rupee. Thus in sowing an acre of improved variety there was an average extra expenditure of nearly Rs. 2 per acre. The increased yield in many cases does not even balance the additional expenditure and unless the average cultivator is taught the method of growing improved varieties they cannot be long

in the field after a few years of trial. A decline has already set in:—

Area under improved varieties of wheat in Meerut District

Quality	1926-27 Acres.	1928-29	1930-31	1931-32	1932-33	1933-34
Pusa 12 ...	1,350	351	1,388	4,250	2,736	nil
Pusa 4 ...	60	141	401	2,418	6,194	3,089
Punjab 8A ...	...	595	2,865	3,250	6,853	4,618
Wheat C 13 ...	...	...	125	410	1,011	nil
Wheat C 46 ...	...	...	...	29	107	nil
Wheat M. Nagar.	1,520	1,745	4,580	7,790	12,437	10,799

A comparison of the last two years shows a great decline which must sooner or later be remedied.

In the case of cotton, climatic factors and marketing conditions have checked the progress of improved varieties, which are more susceptible to the vicissitudes of the easterly winds that blow in September. Even on the Government farm in Meerut in the year 1933-34 the cost of production came to Rs. 52 12as. 6p. per acre whereas the income amounted to only Rs. 43. 12as. 2p. Meerut is naturally not a cotton-producing tract and so the introduction of improved varieties has not been a success. Either the increase of area under new varieties of cotton has been very slight or the area has declined from year to year.

	1929-30	1930-31	1931-32	1932-33	1933-34
American varieties	300	200	nil	400	nil
Cotton C 402	...	391	46	73	nil
Cotton C 520	...	...	84	648	373
Cotton A 19	1183	1330	1500	2208	1802

We have indicated above the tendency that either improved varieties have not been successful or else owing to certain other factors the increased yield has not meant a marked rise in the rural prosperity. Now it may be asserted that they have in no case given greater immunity from famines but there is testimony on record that liability to droughts has increased.

		Wheat		Sugarcane		Cotton	
	Increase or deficiency in rainfall	% of improved variety	Outturn as compared with normal	% of improved variety	Outturn as compared with normal	% of improved variety	Outturn as compared with normal
1925-26	+3.00	3	75	4	95	5	70
1926-27	-2.70	9	80	10.3	95	4	75
1927-28	+3.46	7	100	13.4	75	5	80
1928-29	-13.60	7	60	17.4	70	1.5	75
1929-30	-9.65	1.8	95	12.7	75	2.3	60
1930-31	-5.38	2.7	80	20.9	45	2.8	85
1931-32	-1.98	4.8	60	78.2	85	2.4	70
1932-33	-0.62	7.9	75	71.4	85	7.1	75

It seems that there is a closer correspondence between the outturn of the improved crops and rainfall and the implication appears to be that the local varieties were more drought-resistant. For instance, in the year 1926-27, even when the rains almost failed in September and October, being only 1.91 inches, a condition which threatens the rabi crop, the outturn of wheat could be 80. But with more favourable conditions in the years 1931-32 and 1932-33 it was 60

and 75 respectively. One cause among others certainly was the increased percentage of improved varieties in the later years. Similar tendencies are clearly discernible in the cases of sugarcane and cotton. It seems astounding that the seed varieties which have proved more drought-resistant at Government experimental farms should ultimately turn out to be less drought-resistant in actual practice. But the reasons are not far to seek. In the case of sugarcane it is mainly the ratoon crop which is responsible for such adverse conditions. Still the cultivator adheres to ratooning, even though he realises that it will not stand an adverse season, simply because he thinks that after making allowance for the charges of seed and for sowing it, the resultant yield of a new crop will not be much higher than that of a successful ratoon, as we have previously shown. But to us the most important cause of great proportions of ratoon crop seems to be the great poverty of our cultivators. Generally, they do not possess any money to purchase seed for a new crop and hence when they leave any cane crop unratooned, they feel as if they are losing something which they could possibly save. This practice of ratooning without sufficient quantities of manure has made a heavy demand on soil and this progressive exhaustion of soil-fertility is continually throwing our cultivators on the mercy of nature alone. With regard to wheat particularly and also with reference to sugarcane we may say that the primitive methods of our cultivation are not suitable to the modern varieties. This mal-adjustment is no less responsible for the new varieties to have proved less

formidable against adverse climatic conditions. Lastly, in the case of cotton nearly every new variety is inadaptably to the soil and climate of the district. So it is that there has been a constant succession of varieties of cotton-seeds, one after another, but none could stay. Above all, as we shall indicate in our next chapter, the popularisation of improved varieties and the larger area devoted to the production of particular crops have so adversely affected the soil that now in case of every crop it responds much more to weather agencies than it previously did.

CHAPTER V

IMPROVEMENT OF MANURIAL ECONOMY

Amongst the modern improvements in agriculture nothing perhaps is more striking by its unpopularity among the Indian peasants than the mode and extent of 'artificial' manuring. It might be due to the extreme poverty of our cultivator or his lack of enterprise might have proved a stumbling-block in the way. But he has certainly discarded this valuable auxiliary as unfit for his soil and beyond his resources. Generally speaking, all attempts to solve the manurial problems of India by introducing the conventional methods of the west have proved a failure. Outside the estates of large landholders (for whom agriculture is an expensive hobby) and the Government farms, the consumption of artificial manures is negligible. Mr. Howard holds that this want of success is largely due to the fact that artificial manures do not supply what the Indian soils really need, namely, fermented organic matter in a finely divided condition. The figures on the next page from the Meerut District bear testimony to the above state of affairs :—

Statement showing the distribution of artificial manures in the Meerut District

Year	Issued by the	Mahwa cake	Castor cake	Bona Meal	Am. Sulph ¹	Sanai	Neem	Cake	Nitro. Phos.	Amonia Phos.	Nitrate of Soda
		Md.Sr. Ch.Md	Sr. Ch.Md	Sr. Ch.Md	Sr. Ch.Md	Sr. Ch.Md	Sr. Ch.Md	Sr. Ch.Md	Sr. Ch.Md	Sr. Ch.Md	Sr.Ch.
1926-27	Agr. Dept. Private	...	...	...	350 0 0	...	...	...	...	...	...
1927-28	Agr. Dept. Private	...	2 0 0	...	20 0 0	...	...	...	...	...	...
1928-29	Agr. Dept. Private	...	...	...	162 0 0	...	200 0 0	...	...	33 0 0	0
1929-30	Agr. Dept. Private	...	...	...	41 0 0	...	...	...	...	...	...
1929-30	Agr. Dept. Private	...	...	...	9 20 0	...	20 0 0	...	...	25 0 0	0
1930-31	Agr. Dept. Private	...	...	...	36 0 0	...	...	...	...	42 10 3	0
1931-32	Agr. Dept. Private	900 0 0	...	500 0 0	220 0 0	...	500 0 0	...	2 0 0	27 0 0	0
1932-33	Agr. Dept. Private	...	...	400 0 0	93 0 0	...	1000 0 0	5 0 0	2 0 0	...	...
1933-34	Agr. Dept. Private	...	...	860 0 0	330 0 0	7 0 0	...	...	...	...	...
	Agr. Dept. Private	...	...	...	35 0 0	20 0 0	...	...	...	...	...

¹ During the last two years the quantity under this head has increased manifold.

As a matter of fact 'sanai' cannot be included in the list of artificial manures and the figures here do not convey a true picture, for there are many acres of land under this crop as green manure. The above table on the whole indicates that artificial manures have not achieved any success and their consumption is slight and spasmodic; and this too only by big farm-owners, working under the guidance of the Agricultural Department.

The Indian farmer was not and is not ignorant of the advantages of manuring for either restoring the exhaustion of the soil caused by constant cultivation, or improving his land. He understands quite well that from every cultivated crop the soil sustains a loss proportionate to the abundance and richness of the produce and unless an equivalent is returned to the soil in the shape of manure, the fertility of land decreases. There is a natural give and take between man and nature and we cannot easily afford to overlook it for ultimately land should have its revenge if man does not fulfil his obligation. He was more mindful of restoring this loss fifty years ago than he is to-day, when the necessity has become more urgent. Perhaps the rotation of crops which he practised in the nineteenth century was the best insurance against such exhaustion. The average fertility of the land was maintained by allowing the fields to remain periodically fallow, or by sufficient use of manure when exhausting crops like wheat and sugarcane were raised, or again, by a judicious system of rotation of crops. In 1893 fallowing was reported to be quite well known and extensively practised by the culti-

vator; but it has been continually reduced by the pressure of population on the land. In the year 1932-33 current fallow was only 32,538 acres whereas the net area cropped during the year amounted to 1,095,679 acres. Thus it was only 2.9 per cent of the net cropped area. This is a very unsafe margin considering that in the district more than one-fourth of the cultivated area is double-cropped and that nearly 50 per cent is occupied by exhausting crops like wheat and sugarcane alone.

But much more important than this was the rotation of crops in the past. The cultivator mainly relied on this and mixed cropping for the success of his farm. Dr. Voelcker reported the following rotations in North-West Provinces which were much in vogue in the year 1893 :—

Example No. 1

	Plot No. 1	Plot No. 2	Plot No. 3	Plot No. 4
1st Crop	Indigo	Barley & Peas	Fallow	Wheat
2nd Crop	Barley & Peas	Fallow	Wheat	Indigo
3rd Crop	Fallow	Wheat	Indigo	Barley & Peas
4th Crop	Wheat	Indigo	Barley & Peas	Fallow

Example No. 2

1st Crop	Millet	Fallow & green crop	Wheat &c.
2nd Crop	Fallow (green crop ploughed in)	Wheat &c.	Millet
3rd Crop	Wheat or other winter cereal	Millet	Fallow

Thus land was made to lie idle to recuperate its lost energies once in every three or four seasons. Moreover, cereals followed legumes or were sown after the land had been fallowed. A decade afterwards we get the testimony that if the land be irrigated, one-third of a cultivator's holding is allowed by him to lie fallow for one harvest in the year; but if the land is solely dependent on the rainfall, only one crop is annually produced. Starting with an irrigated plot and with wheat as the first crop, the kharif crop will be maize or bajra, with gram in the ensuing winter. Then will come cotton, and in the following harvest the land will lie fallow. Then sugarcane, which takes up the best part of the year, followed by a light kharif crop grown as fodder (District Gazetteer, Meerut). The rich and exhausting crops never came in immediate succession but were preceded and followed by fallow or some light crop. In the year 1904 the general rule was that land must lie fallow for at least one harvest in three years where there was ample irrigation, while in dry land the period of lying fallow recurred more frequently. For half the fallow season the land remained as it was after harvest, and then the land was ploughed usually in two ploughings. This obviated the necessity of manuring. Owing to the growth of natural herbage, which a fallow facilitates, the surface soil becomes enriched, by the accumulation of organic matter derived by such plants from water and from atmosphere, and further by any valuable mineral substance in the subsoil region being brought up to the surface. Thus the purpose of fresh manuring is quite well

served by a fallow as both the organic matter and the mineral constituents get mixed up in the surface soil through this process. Green manuring is also based on this very principle. However, at present the conditions have changed with the result that even the most popular rotations do not provide for any such natural renovation of the exhausted soil. We may mention the following rotations which are generally practised :—

	5 years' rotation	2 years' rotation	3 years' rotation	3 years' rotation
1st crop ...	'Savni' ...	'Savni, ...	Cotton or maize	Juar and Millet
2nd crop ...	Sugarcane	Gram ...	Sugarcane	... Sugarcane
3rd crop ...	Ratoon ...	Fallow ...	Fallow	... Fallow
4th crop ...	Ratoon ...	Wheat ...	Wheat	... Pulses
5th crop ...	Fallow ...	...	...	... Barley and Peas
6th crop ...	Wheat			

'Savni' includes Juar, Bajra, Mung, Moth, Urd or other early maturing kharif crops like 'savni.' Sugarcane is followed by a fallow of about 3 months as it is usually harvested by March, whereas the next crop (if it is 'savni') is sown in June or July. Another universal practice is to sow wheat after a fallow of at least four months and thus if wheat is sown after sugarcane there is a clear fallow of at least eight or nine months. But it is not very uncommon to have two crops in the same year and though more or less fallowing is still practised yet, owing to the spread of sugarcane and due to the great proportion of ratooning, it is no more possible to have that scientific rotation of cereals after legumes which was

so helpful in providing those constituents which a previously raised crop exhausted. Rich and exhausting crops now come in succession, *e.g.*, sugarcane and ratoon or maize and sugarcane. Thus our rotation has now become less responsive to the conditions of the soil and is more or less guided by the economic motive of raising more of commercial crops rather than of restoring the impaired fertility of land. With manuring, cultivators raise three crops in a year.

	Plot A	Plot B	Plot C
1st crop	... Maize	Maize	Arvi-Corn
2nd crop	... Potatoes	Turnips, etc.	Potatoes
3rd crop	... Tobacco	Tobacco	Onion

As already pointed above, in addition to these preliminary steps, farm-yard manure was usually used in the cultivation of heavy crops. It was a sort of fermented mixture of the solid and liquid excreta of domestic animals and various kinds of litter obtained by storing in a pit in an outside corner of the livestock building. Urine was carefully stored in beds of waste herbage and grass, efficiently prepared for the comfort of the animal. But as with increasing population man and animal are huddled together in the same stud or house, it is clear that in a majority of cases now there are no separate buildings for farm purposes. Consequently farm-yard manure is now collected in open pits outside the village habitation. The whole work is now entrusted to the village sweeper and one can well see what manure can be collected for the village by an only individual, who has no direct interest in its accumulation. It is also strange that,

according to the usages in this district, the sweepings of the ' riyaya ' (*i.e.*, a person living on another man's land and though not paying any rent for it has got certain obligations and duties to the landholder) do not belong to him but are the property of the landlord who disposes them in any manner he likes. As ' riyaya ' originally was not a cultivator as he is to-day, this system must have developed to avoid waste of any of the sweepings of the village. But now it does not suit the changed conditions and needs an immediate revision. Above all, cow-dung which is so rich in mineral constituents, essential for the development of a plant, is burnt as fuel.

Chemical Analysis of Cow-dung

Nitrogen	...	0.5 per cent.
Phos. Acid.	...	0.25 „
Potash	...	0.67 „

The extreme poverty of the people which urges them to sell it in the form of cakes, and to use it as fuel for want of any other substitute, is directly responsible for such a heavy loss.

Chemical Analysis of Cow-dung Cakes

Nitrogen	...	0.81 per cent.
Phos. Acid.	...	0.28 „
Potash.	...	0.95 „

Thus, by burning 100 maunds of cakes we waste 32 seers of nitrogen, 9 seers of phosphoric acid and 37 seers of potash. The restoration of a few acres of waste as common land near every village for growing wood for fuel may go far to solve this difficulty.

Another great quantity of these valuable matters is lost in out-pits where they are stored, as they are too much exposed and thus the loss incurred during fermentation is much more than it ought to have been.

Experience tells us that the utilization of crop residue alone is sufficient to maintain the fertility of the soil. By the methods much in vogue in China, Korea and Japan, the various plant residue are converted into finely divided organic matter with which heavy crops are raised without injuring the natural fertility. Thus Ch. Mukhtyar Singh, Manager, Daural Sugar Works, obtained in his village continuously for 20 years successive crops of sugarcane without lowering the yield simply by giving to the soil the residual wastes of the crop in some form or other. When 'gur' is locally made in a village the residue of cane, either in the form of ashes, 'khai' (the dry part of sugarcane after extracting the juice) or leaf and fodder waste generally after having served as a bed for the cattle, goes back to the field. But when cane as a whole is given in a factory, cultivators can no more utilize its residue. Consequently, while determining whether a cultivator receives a fair price or not, we should not consider it in terms of juice and 'gur' alone but should add something more for so much of the nitrogen and other constituents which are indirectly handed over to the mill-owner to the detriment of the soil fertility which results in the decreased outturns of the other crops which follow sugarcane.

