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ECONOMIC FRUIT-TREES

AND

THEIR CULTURE

BY

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"Rosemary", etc., etc.)

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- I General and Introductory.
- II Vegetative propagation of Fruits Trees
and other practices.
- III Common Fruit Trees.
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- V Descriptive plates.

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GENERAL

Fruit tree plantations were once only the monopoly of the rich and the trees served more as ornamental plantations rather than an economic source of income ; this was only 50 years ago.

The people were ignorant *re* the various branches of sciences of cultivation, manurial systems and irrigation. Due to present economic chaos people have taken up fruit-growing and its culture on more or less larger scales. The farmers have realised the present change of things, taste and education of the public at large, and have felt a keen necessity for fruit cultivation and its upkeep.

Fruit-gardening is a science by itself and needs education, economics and capital. Though it is found that the general acreage is increasing from day to day, still the principle of maximum yield in minimum time limit is wanting. In certain parts the gardens have done well for the first few years but later deteriorated to a great extent. Hence a plea for scientific education and precision is essential.

Capital.—Capital is one of the main balancing factors in Horticulture. The mango, orange, cocos nucifera, grape vines and chikoo require a good amount—especially for the purchase of their seedlings and grafts. The seedlings of guava, fig, lemon and pomegranate require less cost.

Grape vines are costly affairs. The initial cost of seedlings, standards for supports and preparation of soils, irrigation facilities etc. is great, soon after expenses for interculture, pruning, manurial treatments etc. are incurred. Once however it is established most of the income is realised through catch crops—such as chillies, brinjals, onions and other vegetable crops.

Marketing places.—Fruits are perishable goods and hence vicinity to marketing places is one of the essential factors in realising their full economic value. Railway facilities, roads, and if sea and river sides, cheap plying boats are necessary for their safe transportation. Mango-fruits, oranges and pomegranates last longer—while figs and guava fruits are delicate and perish soon.

During recent times motors plying on hire are helpful and have facilitated fruit transportation to a great extent.

Customers.—Before plantation one ought to consider the local demand for fruits. In many areas solitary gardens are unapproachable to a customer unless there are other plantations for purposes of comparing and settling prices of whole sale transactions.

The owner ought to possess sufficient knowledge of tending trees and local labour. In many plantations, due to crowded field operations labour is scarce and trees suffer from unwieldy growth and various diseases. This undue delay is the cause of deterioration in field and consequently regular sales are discouraged. Round about Poona vines have mildews and scale is not uncommon on oranges, hence gardeners ought to possess sound knowledge of local conditions.

Garden Soil.—Garden soils should be well drained, porous and rich in organic material. Heavy soils have tendency to crack and this has a deleterious effect on the roots of the fruit trees.

The best soils are medium black with $\frac{2}{3}$ ' layer soil and below murmi sub-strata. It is found that a slight proportion of Calcium is helpful in soils as it helps proper drainage. The sub-soil strata always differs in its chemical and physical properties though in appearance it may

resemble the surface soil—hence great care is taken in their ultimate pulverization while deep ploughing is taken up. This operation is all the more important in garden soils, before suitable plants are established.

Soils near about nallas and rivers are generally preferable, but in certain tracts of Ahmednagar district soils are deliterious to fruit-growth. It is found that along the banks of the River Seena the soil below $\frac{2}{3}$ shows hard pans and with large quantities of poisonous salts. No fruit tree is capable of growth and often irrigation wells show brackish and saline waters.

In certain parts the adjoining soils and crops therein are some of the factors that determine growth of new plantations. Sugar-cane fields along the higher levels percolate a good deal of moisture into the adjoining gardens and this is an instance in question. Plantains, however, seem to fare well. These also show a sort of limit, or in excessively irrigated fields they grow sterile and in rare cases a small yield is available.

The question of soil drainage along the canal sides is claiming the attention of the Agricultural Department and fruit plantations

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along the canals is not an easy operation to tackle. Soil showing an undue amount of percolation needs drains and such crops as mango etc. that require no irrigation after 4-5 years time, are highly recommended. In certain areas deepdrains along the fields are necessary and so also plantations of guinea grass. The grass is useful inasmuch as it serves in binding the soil particles, absorbs excess of moisture, and is also useful as fodder to cattle.

Now taking for granted the soil is well drained on a higher level, is deep enough and even sub-soil water available, still the irrigation water needs examination. In Ahmednagar and Sholapur district the water is found to be brackish containing salts. This is deleterious to trees but Rabi and Kharif annual crops escape the bad effects in certain areas due to excessive irrigation of salt-water soils which are uncultivable. The irrigation water needs chemical analysis before being utilized for the crops.

Canal-areas and fruit cultivation need further consideration. Fruit trees (mango) require less water and for 4-6 years only are recommended. Papaya and plantains are useful since these last only for 3-8 years respectively. Grape vines and

cane cultivation require consideration, since their harvesting time is in February when labour is generally scarce. Canefields also encourage mildews on grapes, due to damp and cold weather. In well drained soils, oranges, lemons etc. fare well.

It is found sometimes that in small areas which lie in between hills, due to radiating heat, no fruit culture is possible. During summer time there is excessive heat. Trees dessicate enormously and the blossom is meagre. No irrigation improves the condition—these soils are only useful for annual crops and slight chances of wild types of mangoes or fig growth.

Trees and spacing.—This is again an important consideration. In certain parts, orange fruit trees have been planted 10' apart, in other localities 14'-15' apart, and in Khandesh 18'-20'. The same consideration arises in mango-culture. In general, however, sufficient distances in roots of individual trees are essential. *Ficus* sps. are seen to send out roots to a length of 125'. Orange trees are capable of sending out roots to 30'. For practical purposes these distances do not count. On an average, roots and rootlets spread in directions of food and water

and this rule holds good till trees grow to a medium age. The consideration of distances depends largely on the spread of branches, and hence this growth is a criterion of approximate spacings. Moreover this has to be suited to different climes and soil conditions.

Wind belts.—In fruit culture wind belts are essential. This is necessary to afford protection from animals, and thieves as well as hot and cold breezes.

In Konkan, areca, catechu and cocos nucifera trees need protection from sea breezes, hence *Pongamia glabra* and *Thespesia populnea* serve best as wind-belt trees. They show deliterious effects of hot sea breezes and thus healthy growth of blossoms and fruits are affected. In precarious conditions even fresh and terminal buds are scorched and the general appearance of the plantations remains sickly. Surat, Badoch, Kathiawar etc. show cypress wind-belt trees along the coastal regions.

In many parts शेर, शेकरी, पतंगी, तूत भेद्री, सागर गोटे serve as protective trees. The various plantations of oranges, figs, banana, guava, pomegranate etc. need these wind belts. This is essential in protecting wind-borne diseases of various fungoid

spores and more so in grape vine areas. It is also advisable to have these belts erected before actual plantation is done and thus most of the insects and fungoid pests are warded off.

Plantations.—The trees on transplantation show blanks in certain rows and these should be filled in from time to time. One ought to take great care in maintaining even growth of plants and also of the same age and vitality. It is found in certain areas that ordinary farmers have little choice in selecting one and the same species of trees only, and in many cases he has a variety of fruits in one and the same field. This diverts tree growth and yield is uneven and poor. The fruits deteriorate in quality and gradation and fetch less value. Hence it is essential to have trees of the same type, age and vitality in order to effect steady yield and income in regular seasons.

At the beginning of new plantations there is practically no income and it is advisable to have a few catch-crops. These are advisable only on a small scale so that no harm comes to the main crop. Certain plantations, like those of oranges etc., do not require much watering, hence

lucerne grass or banana as sub. or catch crops are deliterious. Even papaya is not advisable since these shade trees and soil.

Only those crops growing short and capable of yield in six months' time and requiring little moisture are recommended, like chillies, garlic, cabbage, knolkhol and other vegetable which are quite suitable. In cases of old plantations, cucumber मटकी, उडदि, ताग etc. are tolerable.

Great care should be taken in irrigated soils. Most of the canal side areas have become permanently useless for cultivation purposes, through excessive moisture. This renders soils sticky, unhealthy and encourages obnoxious weeds like lavalala, पाण, कुंदा, कंदा, and हराकी etc. Hence great care should be taken in proper and timely irrigation of the gardens.

Artificial manures.—These are utilized to excess in foreign countries, like America etc., and only recently India has taken these up. In earlier stages these manures were used in excess with no notion *re.* the “ Law of Minimum Returns ” hence they proved deliterious.

Local manures like those of F. Y. M. pou-drette, green manurings, leaf litre, bone-meals,

blood, various oil cakes and ash need encouragement. The soils not only improve their texture but also the organic-food of plants.

In places like Sirsi and Sidhapur, the arca catechu plantations have leaf litre from such trees as **रोन, किंजक, कुथला, कुंशा, आवका, बिबका, जांथक, हरिड, मोहरा** etc. and soils have available potash and N. per cent increase, and naturally plant food is rich. Hence any dead dying branchlet litre should be well stored and conserved.

These are put in deep pits with alternate layers of earth. The litre rots soon after the rains are over and is available as manure for heavy and sticky soils. It improves soil porosity.

Fruit gardens need bone-meal very often and these are even superior to super-phosphates in many cases. The former has N. while the latter is devoid of N. and is also a costly manure. Hence bone-meal is highly recommended both for young and old plantations.