Moreover, the raising of commercial crops on a larger and larger scale must put an increasing burden

on the soil as experts have estimated that crops like wheat, sugarcane and maize extract more out of the soil than millets and pulses. The following figures are of importance in this connection :—

Meerut District

Wheat		Sugarcane		Maize.	
	Acres		Acres		Acres
1860	2,70,000	1860	73,643	1860	46,680
1890	2,76,200	1902	1,15,411	1890	82,500
1920	3,48,729	1923	1,47,608	1920	1,22,622
1933	3,66,992	1933	1,54,320	1933	1,06,133
1936	3,40,743	1936	1,66,343	1936	1,01,781

These exhausting crops have rapidly increased and thus to-day our soil is more in need of manures than it was about 80 years ago. Not only has the demand on soil increased but manure supply has continually decreased as we have seen above. Certain crops that directly improved the fertility of the soil (*e.g.*, indigo) have now become extinct.

	1860	1890	1903	1920	1932-33
Area under Indigo ...	2,700	15,000	7,430	1,394	98

We do not mean to suggest that all or any part of it was used as green manure, but the advantages of growing such crops cannot be ignored in such a discussion.

Another heavy demand on the soil came from the practice of double-cropping.

Percentage of double-cropped area of the net cultivated area

1860	1902	1923	1933	1934—37
4·5	22 nearly.	23·5	25·4	28·6

It must have surely meant a more rapid exhaustion of the soil. Thus for the last 80 years tendencies were at work which decreased our manurial supply and at the same time increased the demand on soil, for now we extract more of nitrogen and other valuable mineral constituents from it. Even the introduction of improved varieties may be looked on with apprehension in this connection for their popularity, without an efficient system of manuring, greatly reduces the natural fertility of the soil. Seed works in the soil like a spade in a coalfield and the more it yields of a crop from an acre the more must be the extraction of the mineral substances and nitrogen from the soil unless the improvement in seed is accompanied by a corresponding rise in the standard of cultivation and an increase in the quantity of manure applied. We may substantiate it by the following illustrations:—

Chemical Analysis of Wheat

		Corn	Stalk
Nitrogen	...	1·8 per cent.	0·45 per cent.
Phos. Acid.	...	0·8 „	0·22 „
Potash	...	0·5 „	0·62 „

Generally speaking, a wheat crop has one proportion of corn and two of stalk and consequently in raising 1000 seers of wheat we extract the following quantities from the soil:—

Nitrogen—27 srs. Phos. Acid—124 srs. Potash—174 srs.

However, if double the same crop is raised from the same area without any extra manuring or improve-

ment in surface tilth we exhaust the soil by double this amount. Consequently though our improved varieties may give for the time being higher returns, a tendency will sooner or later operate which will scourge back their yield to the level of the local varieties as already there has been a decline in the yield of the indigenous crops which are raised after harvesting these improved varieties.

As a combined result of all these factors the soil has declined to yield to the increasing demands made upon it and though population is increasing our agricultural progress has received a setback. The following may be mentioned as definite instances of this phenomenon :—

*Percentage of double-cropped area in the
Meerut District*

1860	1902—06	1906—10	1910—14	1914—18	1918—22	1922—26	1926—30	1930—33	1934—37
4.5	23.3	24.6	26.7	32.8	26.6	27.6	27.3	26.7	28.6

Thus we see that after the year 1918 the percentage has been gradually declining, indicating that many of the fields now refuse to mature profitably a double crop. Many fields are now refusing to bear any crops at all and consequently, year after year, the area classified as culturable waste other than current fallow is increasing. Figures about Meerut District are :—

	1914-15	1919-20	1924-25	1929-30	1932-33	1936-37
	Acres	Acres	Acres	Acres	Acres.	Acres
Culturable waste	1,66,854	1,77,006	1,74,268	1,80,168	1,76,763	1,69,849

Thus more than 10 thousand acres have been lying unused due to the exhaustion of the soil.

Besides, the yield of the various crops has a tendency either to fall or to remain stationary. Sugar-cane and cotton perhaps are the only exceptions and their yields are increasing not because more manure is applied in their cultivation but due to the fact that a rise in the yield has been achieved by increased proportion of the area under improved varieties of these crops which thus now extract more out of the soil. That wheat has not shown any rise at all despite improved varieties is clear proof of the fact that improvements in the seed of wheat have not been great with the result that even with the aid of the new varieties the outturn per acre has declined. Such tendencies are not restricted to any particular district but our statement applies to the whole of the United Provinces as is clear from the figures we have worked out in this connection from the season and crop reports. Such conditions predict that as a result of continued cultivation without an adequate supply of manures our soils have suffered a gradual decline in fertility as a result of which the yield of the various crops is declining except where it is checked by resorting to improved varieties which under existing conditions further reduce the outturn of the crops that follow in rotation.

Even the average yield of sugarcane in the province, whose production has recently been improved to a great extent by replacing the indigenous varieties by new improved types, is between 325 and 400 maunds per acre. This, the experts tell us, is at

least 50% lower than could be obtained by proper use of organic manures and materials, which the cultivator can easily utilize; and a cent per cent less than could be raised with a rational use of concentrated fertilizers in addition.

Total produce and average yield of the principal crops during the last sixteen years in the United Provinces

	Gram			Rapeseed			Wheat		
	Area cropped in acres	Total calculated outturn in tons	Average yield per acre in lbs.	Area cropped in acres	Total calculated outturn in tons	Average yield per acre in lbs.	Area cropped in acres	Total calculated outturn in tons	Average yield per acre in lbs.
1921-22	6,058,194	2,114,000	782	155,356	32,000	461	6,809,462	26,73,000	879
1922-23	7,121,417	2,543,000	799	118,594	25,000	472	6,992,676	25,77,000	826
1923-24	6,355,575	2,307,000	813	165,231	34,000	461	7,182,242	26,40,000	823
1924-25	6,816,670	1,987,000	653	142,999	23,000	438	7,402,213	2,424,000	784
1925-26	6,641,267	2,070,000	849	143,941	24,000	380	6,883,412	2,287,000	744
1926-27	6,011,938	1,772,000	660	143,061	28,000	424	6,714,010	2,492,000	831
1927-28	5,931,374	1,501,000	567	171,344	18,000	235	7,467,333	2,361,000	708
1928-29	5,424,125	1,065,000	439	539,469	42,000	280	7,112,219	2,480,000	781
1929-30	4,207,504	1,247,000	664	215,401	44,000	434	7,182,021	3,309,000	1032
1930-31	5,102,436	1,402,000	615	240,060	31,000	289	7,611,456	2,686,000	790
1931-32	5,685,928	1,560,000	614	272,785	48,000	394	7,748,285	2,610,000	755
1932-33	5,398,572	1,398,000	580	327,170	57,000	390	7,667,097	2,713,000	793
1933-34	5,299,697	1,276,000	540	219,428	31,000	316	8,452,609	2,537,000	661
1934-35	5,509,904	1,525,000	616	206,330	30,000	313	7,548,926	2,523,000	748
1935-36	5,679,540	1,718,000	677	248,091	46,000	417	7,052,683	2,498,000	792
1936-37	6,444,985	1,917,000	669	279,840	41,000	333	7,484,388	2,532,000	759

Total produce and average yield of the principal crops during the last sixteen years in the United Provinces

	Juar		Average		Bajra		Average		Maize		Average	
	Area	Total	yield per	lbs.	Area	Total	yield per	lbs.	Area	Total	yield per	lbs.
	Cropped	calculated	acre in		Cropped	calculated	acre in		Cropped	calculated	acre in	
	in acres	outturn			in acres	outturn			in acres	outturn		
		in Tons				in Tons				in Tons		
1921-22	2,683,556	647,000	540		2,662,093	556,000	468		2,074,625	815,000	880	
1922-23	2,270,313	486,000	479		2,346,585	461,000	440		1,872,719	598,000	715	
1923-24	2,478,659	598,000	540		2,332,540	458,000	440		1,834,924	766,000	935	
1924-25	2,047,271	411,000	450		1,789,304	330,000	413		1,550,399	533,000	770	
1925-26	1,939,655	397,000	447		1,574,128	270,000	379		1,612,212	554,000	770	
1926-27	2,301,008	524,000	510		1,909,452	445,000	522		1,678,838	660,000	881	
1927-28	2,445,729	557,000	510		1,921,438	401,000	467		1,861,752	777,000	949	
1928-29	2,263,936	334,000	326		1,972,912	266,000	302		2,003,546	689,000	770	
1929-30	2,468,771	643,000	583		2,127,632	366,000	385		2,327,237	914,000	880	
1930-31	2,509,071	538,000	480		2,024,411	398,000	440		2,374,510	933,000	880	
1931-32	2,619,023	526,000	450		2,150,162	343,000	357		2,115,507	833,000	882	
1932-33	2,380,558	497,000	468		2,184,789	429,000	439		2,137,083	751,000	787	
1933-34	2,631,740	493,000	420		2,141,148	379,000	395		2,023,052	695,000	767	
1934-35	2,240,862	450,000	448		2,158,876	451,000	468		2,121,431	796,000	845	
1935-36	2,236,877	449,000	418		2,292,370	457,000	445		2,120,410	808,000	851	
1936-37	2,122,015	426,000	449		2,045,570	372,000	406		1,964,724	534,000	608	

Total produce and average yield of the principal crops during the last sixteen years in the United Provinces

	Sugarcane			Cotton		
	Area cropped in acres	Total calculated outturn in tons	Average yield per acres in lbs.	Area cropped in acres	Total calculated outturn in tons	Average yield per acre in lbs.
1921-22	1,151,255	1,116,000	2170	807,543	43,000	119
1922-23	1,349,188	1,337,000	2220	645,938	32,000	111
1923-24	1,513,902	1,628,000	2362	638,698	37,000	132
1924-25	1,291,097	1,051,000	1923	1,034,627	49,000	106
1925-26	1,418,964	1,407,000	2221	990,099	49,000	111
1926-27	1,613,139	1,675,000	2338	795,859	46,000	118
1927-28	1,585,037	1,517,000	2144	630,073	35,000	124
1928-29	1,344,559	1,207,000	2011	701,477	45,000	143
1929-30	1,348,928	1,297,000	2154	916,548	51,000	124
1930-31	1,488,419	1,543,000	2322	822,273	56,000	152
1931-32	1,576,280	2,199,000	3125	739,640	37,000	112
1932-33	1,773,211	2,564,000	3239	515,659	30,000	130
1933-34	1,713,183	2,801,000	3662	805,219	47,000	123
1934-35	1,813,230	2,710,000	3349	705,241	34,000	109
1935-36	2,211,932	3,275,000	3315	587,769	35,000	138
1936-37	2,464,527	3,770,000	3427	691,810	31,000	100

To stop this marked deterioration of our soils, every form of crop residue must be utilized if we are doomed to use cow-dung as fuel. By the application of Chinese compost at the rate of ten carts per acre the yield of cotton at the Institute of Plant Industry, Indore, has been more than doubled. We see no reason why India should not adopt the same methods as are practised in China and Japan to check this rapid exhaustion of her soil. The crop residues, weeds, leaves, jungle grass and the like are at the disposal of the cultivator in enormous quantities. But so far the cultivator has not availed of these as he is ignorant of the methods of converting these into compost. He has found the Howard or the Indore process—the only method which has been brought to his door—too complex and laborious for him. He requires a simpler and easier method to suit his capacity. Secondly, we should have more judicious systems of rotations of crops and in this respect crop-planning must be the chief objective of every improvement. Finally green manuring and a greater popularity of fallowing will be in the best interests of our cultivators and safeguard them against the slowly growing barrenness of the district. In this connection we may point out that a slight remission in rents of the fields lying fallow or bearing crops for green manuring for that particular season alone will help much and is the only method of the popularisation of such useful schemes.

CHAPTER VI

EFFECTS OF CANE CULTIVATION

As we have already noticed, the cultivation of sugarcane crop has shown an extraordinary increase during the past century. It is on record that in 1807 the Collector of Saharanpur, which then included Meerut, Muzaffarnagar and a part of Bulandshahr as well as the present district of that name, wrote :

“ It is estimated that 22,000 bighas are under sugarcane cultivation; thus this cultivation is already considerable, and that it has not increased to a far greater extent is solely owing to the indigence of the cultivators; nor does the cane which is now produced yield all the advantage of which it is capable, being for the most part made into ‘ gur ’ and exported to Jaipur and other trans-Jumna states; very little indeed is refined and manufactured into sugar.”

But there have been phenomenal changes since then not only in the area under cultivation but to a very great extent in the art and practice of growing and disposing of it. In the year 1860 the area under the crop in Meerut District alone had increased to 73,643 acres or over 7 per cent of the cultivation. About

the end of the last century it had risen to 9.97 per cent of the net cultivated area; the area in 1902 was 115,411 acres or over 11 per cent of the total cropped area; and in the year 1936-37 the area under sugarcane amounted to 174,445 acres. Out of this, nearly the total area is under improved varieties and even assessing as low a figure as 40 per cent as the increase of these improved varieties over 'desi,' the cane area of to-day measured in sugar and 'gur' productivity and expressed in 'desi' cane is not an increase of 100,802 acres only; but, is in reality equivalent to 244,223 acres, over the area of 'desi' cane of 1860 and thus implies an increase of nearly 170 per cent within 74 years. For the purposes of our study this time of expansion of sugarcane may be divided into three periods, *i.e.*,

1. From 1860 to the end of the last century—
a period of canal development.
2. The first decade of the present century.
3. From the ear 1911 up to the present day—
a period of rapid improvement of sugarcane varieties.

During the first period, the extension of sugarcane is chiefly due to the canal-development for canal-water exercises a peculiarly beneficent influence on the crop. During this period the net cultivated area had increased from 1,043,515 acres to 1,066,763 acres. But this slight increase of 23,248 acres cannot wholly account for a general expansion of the areas under various crops marked throughout this period.

Statement showing the agricultural expansion in the latter half of the 19th century

Crop.	Area in Acres (1860).	Average for 1896—1901.	Variation Acres.
Sugarcane	... 73,000	103,000	30,000
Maize	... 46,680	82,500	35,820
Rice	... 17,000	35,000	18,000
Wheat	... 270,000	276,200	6,200
Mixed Wheat	... 70,000	160,000	90,000
Indigo	... 2,700	15,000	12,300
Juar	... 179,000	Nearly same	Nil
Bajra	... 47,000	16,000	—31,000
Cotton	... 89,900	58,200	—31,700
Barley	... 58,800	40,500	—18,300

There was an increase of 30,000 acres in the area under sugarcane alone and there can be no doubt that cotton, which declined nearly to the same extent, had been supplanted by sugarcane; though the depression in the cotton industry was mainly responsible for the great decline of the area under cotton. However, it may be asserted that the other crops could find a field for expansion owing to the large increase in the double-cropped area which rose from 46,000 acres to 232,000 acres. Thus, it may safely be concluded that during this period cultivation became much more intensive than before. But the development of a judicious system of rotation of crops saved the soil from exhaustion and the expansion of sugarcane, one of the most exhausting crops, did not impair the ferti-

lity of the soil. The practice of fallowing the land after and before a sugarcane crop was almost universal and consequently any increased burden on the soil was mitigated by the rest which the land enjoyed to recuperate its lost properties. Even as late as 1902 we find the relics of this system in the account that after cotton ' in the following harvest the land will lie fallow. Then sugarcane, which takes up the best part of the year, followed by a light kharif crop grown as fodder ' (District Gazetteers of U.P., Vol. IV). We may end our account of this period by stating that the extension of sugarcane crop meant a definite rise in the prosperity of cultivators, a rise in the standard of disposing the produce accompanied by a saving of much waste, as the old stone and timber presses were universally replaced by the iron cane-crushing mills, which were generally hired by several cultivators jointly from persons keeping a large stock of them. The expansion meant greater hands in agriculture and thus met the needs of the time, as we know it for certain that sugarcane cultivation and the manufacture of ' gur ' employ more hands than the maturing of any other crop and its harvesting.

During the first decade of the present century, the area under sugarcane again increased by about 25,000 acres—figures for the year 1909-10 being 128,016 acres. Cotton showed signs of expansion and the area under maize increased by nearly 27,000 acres. Bajra gained its lost ground and occupied 30,000 acres more than it did in the year 1900 and perhaps occupied the place of Juar which declined to a great

extent. However, this period coincided with the time of the decline and gradual extinction of the indigo industry in the district. The area under it was only 398 acres in the year 1910-11 and thus the decrease amounted to about 14,600 acres. Out of this a greater part must have been occupied by sugarcane. But the vast expansion of both the kharif and rabi crops in this decade was true of all crops and we cannot assert that one particular crop yielded place to another. The fact is that the net cultivated area increased by 68,264 acres and as the current fallow did not increase in the same proportion it was but natural that the double-cropped area increased from 232,000 acres to 277,499 acres. Thus, lighter crops began to be sown on inferior plots and the richer fields were more intensively cultivated. The outcome was a gradual change in the rotation of crops and the farmer in some cases thought it worth while to grow a light kharif crop before planting sugarcane in the subsequent season. Thus the period of fallowing began to decrease and the soil was more heavily taxed.

It was in the third period of its expansion that it came to be realised that sugarcane cultivation is not an unmixed blessing. The area under sugarcane increased from 128,016 acres in 1909-10 to 174,445 in 1936-37 and this amounts to an increase of nearly 50,000 acres under the crop within a period of 27 years. However, contrary to previous decades, it was not marked with the general agricultural progress as the net area cultivated actually declined from 1,135,027 acres in 1909-10 to 1,090,795 in the year

1936-37. The area cropped more than once also declined though not to a very great extent. Under such circumstances the increase of any particular crop must positively mean a decrease in the area under some other crop or a group of crops. The following have been the fluctuations in the area under the principal crops in the Meerut District during the time :—

Crop.		1910-11. Acres.	1936-37. Acres.	Variations. Acres.
Wheat	...	392,949	339,521	—53,428
Barley	...	64,987	41,277	—23,780
Maize		115,104	96,954	—18,150
Gram	...	206,175	191,893	—14,282
Cotton	...	76,509	51,971	—24,538
Tobacco	...	4,162	3,060	—1,102
Fodder crops		172,485	182,996	+10,511
Sugarcane	...	131,063	174,445	+43,382
Rice	...	7,622	22,215	+14,593
Juar	...	93,798	108,383	+14,585
Bajra	...	34,271	48,457	+14,186
Hemp	...	325	5,850	+5,525

There is a clear indication of the fact that most of the heavy and exhausting crops have declined yielding place to light crops such as Juar and Bajra. The case of sugarcane is peculiar, which has steadily expanded like wildfire. These tendencies bear sufficient testimony to the fact that overworking of the

soil has impaired the natural fertility with the consequence that some fields which previously were full of crops are now barren wastes and still others are on the point of exhaustion. These have been the effects of raising an exhausting crop like sugarcane continuously in the past and the present without any well-planned system of rotation of crops as we have noticed elsewhere. No doubt, in a greater part cotton has been supplanted by sugarcane, but above all it is deplorable that sugarcane has a tendency to drive even wheat out of the field. In Meerut District it was found that in the year 1926-27 there were 212,950 acres under irrigated wheat as compared to 246,733 acres in 1925-26. This implied a decrease of 33,783 acres of irrigated wheat during the year 1926-27. There was a fall of the area under unirrigated wheat also (1,31,560 acres in 1926-27 and 131,988 acres in 1925-26), but the decrease was very slight being only 428 acres and it can be explained by the fact that heavy rains prevented the proper preparation of the seed-bed for pure wheat and hence crops capable of standing rough cultivation were extensively sown. But in the case of shrinkage of the area under irrigated wheat the more important fact is that there was an increase of the area under sugarcane in 1926-27 as compared with that in 1925-26. An increase of 22,020 acres under sugarcane during 1926-27 over the area of 1925-26 may well account for the decrease in the irrigated wheat area as sugarcane is largely grown under irrigation. Variations in the area under sugarcane are followed by inverse changes in the area under irrigated wheat :—

*Variations in the area as compared with the
previous year*

	Under	
	Irrigated wheat.	Sugarcane.
1926-27	—33,783 acres.	+22,020 ac es.
1927-28	—14,412 „	+3,542 „
1928-29	+82,280 „	—38,283 „
1929-30	—47,774 „	+8,272 „
1930-31	—3,090 „	+4,013 „
1931-32	+2,018 „	—19,721 „
1932-33	+5,581 „	+32,011 „
1933-34	+145,431 „	—15,627 „
1934-35	—58,925 „	+14,325 „
1935-36	+6,684 „	+13,325 „
1936-37	—1,222 „	+8,102 „

Thus the rich commercial crops are yielding ground to sugarcane which now occupies the best irrigated portions of the district. But undoubtedly this change has not been in the best interests of the cultivators. If we take into consideration the percentage of improved varieties, the cane area of to-day has increased enormously as compared with the old ‘ desi ’ cane of nine years ago. The effects can well be realized from the following words of Mr. Allan :—

“ It is difficult to conceive how this can mean anything but over-production and, what is more important, over-production of an exhausting crop against which the average grower is not returning, and indeed can-

not afford at present prices to return, to the land the equivalent which he is selling off very often at prices well below the true cost of production."

True it is that the Government farms or a well-organised private farm may boast of producing sugarcane at less than 4 annas per maund of cane but the cultivators in general cannot at present in any case supply at the above rate. Even the Agricultural Department thinks that any rate less than $5\frac{1}{2}$ annas per maund is unfair. But if we take into consideration the fact that the simple village farmer is getting only 2 annas to $3\frac{1}{2}$ annas per maund in most cases for his crop owing to the chain of middle men and lack of organised marketing, we cannot but be apprehensive of the unfavourable effects of sugarcane cultivation on rural prosperity.¹ Such being the prices of his main agricultural produce, he is faced with the problem of making a bare living out of his land in spite of all his methods of greater intensity of agriculture and of efficient farming. Ultimately the standard of cultivation is lowered not only because the irrigated area in the case of other crops has declined as a greater part of irrigated portion is now under sugarcane cultivation but also due to the rising proportion of ratoon in the sugarcane cultivation itself. Economy is first sought in the elimination of the price of seed because it is so easy to manipulate. Ratooning as practised to-day without sufficient

¹ The prices in the year 1938-39 were certainly favourable.

manure or effective tillage does not only harbour insect pests but makes a very heavy call on soil fertility. Similarly an increase in the yielding capacities of a seed without a corresponding improvement in the arts of agriculture and manurial supply causes in general a heavy demand on the soil with the result that there is a tendency in the yielding powers of the soil to be exhausted. Thus as figures on pages 89 and 90 show, there is a distinct falling off in the produce of the cereals and other rotational crops which follow sugarcane. "Unless Coimbatore canes are manured to a standard higher than that given to the old 'desi,' even after a good virgin crop only, the next wheat crop falls off unless it is manured. After a ratoon the effect is much greater and more lasting. The falling off of the standard of intensity is the direct outcome of unsatisfactory cane prices for whatever cause this arises." Such have been the experiences of the U.P. Agricultural Department. It is no wonder that the vast shrinkage in the net area cropped and also in the double-cropped area in Meerut District have been the results of sugarcane cultivation to an unlimited extent. If conditions are not readily changed cultivators will draw on such reserve capital as they have in the soil and the day will not be far off when there will be no reserve at all.

The improved varieties of sugarcane with the apparently high yields seem to attract higher classes. They are, however, either zamindars whose rents remain unrealised for long terms or educated persons of this class who have been whipped into the business by unemployment elsewhere. There may be exceptions

to this but the fact is that educated persons have come forward with a most imperative desire to start farming on large holdings and generally these private farms grow sugarcane primarily. The following figures will show how far the interest is increasing :—

Statement of Private Farms in Meerut District

	Acres under 25.	Acres 26 to 50.	Acres 51 to 100.	Acres 101 to 200	Acres Above 200.	Total.
1923-24	...	...	...	...	1	1
1925-26	...	1	3	...	1	5
1926-27	...	5	10	1	1	17
1927-28	2	13	7	6	...	28
1930-31	3	19	13	5	...	40
1932-33	4	21	17	4	...	46

In any case we cannot look with satisfaction at the unlimited expansion of sugarcane cultivation. We are primarily apprehensive of the loss in soil fertility which it causes under the present conditions of inadequate manurial supply. The period of fallowing is reduced, the rotation of crops has become less suitable for the recuperation of the soil fertility and a heavier demand is made on the soil. Unless there is a corresponding improvement in manurial economy, any extension of this exhausting crop may be a menace to the soil fertility. Perhaps a sounder crop planning will have to include a restriction of the area of the very crop which the Agricultural Department has so successfully introduced in this district.

CHAPTER VII

SUBSIDIARY EMPLOYMENT OF PEASANTS

The inadequacy of agricultural income and the enforced leisure or idleness of the cultivators suggest the paramount necessity of ancillary industries. So far their development has been meagre and even in this district out of 3,17,007 agricultural earners in the year 1931, only 24,821 returned any subsidiary occupation. On the whole 92 per cent were without any subsidiary employment—agricultural or non-agricultural. The existing agricultural conditions indicate four-fold limitations on subsidiary occupations. The limitations are as follows:—

1. Economic standing.
2. Possibilities of subsidiary employment.
3. Sex.
4. Caste.

The following percentages have been worked out for the district from the appropriate tables of the census reports and they reveal that the class of an agriculturist operates as a limiting factor in the determination of subsidiary employment.

Statement showing the percentage of agricultural earners (classified according to the sub-classes) who returned subsidiary occupation

Names of the agricultural sub-classes	1911			1921			1931		
	Total	Agricultural	Non-agricul- tural	Total	Agricultural	Non-agricul- tural	Total	Agricultural	Non-agricul- tural
1. Non-cultivating owners	25·85	19·87	5·98	25·13	14·37	10·76	35·05	25·12	9·93
2. Cultivating owners								12·91	11·34	1·57
3. Non-cultivating tenants	9·05	3·51	5·54	4·93	2·07	2·86	11·01	5·77	5·24
4. Cultivating tenants								6·29	3·11	3·19
5. Growers of special crops etc.	Not available	Not available			7·15	3·13	4·02		
6. Agricultural labourers	4·37	1·09	3·28	2·75	0·50	2·25	2·20	0·65	1·55

Agricultural classes are now ranged in a sort of hierarchy, each having a distinct economic and social standing. The consideration thus gained ranks supreme in eliminating some and selecting other ancillary employment for an agricultural class. These class-distinctions—distinctions of high and low, of proprietors and tenants, of cultivators and labourers, of rich and poor—are successfully preserved by assigning certain occupational groups to each class and precluding others from it. Such classifications have sometimes been founded on the fact that certain occupations are considered as elevated, whereas others as degraded, and as such, the higher classes or those having a better legal status do not as a rule take to the latter for they endanger the class status. Thus pride and status stand in the way of landowners devoting themselves to occupations like those of barbers, weavers, oil-pressers, washermen, potters, etc. Again, the better the legal status of the agricultural class, the greater is the margin of profit and consequently the greater is the possibility for its individual members to follow occupations requiring investment of capital. On the other hand the dearth of money in the agricultural labourers naturally precludes them from money-lending and grain-dealing. Finally, as we pass from the proprietors and cultivators to the sub-tenants and labourers we gradually descend through different levels of literacy. This again is responsible for the monopoly of the so-called liberal professions by the higher classes. How far these class-distinctions have split up and divided the subsidiary occupations of the agriculturists may be

estimated from the following table:—

Details of subsidiary occupations of Agriculturists in the year 1931

Name of subsidiary occupations	Owners		Tenants		Growers of special crops	Agricultural labourers.	Total
	Non-cultivating	Cultivating	Non-cultivating	Cultivating			
1. Moneylenders (Cash or grain) bankers etc.	223	496	9	149	5	...	882
2. Grain dealers ...	98	112	6	157	...	...	373
3. Other traders of all kinds.							
4. Cattle breeders and milkmen and all other forms of stock raising.	92	109	15	479	2	155	852
	22	116	18	384	8	322	870
5. Manufacture and Industry (organised)	8	9	...	169	9	98	293
6. Police (excluding village watchmen)	14	7	3	26	...	...	50
7. Army ...	154	239	4	44	...	...	441
8. Schoolmasters and teachers of all kinds.	3	5	...	...	...	...	8
9. Other Government or public servants (including village watchmen)	13	32	4	99	2	2	152
10. Priests ...	10	...	...	...	...	...	10
11. Lawyers ...	2	...	...	...	...	...	2
12. Estate Agents and Managers	4	...	...	...	...	...	4

Name of subsidiary occupations			Owners		Tenants		Growers of special crops	Agricultural labourers.	Total
			Non-cultivating	Cultivating	Non-cultivating	Cultivating			
13.	Medical Practitioners		2	...	...	...	...	...	2
14.	Clerks of all kinds (not Government)		...	11	...	...	...	...	11
15.	Pensioners	...	13	83	3	94	...	...	193
16.	Barbers	...	...	3	...	245	...	...	248
17.	Weavers	...	...	2	...	40	...	27	69
18.	Oil Pressers	...	...	...	...	38	...	10	48
19.	Washermen	...	...	...	5	33	...	10	48
20.	Potters	...	1	1	...	9	1	1	13
21.	Blacksmiths	}	...	83	...	654	...	80	817
22.	Carpenters								
23.	Leather workers	...	...	—	...	...	...	52	52
24.	General labourers.	...	...	6	3	199	3	34	245
25.	Others	...	60	246	30	1658	23	445	2462
Total									8,143

These figures materially substantiate our contention that the status and resources of a class regulate and stimulate its economic activities and vocational pursuits. There may be exceptions to this but they are few and far between. To illustrate, the callings of barbers, weavers, oil-pressers, washermen, potters,

blacksmiths and carpenters give shelter to 1295 persons in the form of subsidiary employment. Out of these, however, only 90 are from the land-owning class and this small proportion is due to the fact that generally these occupations are considered degrading and hence these have been discarded by this class as unbecoming of its rank. Both in the case of landlords and tenants the implication seems to be that the numbers returning these occupations as their subsidiary employment were originally recruited from these occupational groups and though now they follow agriculture as their primary occupation, yet they adhere more or less to their occupational callings.

The above discussion and the testimony of the table on page 105 unerringly indicates that subsidiary employment is largely governed by class-distinctions among the peasants themselves. We arrive at the following conclusions :—

- (a) The greater legal protection enjoyed by a class not only measures its higher prosperity but also indicates the larger possibilities of its members having subsidiary employments due to the interplay of a series of factors discussed above. For instance, in the year 1931, whereas more than 35 per cent of the non-cultivating owners returned subsidiary occupations only 2·20 per cent of the agricultural labourers had any subsidiary employment. The least protected class is the poorest and the poor-

est has the least subsidiary employment. Consequently, in formulating a policy of the development of subsidiary industries it must be remembered that each class is not equally benefited by an outlet. Each class has its own difficulties and shortcomings and therefore a sounder agricultural planning in future must be based on a study of class-distinctions. So far it seems that the higher were always elevated and the lower always depressed with the result that class-distinctions have become more and more apparent in the agricultural economy.

- (b) Again, though during the period 1911—21 every class except the landowners lost heavily its subsidiary occupations, yet the next decade witnessed a revival which however did not benefit the agricultural workers. They further lost with the result that whereas in the year 1911 4·37 per cent had subsidiary employment, in the year 1931 such numbers fell so low as 2·25. The implication seems to be that the higher classes have a greater capacity to resist a depression and a still greater capability for revival than the lower and poorer classes.

The second determining factor is the scope and extent of subsidiary occupations. Broadly, subsidiary

occupations have been classified as agricultural and non-agricultural. The non-agricultural subsidiary employments have declined proportionately more than the agricultural ones. But this is not true for the land-owning class, especially in the case of the non-cultivating owners, whereas the table on page 105 reveals that the statement truly depicts the picture of the position of the tenants and labourers in this regard. In any case we are left in no doubt that the subsidiary employment of agriculturists, as a general rule, has not risen proportionately to the increase in the number of the agricultural earners and hence the figures of the year 1931 with regard to the subsidiary occupations of the agriculturists are not even as satisfactory as the corresponding figures for the year 1911. We shall now analyse the position with regard to every occupation treating it separately.