Young plants should have N. as plant-food since it is an element essential for leaf growths. It is also available in F.Y.M., poudrette, **तागाथे, बिबड** green manures, oil cakes, fish etc. These manures rot soon in soils and as such are very

advantageous and are useful within 30 days time, or so.

Besides the above there is sulphate of ammonia or sodium nitrate. In soils where calcium is seen in high proportions, sulphate of ammonia is recommended, while sodium nitrate is useful in sandy soils. In certain areas trees are being treated for Bahars and mostly F.Y.M. is given. This manure has less of N. and more of phosphates and potash, hence it should be replaced with N. manures in order to encourage leaf and blossom.

It should also be noted that freshly dug out manures should not be immediately utilized since these have harboured insects which are more deliterious as crop-pests than the disadvantage gained in wastage of the raw elements of the manure.

This needs exposure and stirring so that the eggs and caterpillars may be destroyed. The litre is also full of hot gases as soon as it is dug out, and it is deliterious to apply the same directly to the trees. Hence it should be exposed and dried before it is finally applied.

In certain tracts fruit trees need protection from birds, thieves, bats and even monkeys. Figs,

guava, chikoo and pomegranate fruits are often destroyed. In Konkan monkeys are very troublesome and even plantain fruits are to be protected by means of wire netting; thus it will be seen that fruit trees need careful attention and tending for a long time.

During recent times fruit culture has been taken up in many parts of India and there seems a great possibility of its spread, especially in the Deccan. Mango *Artocarpus*, *integrifolia* etc. are being keenly taken up in many parts of Konkan, Mawal, Nasik, Poona, Satara and Belgaum. Side and wedge-grafts of mangoes are keenly practised.

Kandesh, Nagar, and Sholapur have orange sps. gardens and these also thrive well on irrigation waters. Poona, Satara and Khandesh are places where fig culture shows great possibilities. Bananas need further cultivation. In Konkan *Ananasa sativa* seems to be a paying crop, but the fruiting season being in the rainy months, transportation is hindered. Guava trees, however, are grown everywhere excepting S. Konkan.

On the whole it is found that fruit transport by rail is inconvenient and negligent. The parcels are very roughly handled and at places

kept for days without transportation. There is a practice in some parts of Nagār to send grapes through earthen pots and this needs great responsibility on the part of the Railway authorities. Fruits, vegetables etc. are perishable commodities and are soon destroyed—these ought to be transported at the earliest convenience and at lower rates. It is found that freight-charges from Goa to Bombay are much higher than those from Ratnagiri to Bombay. These and other grievances need to be rectified.

The negligence found on the Railway is also accelerated by careless packing of fruits by the gardeners themselves, and naturally the market value is lessened. In short, fruits ought to be graded and well packed and would thus fetch higher values and create a better demand.

Here in India there are no suitable Farmers' or Fruit-growers' Associations and in many cases therefore fruit is either lower in quality or fetches lower prices. In some of the orange gardens the fruit is ready as early as March but they are uneconomic, due to on suitable demand and transport, hence the successive Bahars are neglected and overlooked. The middlemen are a regular nuisance inasmuch as the fruits are secretly sold

rather than in open auctions and the fruit-grower is hard hit.

Perishable goods need wide advertisement, and their rates to be published through the daily local papers.

There is also great demand for raw and canned fruits outside India. England imports large quantities of fruit every year from America, W. Indies, the Phillipine Islands, S. Africa and Australia.

Countries like those of Iraq, Busra, Arabia, Egypt are in close vicinity to India and there is also a great demand for oranges, mangoes, bananas, chikoo and fruits like ananasa, sativa. It seems, however, that scientific knowledge, enterprise, capital and industrial outlook are neglected, hence a great deal of work has to be done in the near future.

The raw materials and by-products from fruit-trees are important and most economic in some ways. Mango and orange fruits can be canned and juices utilized for suitable drinks. Lemon fruits which grow during rainy seasons can well be bottled, oil extracted, and even products like Citric Acid are most useful. Similarly

fruits like guava, banana, ananasa, sativa and *Artocarpus integrifolia* can be tinned if suitable factories are established. The above suggestions are useful and should be taken up and practised to suit different climates, seasons and circumstances.

Above all, the owner is responsible for the proper management, economic yield and healthy growth of fruit trees. Science as applied to soil, irrigation and tending of fruit trees, is always interesting and economic, hence the owner's care and personal experience counts. Daily routine and practical suggestions are the keynotes to economic fruit-gardening.

Vegetative Propagation

GRAFT AND GRAFTINGS

The importance of growing seedlings with the explicit idea of growing better and healthier varieties is coming in the forefront, especially as studies are advancing in suiting the trees to environmental conditions; wild types are dominating at the expense of more economic ones. Vegetatively grown sps. deteriorate and thus growing of scions over pedigreed stocks combine vigour, strength and suitability with production and immunity to various diseases.

Graftings.—Union of scion and stock cambium. Elaborate plant food material descends down to growing, parts of buds and on union of cambium tissue the joints are healed up into one plant-life. There are several types of grafts suitable to different occasions and different fruit trees.

(a) *Whip graft.*—In grapes and guavas.

(b) *Side whip graft.*— $\frac{2}{3}$ scions can be grown on one vigorously growing stock.

(c) *Cleft graft*—Oranges, mangoes and

here conical shaped scion is worked on to thicker stocks as in broken and heavily damaged trees.

- (d) *Bark graft.*—
 (e) *Veneer graft.*—(Not of economic utility.)
 (f) *Side graft.*—
 (g) *Bridge graft.*—
 (h) *Enarching.*—This is fairly common in Bombay and even on a commercial scale in mangoes, chikoo and oranges.

This is easiest and brought about by “approach”. The scion is gradually separated by giving cuts and thus nurtured from the stock plant into a healthy and productive one.

Fruit Trees.	Wild varieties.	Propagation.
Mango	Wild Variety.	Enarching.
Chikoo.	Chikoo.	" "
Orange.	Mahwa, <i>Bassia latifolia</i> , Jamburi, eer lemon,	Enarching.
Pomegranate, Banana, date, pine apple, guava.	Pomelo, lemon. Sour variety.	Seed as well. Suckers. Seeds and Root cuttings.

Cuttings.—This form of propagation is most common and trees breed true. This is all the more important in producing quick results and at the same time interesting from the point of view of fruit and ornamental gardening.

Cuttings are taken near about the inter nodes where the cambium tissue is most active. A cell is a living unit and has power to produce roots, leaves and branches. Cells of cambium grow, adding wood tissue inside and bark outside, and when the wood is formed the cells of cambium help to grow callus from which roots are thrown. Some of the cuttings grow much quicker than others and there are several kinds of cuttings such as :—

- (1) Single eye cuttings, Figs.
- (2) Simple cutting, 2-3 buds on.
- (3) Heel cutting, part of branch, bark and stem taken.
- (4) Mallet cutting, part of stem.
- (5) Root cutting, Guava.
- (6) Nurse root cutting, roots of same plant fixed in it and being nursed from the same plant, Mulberry.
- (7) Tip cutting, Olives.

- (8) Trenchon stem with 2-3 eye and branches.
- (9) Dormant cuttings; mostly hard wood cutting. Trees have distinct resting period, apples, pears, figs and grapes, and naturally buds sprout before roots eminate.
- (10) Semi-dormant cuttings, oranges, lemons, tropics and subtropics, leaves are ever green While taking cuttings leaves must be left on as there is less storage of food material and they die before formation of rootlets.
- (11) Succulent cuttings ; soft wood cuttings mostly in ornamental plants. Spineless cactus.

Transplanting of cuttings is very important, the main idea being to give greater space and to make plants healthy and hardy when taken up from the callusian beds.

Taking up from the callusian beds and transplanting into open fields is to give these plants light, air and moisture to make them grow into vigorous plantations. Care, however, should be taken to preserve loops and free play of fibrous

roots with mellow soil all round. The roots could, however, be cut with scissors whenever the transplanting of hardy plants is overdue, due to neglect or want of labour.

Nursery diseases: Blights—aeration is the remedy. For caterpillars, Pb. arsenate loz. 4 gals. water.

Aphis, 2 lbs. tobacco 2 gals. water, boil and after 24 hours add 1/2 lb. soap. Dilute 7 times and spray.

Budding.—Budding consists of removing the bud or eye of one plant and making it grow on another of a closely related variety. For instance, oranges can be budded on lime trees or a rose on another rose plant. Cut out from below upwards a single bud from the plant to be propagated. Make a T-shaped section on the bark of the plant to be budded and raise the bark by inserting the thin end of the handle of the budding knife and insert the bud in it. Then secure the bud in the slit by means of “sopat” or strips cut out of the stem of the banana plant.

In budding the several kinds of oranges only a vertical slit is made and the branch is slightly bent in order to raise the bark. It is difficult to learn the operations of budding and

grafting from mere reading. They are quite simple and easily learnt from an experienced *mali* (gardener).

Layering.—Layering consists in getting a new plant from a tree you want to propagate, by making a branch of the parent tree strike roots, while not, as in the case of the cutting, being completely severed from the tree.

To do this select a branch that will bear bending down without breaking. Below one of the joints make a slit in the direction of the root end, about an inch or two long. Care should be taken to leave the ring of the joint intact. From this ring the roots are thrown off. Keep the slit open by inserting a small flat stone. Then bend this slit portion of the branch into the soil in a pot or into the ground and cover it up with mellow soil. Put a weight on the soil to fix the branch firmly in it. Water should be given as in the case of cuttings.