In the year 1931, out of 882 persons practising money-lending as their subsidiary occupation 719 were landowners. Only 158 were tenants and 5 were growers of special crops. This is a business requiring investment of money and it is only those who have something to save that can devote to this occupation. As such, it is mainly suitable to the large estate-holders. The Vaish landowners generally follow up this vocation whenever opportunities are favourable. Besides, the Jats advance loans on mortgage-deeds—the motive generally being to acquire the mortgaged property. There is yet another class of petty landowners and tenants dabbling in this business on a small scale, generally lending grain rather than cash. In any case, money-

lending as a whole is not a subsidiary employment for the average cultivator—it is no panacea for the peasants' poverty. Its development pre-supposes high profits from the main occupation and consequently its scope is limited even for the land-owning class. On the whole, since 1901 there has been an increase from 788 persons in the business to 882 only in 1931. The recent depression in the land prices has dwindled the security for their loans, whereas the various debt legislations of the year may reduce the amount of their advances considerably. Hence, even for those who are already following it as a subsidiary employment, the prospects seem to be gloomy.

As regards occupations requiring educational and other qualifications, any possibility of developing such ancillary vocations is precluded by the proverbial illiteracy of our rural population. Moreover, there is a strong tendency for a continuous exodus of the very few literates of a village to an urban area and it may partly be ascribed to the peculiar outlook one acquires after going through a school course in middle and secondary schools. But within a village there are better opportunities to get a subsidiary employment for the educated peasant or labourer than for an illiterate one. For instance, an overwhelming proportion of our villages requires a schoolmaster and in the absence of any better arrangement part-time teaching may develop. In any way, so far, as a general rule, tenants and agricultural labourers have been unable to pay the fees and dues of education and it is therefore that illiteracy is more universal among them than in the landowners. However, there are

possibilities in this direction and it is not satisfactory to note that there are no tenants and agricultural labourers in such few subsidiary occupations as exist even today. On the other hand, among the landowners too, a progressively decreasing number is finding employment in these occupations and thus the landowners are gradually losing one of their subsidiary branches of occupation:—

Landowners following as a subsidiary occupation the pursuit of

Year	Clerks (not (Govt.))	Schoolmasters	L a w y e r s' clerks, etc.	Estate Agents and Manag- ers.	M e d i c a l Practitioners	Pleaders	Total
1911	17	7	5	7	16	...	52
1921	5	7	2	4	5	2	25
1931	11	8	...	4	2	2	27

Cattle-breeding and other forms of stock-raising are the main subsidiary occupations with the peasantry of the district. Dairying affords ample opportunities for every class—milk and 'ghee' being the chief products. It is more important and profitable in the district than the breeding of the drought-cattle. From 1911 to 1921, *i.e.*, for a decade there was a phenomenal rise in the industry and as a subsidiary occupation the numbers accommodated in it increased from 597 to 953. However such numbers have actually declined since 1921 from 953 to 870 in 1931, and if we are to exclude from the latter figures the number of landowners which are not included in the

former figures, the number comes to 732 only in 1931. In the next chapter we will have an opportunity to analyse the problem in detail. Here it may be pointed out that this great decline has been caused by the dwindling of the grazing areas, the continuous fodder scarcity in some years immediately preceding the census of 1931 and the failure of money crops. No doubt, with increased and improved means of transportation a cultivator can now avail of better opportunities to sell his milk in a city or town and thus may earn something more than that which he would have got by making 'ghee.' However, such opportunities are still very few and even those are not satisfactory.

Carting is said to be another subsidiary employment of the agriculturists leaving aside the agricultural labourers. But even with regard to this, conditions to-day are not so favourable as they were previously. It has developed here to a very great extent due to the greater proportion of the commercial crops which in a majority of cases are exported from the villages to the 'Mandis.' This necessity of exporting crops coupled with the inadequate means of transportation encouraged the growth of carting. But the vast development of transportation facilities in the present century, while conferring so many advantages, unfavourably affects the carting business of the cultivators. Still, to-day cereals are transported from villages to the 'Mandis' in the bullock-carts of the cultivators for neither motor trucks nor goods trains are competitors. But the recent improvements in sugarcane transport have adversely affected the

occupation. For instance, when sugar factories were newly started, carts were in great demand to transport sugarcane to the factories from the cane-producing areas. But now a great majority of these transports has been monopolised by trucks and goods trains. Thus the construction of the branch line from Daurala to Muwana *via* Lawar in the beginning of the year 1935 mainly for exporting sugarcane from the underlying villages has marked a signal decline of the carting activity of the cultivators in this rich sugarcane tract. Yet there is the redeeming feature for the factory-owner that transportation charges have enormously declined and at the same time his market for making purchases has been widened.

Meerut is not a great manufacturing district. Leather-curing may be said to be its chief industry, but of late years there has been a marked decline in the numbers finding subsidiary employment in it. The Chamars who form the bulk of the agricultural labourers sometimes get employment in tanning hides which are exported to Cawnpore and Calcutta from this district. But the number of those who got subsidiary employment in it has fallen down from 166 in 1911 to 101 in 1921 and again to 52 only in 1931. This decline is due to the increased number of hands in the industry itself and thus outside labour gets little accommodation. Cotton-weaving is carried on for local consumption alone and though the Congress gave an impetus to the manufacture of 'Khaddar' the period of boom is now followed by a period of depression. Again, there has been a mark-

ed specialisation in the industry which has ousted the agriculturists from it as they could not possibly maintain the same standard of improvement.

Following weaving as a subsidiary occupation

	Tenants.	Agricultural labourers.	Total.
1911	79	55	134
1921	119	33	152
1931	40	27	67

Spinning, however, provides an independent means of livelihood to a great number of uncared-for widows but is not in general a subsidiary occupation for the females of the tenants or landowners, for they look down it as a sign of calamity and social degradation. The earnings range from 1 anna to 6 pies a day. Lawar and Nirpura, the chief centres of the blanket-making industry, give opportunities of spinning wool for the women. But the same considerations which are paramount in cotton-spinning stand in the way. The industry, however, has suffered much from the competition of mill-made blankets. The brief analysis of the subsidiary occupations of the agriculturists inevitably leads us to conclude that there are a few subsidiary occupations which are helpful to villagers; and these are more varied in the case of the land-owners and cultivators and less in the case of the agricultural labourers. However, such occupations are slowly decaying.

Sex, as pointed out above, is another vital factor that has to be reckoned for the work of a woman in many a case is dissimilar to that of a man. Though both can be agriculturists, subsidiary employment

bears the peculiarities of each sex. Women are generally occupied only in the simpler and lighter forms of employment and this has reduced the subsidiary avenues for the women agriculturists. Moreover, the mode of living, social status and dispositions of women are other additional factors that define their subsidiary occupations. These factors differ in their application according to the social and economic status. Thus, among the cultivating owners, whereas more than 11 per cent men had non-agricultural subsidiary employment in the year 1931, the corresponding percentage of women of this class was so low as 1. The relative disparity is mainly due to the cloistered lives of women of this class as a whole, who thus are precluded from out-door tasks especially among the high castes. Moreover, money-lending and grain-dealing do not find favour with women as they prefer to hoard or invest in ornaments whenever they get any surplus. On the other hand, the relative proportion of the male and female earners, who have a subsidiary occupation, is not so disparate among the agricultural labourers. These are generally recruited from low-grade castes and as amongst them, there are no restrictions for women to work outdoors, they have all the avenues open to a male labourer except those from which they are debarred by their natural infirmities. But among the tenants again, a disproportion is marked. However, it is not so prominent as in the case of the landowners. It is undeniable that the higher the caste or an agricultural class, the more prevalent is the custom to exclude women from work.

*Proportion in 1931 of agriculturists of all classes
having non-agricultural subsidiary occupations*

	Percentage of males with subsidiary employ- ment.	Percentage of females with subsidiary employ- ment.
Non-cultivating owners	... 11.5	1.0
Cultivating owners	... 1.7	.68
Non-cultivating tenants	... 5.9	2.5
Cultivating tenants	... 3.29	1.7
Growers of special crops, etc.	... 4.2	1.5
Agricultural labourers	... 1.7	1.1

Lastly, while studying the Indian agricultural problems one is reminded of caste at every step of one's inquiry. Having lost ground in its own occupations, every caste and tribe has sought refuge in agriculture. Often it is no longer possible to assign for a caste an occupation or a group of occupations quite apart from agriculture. This is a fact of paramount importance in determining subsidiary occupations of the agriculturists, for leaving aside the case of a few like cattle-breeding and carting, every occupation is restricted by limitations of castes. Every cultivator has a tendency to concentrate on his own traditional occupation while attempting to supplement income from outside. Castes and agricultural classes do not determine each other but both of them govern jointly the subsidiary employment of an individual by primarily defining a group of tasks and occupations compatible with his rank and status and, secondarily, excluding certain occupations which one

cannot enter despite all economic advantages. The Rajputs, Saiyads, Tagas and Jats who form the bulk of the landowners and the tenants in the district have agriculture as their main occupation and do not take up any other non-agricultural subsidiary occupation, except of course dairying which is intimately associated with intensive farming. Similarly the Vaish community has got money-lending and grain-dealing as its subsidiary employment whereas the Chamars alone devote themselves to the work of leather-tanning, etc. Except cattle-breeding and carting, every other subsidiary non-agricultural occupation of the average cultivators has been more or less limited by caste restrictions. Some light may be thrown on this point from the figures obtained by local enquiries in the village Baizadka of Tehsil Muwana :—

Subsidiary occupations of agriculturists by caste show

	Chamars	Brahmins	Jats	Vaish	Kahar	Gusain
Total number	... 49	7	38	1	1	1
Without subsidiary occupation	19	1	19	...	...	...
Grass cutting	... 7	...	...	...	...	...
Cattle breeding	... 20	2	19	...	...	...
Leather industry	... 6	...	...	...	...	...
Weaving	... 8	...	...	...	...	...
Carting	... ..	3	...	...	...	...
Priesthood	... ..	3	...	...	...	...
Grain dealing	.. ...	...	...	1	...	...
Money-lending	... ..	...	...	1	...	...
Domestic service	. ...	...	...	...	1	1

Thus there are distinctions of sex, class and caste in an agricultural community itself which determine the subsidiary employment of its individual members. Consequently, an economic planning for the development of subsidiary industries, which is the crying need of the villager, must be based on a clear recognition of such distinctions.

CHAPTER VIII

RELATION BETWEEN DAIRY AND INTENSIVE FARMING

The density of population as well as the rate of its growth have hitherto been governed in this part of the valley by the amount and progress of intensive farming, *i.e.*, by the proportion of the double-cropped area, by the percentage areas under rabi and mainly wheat crops and last, but not the least, by the development of irrigation facilities. A correspondence develops not only between aggregation of population and agricultural cropping but also between densities of human and dairy-cattle population, for as man by his multiplication outreaches the means of his subsistence he augments his agricultural income by dairying and the potential supply of manure from his cattleyard. It seems that cattle have followed men in their expansion and, consequently, a correspondence arises between the proportion of the double-cropped area, the human density and the number of cattle in any district.

*Relation between density, cattle and double-cropping,
1930-31*

District	Mean density.	Percentage to culturable area of double cropping.	Bullocks	Cows	Buffaloes.
Muzaffarnagar ...	541 (469)	15.3	165,775	80,153	90,249
Meerut ...	699 (579)	21.1	255,421	98,172	153,197
Bulandshahr ...	595 (517)	21.6	192,230	70,574	138,238
Aligarh ...	602 (508)	17.3	174,614	56,956	157,897
Muttra ...	461 (373)	7.3	95,978	61,688	76,456
Agra ...	567 (416)	8.1	133,790	71,453	97,291

But the relationship is not simple, for various intervening factors have to be considered which govern human and cattle concentration. Previously there were extensive grazing areas in the Upper Doab, where excellent working cattle were reared. But the growth of population and consequent extension of cultivation restricted the tracts, once given over entirely to open ranch-farming, to such an extent that grazing became more and more difficult. With the reduction of grazing areas the production of livestock became progressively less economic and finally when breeders were forced to cultivate forage crops for their animals, dairying rather than stock-raising came into prominence. Ultimately, for its working cattle, this portion of the valley came to depend on imports from those parts of the country where grazing land is still available, but as regards the dairy cattle, many good breeds are to be found within this plain itself. Thousands of working cattle are brought to Meerut District every year from the cattle fairs of Parvatsar, Pushkar and Jahazgarh besides such as are imported throughout the year through the agency of the "beoparis." But a comparatively small percentage of the dairy cattle is imported and thus the conclusion is forced on us that in any intensively cultivated area cultivators find it more to their own advantage to keep and rear dairy cattle on their farms than to produce working cattle. Livestock raising was extensively practised by the Gujars of Meerut District but could not be profitably carried on with the restriction of the grazing areas and the deterioration of the 'khadir' lands. That the Gujars have gradually

settled on the land as cultivators leaving their hereditary profession of stock-raising is, besides other factors, due to the following facts :—

(A) *The history of Khadir (Meerut Settlement Report, 1900)*

Pargana	Former Settlement	Average for			
		1285-89 (Fasli)	1295-99 (Fasli)	1300-1302 (Fasli)	1303 Fasli
	Acres	Acres	Acres	Acres	Acres
Loni	9,841	9,561	7,986	7,188	5,698
Puth	911	1,016	1,020	659	263
Garhmuktesar	2,176	2,076	1,070	777	286
Kithor	1,070	1,111	1,092	1,077	1,002
Hastinapur	1,828	2,213	1,982	1,323	535
Total	15,826	15,978	13,150	10,879	7,784

(B) *Uncultivated area in Meerut district*

	1835 Acres.	1870 Acres.	1932-33* Acres.	1936-37* Acres.
Barren and revenue-free	233,453	217,501	163,067	167,719
Culturable (waste)	318,319	244,808	176,763	169,849

We do not suggest that all this area was previously used for stock-raising. But it cannot be denied that livestock production mainly depended on the major part of this area and as it decreased the breeders lost ground and had to settle on the land as culti-

* The figures are taken from the Season and Crop Reports, the first being the 'area not available for cultivation' and the second the 'culturable waste other than current fallow.'

vators. However, "with the increase of population and the progress of scientific management, the ranching type of farming has in fact everywhere given way to a more intensive system of which the raising of a moderate head of livestock on each farm is an essential part and an important source of revenue, besides providing largely for the proper nutrition of the people, helping materially to maintain the fertility of the soil and increasing its total return to the cultivator" (Col A. Oliver : Agriculture and Livestock in India, Vol. IV, Part IV). Similarly, in the Upper Ganges plain, as agriculture became more intensive, dairying was much more adhered to by the farmers. The gradual dwindling of the grazing areas has discouraged open ranch-farming, while the pressure of population on soil ultimately leads towards mixed farming. The dairy-cattle depend chiefly for their upkeep on fodder supply and consequently we find an interesting correlation between the number of such cattle and the area under fodder crops. The following figures are for the year 1930 :—

District	Fodder Crops	Acres	Cows		Cow-buffalows	
			Giving 3 srs. of milk or more per day	Others	Giving 4 srs. of milk or more per day	Others
Muzaffarnagar	...	128,450	31,148	49,005	62,167	23,082
Meerut	...	159,035	52,047	46,125	122,286	30,911
Bulandshahr	...	53,425	35,090	35,484	101,855	36,380
Aligarh	...	57,305	23,277	33,679	110,513	47,354
Muttra	...	58,301	30,140	31,548	51,441	25,015
Agra	...	33,483	31,366	40,087	63,907	33,384

The relationship is not apparently close but it can be very well accounted for by the fact that, besides the fodder crops grown as such, other produces like the ' *kadbi* ' of Juar, Bajra and Maize, and straw of wheat and gram are given to the cattle. In any case, availability of produce of the fields rather than of grazing areas is more important for the proper maintenance of dairy cattle in any system of intensive farming. The area under fodder crops and the character of the crops grown act and react on the number, health and efficiency of the dairy cattle. A farmer will not increase his area under forage crops unless there is an imperative necessity for it and he will not limitlessly increase the number of his cattle without first assuring himself a sufficient fodder supply from his own farm as little grazing land is available and it will not be economic for him if the fodder is to be purchased. True it is that a large number of dairy cattle are maintained in this Province, especially in the eastern districts, by the cultivators without any feeding except what they themselves pick from waste land, and consequently it may be argued that the factor of fodder supply does not exert any effective control in the determination of the dairy cattle. Nevertheless, if dairy cattle increase without any regard to the fodder supply, they are no longer assets for the cultivators, for sooner or later there is such a reaction on their health and efficiency that their milking capacity is reduced to a level which is incompatible with their upkeep. Thus there is a close inter-relation between the number of the dairy cattle economically maintained by the

farmers and the fodder supply at their own farms. As a farm provides fodder either in the shape of fodder crops or as by-products of other crops such as the straw and stalks, the size of holdings and the class of crops grown effectively react on the number and efficiency of dairy cattle. An almost similar conclusion was reached by the U . P. Banking Inquiry Committee when it concluded that ' there is a close inter-relation between the size of holdings, the class of crops grown, and the number and quality of cattle employed ; and it is this which accounts for the violent contrasts between the cattle in different tracts, from the costly and powerful animals on the large holdings in the western districts, where fodder crops are freely grown, to the miserable and half-starved beasts in the rice-tracts of Azamgarh ' (page 239). Under-sized holdings cannot normally grow the same amount of fodder crops which large-size holdings can easily afford. Similarly a less number of cattle can be maintained in rice-growing districts as compared with wheat tracts. The by-products of millets like Juar and Bajra form the main food of the cattle and hence a greater percentage of these crops enables a larger number of cattle to be kept, if other conditions are favourable. In the following figures for the year 1930 we have summarised agricultural contrasts and their incidence on dairy industry in different parts of the province :—

Agricultural contrasts of the eastern and the western districts of the United Provinces

District	Average area in acres per cultivator		Percentage to culturable area of net cultivated	Percentage to the net area cropped of			Number per 100 acres of net area sown of			
	Intensive	Ordinary		Fodder crops	Wheat	Rice	Cows giving 3 srs. or more milk per day	Other cows	Cow-buffaloes giving 4 srs. or more milk per day	Other cow-buffaloes
Meerut	2.8	10.2	83.0	15.2	33.3	1.5	4.9	4.4	11.6	2.9
Bulandshahr	7.8	18.83	80.6	6.2	21.6	.3	4.1	4.1	11.8	4.2
Muttra	1.8	11.12	76.8	8.8	11.8	.006	4.5	4.7	7.7	3.7
Farukhabad	2.0	5.38	67.7	1.6	27.8	4.7	.8	12.6	3.7	11.8
Fatehpur	2.0	7.0	70.6	1.9	12.2	16.4	.02	17.4	.09	12.1
Jhansi	1.5	10.06	37.8	.1	9.9	2.9	.2	26.1	.3	9.1
Gorakhpur	1.3	4.3	84.8	1.1	20.5	40.6	.2	17.7	.6	6.5
Basti	1.0	3.1	81.6	1.9	24.1	48.4	.08	19.5	.3	9.5

In the above table we have maintained the classification of cows and cow-buffaloes according to their milk capacity, on the lines of the cattle census of 1930. Cows giving less than 3 seers of milk per day and cow-buffaloes yielding less than 4 seers of milk per day are not remunerative as dairy cattle according to the official estimate. "Three seers of milk per day from a cow may not permit of it being brought to market, but it is the minimum that would pay the cost of a cow's upkeep to one who may work on it for the sake of good milk with one's own hand, as many an Indian does . . . As a buffalo needs greater attention and is costlier to keep and its calves are less valuable, the amount was fixed for it at 4 seers." (U.P. Cattle Census, 1930.) That large numbers of cows and buffaloes, with an yield less than the economic minimum calculated for them, are kept, is no proof that such dairy cattle have practically been profitable to the cultivators. On the other hand, such cattle are kept perhaps more on religious grounds or for the sake of a false dignity which a cultivator feels in keeping milch cattle, howsoever a poor yielder it may be, or again, on account of the cultivator's ignorance, than for any economic gain. They remain half-starved, and occasion under-nourishment for their owners. A policy of elimination and selection which private effort cannot enforce must be vigorously followed up without any delay.

The census figures show that about 6·8 per cent of cows in this Province can give 3 seers or more of milk per day, whereas of buffaloes 26·5 per cent have an yield of more than 4 seers of milk per day. Out of

such cows and buffaloes two-thirds are to be found in the two western divisions of Meerut and Agra alone. It is interesting to note that the western districts, where is to be found a more intensive agriculture than that of the eastern districts, also show a far greater development of dairying. No doubt the districts of Gorakhpur and Basti have each a greater number of cows and cow-buffaloes per 100 cultivated acres than the district of Meerut and still in the latter is to be found the most phenomenal development of dairy industry as can be judged by the number of useful dairy cattle. The small size of holdings, the preponderance of the rice crop over the wheat and the very small percentage areas of fodder crops in the eastern districts make dairying an impracticable proposition with the farmer who allows in his un-economic holding the indifferent multiplication of the useless dairy cattle. On the other hand, the districts of Meerut and Bulandshahr have greater number of remunerative dairy cattle than of useless cattle pests with the result that dairying helps the cultivator in meeting his monetary obligations. The greater development of dairy industry in the western districts may, again, be inferred from the greater number of cow-buffaloes than of cows as the former are mainly kept for their milk and ' ghee ' than for any other purpose.

In any intensively cultivated tract where commercial crops occupy the major portion of the cultivated area, as is the case in the Upper Ganges valley, cultivators have, as a rule, a greater margin of profit than in those districts where light and poor crops are grown. In this respect, the districts of

Meerut and Bulandshahr having large areas under wheat are better off than those of Gorakhpur and Basti which have a preponderance of the rice crop. These differential margins of profit measure the greater initial capability of the two western districts to invest more in costly dairy cattle either in cash or credit. Moreover, the straw of wheat supplies in the dry months a ready fodder which is superior to the rice straw and stalks of *juwar* given to cattle in the eastern districts. Such facilities account for a striking development of the dairy industry in the Upper Ganges Doab, while it has provided valuable diet for the cultivating classes, for whom buttermilk is as customary a drink as tea with a Westerner.

The economic motive of having high profits has been more important than any other factor in encouraging a system of mixed farming which is still in its infancy. The smaller agricultural countries of Europe have similarly resorted to mixed farming which results in high profits from dairy products and decreases chances of over-production of cash crops which in recent years has caused a phenomenal depression in the agricultural markets most detrimental to the growers of commercial crops. The agricultural progress of the western districts, though eclipsed in many respects by the agricultural development in the eastern districts, is on sounder economic footing. In many districts, even in the central portions of the plain, mixed farming has not emerged at all. Fatehpur with 1386 villages of 652 thousand souls has only 111 cows and 548 cow-buffaloes according to the cattle census of 1930 which can really be termed as dairy cattle.

“ With such small numbers of dairy cattle, it is doubtful if even the children in this district can get more than homoeopathic doses of milk for their nourishment.”

Moreover, the greater proportion of dairy cattle with low-yielding milk capacity in the eastern districts stands in a vivid contrast with those of the Upper Valley. The reasons are not far to seek. It has been continually observed in these districts that even the imported high-grades, instead of progressively maintaining their conformational productive excellence, deteriorate in no time and finally fall to even a lower level of profitable returns than the ‘unimproved’ local stock. It appears that these districts are poor in certain mineral ingredients of the soil which are not lacking in the Upper Doab. The manifestation of inherited characteristics is dependent on environmental influences and limitations; and hence the extent to which we may raise the inherited characteristics of our stock is rigidly defined by the soil and climate. It has been suggested that to eliminate these low-yielders both from the western and the eastern districts, while our objective should be to have a dual-purpose animal, our breeding policy must aim at a balance between inherited potentialities on the one side and the probability of their finding full expression under prevailing environmental conditions on the other. In the development of dairying in the eastern districts to the standards reached in some portions of the Upper Ganges valley, we shall always be handicapped in our breeding endeavours by a relatively poor environment.

Even in the western districts selection has not gone very far as can be seen from the existing numbers of the low-yielding dairy cattle. There are great potentialities in the Upper Valley for the building-up of superior breeds from the native stock. Further, a policy of cross-breeding, segregation and selection of new types after a very careful observation must be followed up in the interest of profitable dairying in the region.

From a cultivator's point of view a cow or cow-buffalo is sometimes an asset in which he has invested his money, usually a productive debt in kind which he has to repay in instalments of 'ghee.' Occasionally he simply breeds it, while it belongs to a second person and keeps it for him and gets a definite portion of its valuation as remuneration for its upkeep at the beginning of the lactation period when it is to be returned. In any case he gets an extra income by keeping it and also an additional supply of manure to follow more intensive agriculture. It furnishes every week during the greater part of the lactation period small amounts of ready cash which are helpful in picking up improvements and thus the standard of cultivation and of living simultaneously rise. Within the last thirty years, 20,838 cows have diminished whereas cow-buffaloes have increased in all by 43,189 in this district. It appears that, as dairying has gained in prominence and value, cow-buffaloes have gained in number at the expense of cows.

Cattle Census of Meerut District

		1904	1909	1925	1930	1935
Cows	...	132,387	115,796	108,631	98,172	101,549
Cow-buffaloes	...	125,518	130,635	162,749	153,197	168,697

The decline among cows may, to a certain extent, besides so many other factors, be attributed to a process of elimination whereby the worthless stock, or rather that yielding poor quantities of milk, has been eliminated by the cultivators due to the high cost of upkeep. But the process of elimination and selection is not the only factor. Generally, cows are kept by poor cultivators and when the crops fail it is the cows which are the first to be disposed of either in payment or rent or interest, or to keep off starvation. Sometimes even the best breeds are thus given away and fodder famine caused by the failure of either kharif or rabi crop accounts for a wholesale disposal of cattle and if there be no relief high cattle mortality becomes inevitable. Besides this change of cows into cow-buffaloes, a decline has been marked in the total number of dairy cattle. We may note a few more illustrations.

Dairy Cattle (Cows and Cow-buffaloes)

Tehsil Muwana	1904	1909	1915	1920	1925	1930
Pargana Has- tinapur	26,295	25,971	25,371	25,144	25,427	24,836
Pargana Kithor	22,767	20,783	20,248	18,534	19,311	18,955

This decline has been due to the agricultural depression and stress of the dry years. It is also not a very uncommon feature of years of scarcity that many cattle change hands simply because there is no fodder to be given. Thus, any agricultural calamity doubly hits one's dairy industry—firstly by shrinking one's fodder supply and secondly by compelling the sale of

one's only available asset in the form of livestock to pay rent, interest and other obligation. The restoration of a few acres of pasture land in every village is most desirable if this unwholesome decline is to be checked. Very recently the Settlement Officer in his Rent-Rate Report of Pargana Kithor complained of this 'new feature which has been forced on the cultivator by the problem of fast diminishing grazing grounds.'

We find the most steep decline in dairy cattle between the period 1925—30. Cows as well as cow-buffaloes declined in numbers. The failure of rains in the year 1928-29 and a sharp frost in February, 1929, followed up by dry westerly winds, created abnormal scarcity of fodder and cattle diseases followed drought. Further, the failure of the money crops was also responsible for large disposals of cattle to the 'Beoparis' who exported them.

The fall in commodity prices since 1929 has adversely affected the dairy industry. Local investigations show that the cultivators have now less of dairy cattle than five years ago. Mixed farming, which is yet in its infancy, has received a setback and there are definite reasons for it. The collapse of price-level has been precipitate and momentous. Agricultural indebtedness increased in volume. Active efforts were made to adjust rents to prices by remissions, but the time-limitation worked unfavourably. There was a reluctance on the part of the cultivators to sell their grains, but the advantages of the apparently conditional remissions could only be secured by selling dairy cattle, wherever possible.

Even a postponement of rents would not have benefited the cultivators much unless the realisation of agricultural debts and the attachment and sale of dairy cattle in execution of decrees were stopped. Dairy cattle, during this period of five years, were freely accepted in satisfaction of a debt or rent, the whole transaction being known as 'Lao Patti,' and though it is not new it was never so popular in previous years. Due to the shrinkage in credit, the practice of selling a dairy cattle on instalments of 'ghee' is now less in vogue. Many of the poorer cultivators are in fact left without any dairy cattle at all and hence there may be now more cases of failure of payments of rents and debts, which for the last five years had been liquidated substantially by the transfer of dairy cattle. Under these circumstances, it is not at all surprising that the percentage of collections to rental demand in the district is only 39 in the year 1933-34. For the growth of dairying and the development of mixed farming the farmers require an immediate protection of their dairy cattle from the clutches of the moneylenders and landlords. The dairy industry is now having more than its share of the burden of the debts of the parent agricultural industry. A few years of exemption of the dairy cattle of the agriculturists from liability to sale or attachment in execution of a civil or revenue decree will greatly facilitate the systematic development of mixed farming. We cannot over-estimate the advantages of the development of mixed farming to cultivators as well as for the purposes of state revenue, for combating the low-level of prices by a reduction of cereal production

and finally for diminishing risks caused by a failure of rains. Milk can be bought at rupees 3 a maund and we feel confident that with effective Government assistance we can even compete in the world markets. The average minimum regional pool price, fixed by the Milk Marketing Board in England, is now 13d. a gallon (Rs. 6/- a maund) for milk of a fat content of about 3·7 per cent, while our milk usually has a butter-fat content of about 6·5 per cent. Having such an advantageous position with regard to dairy, cultivators should be helped to tide over the years of agricultural depression by special protective measures. Such measures will indeed facilitate the development of dairy industry to which we shall have to look more and more for the stabilisation of agricultural conditions in a region where commercial farming has developed to such an extent.

CHAPTER IX

HYDRO-ELECTRIC DEVELOPMENT AND RURAL INDUSTRIALISATION

There is no doubt that there are extensive opportunities for the development of minor industries and the more so in rural areas. Even in the western countries, which have largely adopted large-scale production such as Great Britain, France, Switzerland and Germany, there exist small industries and petty trades. But many of our village industries, though efficient in their own way, are threatened with extinction as these are isolated and unorganised and have hardly profited from the applications of science. The success of small industries in the west, even where they had to face competition with large-scale production, appears to be in large measure due to cheap power ready at hand especially in the case of isolated handicrafts. The recent development of hydro-electric power in the Ganges Canal Grid area removes one of the inherent difficulties, which was a stumbling-block in the development of village industries, by offering cheap power. It opens a new era of prosperity for

the Upper Doab not only because the region will be more immune from droughts with the development of tube-well irrigation but to a far greater extent because the expansion of ancillary industries will follow as a natural consequence of cheap power supply. In his note submitted to the Industries Reorganisation Committee, 1934, Sir W. L. Stampe remarks : “ It is sufficiently clear that power at nine pies per horse-power hour flat rate prevailing in the rural area is cheaper than any other form of power and is bound to result in the development of many agricultural processes hitherto beyond the reach of the rural industrialist. Any further cheapening of such power, as would appear to be feasible with an expansion of the grid scheme, will obviously still further stimulate the development of irrigation, the basis of all agricultural development as well as of industry.”

Developed in a series of stages since its inception in 1929, the Ganges grid has a gross output of 29,000 kilowatts which is distributed by, roughly, 4000 miles of transmission lines to some 1600 sub-stations scattered over the western districts of the province. By means of the grid electricity more than 2,500 cusecs. are now being pumped either from the sub-soil reservoir through some 1,500 tubewells or from low-lying rivers for canal irrigation as in the case of Ram Ganga and Kali Nadi systems. The area commanded is roughly one and a half million acres, of which 42·5% or approximately 600,000 acres is proposed to be irrigated in normal years. In the following table the gradual development of the state Tube-Well Irrigation Scheme has been summarised and an attempt has been

made to show the extent of protection against famine, that has been rendered possible by it :—

Year	No. of Tubewells	Estimated area, which can be irrigated				
		Area com- manded Acres	Rabi		Kharif	Total
			Acres	Sugarcane Acres		
1934	57	57,000	13,680	7,125	3,420	24,225
1935	181	181,000	43,440	22,625	10,800	75,925
1936	752	752,000	180,480	94,000	45,220	319,600
1937	1490	1,490,000	357,600	186,250	89,400	633,250

Thus in a normal year the percentage of the irrigated area is estimated to be about 42% of the commanded area. On Meerut and Bulandshahr Divisions of the Upper Ganges Canal the percentage of irrigated to the culturable command is about 63. In times of necessity, however, a tube-well is capable of doing more irrigation than the estimate given above and the maximum of the tube-well scheme may fairly be taken in the vicinity of 55% of the culturable command.

The tube-well area may be divided into two main tracts : (a) the dry zone with an average rainfall of 25 to 30 inches and with a spring level 25 feet deep on the average, lying west of the Ganges, comprising the districts of Muzaffarnagar, Bulandshahr, Meerut and Aligarh; and (b) the tract east of the Ganges comprising the districts of Bijnor, Moradabad and Budaun. Here the spring level varies from 15 to 20 feet and the climate is more humid. About 500 wells are working in the former area and 1000 in the latter.