Roots will be thrown out from the ring referred to above. When they are well developed the branch can be completely severed from the tree. This if practicable is a surer way of propagating trees.

Propagation by Seed.

In nature one can find several kinds of propagation and especially that by seeds. Seeds do not breed true to their kind and as such this problem of propagation by seeds has become an absorbing subject in recent times. These should be always from ripe fruits and well stored and preserved before planting. Pomegranate seeds can be kept for a year or more in naphthaline or 2% formaline solution. Some of the fruits can be kept in sawdust or charcoal in order to keep them safe from insect pests and unhealthy conditions. The ideal condition is the maintainance of Temp. 65 and moisture 8/9 under glass in colder regions.

Stratifications.—Done generally in hard coated seeds (stones), such as in mangoes and cocoanut. This is economic, saving labour and watering charges. One layer of sand over a layer of seeds in moist condition or even by using sawdust in barrels ; these could be sprouted into healthy seedlings. Germination can be hastened by putting them in hot water formaline or even cracking the hard seed coats, thus giving suitable impetus to coty lidonary leaves.

Preparation of seed beds, seeds and their vitality, germination percentages and their growing under suitable conditions, are the most important questions a successful Horticulturist should bear in mind.



Heavy Soils and Root Exposing

This operation has been found necessary in orchards and fruit gardens, especially soils under citrus plantations and such xerophytic plants as pomegranates. It not only draws one to the question of overcoming soil conditions by mechanical and manurial operations but studying plants and their adaptability in overcoming physical and physiological conditions in which they feed and nourish their very species from generation to generation. One has only to understand how and when to apply a few theories and principles in order to help economic yields.

Green manuring.—Soils due to organic humus are rendered porous and open, and moreover soil moisture and absorbent capacity are helped. They add nitrogen and prevent washings of nitrates. Sann Hemp is commonly used for such purposes and it is found to be cheap in citrus plantations.

Hard pans:—These are due to various conditions, either ploughing, precipitation of salts, or using heavier implements indiscriminately.

These are responsible for causes of such phenomenon in trees as "Die Back". A tree shows dying back or tops get withered till the whole tree dies due to the roots hitting the hard substratum.

This could be overcome by breaking the rock below or hard substratum due to salt-pan or plough-pan.

The causes of die back may also be due to *Diplodium* (Fungoid disease) and healthy open soils and growing roots enunciate the principles of root exposing.

Root exposure.—This has come to stay as an important operation in fruit culture. The soil round about the roots is turned over, plant food made available and along with these root pruning is effected. Leaves dropped, and food material within plants accumulated, is a direct impetus to fruit buds. Thus the very principle of "Forcing Climate" is evolved or treating plants for different "Bahars" in order to tide over unsteady markets. This is all the more important considering country-side fruit plantations are almost on the wane or reduced to a nonentity.

Pruning in an Orchard (Viticulture)

This operation, along with training and grafting in vineyards in particular, is an essential factor in the production of a successful farm. The internodes are filled with soft pith, but at each node there is a continuous growth of hard wood through the cane. If a cut is given just above the node the flow of muciligenous material quickly heals up the incisions. It is due to the understanding of this principle that more vigour, strength, shape, and setting of fruits are seen. A cane cut back $\frac{1}{4}$ buds is a spur. A branch more than one year old is called an "arm". A spur with $\frac{3}{4}$ buds is a fruiting spur and a short spur with one bud is called a renewal spur.

The fruit is borne in a few clusters near the base of the growing shoots of the season which spring from the wood of the last season's growth. Thus pruning is essential and corrects faults of habit such as suckering and water sprouting, though the effect is so indirect. Due to prevailing practices it is seen that various systems mould

the shape of plants and consequently final production of yield as seen below :—

If umbrella system affected ...	27 lbs.
Junar system ...	8 ,,
Single stake system ...	5 ,,

This mode, and knowledge of pruning, goes a long way in ultimate fruit production, taking soil and climatic conditions as even.

In plantation it is a question of renovating older vines rather than doing top working of spurs. Vines send strong suckers from the ground ; such suckers should be encouraged and trained to stakes. The secondary canes growing should not be pruned as early as April but be left for ripening till October, the rest of the treatment being as practised in up-to-date vineyards.

System of pruning : Apart from pruning in grape-culture we have several others such as

- (1) *Leader system* : The central one allowed to grow and side branches removed, viz., in road-side trees.
- (2) *Delayed open centre* :
- (3) *Open centre* : This is an improvement over the other two and mainly useful

in orchards. Only the centre is open and the side or lateral branches cut as the main one. This encourages fruit growth and healthy regeneration due to even sunshine.

Fruit Trees

Mango.

Mango is grown in tropical countries, Italy, E. and W. Indies, coastal areas of Konkan, Goa, Turkey, in Asia, Arabia, China and Brazil. It thrives best in a humid climate with black soils but grows fairly well on laterite soils. In Bombay, Belgaum and Ratnagiri it is cultivated on a large scale and its cultivation as a canning fruit is drawing greater and greater attention in recent times.

Rainfall 30/100" and altitude 200°. Propagation by seeds is carried on in many parts but recent scientific ways of grafting and enarching, and even budding as done in the Philippines, show better yields and produce superior fruits. Stocks can be grown in situ with full and vigorous growing seedlings, having drought-resisting qualities. Budding, however, is difficult due to monoembryonic types and delicate tissues underneath the bark.

Manuring.—112 lbs. F. Y. M.

5 lbs. bone-meal

10 lbs. ash.

Goat manure is applied in some parts.

Application of salt is also recommended.

Pits taken 30 ft. apart. In Sindh 20-25 ft.

Ten year tree yields $4/500$ fruits

40 year tree ,, $1/1500$,,

Cost Rs. 250 per acre.

In the Nawabshah district, Sindh, many inter crops are being taken for the first 3-5 years, such as chillies, brinjals, bhindi, onions, barley and even *jawar* during the hot season for purposes of fodder.

Fruits generally from the fifth year, though much depends upon manuring irrigation; and silvicultural method. Top working is done occasionally in order to eliminate drones or barren branches. Heavy pruning is, however, deliterious.

Marketing.—Semi-ripe fruits are taken down and stored in wheat or rice straw. Proximity to a railway station, age-bearing capacity of trees and consequently early or late types, behaviour of bearing are some of the important factors which influence a successful financial return to the farmer.

There is need for useful propoganda and knowledge of transport packing, and lastly can-

ning. The ripe fruits are wrapped with moss, charcoal dust, newspapers and oil papers in order to effect proper temperature, moisture, cool and dry conditions. Fruits as well as seedlings can be sent to distant places with proper care and protection.

FRUITS.

Gopal bhog.—

Langra.—

Malgoba.—(Madras).

Fernandin.—(Goa).

Pairi and Alphonso.—In one type both shoulders fall equally while in the other the right side is higher. These are nice fruits for canning.

Cowasje Patel.—Utilised in pickles and jam. There are several local varieties in the Deccan and coastal areas which are a mere waste as compared to the foreign mart and economic utility.

Canning.—Raw fruits can be stored for one month or so.

The storage of fruits with the aid of the latest appliances serves to tide over marketing and shipping encumbrances. Rice husk used for walls, ammonia for lowering the temperature,

wooden walls with rubber linings, and platings of asbestos are the facilities in the latest model ships' cold storages.

Ripe mangoes can be bottled with saline solution with proportions 8-9lbs : 100 of sterilised water. (sp. gravity 1.04).

Ripe mangoes are clean washed and juice with sugar solution is capped with tin covers after elaborate processes of sterilization and balling. In Pressure Cooker where mango pulp undergoes exhaustion, nearly 3lb. pressure lasts in clean and handy but suitable size bottles, which later could be used in marketing abroad now that the demand is becoming greater.

Canning centres.—

- (1) Hanover, Canada.
Muzafergarh, Bihar,
Ratnagiri, Konkan, India.

DISEASES AND PESTS.

Capnodium meliola.—On Dharwar side. Mostly Spray Bordeaux mixture with spraying machines.

Jassites and thrips.—Rosin soap compound best.

Beetles and weevil.—Cementing holes or using petrol gas.

Grapes.—Viticulture has been known to gardeners since the days of early history. Vineyards of the U. S. A., S. Europe and eastern countries of the Asiatic continent are well known and so also are their by-products. There are nearly 40 species and of them all *V. vinifera* claims the most attention, since the largest areas are covered under its cultivation. Egyptian mummies show evidences of grape stones as old as 3000 years and Swiss and Italian dwellers of lakes trace them to the Bronze period.

COUNTRY.	ACRES.
France	... 2.4 mil. hectares.
Spain	... ..
Germany	... 181,872 acres.
Switzerland	... 37,000 acres.
U. S. A., California	... 675,000 acres.

Italy and Greece.—2 mil. hectare.

France.—“Vine land”. The second greatest country in the world, its products of grapes being well known. Cognac, armagmac, vinis roses,

and champagne are some of the famous French brandies and drinks. A great import trade is done from centres like Bordeaux and Loire regions to various parts. Areas : 1.36 Mil. Hectares.

England.—Varieties.

(1) Black cluster.

(2) Black Prince.

● (3) Royal muscadine. There are no vines growing nor any fruit for table purposes, though, the above types may be found in a sunny aspect but more as an ornamental growth.