Tube-well water is sold on a quantitative basis and not at flat rates as on canals. But the volume is not measured at the gauge-tanks, as the basis of computation of charges is the amount of the electric units consumed in pumping as indicated by the meter. The volumetric system is undoubtedly better than the flat-rate system, which has been criticized both by the authorities and the public as it leads to waste and uneconomic use of water. Moreover, the cultivator does not benefit through reduction of rate on account of rains. But under the former system, now being practised on the tube-wells, the cultivator is the arbiter of his own needs. He pays according to the quantity consumed and in the event of rain-fall is saved from buying additional quantities. "During breaks in the monsoon and in a year of early cessation, the volumetric system enables cultivators to balance savings they may choose to effect in the purchase of water against a possible increased yield in the crop due to extra waterings."* In normal years it is estimated that the cultivator will have to pay between Rs. 4 and Rs. 5 per acre for the irrigation of the Rabi crop and from Rs. 15 to Rs. 25 per acre for sugarcane.

* State Tube-Well Irrigation Scheme by Sir William Stampe, page 4.

Water-rates per acre

Crops	Number of waterings	Tube-wells		Total units	Rate per unit	Canals.	
		Water per watering	Units consumed per watering			Total cost	Water rate
		Gallons.				Rs. a. p.	Rs. a. p.
Rabi	2.25	88,000	22	49.50	0-1-6	4-10-3	5-0-0
Sugarcane 1 (for sowing)		110,000	27.5	27.50	0-1-6	2-9-3	
	4 (for germination)	110,000	27.5	110.00	0-2-3	15-7-0	
	2 (after, mon-soons)	110,000	27.5	55.00	0-1-6	5-2-6	
				192.50		23-2-9	10-0-0

The rates on tube-well for sugarcane appear to be unduly high in comparison with the Ganges-canal rate. This is so because we have computed for a dry year and this is the maximum cost likely to occur in the worst drought year. In normal years one of the higher rate waterings and one of the subsequent waterings will not be required and so the average cost comes to Rs. 16-11-9 per acre. Actual figures indicate that the charges are not relatively high. In the dry zone in the year 1936, 34,000 acres of sugarcane were irrigated in all and the average amount charged was Rs. 11 per acre. On the east of the Ganges in the districts of Bijnor and Moradabad 36,000 acres of sugarcane were irrigated at an average cost of Rs. 6-13-0 per acre. Finally, it may be said that cultivators have not found the rates prohibitive and there has been an incessant pressure from the tenants and their landlords for a rapid expansion of the scheme.

Moreover, power is being utilized—leaving apart big factories which generally use steam-power—in small sugarcane factories and the number of such installations is now one hundred and four in the grid area. The implication seems to be that, wherever possible, the cultivator finds it much more profitable to use electric power for such operations as irrigation from wells and cane-crushing, leaving the bullocks free for intensive ploughing and transporting his produce.

As regards the rural industries, the following figures reveal that consumption for such purposes is rapidly increasing. This affords a sufficient ground to maintain that hydro-electric power will be a powerful factor in the development of our cottage industries.

*Statement showing development of hydro-electric
energy in the grid area for rural
industries*

Year	Consumers	Load	Lines
March 1931	38	644 H P.	67 miles
„ 1932	83	1367 H.P.	87 „
„ 1934	140	2500 H.P.	120 „

This consumption is mainly for flour mills, oil presses, sugar centrifugals, etc. In any way, this development, though a great achievement in itself, has not been so rapid as it might have been if conditions were a little more favourable for the small industrialist. It seems that the Irrigation Department, which pursued a wrong policy in the distribution of canal water by the area irrigated rather than by

volume, is making a similar mistake by adopting differential rates for the distribution of hydro-electric energy. The following description of the tariffs has been taken from the ' Report of the Industries Re-organisation Committee, 1934 ' :—

“ For industrialisation purposes power is supplied on three different tariffs. Originally a flat rate of 1 anna 6 pies per unit was charged. Two years ago the Irrigation Department offered, as an alternative, a sliding scale industrial tariff based on the relations of units consumed to horse-power connected. Its introduction has enabled several factories to be connected, as for instance the Strawboard Factory at Saharanpur, to which 170 horse-power is retailed at a rate of 5·1 pies per unit, and oil-extracting mills at Hapur and Hathras, to which energy is being sold at approximately 7·2 pies per unit. As a third alternative, a two-part industrial tariff has recently been introduced according to which a monthly charge of Rs. 6/- per H.P. connected is made plus a flat rate of 6 pies per unit. This tariff enables a seasonal consumer to avail himself of reduced rates on the consumption of a few months instead of that of the whole year. We understand that under this tariff a rice-hulling mill, working about 16 hours a day during the season, can get power at about 9·8 pies per unit; a sugar centrifugal

and crusher, working the same number of hours per day, at the same rate; a cotton-ginning mill, working about 20 hours a day, at 122 pies; as against 18 pies per unit on the flat-rate system."

With regard to these differential rates we have only to say that they are most unfair and impede the development of our cottage industries. From a commercial point of view they may be justified but, in a region where rural industries on a small scale are more important than large or medium-sized factories or workshops, such a policy is not tenable, particularly when Government is putting forward schemes for rural uplift and intends to encourage ancillary industries. Cottage industries should not be handicapped by preferential power-rates to the big industries. When Japan, France, Switzerland, Germany, etc. encouraged their cottage industries, the state did not pursue a policy of differential rates with regard to the distribution of electric power. We see no reason to believe that our cottage industries are on a sounder footing. It is perhaps the other way. In this respect full effect must be given to the recommendation of Industries Reorganisation Committee that tariff rate for small industries, particularly those which use motors of 2 H.P. or less, should be reduced as far as possible.

Again, while the extension of hydro-electric power has opened new opportunities for development of cottage industries and thus possibilities of rural industrialisation have been made more real, these are not availed of by many. "Ignorance and inertia"

on the part of our rural population presents a difficulty of overwhelming character in the way of rapid utilization of hydro-electric power. True it is that a cheaper power has been made available but for the villager it is of no use unless he is acquainted with methods of utilizing it. The demand for energy is yet small in the villages. Rural industrialisation cannot progress unless there be industrial education. What new industries should be started? What plants should be established? What motors should be the cheapest and most useful? In all such matters the cottage industries should be guided by Government. In this respect the work before the Government is more difficult than that which lay before the Agricultural Department when it sought to introduce improved crop varieties. In agricultural improvement it was merely a case of substitution of improved seeds for unimproved. But about a machine and a plant villagers have only vague ideas. They do not know even what capital will be necessary for these. It was suggested by the Industries Reorganisation Committee, 1934, that detailed schemes for specific industries should be drawn up by the Irrigation and Industries Departments in consultation with each other showing the capital cost, the probable running expenses and the estimated expenditure on raw materials and income from the sales of the articles produced. However, illiteracy in rural areas is so high that even with demonstration and propaganda such schemes will not easily succeed. But we think that the creation of a Board of Experts at least in the beginning to advise people in matters of selection

of industry, plant, machine, site and other details will remedy the situation to a great extent. The foundations of a rural industrial development must be laid with caution and foresight. If, however, cottage industries are allowed to develop without any well-planned schemes it may be that their failure may check the growth of industries in future.

Other difficulties in the way of the growth of the cottage industries are those connected with finance. The whole question was recently investigated by the U.P. Industrial Finance Committee. The non-availability of suitable machinery and lack of suitable maintenance and repair services are not very great difficulties but sufficient attention has yet to be paid to remove these. As industries will grow such defects would of themselves be corrected by the increasing demand. But now they require state aid and guidance and these should be given. In any case, hydro-electric development must be followed by rural industrialisation and though there are great difficulties of credit and finance, these may be remedied if the Government adopts a forward policy of industrial guidance and aid.

CHAPTER X

ECONOMIC CONDITION OF THE AGRICULTURISTS

Meerut has the reputation of being a most prosperous district in the United Provinces and yet within it may be found a number of persons below the economic level. If we take into consideration the standard of living alone, as we pass from the proprietors and peasants to the sub-tenants and labourers we come across different levels ranged in a sort of hierarchy. The better the legal status of the cultivator and the less the rent or revenue demand, the greater is the margin of profit and, consequently, the higher is the standard of living and comfort. Unfortunately, with the lower Government demand, as the profits of the cultivator increase and consequently the security which he can offer, indebtedness also increases and thus he is burdened more heavily with the charges of interest. A recent debt inquiry by the Government into some of the villages gives us the following information :—

Statement showing indebtedness of families in Pargana Kithor of Tehsil Mauvana

Tenure	ALAMGIRPUR BHUDLA (1ST CIRCLE)				BALI (BHUR CIRCLE)						
	Families free of debt		Total Debt Rupees	Incidence of debt on	Families free of debt		Families indebted	Total Debt Rupees	Incidence of debt on		
	...	...	...	...	...	...	...	...	...		
Proprietary	...	7	32	50,580	1,297	1,580	28	36	14,306	223	397
Ex-proprietary	...	1	6	5,078	740	863	4	2	160	26	80
Occupancy	...	24	16	9,545	238	596	14	16	3,490	116	218
Statutory	...	4	14	15,942	886	1,138	1	7	680	75	86
Others	...	...	2	170	85	85	1	5	603	100	120
Without land	...	79	29	1,722	16	59	49	44	3,196	34	72
Total excluding proprietary	108	67	32,557	186	486	69	74	8,049	56	103	

The above table has been worked out from the Rent Rate Report of Pargana Kithor, 1931.

Detailed debt inquiries of three villages in Parganas Hapur and Sarawa, Tehsil Hapur

Tenure	BIJAULI PARGANA SARAWA			MAHMUDPUR PARGANA HAPUR			ASRA PARGANA HAPUR		
	Percentage of indebted families	Incidence of debt per Family		Percentage of indebted families	Incidence of debt per Family		Percentage of indebted families	Incidence of debt per Family	
		Indebted Family	Indebted family		Indebted Family	Indebted Family		Indebted Family	Indebted Family
Proprietary ...	...	77.6	1,639	2,113	28.6	2,208	7,728	...	...
Ex-proprietary ...	...	86.4	1841	2132	100	159	159	...	...
Occupancy ...	...	85.5	245	287	68.6	74	109	...	...
Statutory ...	...	100	229	229	...	...	...	91.7	242
Others ...	...	100	582	582	25	25	100	100	48
Without land ..	..	21.6	28	128	100	22	44	75	60
Total excluding proprietary		41.5	185	447	57.3	44	77	83.3	124
									148

The above table has been worked out from the Rent Rate Report of Parganas Hapur and Sarawa.

It is clear that, excepting in village Mahmudpur, the percentage of indebted families among proprietors is as a rule greater than that in those which have no land. The exception there is due to the fact that in this village the proprietary body is comprised chiefly of Jats. Again, a greater proportion of families is indebted amongst the statutory tenants than in the case of occupancy tenants. Between tenants the extent of indebtedness increases with the rent and revenue demand but its amount varies inversely with it. Debts are heaviest where the security offered is greatest and most desirable to the creditor. Thus, the proprietors are most heavily indebted and the low-rented occupancy tenants are much more indebted than the high-rented statutory tenants. Finally, the debt per family of the landless class is the least and it is also the most limited in extent. Again, as we pass from a canal-irrigated village to a 'bhur' village, debt of every class per family increases in amount and this leads to the obvious conclusion that credit increases with irrigation. Similarly, in the case of proprietors' debt the incidence of debt per family is the least in the 'bhur' village and it may be accounted for by the fact that land value in this village being below the average, credit shrinks. Caste is another important factor in the determination of debt not only because social status has an economic bearing but also because the skill, efficiency and social institutions of a caste affect its prosperity. For instance, the proprietary debt in village Mahmudpur is heaviest because the bulk of the proprietors who are Jats have an inclination to incur debts for purchas-

ing landed property. But the low level of tenants' debt in this very village is entirely due to the skill and industry of the Jat cultivators. However, the local soil inferiority has been responsible for the higher level of debts in Asra. To conclude, the amount of indebtedness increases with higher credit and thus, as the value of land rises, debt per acre increases. A higher rent and revenue demand is a measure of the greater agricultural prosperity of a village and consequently as credit increases it has come to be associated with a higher incidence of debt per acre and per family. The following figures materially support our statement :—

Relationship between debt, rent and revenue

Village	INCIDENCE PER CULTIVATED ACRE OF			Interest at the		
	Debt	Revenue	Rent	average rate of 25% per annum		
	Rs a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.		
Mahmudpur	98 1 10	3 3 3	7 7 10	24 8 5		
Bali ...	22 10 4	1 7 9	9 7 1	5 10 7		
Asra ...	8 2 2	1 12 2	7 3 6	2 0 6		

Among our agriculturists, a higher capacity to borrow has occasioned a greater indebtedness with the result that proprietors are the most heavily burdened people. It may be judged by the fact that, as Government inquiry into proprietors' debt in pargana Kithor extending over 72 villages reveals, whereas the average revenue per cultivated acre comes to Rs. 2-1-0 the interest on the debt payable is three times as much as the revenue at an average rate of interest of 25 per cent. The incidence of debt in regard to the total

number of proprietors is Rs. 125 and on indebted proprietors it is Rs. 1,106. These debts are generally incurred for domestic expenses. The inquiry also shows that 63 per cent of the proprietary debt was incurred on account of marriage and domestic expenses. A similar inquiry in tehsil Hapur into the proprietary debt of 125 villages shows that 68% of the debt is incurred on account of marriage and domestic expenses, 15 per cent for purchasing landed property, 4% for cattle purchases, 8% on account of litigation and only 2% for the payment of revenue. On the whole the economic condition of the proprietors has very much gone down and the implication seems to be that with chances of bettering their lots they become more extravagant and raise their standard of living proportionately more than the increase in their incomes. This indebtedness of the landlords has already occasioned a great deal of land transfers and as the change of proprietors has not merely been a change of persons but virtually a change of the proprietary communities, a greater number of the non-agriculturists have occupied land and because they have no direct interest in land improvement, agricultural progress has been hampered. Even up till the year 1901, as was observed by the Settlement Officer, the Jats had lost 1 per cent, Gujars 4 per cent and Tagas 3 per cent. Rajputs lost heavily, *i.e.*, 17 per cent of the cultivating communities. Such transfers are not restricted to any particular district. The whole of the Upper Doab has witnessed a gradual change of its proprietors. The transfers in the Meerut Division have been as follows :—

*Statement showing transfers of land in Meerut
Division*

Held by	Area in thousands of acres in		Difference.	
	1907-08	1925-26		
Rajputs	572	572	—1	
Muslims	1,327	1,186	—146	
Brahmans, Bhuinhars & Tagas	557	571	14	
Other Agricultural castes ...	1,309	1,321	12	
Non-Agricultural	983	1,183	200	

The transfers of land from an agricultural to a non-agricultural community adversely affect the prosperity of the region as a whole. Stability of tenure is lost, for tenants' cultivation is substituted in place of the proprietors' holdings, and thus, finally, the standard of cultivation falls down which necessarily means a substantial reduction in the total net agricultural income of the district. This further leads to the falling of the average incomes of the individual cultivators and a corresponding fall in the standard of living is thus inevitable.

It is interesting to observe that a certain correlation exists between the size of a holding and indebtedness. As with a smaller size the holder has less marginal profits, his credit is proportionately lower and consequently the debt which he has contracted is below that of the owner of a comparatively bigger holding. In this connection the following figures taken from the Report of the United Provinces Bank-

ing Inquiry Committee, 1929-30, substantially uphold the truth of our statement :—

Indebtedness according to size of holding in Meerut

		Number Indebted	Amount of Debt
Less than 5 Acres	...	163	8,146
Between 5 and 10 Acres	...	224	25,550
Between 10 and 20 Acres	...	253	56,776
20 Acres and over	...	61	15,870
Total	...	701	106,342

From whatever viewpoint we scrutinize the problem the same conclusion forces itself on us that a greater agricultural security and a high standard of farming inevitably raise rural credit and are invariably associated with greater indebtedness per acre and per family. As a greater proportion of our peasants' debt has been contracted for unproductive purposes, a contraction of credit which may result from the new debt legislation will not in any way hamper the smooth working of our agricultural economy.

Rural prosperity and credit are linked with the traditions and institutions of a caste. In this there is a difference between good agricultural castes on the one hand and the high castes on the other. Cultivators of high castes show higher expenses of cultivation and spend lavishly on ceremonial occasions. Hence, they run into debts sooner and to a far greater extent than the low castes. Agriculturists of low social status cannot get money easily. Their standard of living is not disproportionate to their incomes;

expenses in marriages and deaths are greatly reduced and consequently the burden of their debts is light. The information collected by the United Provinces Banking Inquiry Committee in this respect is as follows :—

Statement of indebtedness in Meerut by caste groups

			Number of debt- free.	Number of In- debted.	Amount of debt Rs.
1. High castes	...	...	46	628	98,701
2. Castes of good agriculturists		...	40	6	576
3. Market gardening castes		...	6	14	2,114
4. Agricultural castes of low social status			7	17	1 547
5. Non-agricultural castes		...	9	1	200
6. Other castes	...	...	6	35	3,104
	To'al	...	114	701	106,342

Although greater indebtedness is the mark of greater rural prosperity, we do not think that is a desirable state of things. It is our social backwardness that allows extravagance to feed on prosperity and ultimately brings poverty. There seems to be a vicious circle of prosperity, extravagance and poverty.

Coming to the actual conditions of living we find that a majority of cultivators, owing mainly to the slump in prices, finds it difficult to maintain a standard of living to which it had become accustomed in an era of high prices. The remarks of the Settlement Officer Mr. A. A. Waugh in this respect truly speak of the situation : “ An attempted analysis of tenants’

expenses suggests that those castes who themselves do most of the work of cultivation can meet their accustomed living expenses, rents and interest payments and still show a small though greatly reduced margin at present prices of grain. High-caste tenants accustomed to have most of their cultivation done by hired labour are faced with the necessity of reducing hired labour to a minimum if they are to keep their holdings." We may add that the general conditions have become so unsatisfactory that a bulk of the debt cannot be repaid and even rent and revenue collections have been endangered. To illustrate, large transfers of land took place for the liquidation of debts in the recent years. It was followed by a diminution of the area under 'Sir.' The tenants failed in many cases to pay their rents and thus there was a great number of ejectments. The following figures for the last few years may be found interesting in this connection:—

Statement of protected holdings in Meerut District

	1932-33 Acres	1933-34 Acres	1935-36 Acres
Sir of landlords	394,209	384,487	376,637
Held by exproprietary tenants ...	47,653	53,449	55,639
Held by occupancy tenants ...	281,645	278,617	272,269
Held by tenants of not less than 12 years in 1333 Fasli	15,469	15,114	13,755

The figures indicate a loss of 4·5 per cent of the area under 'Sir.' The area held by exproprietary tenants shows an increase. But when we consider that a loss of 'Sir' rights is in general an acquisition of exproprietary rights, it is clear that

as the area of the exproprietary tenants has not increased by an equivalent of the area lost in 'Sir,' old exproprietary rights in land were also lost. Either the old expropriators were ejected or the persons selling their 'Sir' land have given up their 'Sir' rights to fetch a higher value of the land. This indirectly means that '*Sir*' rights were sold in liquidation of debts—a position which was never contemplated by the legislation. Similarly, ejectments of occupancy tenants have been great.

This increasing instability of tenures is detrimental to the cultivators. As cultivation changes hands, the landlord finds an opportunity to enhance rents and consequently we find that the rates of rent per acre differ for the different classes:—

Average Rent-Rates per acre in Meerut District

	1865	1901	1933-34	1935-36	Percentage of increase, 1865—1934
	Rs.	Rs.	Rs.	Rs.	
Exproprietary tenants ...	...	5.44	8.69	8.51	60
Occupancy tenants ...	3.47	4.70	7.62	6.47	89
* Others ...	4.02	7.62	15.47	14.45	259

There is a clear tendency that the last class has been exploited to a very great extent and though now even this enjoys a security of tenure, yet the rents of this class are much above the economic rent. These differences in rents have caused corresponding changes

* Figures are for statutory tenants and their heirs for years 1933-34 and 1935-36, whereas for previous years they have been worked out for tenants-at-will and at full rates.

in the profits of the cultivators and consequently in their standard of farming and living.

An economic survey of village Baizadka of Tehsil Muwana further gives us information regarding assets, liabilities and incomes, etc., and is of great interest in our estimation of the economic condition of the agriculturists.

		Cultivating owners	Occupancy tenants	Statutory tenants	Agricultur- al labour- ers
<i>General information:—</i>					
Number of families	...	30	9	5	34
Number of people	...	197	71	31	138
Number per family	...	6.6	7.9	6.2	4.1
<i>Economic Data:—</i>					
		Rupees	Rupees	Rupees	Rupees
Average value of livestock	...	199.5	123.4	116.0	12.6
Average value of movables	...	46.4	20.0	17.4	7.1
Average annual income per family	...	568.3	235.6	200	51.9
Average annual income per head	...	86.5	29.9	32.3	12.1
Maximum income per family		1,200	400	300	150
Minimum income per family		500	100	100	15

The above figures themselves indicate different economic levels amongst the agriculturists and fairly prove that poverty pervades throughout. To contrast the economic status of the agriculturists with the non-

agriculturists we reproduce here some data regarding the latter.

AVERAGE VALUE OF				AVERAGE ANNUAL INCOME			
	Livestock Rupees Movables	Rupees	Per family Rupees Per head	Rupees	Maxi- mum Income Rupees	Mini- mum Income Rupees	
Shopkeepers	...	32.5	175	43.8	200	150	
Tailors	18.8	51.3	135	25.8	300	35	
Oil-pressers	10.0	18.0	100	25.0	150	50	
Leather tanners	30.4	15.4	143.6	23.6	300	40	
Barbers	...	20.0	133.3	22.2	150	100	
Carpenters and Blacksmiths	...	36.7	116.7	16.7	150	100	
Shoemakers	28.6	11.9	107.1	12.5	200	40	
Weavers	14.4	9.5	64.6	11.9	150	20	
Pig breeders	28.0	20.5	70	7.8	100	40	
Sweepers	...	3.3	15	6	25	5	
Others	20	15.5	45.0	22.5	50	40	

A study of the comparative figures leaves no doubt that the economic situation of the cultivators is not very sound. The high average income of the peasant-proprietors seems to indicate that they have got enough to spend and spare. That this is not true is easily realised when we consider the widespread indebtedness among them. An inquiry into the proprietary debt and the valuation of land concerning this village reveals that whereas the former amounts to Rs. 55,600, the latter is worth Rs. 66,200 only. An accumulation of interest within a year or so will inevitably cause the total assets to vanish. Even at pre-

sent, considering that a few of the proprietors are debt-free, the conclusion is forced on us that a majority of the indebted proprietors has already become insolvent. Apart from the assets in landed property, which have practically vanished, the possessions of the ordinary peasants, allowing for an unsaleable house, are limited to a few implements and bare necessities. Their average costs amount to so scanty a sum that it seems that it is under-valued. But the truth is that the total wealth of a villager consists of a few utensils of daily use, which in many cases are earthen, a grinding mill, the paternal smoking pipe, a torn and tattered shoe and the insufficient raiment which, in some cases, includes an extra wrapper for the female, a 'chadder' for the male and occasionally one blanket for both. To these may be added a house of mud with thatched roof, the most essential agricultural implements and the livestock. Many of the cultivators do not possess even all the requisites of cultivation though in all they cost a few rupees. Borrowing of implements or begging for these is not unusual. In summing up the price of movables we have not included the price of corn which sometimes the cultivators keep as its amount is variable according to the season and is not very helpful in arriving at an estimation of the economic condition of the agriculturists.

Comparing the two classes we find that the wealth of the non-agriculturists (excluding of course the livestock of both) is on the whole greater than that of the cultivating class. Among the agriculturists themselves there are variations between one cultivating

class and another. The differences have been occasioned by the greater legal protection which one class enjoys as compared with another. That the past had not been gloomy, is abundantly clear. Thus keeping a 'tonga,' a horse or a mare and among the better classes a 'chariot' for conveyance was customary amongst the agriculturists rather than an exception as it is to-day. Again, the custom of presenting metal utensils to a daughter at certain ceremonial occasions, is recently being replaced by giving more inferior utensils or earthen polished ones in some cases. These are minor things but they help in revealing true circumstances.

Coming to annual incomes, which do not represent income from agriculture alone but also includes the earnings from subsidiary occupations, it may be observed that as a rule they are so inadequate that the majority of the rural population, mainly of the agricultural class, lives from hand to mouth. Generally, a farmer gets a bare subsistence, while agricultural labourers hardly get a full meal throughout their lives. Among the non-agriculturists, sweepers are the poorest. No doubt, the average incomes of the agriculturists are greater than those of the non-agriculturists; but in the case of the latter alone the figures denote the net incomes. The case of the agriculturist is different. Before feeding his family he must pay the landlord and the moneylender, whose demands are the primary charges on his land and labour. The appalling poverty of our agriculturists is a tragic reality. It is hardly recognised that such poverty often means actual starvation.

CHAPTER XI

CASTE AS A FACTOR IN RURAL PROSPERITY

The conditions which make for agricultural prosperity are determined no less by the character of the agricultural community than by the presence or absence of external aids. The social institutions of a tribe, the economic and social status of a caste and finally the settlement of a clan are the dominant factors in determining efficiency and skill, size of a holding and indebtedness, and wealth and prosperity. Throughout the district, the thrifty and industrious class of the Jats with their Bhaichara tenures have achieved marked agricultural progress and account chiefly for the unique prosperity in the agriculture of the district as a whole. The chief cultivating castes of Meerut are the Jats, Rajputs, Tagas and Gujars. With a few material changes of recent growth the proprietary body of the district is composed of these very castes. Thus the district possesses the distinct advantage of having the best farmers and proprietors and it is due to the character of its cultivators that the district could maintain uniform progress. The following observation of Sir H. M. Elliot made in the year 1835 conclusively proves that the district, despite so many turmoils, could attain to the highest rank in the agricultural progress of the country owing to the character of its people. "It is a matter of astonishment that, notwithstanding the visits of Meerut to

the scene of perpetual revolutions and anarchy, almost all the landed proprietors traced their descent from periods long antecedent to those very revolutions. The *chouraseis* may be considered to exist in almost their pristine integrity amongst the Jat and Rajput communities, and subdivisions into 42 and 12 villages are still more frequent. The headman of the chief villages in the communities is still looked up to as a superior to whom all others of the clan owe allegiance, and are scarcely considered to be zemindars until he has presided at the ceremony of binding on their turbans and pronounced the investiture to have been duly performed." It was the tenacity of their village communities and the close bonds of family which united them that accounts for their agricultural rise up till the 19th century. Since then, however, with the administration of their personal law by judges who could not conceive of big family unions comprising a whole tribe and due to their land settlements by officers not bred in their own institutions, these bonds have gradually weakened; and perhaps as the moneylender gradually entered by the backdoor, the economic stress of the present century severed the bonds of solidarity which a thousand wars and revolutions in the past could not snap. By the beginning of the present century individualistic notions about property had been forced upon the proprietors and thus, within a period of 30 years, there had been an increase of 50 per cent in the number of proprietors in the year 1901. The then settlement officer observed that 'it used to be the custom to have a family property, held by many co-sharers, recorded in the name

of one representative, while to-day each sharer must have his name put down.' This breakdown of the village community, on which had been based the uniform progress of the district throughout the past centuries, certainly accounts for the dominance of the moneylender now, who finances nearly every cultivator and we can well conceive of the stability of a prosperity that depends on his sufferance.

However, more important than this are the customs affecting social status in the agricultural history of a region. The industry and skill of the Jat, the carelessness and pride of the Rajput, the reckless and dishonest habits of the Gujar, the cunning and lethargy of the Taga are all too well known and have their own repercussions on the prosperity of the different tribes. Jats have the most fertile tracts of the district and elsewhere they have usually managed to occupy the more productive soils and make the best of them. The average size of their holdings is the largest in the district, the standard of farming is the highest and they possess the best farming equipment. As a majority of their holdings are either held in proprietary rights or in occupancy tenures the rent and revenue demand per acre is comparatively less. Hence their net profits per acre and per holding are greater than those of any other tribe or caste, especially so as they seldom employ a labourer. Their women assist them in lighter farming operations and do not remain in seclusion. In fact, the status of a woman and her standards of work and expenditure greatly influence family cultivation and riches. The cloistered lives women lead in such

castes as the Tagas, Saiyads, Rajputs and Brahmans, etc., reduce the working capacity of a family and, as these very castes develop imperviousness to ideas about the dignity of labour, agricultural progress is impeded. It is so because, in such cases, cultivation is entirely in the hands of hired labour and not carefully supervised. Consequently, costs of cultivation are high or low according to the customs prevailing in a caste. Agricultural indebtedness is as well associated with ceremonial observances and their performance is at least one of its causes. Hence, where custom demands high expenditure on this item we meet the most heavily indebted cultivators, but where the social ceremonies of a birth, marriage and death are cheap debts are comparatively low. We have already observed elsewhere how caste influences subsidiary occupations and the size of holdings.

As a combined result of all these forces social differences have an economic importance. Thus, the superior advantages of the Jats have brought about a more prosperous condition for them with the result, as Mr. R. W. Gillan remarked, that they have paid heavy assessments without flinching. He even thought that they can pay whatever is laid on them. In contrast with these may be taken the Rajputs or the Saiyads who allow their property to be encumbered with debts for the false dignity of keeping up the name of their family and increase the cost of cultivation by employing hired labour. Their cultivation is the cultivation of their servants with the result that they have poor crops under high costs. Debts go on accumulating and ultimately they are turned out of their

fields to perish in poverty. The peculiar characteristics of every caste have been responsible for the fact that some have more resisting power against adversity whereas others invite it by their own extravagance and social habit. The following comparative study of the transfers of the proprietary interest in land during the present century materially supports our viewpoint :—

Statement of the proprietary rights of different castes

Caste	Area percentage			
	Pargana Hastinapur Upland areas.		Pargana Kithor Non-alluvial areas.	
	Last Settlement	Present Settlement	Last Settlement	Present Settlement
	1901	1931	1901	1931
Jat	... 13·4	15·9	18·5	19·6
Taga	... 5·3	4·2	18·9	17·1
Gujar	... 15·3	15·8	11·4	10·0
Mahesra	... ...	...	12·1	10·0
Mahajan (Vaish)	... 18·2	25·8	6·0	11·3
Brahman	... ...	2·2	2·8	4·4
Chauhan	... 1·8	1·8	...	...
Ahir	... ...	...	1·9	2·0
Saiyad	... 26·0	15·2	5·7	4·2
R a j p u t (Mussalman)	...	...	2·9	2·7
Pathan	... 2·5	2·3	6·5	5·8
Seikh	... 7·9	6·7	6·0	5·3
Others	... 8·3	5·6	5·9	6·2

We have taken the figures for these two parganas only as they are representative of the conditions in the whole district for which such accurate figures are not available as settlement operations in other parts are not yet complete. It is abundantly clear from the above that different castes are differently affected by economic strain. Again, certain traditions in some castes are responsible for their decay. For instance, the improvident succession laws among the Mahesras necessitate such constant division of family holdings that they are easily exploited by the money-lending classes and so it is not surprising to find their shares continually diminishing.

Rural prosperity is affected by caste also because certain castes are more favourably placed as regards tenures and thus enjoy a distinct advantage over the others. A Chamar has an inferior standard of living, not because he lacks the stamina of a farmer, but because he has to pay the highest rent on the most inferior soil, possessing the smallest average holding among the castes and usually having the least secured rights. The past history of tribal and communal settlements has occasioned differences even in the tenures of the various castes and thus to-day it seems that law has favoured one caste more than the other, eventually accounting for differences in their economic strength. The following figures for the year 1931 illustrate as to what extent different castes enjoy the benefits of better tenures and consequently of lower rent and revenue demand.