Spain and Portugal—These countries are reckoned to be 3rd in the grape growing countries of the world; the chief centres being Barcelona and Andalusia. The varieties, Malega and Almera, are heavy bearing, especially the former which is used for raisin industry.

Thus looking to world statistics, our grape culture and its economic outlook, scientific pursuits are becoming more and more hopeful. It is true vineyards from the Indian soils, especially in Bombay Presidency, are on the wane, but places like Nasik and Poona experimental stations may become a nucleus in future under the new venue of co-operative and capital organiz-

ations which are the chief stakes in these days of economic glut.

Classification.—

- V. labrusca (Northern Fox grape).
- V. rotundifolia (Northern Fox grape).
- V. aestivalis (Summer grape).
- V. venifera. (Bom. C. D. India.)
- V. cardifolia.
- V. vulpina.

Vitis Venefera.—This is extensively grown in India and Baluchistan, Quetta, Sindh, Shikarpur and Larkans Districts. In foreign countries these have been utilised extensively for the production of raisins, wines, alcohol and currants. Apart from the economic outlook, vineyards from the Moghul periods have been landmarks of fame and formed one of the most famous and ornamental gardens :

VARIETIES.

(1) **Black.**

Hafsi or Kali or Black Morocco. Shy bearers deeply lobed, bright green. Bunches heavily shouldered, large irregular berries.

Neela—Miller's Burgandy. Leaves pubescent, bunches oval, black with purple bloom.

Karwandi per cent. Black Prince per cent. Bunches with tapering berries, small, round, dark when fully ripe.

(2) **White:**

Sahebi (Decons superb) amber coloured. Berries narrow at the base and broad towards apex. 18/22 per cent. sugar. Best for wines.

Fakdi (muskat of Alexandria), amber coloured, musky broad at base and narrow at apex 16.4 per cent. sugar. Heavy bearing such as with phyllosticta stock.

Kishmishi.—(Seedless variety) Berries greenish white.

Bhokri.—(Red coloured or Abi) assumes a reddish bloom when fully ripe. 18.60 per cent. sugar, heaviest and best commercially. (Nasik. wt. 27 lbs.)

Gosani: rare.

Soils and Climate.—Centres, Nasik, Poona, Quetta and Aurangabad; soil being light porous with *murum* substratum and with moderate rainfall 28". Heavy rain is deliterious. Deep

ploughing during the cold season and ploughing-in of *Sann Hemp* (*Crotalaria juncea*) towards the rains is done in order to improve the fertility of soils.

Propogation.—Seed propagation gives spontaneous variation for selection and breeding purposes. The roots of *V. venifera* are found to be susceptible to the phylloxera insect, hence graftings of choice varieties are most useful. In **W.** countries the “phylloxera” type serves as “stock” for the European varieties, just as the Erivan type in Russia Armenia, Bukhara and even in the Alps, serves as a most suitable variety growing in the colder regions. Here local type *Fakdi* grafted on *Bhokri* yields 2lbs. more than the average yield on its own roots.

Yema graft is done in Spain. Here bud with wood is taken. Grafted seedlings infuse a resistant character, induce early and late fruiting qualities and moreover a standard of quality is maintained. Layerings and cuttings from ripe wood with 4-6 buds on are also means of propagation.

PLANTING AND LATER TREATMENT.

Seedlings grown in nurseries and transplanted after 6 months or so 7-9 ft. apart, with 4 stakes around. The practice of training and pruning comes in and it is said "Train for convenience but prune them for effect".

Grapes bear on shoots from the wood of previous years; grown as such there are two seasons. The ones pruned in April leave one bud and later in October, giving cut, leaving three buds : spur or short pruning. In long or cane pruning they are coiled round *pangara* or *Erithryna Indica*, and later systematised to short pruning.

In the second year of the treatment a few flower bunches may appear opposite 5/7th leaf on shoots on secondary canes (Fruiting spurs). These give fruit bunches by March and when fruits are removed pruning is done once again, leaving 1/2 buds from the base renewal spurs. Near these buds there are also 2/3 auxiliary buds but dormant, and thus in the third year the number of secondary canes increases. Dead ones may be cut short and cleansed or they serve best as hibernating places for insects.

Manuring.—This is one of the most important subjects before fruit growers of tropical countries, especially when most of the soils are devoid of organic material. The question of maintaining the balance between the leafy growth and desired fruits lies in using the right sort of fertilizers. Nitrogen encourages leafy growth while potash and phosphoric acid are necessary for fruit and fruit sugar. In addition to F.Y.M., poudrette, and sweepings,

Sulphate of Potash	...	2/3 cwt.
30 per cent k.		

Bone meal	...	1/1½ cwts.
21 per cent P. acid	...	per acre.

Soon after setting of the fruits, minor operations, such as pinching and “twisting”, is done in Southern parts of Spain and France and this ripens the sugar against the sun. In hot regions fruits crack and there is considerable loss due to encouragement of fungoid diseases.

Sterility.—In America and S. Mediterranean countries not only is the shape of fruits studied but also the mucilaginous material therein. In many of the weaker varieties the germinative nuclei degenerates due to constant planting

from generation to generation. These are partially self sterile, the natural effect being small and seedless varieties with no economic utility.

Pandhri type		Bhokri type
with	and	with
Phakdi		Pandhri

may be grown side by side in order to effect fertilization, thus securing uniform and flavoured bunches.

DISEASES AND PESTS.

There are several pests, both insect and fungoid, and a few physiological ones. Of all these downy and powdery mildew diseases are most common. They need several sprayings with Bordeaux mixture:

Cu. sulphate	...	3	parts.
Lime	...	...	2 parts.
Water	...	...	25·50 parts.

and soap in the subtropical region reduces flavour and taste to untimely sprayings and it is a study in itself to eradicate the fungus.

(2) *Anthracnose*.—Another disease with ring markings and depression on fruits. Spray:

Iron sulphate	...	50 parts.
Sulphuric acid	...	1 part.
Hot water	...	100 parts.

(3) *Cercospora viticola* : rust.

Spraying.—Timely spraying before and after flowering and even pruning and also proper strengths of solutions (caustic) are the chief means of harvesting healthy and bumper crop.

(4) *Insects*.—*Scelodonta strigicollis*. Beetle ravages on young shoots and buds. Should be collected and trapped in plantain leaves and bark tussels and destroyed by burning along with other rubbish and litre.

RAISIN INDUSTRY.

In Bukhara, Samarkand, Baluchistan and Western parts of the Bombay Presidency Muskat Sultanina Sultana, panarette, phakdi and black manuke types may be given trials on commercial scales. But further knowledge is required in utilising our own local varieties.

Conditions.—Light showers mainly distributed throughout the season and Temp. 117° F. and absence of dew help in the formation and drying.

Fruits are dipped in Lye (soda-bicarb. and water 30/30) diluted with 70 gals. of water and kept at temp. 70/75 C. This opens the pores of the fruits and gives light purple colouration, easily dried within 2-3 weeks.

Sweating in.—Ripe and dried raisins are rowed in along with half dried ones and thus uniform per cent. of moisture is maintained and 3 lbs. weight is reduced to 1 lb. The commercial value lies in competing in the foreign marts.

<i>Exports.</i> —Persia	..	70,252,000	Lbs. per year.
Austria	..	1,350,600	„ „
<i>Imports.</i> —U. S. A.	..	1,247,000	Cwts.
Bombay	..	1,000	Tons.
France	..	17,540,000	Lbs.

— — — — —

Cost of Cultivation of One Acre of Vine.

FIRST YEAR.

			Rs.	a.	p.
(1)	Sunn hemp seed	..	2	0	0
(2)	Sunn hemp sowing	..	1	10	0
	Ploughing in sun. hemp as green manure				
	2 x 2 bullock ploughs, 2 men, 6 women ; days three at Rs. 2-10	..	7	14	0
			<hr/>		
			11	8	0
			<hr/>		
(3)	<i>Preparation of Soil</i> :—4 ploughers by 2 x 4 bullock ploughs ; 4 days at Rs. 3	..	12	0	0
	Crushing clods by Maind	..	1	8	0
			<hr/>		
			13	8	0
			<hr/>		
(4)	<i>Planting</i> :—800 rooted cuttings at Re. 1 a hundred	..	8	0	0
	Laying, planting ; basins and water channels by piece work at Re. 1½ per 100 Vines	..	10	0	0
			<hr/>		
			18	0	0
			<hr/>		
(5)	<i>Irrigation</i> :—20 waterings January to May by 2 bullock ; <i>motas</i> and 2 men, 50 days (45) at Re. 1-12	..	87	8	0
	Proportion of cost of <i>mote</i> ropes	..	12	8	0
			<hr/>		
			100	0	0

	Rs.	a.	p.
(6) <i>Stirring in basins</i> :—(8 to 10 times) at Rs. 2	20	0	0
(7) <i>Manure</i>	15	0	0
	<hr/>	<hr/>	<hr/>
	35	0	0
(8) <i>Training</i> :— <i>Karni-canes</i>	1	8	0
<i>Pangara</i> posts, green, 800 at Rs. 7 per 100	56	0	0
Putting up posts at Re. 1 per 100 ..	8	0	0
One man employed to train vines for four months (March to June) ..	40	0	0
<i>Extras</i>	4	0	0
	<hr/>	<hr/>	<hr/>
	109	8	0
	<hr/>	<hr/>	<hr/>
Therefore First Year Total Expenses	288	0	0

SECOND YEAR.