Cultivators by communities in Pergana Hastinapur
Area in Acres

		Sir & Khud Kasht	Occupancy	Non- Occupancy	Total
Gujars	...	5,750	8,675	6,088	20,513
Jats	...	7,440	9,910	3,043	20,393
Chamars	...	...	1,794	3,009	4,803
Brahmans	...	331	2,591	878	3,800
Chauhans	...	1,381	1,462	822	3,665
Sainis	...	180	1,277	1,185	2,642
Tagas	...	1,526	623	187	2,326
Saiyads	...	790	1,036	277	2,103
Mirs	...	613	427	326	1,366
Others	...	3,700	5,906	4,688	14,294
Total	...	21,711	33,701	20,503	75,915

Lastly, indebtedness as well as rates of interest are affected by caste. With certain castes, as for instance the Chamars, the size of a holding is very small and hence the credit is low and thus the debts contracted, though not much in amount, carry exorbitant rates of interest. Hence we find a co-relation between caste, size of holding, amount of indebtedness, rate of interest and the rent per cultivated acre besides a correspondence between the caste of the cultivator and the grade of the soil. The higher the grade of the agriculturists' caste with regard to skill and social status the superior is the farming standard. Hence we maintain that caste is as much a factor in rural prosperity as climate, topography and the condition of the soil.

CHAPTER XII

CLIMATE AS A FACTOR IN RURAL PROSPERITY

Temperature exercises a potent influence in the natural distribution of most wild perennial plants; but with annual crops, rainfall is a more important factor. The climatic conditions of a region, *i.e.*, its temperature, humidity and rainfall not only offer an explanation for the distribution of crops but also indicate the precariousness or prosperity of a tract. According to the index of aridity, as devised by Prof. Martonne and as applied by Prof. Mukerjee to the study of droughts and famines in the U.P., the Upper Ganges Doab does not rank high in agricultural security. Indices about 10 correspond with the dry steppes whereas those of 20 more or less to the prairies. Moreover, the greater the number representing the index the greater is the security enjoyed against liability to famines. Accordingly, the following are the comparative indices of aridity as worked out by Dr. Radha Kamal Mukerjee:—

Districts arranged in order of aridity

Dry Steppes.	Index of aridity.	Prairies.	Index of aridity.
1. Muttra	... 15.5	5. Meerut	... 21.2
2. Aligarh	... 17.0	6. Mainpuri	... 21.2
3. Agra	... 17.0	7. Muzaffarnagar	... 22.0
4. Etah	... 18.2		

The following figures about the drought year of 1928-29 corroborate the statement that the deficiency of the cropping in years of short rainfall is greater in districts which rank higher in order of aridity :—

1928-29

Districts.		Normal Rainfall	Deficiency of rainfall in inches	Percentage of deficiency in the net cropped area of the normal cultivated area
Muttra	...	23·61	12·16	9·8
Aligarh	...	25·09	12·49	2·4
Agra	...	25·08	12·33	5·9
Etah	...	27·66	17·24	5·5
Meerut	...	28·09	13·60	4·3
Mainpuri	...	29·70	13·45	8·3
Muzaffarnagar	...	29·67	11·83	5·3

But the table indicates that climatic conditions alone do not determine agricultural security. Aligarh shows, for instance, the least shrinkages in the net area cropped though it stands second in order of aridity. Mainpuri, on the other hand, registers the highest deficiency in the net area cropped. However, it is due to the fact that the distribution of rainfall in the latter district was most unsatisfactory—rain-

fall between April 1 and August 31 being only 9·92 inches as against a normal of 21·94 inches for the same period. But the greater security of Aligarh is due to the increased insurance derived from measures of irrigation—48·1 per cent of the gross cultivated area being irrigated normally. In fact, artificial water-supply confers an additional insurance which must be taken into consideration side by side with conditions of aridity while determining the liability of a district to famine. About 50 per cent of the gross cultivated area is irrigated in Mainpuri. The districts of Muzaffarnagar, Meerut, Bulandshahr, Aligarh and Etah are all protected by the Upper and more reliable portions of the Ganges and Jamna Canals. Thus, conditions of aridity alone do not define rural prosperity as man has in many cases combated the natural unfavourableness by artificial aid. Consequently, both the conditions of aridity and the nature and extent of the measures of irrigation are the determining factors in agricultural security.

But it should not be forgotten that the beneficial effects of irrigation have been counterbalanced in some respects by deterioration of the soil or the extension of cultivation to inferior lands. Meerut District, which during the last three decades has witnessed a steady expansion of its irrigation facilities, is now on that account not affected less adversely, as the exhaustion of the soil and the extension of cultivation make agriculture more liable to the changes of rainfall than ever. The following figures are of considerable interest in this discussion :—

Years of deficient rainfall	Deficiency of rainfall in inches	Percentage variation in the net area cropped to the normal cultivated area
1905-06	11.19	-4.7
1907-08	14.77	-14.9
1911-12	3.90	-2
1913-14	8.30	-10.7
1915-16	7.60	-1.9
1918-19	12.98	-23.4
1919-20	3.96	-3.6
1920-21	5.69	-9.8
1926-27	2.70	-2.5
1928-29	13.60	-4.3
1929-30	11.65	-9.3
1930-31	5.38	-5.8

Thus, deficiency of rainfall does not register its effects less violently than it did 35 years ago but in certain cases there is a tendency of greater shrinkages in the net area cropped due to it. The area and the outturn of the kharif crop is closely dependent upon rains in the months of June, July and August. The normal rainfall from April to August in the district is a little less than 20 inches and as there are practically no rains in April and May the figure may be taken to represent the rains of the last three months alone. We have worked out the following figures for

tracing out the relation between kharif crops and rainfall:—

Year	Rainfall from April to August Inches	Area under kharif Acres	OUTTURN AS COMPOUND WITH THE NORMAL (100=NORMAL).					
			Rice early	Rice late	Juar	Bajra	Maize	Cotton
1923-24	22·84	663,881	80	85	80	75	75	75
1924-25	12·41	654,524	75	70	80	75	75	70
1925-26	27·27	648,851	80	80	60	60	60	70
1926-27	20·64	680,178	85	85	85	85	80	75
1927-28	22·83	667,885	80	80	95	95	85	75
1928-29	11·12	642,128	55	55	60	70	70	75
1929-30	12·42	681,513	50	55	55	55	70	60
1930-31	19·74	680,009	70	75	60	60	70	85
1931-32	11·85	652,939	75	70	75	75	85	70
1932-33	14·16	673,460	75	85	80	80	75	75
1933-34	33·09	666,966	75	75	50	50	55	60
1934-35	28·80	684,606	80	80	75	75	60	70
1935-36	15·35	699,080	75	75	75	80	75	75
1936-37	25·10	700,377	75	75	75	75	75	60

Excess or deficiency of rainfall in these months is accompanied by shrinkages in the kharif crop and causes a reduction in the yield per acre. A deficiency of rains in the beginning may be counteracted by abundant rains in the following months and thus the outturn may not be affected to the same extent. This actually happened in the years 1924-25, 1931-32 and 1932-33, when the rainfall in September and October was 371%, 246% and 208% respectively of the normal

rainfall of these months. Sometimes it is also possible, as was the case in the year 1929-30, that a large area under the impetus of good monsoons in the beginning may be sown with kharif crops; but if the rains are not good continually during these months, the yield is greatly reduced. The deficiency of rainfall affects the outturn of unirrigated crops to a far greater extent than that of those which are protected by measures of artificial water-supply. Kharif in general is grown without irrigation but maize, sugarcane and cotton are not. Nearly 34% of the area under maize, 95% of sugarcane and 45% of cotton are irrigated in the district. Consequently, in years of drought and deficient rainfall, either the shrinkages in the area sown or the decreases in the outturn of these crops are not so great as are to be found in the case of other crops like Juar and Bajra.

Year of Deficient rainfall	PERCENTAGE OF DIFFERENCES BETWEEN THE CULTIVATED AREA AND THE AREA OF PRECEDING YEAR						OUTTURNS AS COMPARED WITH THE NORMAL (100=Normal)			
	Juar	Bajra	Maize	Sugar- cane	Cotton	Juar	Bajra	Maize	Sugar- cane	Cotton
1905-06	-9.6	-32.3	-7.9	-14.7	-25.8	60	50	60	50	75
1907-08	-10.9	-20.0	-8.4	-21.2	-7.8	25	35	60	80	50
1915-16	-13.8	-22.9	-24.1	-6.4	-33.9	90	80	100	80	...
1928-29	-6.6	-23.2	-4.9	-22.8	-22.5	60	60	70	70	75

But in case of excessive rains even these crops suffer heavily. Consequently, in the year 1925-26 with a rainfall of more than 136% of the normal in the months of April to August the area under kharif crop shrank back to such an extent that it was the least in the whole decade except that of 1928-29 when the rainfall in these months was less than 50% of the normal. The outturn of the kharif crops was as a whole the least in this year as compared with the other years of the decade. It seems that as the development of canal irrigation is associated with a rise in the spring level the excesses of rainfall are now more detrimental than before:—

Outturn of the principal kharif crops in years of excess rainfall

Years	Maize	Juar	Bajra	Sugarcane	Cotton
1906-07	100	100	110	100	95
1909-10	100	85	85	100	60
1914-15	75	70	75	80	...
1923-24	75	80	75	85	75
1925-26	60	60	60	95	70
1933-34	55	50	50	60	60
1934-35	60	75	75	75	70
1936-37	75	75	75	95	60

Generally, the output of cotton crop is greatly reduced owing to rains and easterly winds in September. Dry season with westerly winds is favourable for the prosperity of this crop but these very conditions are detrimental for sugarcane production. Meerut District, leaving apart the factors of soil and topography, is more suitable for the cultivation of

sugarcane rather than cotton on a consideration of its climatic conditions alone. Besides many other factors, the difference of soil and rainfall is manifesting itself in the steady variations in acreage under various crops :—

Area in acres in Meerut District

	1860	1902	1922-23	1932-33	1936-37
Sugarcane...	73,643	115,411	1,47,608	1,54,320	174,445
Cotton ...	89,900	66,800	35,612	46,761	51,971
Rice ...	17,000	35,000 (Average 1890-95)	12,014	8,603	22,215

As we have found, the good outturn of a rabi crop with which is interlinked the prosperity of the cultivators in the district is more or less dependent upon normal rains in September and October. Abnormally heavy or deficient rainfall in these months causes shrinkages in the various rabi crops and if winter rains also fail or are excessive the yield per acre is greatly reduced. Thus during the last 15 years it was found that in three years (*i.e.*, 1926-27, 1929-30 and 1930-31) the area under rabi crop shrank enormously with the result that though normally it exceeds the area of kharif crop it was far less than the area under kharif during these years. The distribution of rainfall was as follows :—

Year	From September 1 to October 31		From November 1 to March	
	Normal	Actual	Normal	Actual
1926-27	5.47	1.91	2.83	2.84
1929-30	5.47	1.46	2.83	4.56
1930-31	5.47	0.90	2.83	2.07

Though canal irrigation has now afforded ample protection to this crop the yield of the unirrigated plots is bound to be dependent upon normal rainfall with a fair distribution. Gram is still grown without irrigation and consequently both the area and the yield of this crop have varied from one extreme to the other with the rains :—

Area and Outturn of Gram in Meerut District

Total Rainfall. Year.	Rainfall. Inches.		Area under Gram Outturn.	
	Normal.	Actual.	Acres.	100=Normal.
1906-07	27·48	36·89	193,543	100
1907-08	27·48	12·71	16,452	45
1910-11	27·48	34·74	206,175	120
1913-14	27·48	19·18	32,377	45
1914-15	27·48	43·44	238,006	90
1918-19	28·12	15·14	11,816	...
1924-25	28·09	33·97	217,440	75
1928-29	28·09	14·49	57,599	12
1936-37	28·10	34·90	191,893	85

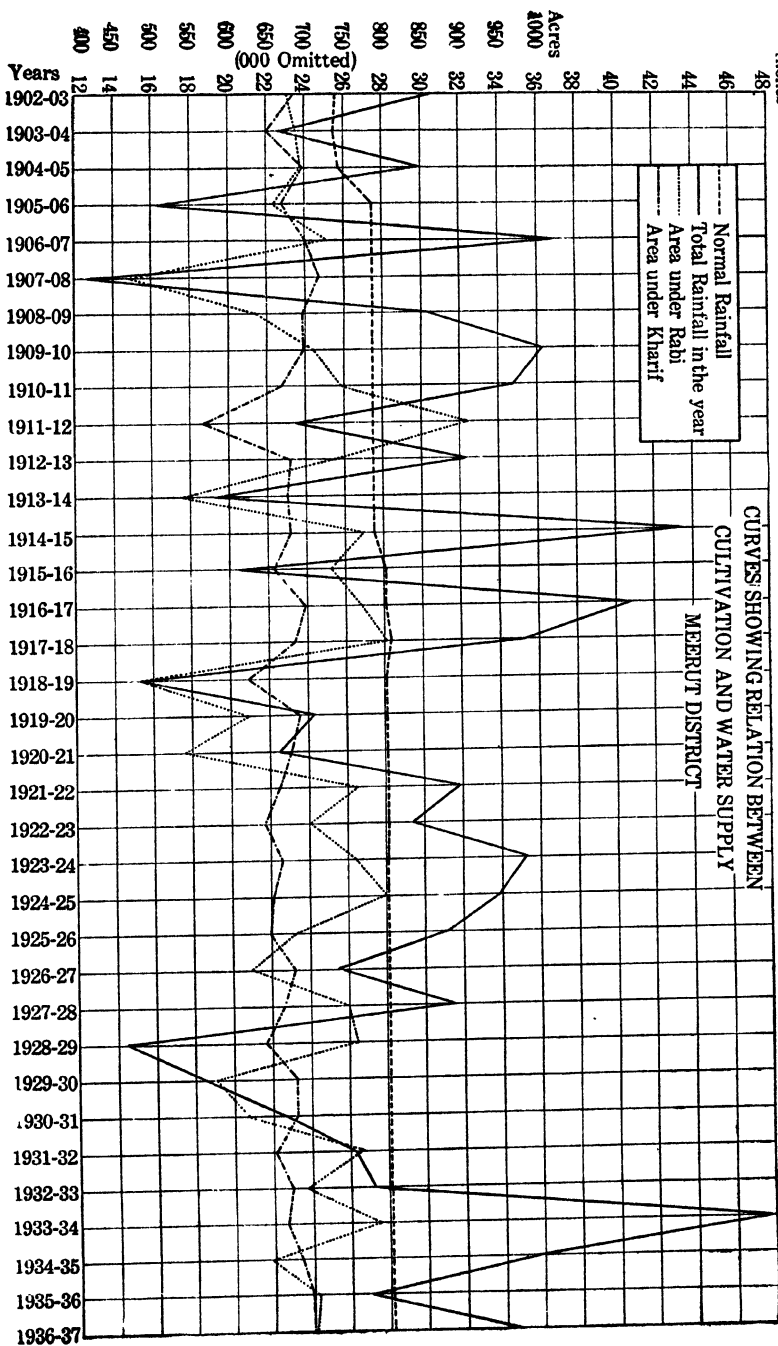
Now we are in a position to conclude that the prosperity of the cultivators depends upon normal rainfall to a far greater extent than any other single factor. Besides, the hot and dry winds, if they set in early in March and April, do not allow the grain to mature and in such cases the rabi crop is threshed light. Though artificial irrigation has aided much in man's fight against drought and famine, new problems connected with the exhaustion of soil have cropped up. In spite of the remarkable progress in the application of science to cultivation and irrigation

in the Upper Ganges Doab, agricultural productivity in the region now seems to depend more and more on climatic conditions than ever before. The ceaseless cycle of kharif and rabi croppings and the growing of the rich crops, season in and season out, without sufficient manure have depleted the soil reserve to a great extent with the result that this part of the Ganges valley, proverbially one of the most fertile parts of India, seems to indicate signs of soil depletion. The restoration and maintenance of the soil fertility ought to be the chief feature of a planned agricultural economy in order that high profits in one generation may not be bought at the expense of productivity of the generations to come.

Inches

Normal Rainfall
Total Rainfall in the year
Area under Rabi
Area under Kharif

CURVES SHOWING RELATION BETWEEN
CULTIVATION AND WATER SUPPLY
MEERUT DISTRICT



**CURVES REPRESENTING THE YIELD PER ACRE
OF THE VARIOUS CROPS IN THE
UNITED PROVINCES**