(1) Pruning twice in the year at Rs. 2 ..	4	0	0
(2) 4 Ploughers, twice in the year by 2 x 2 bullock ploughs, 6 days at Rs. 3 ..	18	0	0
(3) Preparing basins and water channels, twice in the year at Rs. 6	12	0	0
(4) <i>Manure</i>	12	0	0
(5) <i>Coir string</i> for tying	2	0	0
(6) 12 waterings :—two 2 bullock <i>motas</i> , men 2 and days 30 (24) at Re. 1-12 ..	52	8	0
6 Stirrings at Rs. 2	12	0	0
(b) 12 waterings (contd.)			
Part of cost of <i>motas</i> , ropes etc. ..	8	0	0

	Rs.	a.	p.
(7) Extra for plantation, leaf tassels, collecting beetles etc.	9	8	0
Therefore second year Total ..	<u>130</u>	<u>0</u>	<u>0</u>
THIRD YEAR.			
Same as second year	130	0	0
2 to 3 sprays with Bor. Mixture ..	15	0	0
Therefore third year total ..	<u>145</u>	<u>0</u>	<u>0</u>
Initial Cost first year	288	0	0
second year	130	0	0
third year	145	0	0
	<u>563</u>	<u>0</u>	<u>0</u>
Deduct value of the crop in the third year (more or less)	63	0	0
Net Initial Cost ..	<u>500</u>	<u>0</u>	<u>0</u>

From 4th Year the plantation becomes more than self supporting.

	Rs.
5 lbs. grapes per vine in 4th year and sold 2 Ans. a lb., 800 vines in acre ..	500
Deducting 15 as cost of cultivation and 150 for watching etc.	300
Net Profit ..	<u>200</u>

Later on a vine has 10 to 15 lbs. grapes and profit may be, if manure is used, Rs. 350 to 400

Citrus and its Culture

Citrus plantations are indigenous to Asiatic countries and careful researches show that these are spreading slowly to Western countries of Europe. Arabs were the chief agents in the transplantation of Citrus from Mesopotamia, Oman, Syria, to Spain and Africa. Kurg and Kamala varieties are well-known throughout regions of Travancore, Mysore. Navel oranges come to Bangalore from Washington. In some respects the Portugese, who had circumnavigated Africa visiting India and China, were responsible in introducing the Citrus to Europe.

CLASSIFICATION:

Citrus aurentium.

- (1) *Amara*, sour orange, Sevelle.
- (2) *Bergamia*, Bergamat orange.
- (3) *Sinensis*, common orange.
- (4) *Bahia*, navel orange.
- (5) Valencia.

Citrus Decumana.—

Includes Pomelo and shaddock.

Citrus Médica.—

Genuna—all citron.

Lemon.

Acida.

Citrus Joponica.—

Kamkuat—Negami.

Marumi

Citrus Nobilis.—

Most of the Mandarin oranges.

Satsuma.

Tangerine.

Citrus Trigoliali.

STATISTICS :

Countries.	Production.	Importation.	Box wt.
(1) U. S. A. ..	31,756,000	397,000	70/80 Lbs.
(2) Spa in 1927 ..	33,898,000	..	70 "
(3) Italy ..	9,168,000	..	..
(4) Japan ..	9,802,000	..	..
(5) Gr. Britain ..	..	12,105,000	70 "
(6) Australia ..	2,098,000	..	..

China produces a large amount but figures are not yet available. There is an extensive mart outside especially for the finished products and different varieties, as the above figures show.

Soils of the Bombay Presidency.—Citrus prefer well-drained soils on the whole. Round about Poona District soils are medium black and as such suitable for *Santra* and *Musumbi* culture. In Khandesh loamy medium black soil underlaid with yellowish subsoil mixed with lime nodules is found. By the river sides alluvial soil is best but in certain places, such as the Nira Bank Canal, water is too near the subsoil substratum to allow of successful citrus gardening. It is also known that due to greedy and careless irrigation soils have been made so useless as to be turned into waste or salt lands; and this is really a great problem before fruit growers.

Stocks and Budding.—This operation is most important in making an orchard a success. In the case of most farmers who fail it is in their selection of stocks or budding on a suitable stock. This not only helps immunity from pests and diseases but aids in securing fruits of the right type. There are various types of stocks such as *mahalung*, *santra*, *kagdi limbu* and *jamburi*. It is found that the last one remains in a sap flowing condition for a long time and withstands budding operations well.

Pomelo stock.—Does not stand transplanting and trimming of its tap roots while treating for Bahars.

Mosumbi stock.—Is sensitive to flooding.

Reshmi orange.—bark does not easily lift up nor has it any muciligenous sap to bring about union.

—Buds must be from healthy plants and preferably from young trees. Scions, round with whitish streaks, and plumpy buds are best. These last for three weeks if called for from long distances.

In the Bombay Presidency oranges and lemons are mostly grown from seeds, whether exotic or indigenous. It is, however, realised that growing from stock of *jamburi* has given the best results and even been shown to be responsible for effecting thornless types, and best yields.

Manuring.—The most common is F. Y. M. (farm yard manure, mostly cow-dung manure) but bone meal and wood ashes, which help in the formation of pulpy fruit, early ripening and acid % are the latest and best tried.

20 lbs. F. Y. M.	...	10 lbs. F. Y. M.
10 ,, Wood ashes	...	2 ,, Ash.
5 ,, Bone-meal	∴	1 lb. Bone-meal.

are the proportions to be used. After one year of plantation, increase the latter proportion for 8 years. These are mixed with soil and given in the beginning of the rains.

Diseases and Pests.—Scab, gummosis (gummy appearance) die back, and tampera (*Fusearium limonis* Remedy—paint with 50% carbolic acid.) The last of the diseases is also attributed in certain circles to mite-cause.

Red ant.—Katol powder.

Scale insects.—On fruit and leaves. 2 lbs. rosin, 1 lb. washing soda and 8 gal. water.

Lemon caterpillar.—Attracting to light and moths destroyed.

Aphides.—Serious during the cold season, from October to February. Remedy:—

(1) Incosopal one lb. in 8 gal. of water; mix and spray.

(2) Tobacco mixture:

2 lb. Tobacco

2 gal. soap solution, water kept boiling and mixed with 7 times water.

TREATMENT FOR BAHARS.

Orange plants are deciduous and it is in this condition that bearing of flowers and consequently formation of fruits are controlled by irrigation and manuring. It is akin to forcing of climate on account of pressure of marketing and tiding over unnatural conditions brought about by soil or insect or climatic conditions.

Ambabhar.—Flowering towards February.

Mrigbahar ,, ,, June.

Hastbaha ,, ,, October.

The last named is seldom taken unless in precarious tracts or when *Mrigbahar* is missed. The resting period depends upon soil and subsoil percolation, and they are found to flower irregularly wherever they are in the vicinity of sugarcane plantations; roots exposed, pruned and manured, and flowers appear after one month and fruits after 10 months. Soon after manuring and earthing up, very little watering is done on the first day, 2nd (Aмбаuni Chimбаuni) day and 5th day (Chimбаuni) and afterwards irrigation is done in the usual manner. In Khandesh *Ambabhar* and also at Nasik, but at Nagar *Hast*

bahar; it fetches a good price though much care has to be taken against insect pests.

Kagdi and Pomelo are pretty hardy plants and do not require rest. In other varieties, however, Pomelo and *Kagdi* can effectively be used in cases of soil exhaustion.

Inter-Crops.—These are taken under certain conditions, such as that they should not shade the main crop, utilize most of the area instead of predominating Lavala, Kunda and Haryali, or even such abnoxious weeds as mimosa pudica and moreover adjust themselves to the time of harvesting and reaping. Chillies, onions, garlic, rozelle, capegooseberry are nice. In Khandash plantains, papaya and at times cotton jawar and *bajri* are taken in days of scarcity. In Ahmednagar District, lucerne is taken but it is deliterious in this sense that it removes much organic material from the soils.

Smaller type of plantain (Basrai) are found in certain parts but the question of judicious mixture, times of harvesting, irrigation facilities, and labour is really the key-note to a successful fruit culture.

FRUIT CLASSIFICATION AND THEIR
COMMERCIAL USES.

(i) Juice sacks are easily separated from one another. (The young shoots and leaves are hairy).

(1) *C. Decumania*: the Pomelo, are found with white and red pulps, the latter fetching a better price. There is also an intermediate variety to be found.

(ii) Juice sacks in fruits are not easily separated and adhere *en masse*. Young shoots and leaves not hairy.

(1) Fruits are not mammillate—stigma end is flattened. *C. Aurentium* and its varieties.

(A) Loose skinned varieties:

(a) *Santra*. Loose skin and globose shape, sweet flavour, yet acid. Shape of tree inverted cone. Leaves small and bright green.

(b) *Ladoo*. Is flattened at the top and drawn at the stalk end. Fruit seedless. Tree crown rounded and compact. A miniature fruit with about 6 carpels found within fruit

at the stigmatic end. Flavourless.
Found in *Santra* gardens.

- (c) *Kawla*. Fruit has inferior pulp. Has circular ring near the apex. Juice scanty and seeds many. Rare.
- (d) *Reshai Narang*. Fruit small and worthless; many seeds.

(B) Tight-skinned varieties:

- (a) *Mosumbi*: Fruit has verticle ridges and flat ring at the top.

Kagdi (thin skinned).

Godhdi (thick skinned).

Navel orange, Malta bloodred and Jamaica are also found grown, but not very common in ordinary farmers' gardens.

- (2) Fruits are mammillet—stigma end is prominent. The citron and its varieties.

- (a) *Citrus medica proper*: The citron (*Mahalung*.) Skin warty and rough and rind very rough and thick. Tree rounded and flattened from above and yellowish in appearance. Fruit used in pickles, preserves and mar-

malade and is cultivated alone. Pulp bitter and acid.

(b) *C. Medica*—variety Limonum—*Jamburi* wrinkled and loose skin. Pulp acid.

(c) *C. Medica*—variety Limetta *Sakar Limbu*. Tree yellowish and rare. Fruit sweet.

(d) *C. Medica*—Variety Acida: *Kagdi Limbu*. (*Godhdi* and *Kagdi*).

Pat Limbu, long and thin skinned.

Used in pickles and drinks. Found in Sholapur District, Deccan.

CITRUS FRUITS AND THEIR COMMERCIAL USES.

There are several species but the best cultivated and grown being those on hardy and staying stocks either propagated by grafted buds or air-layerings as practised abroad. These plantations last 50/80 years under proper management and manurial systems. On a commercial scale they serve as table fruits; trees for beauty of foliage and ornamental plantations for research utility and economy. The following are some of the uses on commercial scales:—

(1) The Bergamot (*C. Bergamia*)—a hybrid from Sicily and Brindizi yielding perfume on a large scale.

(2) The sour orange.—chiefly cultivated for aromatic qualities and was introduced by Moors in the Southern parts of Europe. It is largely exported into Great Britain for the manufacture of the following products :—

- (a) *Orange marmalade*—from rind and pulp usually mingled with the pulp of a sweet type. •
- (b) *Fresh peel*.—employed as an aromatic tonic and often in Tincture syrup and “orange—wine” as a mere vehicle to disguise the flavour of more nauseous remedies; the bitter ingredient being aurin-tiamarin. The other constituents are glucosides, hesperidin and ischesperidin. There is also oil known here as Limonene (*Terpens.*)
- (c) *Essential Oil*—mostly used for perfumes—is obtained by pressing the peel against a sponge or by a process known as “Ecuelle”. In France “essence de petit grain” is from the

distillation of leaves from which also aromatic water is prepared. (*Eau-de-cologne*) Oil of Neroli, mostly from bitter orange flowers. This really being saturated solution of the Volatile Oil of the fresh flowers.

(d) *Curacoa*.—The fragrant liquor which derives its fragrance and flavour from the rind of the fruits.

(3) CITRUS LIMONIA.

Lemon.—Lisbon and Eureka are the two varieties on the continent; unsound and ill-shaped fruits are reserved for the manufacture of Citric acid, pectin, lemon oil and other by-products.

Lemon Juice Citric Acid.— $\frac{3}{4}$ per cent gum and sugar albuminoid matter.

Malic Acid.—2. 28 per cent inorganic salts.

The simplest method to preserve it in smaller quantities for domestic or medicinal use is to keep it covered with a layer of olive oil or almond oil in closed bottles. It is many times adulterated with H_2SO_4 in England.

Essential Oil.—From irregular green fruits

better. The chief ingredient being terpens $C'OH_{16}$.

Lemon squash.—Pulp of lemons drunk with sugar and soda water.

Lemonade.—(Aerated waters.) This is squeezing the juice of lemons to which is added boiling water, white sugar and rind of the squeezed lemons. The moisture is evaporated and later the mixture is covered and left to grow cold. It is strained, and in order to improve its keeping qualities, a small amount of tartaric or citric-acid is added.

Scitaminiceae Musceae

- (1) *Musa superba*—chavene grown wild round about forest areas.
- (2) *Revenela madagascerienus* or travelers' tree.
- (3) *Musa sapientum* or *peradesica* : most of the cultivated varieties.

This is a tropical tree and found to have spread in most parts of the Bombay Presidency, Madras, Bengal, U. P. and the Punjab along with the Malayan Islands.

Soils and Dists.	Area.	Rain.	Temp.
Kanara -lateroite light and porous ..	5508	120	60·5/91·3
Bijapur, deep black	1006	20·5	104
Poona, medium black ..	1029	27·52	45·5/85·8
Thana, sandy ..	2131	70	70·6/89·1

Propogation.—Most of these grew wild through the agency of seed, and later, due to hybridisation, new varieties came to be established which, due to vegetative-suckers propogation, have lost their wild seed-bearing qualities.

There are two sorts of suckers—sword suckers and cylindrical ones which fold away into broader leaves for purposes of manufacture of food material.

Suckers are planted 10/10 ft. by March to August, and it is found chillies and brinjals can be taken as catch crops. Generally “The Mother” or main one comes for harvesting every 14 months, which could be destroyed in turn to be replaced by other suckers.

This is grown in the Deccan in almost every household by the well side or in small gardens. It is ornamental and relieves the monotony of the surroundings by its green and cool aspect—Travellers' tree (watery)

Fruits.—The plantations are manured every 6 months. Given natural conditions it is found that suckers 2½ ft. in height at the time of transplanting yield as heavy as 24 lbs.

Banana.—Edible or table varieties.

Plantain.—These varieties mostly used for vegetable purposes.

Rajapuri, Welchi, Soneri and Sonkale are others found in local bazars all over the markets. The leaves are being mostly utilised as dishes

for marriage and dinner functions. The psuedo stems are and can be economically used in paper pulp industries; so also in the manufacture of ropes. The juice itself is used by local people for tanning and medicinal purposes.

There are few pests but a weevil—*Cosmopolitus sordidus*—works havoc if there are dried leaves and fibres about the main stem. It would be interesting to cross these domestic varieties with wild ones and create immune types from insects, and colour variation of fruit skins.

Figs and Fig Culture

Moraceae.—This family, mostly from Eastern countries, namely China, India—Punjab North West Frontiers—South Italy, Portugal, Persia and South Arabia. In America, California and Mexico have intensive cultivation along with drying and canning factories. In Bombay Presidency places like Rajewadi, Alandi and Deva from the Poona District are centres in miniature, almost a fig industry, for the Eastern countries.

Cultivation and soil.—Wild varieties along the Medeterranean countries grow in profusion. Light limey soils along slopy banks, with even 15 inch rainfall but well-drained soils, are feasible. In Bombay Presidency *Mitnabahr* is secured and fruits are ready by March to May. Root cuttings are planted in the beginning of the Monsoon and pits 3/3/3 ft. with F. Y. at 15 ft. are taken and in most of the places light croppings of chillies and onions.

Caprification.—*Ficus carica*.

CAPRI FIG.

- (1) Melico.
- (2) Loomis.
- (3) Newcastle.

EDIBLE FIG.

- Symrna adrietic.
- (1) Lobinger.
- (2) Kassaba.

The fertilization of fig plantations is a close study of male and female inflorescences on different trees in the same orchard. People have known this phenomenon of capriciation for ages past. Due to extensive cultivation the diocious nature has diminished and in Sindh and elsewhere wild varieties are cultivated along with edible ones in order to bring about proper formation of fruits ; the agency being minute insects—*Blastopnaga* and *sycophaga*. The monacious nature seems rampant and most of the edible types possess female flowers to a greater extent. The capri figs may be kept half buried under the sand or kept hanging on the branches of Smyrna types.

Notching and pruning.—Pruning is done keeping $\frac{2}{3}$ buds in order to affect shape to admit play of air and suns rays in growing healthy buds and to eliminate eterile branches. Bud strength or strength of fruiting branches is responsible for evading insect pests and helps as well to keep up a regular flow of food material from the leaves downwards. Due to the practice of notching, dormant buds revive and with proper regulation of temperature and root manure, trees respond to their greatest produc-

tive capacity. The main leader determines the "head of the stem" and carries with it the proportion in length to the side branches. Thus, if at all, any farmer loses sight of these practices of pruning and notching, it is due to sheer ignorance of scientific principles and unbiased interest.

Drying of figs commercially.—This is really the rub in fig industry, in order to make surplus stock pay. The fig as a table fruit is laxative in constipated conditions and is nutritious to taste in proper seasons. In foreign countries it is largely utilised in the production of wine and alcohol. In India it is a great problem, and due to ignorance in marketing and middlemen, poor farmers either flood the markets or ruin themselves in not knowing the technique of even simpler by-products. Raw fruits not only have limey juice but are commercially valued in the production of caecutachou. The dried fruits equally are in demand all over the world. Fumigation with sulphur fumes and pressing down when in a semi-dry condition help them to go a long way as "dried Smyrna figs." The process takes 5/7 days with 10 minute fumigation on each day and under moderate temperature condition of 30°C

CHIKOO ACHRAS SAPOTA.

Habitant—These grow extensively in America and in certain parts of Mexico. They are seen to grow even to the height of 50/60 ft. and the juice or the by-product is utilized in the commercial preparation of what is called “Chewing-gum.”

These grow even at altitudes of 3000 ft, and prefer the sea-side. In India they are found in the South of Surat, Junagad, Jamnagar, Gondal and near about Bombay. Recently Khandesh and Poona districts have taken to its cultivation on an extensive scale. At Bijapur there is one of the finest plots, and thus it is seen that the Bombay Presidency grows these to a greater percentage these days. The fruit has rusty powder from the shell. The flesh is yellow, soft and delicious in flavour, sweet, and contains about 14 per cent. of sugar; unripe fruits show a good percentage of latex and tannin; 3.40 lavalose, 3.70 dextrose, 1 per cent. ash; and contains about 14 per cent. of sugar.

Soil—Well drained, sandy warm or light-black soil with Murum below is preferable. These, though found growing near about sea-side

regions, still even deep black soils with copious manurial treatment are also found useful.

They grow for about three years pretty vigorously and it is found sometimes that one side of the plant dries up ; this is attributed to black soil particles sticking to rootlets towards the end of the rainy season. The proper and healthy growth depends mostly upon manurial and after treatments. The digging system around the stems is highly recommended, and this saves wilting to a great extent. In places like Khandesh and Bijapur, in dry climatic conditions, the trees ought to be sheltered against winds towards South and West directions.

Propogation.—These are propogated from seed as well as from grafts. The seed-grown trees take a long time in bearing fruits and the fruits deteriorate both in yield and taste.

In taking suitable grafts—new healthy and profit-bearing qualities are introduced. The seed grows in about a month's time and it takes 2½ years more for graft ; the following being suitable types of stock:—

Rayan (M. Hexandra) Wild Chikoo ; Mowa ; Baculi ; Khirni etc.

These give strong root systems to fruit-bearing varieties of Chikoo. In localities like Bombay, Ghatkopar, Man, Thana, Umbergaon, Gholwad, Pardi, Amalsad, etc. Chikoo is grown extensively and economically. Besides the above methods of propagation a few do have "budding." In this operation great care is taken in selecting a succulent variety and branch, and the buds are introduced in a slit-form cut. It is also seen that milky juice retards healthy operations, and hence this is not commonly practised.

The most economic and profitable method is "Gooty." About 2 inches of bark is lifted and a thick layer of soil is put around with suitable arrangements for water dripping over it. Generally horizontal branches are selected and those bearing fruits during the previous year. The cut portion near about a side branch throws many rootlets and those, too, in a short time. The best time for "Gooty" is March and by June/July innumerable rootlets are thrown and thus are ready for cutting down in September/October. These are profitable in Konkan where the climate is most suitable.

They are planted at a distance of 20/25 feet.

In Konkan these are dug around the main stems and root pruning done. This is done in the beginning of the rainy season and towards January. Sheep manuring is recommended. The trees need interculture and respond to artificial manures wherever applied.

Near about Bombay vegetables, sweet potatoes, flowering plants (like, मोगरा जाई, जुई, नेवाळी कुन्द etc.) are planted in between the rows and these last for 4,5 years. It is also interesting to note that the mixture of Chikoo and citrus plantations is becoming popular with owners of small areas and is most suitable for private premises.

The trees bear fruits from October/April. Soon after the fruiting season is over new leaves and flowers appear. Each tree is capable of bearing nearly 2000 fruits. There are two types of fruits—one is roundish and the other long. It is seen that during the rainy season round types appear and during winter the other form is found on the trees. Many times, however, trees bearing longer leaves have longer fruits.

Pests and Diseases.—In certain tracts there is an attack of Mealy-bug (*pulvinaria psidii*) This insect is also found on guava trees. The re-

medy being to spray with antiseptic solutions—like Fish-Oil etc.

In the case of red-ants—Catol powder is useful; this destroys most of the winged ants, Calcium Cyanide is also recommended along with dumping with earth, on their nests.

Carica Papay (पापया)

The proper home of this fruit tree is America but it seems to have been introduced here in India—sometime during the 17th Century.

In 1656 it is stated that it was taken to China from India. It grows extensively in the tropics—Hawaii, Australia, Africa, Malaya, Ceylon etc.

In the Bombay Presidency—places near about Ahmedabad grow them.

The leaves are used in cooking mutton as it promotes quicker boiling. The fruits as such are said to be digestive.

This tree is found everywhere—even in places like Konkan. It prefers light and sun—porous and well-drained soils. The trunks rot if there is continuous rain. The roots ought to be well ventilated and kept free from water logging. These need wind shelters as the stems are light and fibrous.

Propogation.—These are best grown by seed towards September. The soil ought to be well cultivated and pulverized before transplantation.

The seeds are generally taken from *longish-fruits* so that there is less chance of getting male fruit-trees. The round-fruits are found to grow more male trees and those, too, sterile ones.

Hermaphrodite flowers are hardly found on an individual tree.

The male tree bears flowers in long inflorescence, while the female one bears small flowers in the axils of the leaves.

Home-made seedlings are preferred. There is the possibility of having nearly half of the number of the transplantations to be male and the other half female—hence planting $2/3$ plants in one place is recommended.

There is a practice of *keeping only 2/3 male* trees in the whole of the plot. Each tree is given half a basket of F. Y. M. in the beginning. They bear flowers after *6 months* and fruit is ready in another 6 months' time.

Every tree is capable of bearing one maund weight of fruit from January/May. It is advisable to remove fruits from time to time from the heavy clusters as this thinning gives better space and consequent growth of individual fruits.

In certain trees side branching may be encouraged by lopping off tops—this is resorted

to whenever neighbouring trees are removed or happen to be male ones.

Manuring.—In the beginning a half basket of F.Y.M. may be applied and later every 6 months 2 basketsful may be given. (June and October.)

These may be taken as a catch-crop in a mango or citrus plantation, but it is better to have a crop of its own.

Cultivation.—As seen before, these are grown from seeds but in Lucknow and round about, these are also grown from simple cuttings as well as grafts.

The cuttings are mostly from the female tree and are grown in a bed where great care is taken while watering. Slight stagnation rots these tender cuttings and hence they are not commercially grown.

There are two types.—

- (1) Common Variety, and
- (2) Washington.

The common variety bears both long and round fruits. It also depends upon cultivation and manurial treatments of the plants. In places like Palghar, Dhanu etc., these bear larger fruits.

The *Washington* type is easily recognisable. The stems of the leaves are pinkish. The inflorescence or flowers are larger and bright yellow. The leaves show a green tint as the tree grows older but towards the rainy season they assume pinkish colouration once again. The fruits have less seed. It is found that these are narrower towards the stalk-end and broader towards the top-end and it is at the latter regions that seeds are found. Seedless fruits are not uncommon.

Diseases.—The trees have “anthracnose disease” in ill-drained soils and unhealthy conditions. The effect of rotting and ring-formation is seen on the leaves and fruits. In severe cases fruits drop. The remedy lies in spraying with Burgundi mixture:—

Cu SO ₄	10 lbs.
Washing Soda	12 lbs.
Water	100 lbs.

The greatest danger lies in excessive watering. In N. Konkan ample earth is thrown up near the stems and this prevents rotting. In heavy rains roots rot and trees show top withering and diseased tops—under these circumstances

proper drainage systems are the only economic means.

The papaya garden lasts only for three years. This has a commercial by-product---papin. The fruits when raw are given longitudinal cuts and a sort of milky product trickles down. Each tree is capable of yielding 10 tolas of this white juice (latex). This is mixed with double the quantity of alcohol and is then filtered through blotting paper. The residue is white when dried in the shade—yellow when dried in the oven. It is useful for digestive purposes.

In Ceylon it is procured on a commercial scale. Every pound costs Rs. 6-4-0 in 1914.

Date.	yield.
1911.	6,600 lbs.
1913.	18,500 lbs.

This is exported to America, and Germany in large quantities.

It is still a dubious point as to why Ceylon produces this by-product on a finer scale, and not India. It may be due to soil and climatic conditions.

Guava

This is typically a tropical climate fruit and we find it growing in various parts of the Bombay Presidency. Most of the orchards, their cultivation, the manurial system and scientific handling make their economic production vary from place to place. The latest knowledge and application of modern machinery along with its many advantages have brought this section of Horticulture to the forefront.

CLASSIFICATION.

1. *Psidium cattianum*, (strawberry guava.)
2. *Pumilum*.
3. *Guinenses*.
4. *Plycarpum*.
5. *Guajava* variety (*pomiferum* red variety.)
6. Variable (*P. cattianum*).

In selecting seedlings one ought to look to various important points, such as the quality of fruits from which the seedlings are to be selected. Few seeds or no seeds, succulent and flavoured pulp, brilliant yellow peel and at the same time hardy are the qualities one so very often misses in the markets.

Poona and round about.—White and rosy are the two varieties growing in light black with murum substrata, but the latter variety has no staying quality and soon rots.

The seedlings are besmeared in ash and broadcasted and by August they are ready for thinning. Pits 2/2/2 and *oft apart are in vogue. Mostly F. Y. and ash is used. The inter crops, such as cucurbits, groundnut and even lucerne are taken according to means, irrigation and market facilities.

Treatment for Bahars is an important operation and most of the plantations have Mrig and Ambebahar by exposing the roots in and about February and September respectively. By practising the careful system of bending and trailing one could easily affect numerous flowering shoots and make a productive cultivation. After a dozen of years the cultivation deteriorates due to exhausting the soil and bad system of root exposure but it could be run even to fifty year old plantation with scientific precision and proper manurial system.

Gujrat and round about.—In Gujrat it is mostly alluvial soil due to several rivers traversing the plain to the Gulf of Cambay. Soils are

porous and rich in plant food and silt. They are loamy in texture and seem to contain greater percentage of sand at places.

Baroda.—Seed collected, dried and sown by July. Pits are taken at 4 ft. apart and manure applied, being 4 oz. salt and 4 oz. castor cake mixed. At places greater distances (16/20) are observed and amongst the inter crops are Bhandi, chillies, brinjals, sweet potatoes and even Sundhiya jowar are taken.

Here Mrigbahar is taken and many times people neglect even root exposing. In July roots cut about a foot distance all around and after a shower or two they are again earthed up. Watering from October and November is indispensable.

In many cases standing crops are sold. Plantation lasts about 15 years though bearing from 3/5 years.

Ahmedabad.—Seedlings are collected from August. Beds prepared 6/4 ft. Transplanted at 20 feet apart and most of the vegetable crops such as cabbage, knolkhol, and potato are taken in October. Fruits 5/1000 per plant, pink and white varieties are secured. Plantations lasting for 40 years.

Dholka.—Fruits are collected and stored in

a dark place to rot, mixed with ashes and then dried. Broadcasted in beds (6/4') and again replanted in beds (16/8') in October, in order to make the seedlings all the more hardy.

In July or so they are transplanted in a field with cow dung and tank mud. 1st year garlic onion and potatoes are taken. 2nd year light crops, such as corriander and methi are taken. Fruits in November-January. Plantations last for twenty years and then rot. This deterioration is mainly due to their planting 4/5' at each place and inadequate system of manuring and root-exposures.

Satara and round about.—A hilly region and naturally well sheltered from winds. In the District Limgan seems to be almost a centre with good black soil and irrigation facilities. Pits are taken 3/3/3 at distances from 10/16 ft. and the longer they are planted out the better. This is really the most important consideration looking to the interculture, root exposures and inter-croppings for successful remuneration.

The seedlings are transplanted by June and cowdung and sheep manure is common. The seeds are collected and it is a practice with many farmers to have them besmeared with sugar and later broadcasted in seed beds before planting out.

The inter-crops are turmeric, onion, garlic and other catch crops which are useful along with the main crop. These subcrops are generally harvested by December. Regular crop is secured from 4/5th year. Cowdung manure in pits are given while treating for different Baharas.

The harvest of Mrigbahar is sold off by contract. The Mohwa, the mealy bug disease shows blackened patches underside the leaf surfaces, but it is not very serious nor the *Capnodium meliola* or sooty mould.

Most of the Guava plantations are being slowly replaced by fig, lemon and pomegranate plantations.

Dharwar and round about.—Most of the old plantations are on the wane due to neglect and need replanting. Sites with rainfall 30" and well drained soils are congenial factors for its growth, though irrigation water may be deep at places.

Seeds before planting are rolled in ashes and dried. Pits (2/2/2) are taken 12 ft. apart and after F. Y. M. is given, flowering is seen after three years. Roots are exposed in September and fruits ready by April to June.

Fruits in general taste sweeter with white pulp and are seedy but deteriorate after two weeks or so.

Conclusion:—

There are many defects which an ordinary farmer can take in hand and thus make plantations paying and interesting, utilising skill, patience and timely suggestions. Looking at the different countries there are several irregularities in methods of root exposures, distances in between the plants, manuring, planting and irrigation.

In Gujrat plants are planted at great distances and at some places even 5/7 seedlings at a place. This encourages several suckers, low yield, pests and white ants. At Ahmedabad and Dholka there is difference in irrigation. The soil is sandy loam but heavy watering is found to be wasteful and deliterious.

In the S. M. countries root-exposing, bending and topping operations are seen with a fairly good knowledge of inter-cropping but with little understanding of the delicate operations; the result being exhaustion of soil and many times worthless varieties, useless for the table, encourage waste and unnecessary glut through the markets. At Dharwar sweet seedless pulpy variety found but present gardens deteriorating through neglect.

Canning:—In foreign countries great impetus is given to this industry. *P. Guajava* from W. Indies and America, is thin yellow skin, pear shape, soft pulp, sweet, pleasant, acid and aromatic in flavour.

P. Guajava:—*Pmiferum*, red variety, is mostly imported into England as guava jelly and chese sent out from the W. Indies.

Similarly immense cultivations in Peru and Mexico and so also in California and Florida, are seen and such industries coupled with scientific knowledge and Government facilities are popularising the Guava cultivation all the more. In the Bombay Presidency (Satara, Poona and Dharwar) there is a great demand for such a canning industry to encourage healthy plantations of the right sort of varieties of taste and flavour.

Pomegranate—*Punica granatum*

Known to garden annals for a long time. Old Egyptian buildings are studded with carvings of pomegranate fruits and flowers. Its home being Persia and N. W. countries of Afghanistan and Peshwar, and slowly spreading from Jalalabad to Lucknow, and Rajputana to Rangoon. It is characteristic to severe climates and lighter soils and thus a "friend of the poor man" on poorer soils ; the orchards are seen to be faring well on Murumi and limy soils of the Deccan. On better soils, however, it responds to its fullest capacity and gardens last 70-80 yrs.

Propogation.—Cuttings 12 inches long kept in the nurseries and are protected from the ravages of white ants. Transplanting done 12 ft. apart. Flowering after 5th year. It is seen that chillies, brinjals, chuka, methi are good as intercrops for 3 years or so and later natural grasses may be grown to feed cattle. Manuring done by February when plants are leafless.

TREATMENT FOR BAHARS.

Ambebahar.—February.

Mrigbahar.—June.

Hastbahar.—October: People prefer March-April flowerings. These are controlled by root exposures and irrigation, and fruit is set after 3-4 months. Dead and dried branches are pruned and coppice growth is all the more vigorous and helps in renovating plant life.

DECCAN

Varieties:—

Red seeded ... Soft seeded—Satara

White seeded... Hard seeded—Poona.

Black type.—Grown in N. India.

Sour variety.—Used by the Arabs for pickles and colouring matter.

Statistics:—

Central Divisin Poona 1,092. Acres.

Ahmednagar 141. Acres.

Satara.....Acres.

Gujrath.— Ahmedabad 297. Aeres.

Kaira and Dholka.....Acres.

N. Hyderabad

and ... Sucker 258 Acres.

Sindh ... Hyderabad 215. Acres.

Karachi and Nawabshah 69-22
Acres.

Diseases and pests.—Wet rot sets in in the rainy season, but not very economic. Bordeaux mixture may be tried. *Virocola isochratis* bores through unripe fruits in its caterpillar stage. Fruits rot and encourage moulds and natural infection is seen. These moths are trapped by light and destroyed.

Uses.—Pomegranate fruit gives cool beverages and drinks in the heart of Persia and Arabia. The rind and flowers are used in dye for wool colouring. Unripe leaves and flowers dried into snuff and applied in the eyes during conjunctivitis. The bark is also utilised for medicinal purposes.

Areca Catechu (सुपारी)

The Supari (fruit) is extensively used by Indian gentry, especially Hindus, in their religious rites and social practices. These palms are found to be natives of Malaya, China, Brahmodesh, Bengal, Ceylon, Malabar, Mysore etc. In the Bombay Presidency it is found in Goa, Kanara, Ratnagiri, Kolaba, Thana districts. It is famous in places like Sirsi, Sidapur, and Yellapur—from the Kanara district.

Climate—It prefers tropical climates and humid regions along sea-side places. Rain 100/150 inches preferred.

These are cultivated to suit climatic and soil conditions and the methods differ largely.

N. Kanara and Cultivation:—The plantations grow in sheltered areas of mountain regions in the valleys. The soil is porous and well drained. The trees are shallow rooted and feed near the surface. The soil on the slopes is liable to be drained off and is protected by litter and dry leaf layers and branchlets. It is also replenished every 4 years or so with fresh earth from the adjoining areas.

These are sheltered from the southernly rays of the sun, and trees like Phanus, Ayen, Kinjal etc. are planted on borders. The leaves of the protecting belt-trees are useful as ground-layer and for mulching purposes.

The soils may be red, yellowish, lighter or a heavier type which has the capacity of holding water for long and is also incapable of being washed off.

In lighter soils there is a possibility of flowers and raw fruits being dropped in case of untimely watering from Dharans.

The yield and good results also depend upon manurial treatments.

The soil is very often wet under Dharan waterings. In March/April, however, these need regular weekly irrigation by Budki.

Propogation.—These are grown from seed.

The good seed-fruit is selected from 20/25 year old trees. These are specially kept growing till they attain a larger size and proportion. In Mysore and Assam the fruit-bunches are thinned out, and while ripening is evident these are lowered down for seed purposes.

The Suparies are planted vertically along with stalks and kernels. Each guntha requires half a cart load of F. Y. M. and grows 1600 seedlings. These are sufficient for 2 acres of land. The seeds are sown 9'' apart and about 3'' deep and are generally covered with plantain leaves and fibrous stems. The cover is removed after a lapse of two months. When the seedlings grow 6'' high, these are planted out at a distance of 2' each. They are planted in permanent places after 2 years time.

Planting out.—Pits 2 c. ft. are taken. The transplants are planted in October. The rotten plantain-leaves and stems serve as manure. Near about the plants, plantains may be grown both for shelter from sun and wind.

In this Crop Cardimum, Ananasa sativa etc. are grown as inter-crops. The plots are manured every alternate year.

Manure (**सोणू**)—Pit 20×12×6'. Sufficient litre for 1½ acres land. The leaves (of kinjal, Jambul, Ayen, Aunla, Kuchla, **कर बेल** Charoli Mohra etc.) are mixed with, earth cowdung, urine etc. and this manure is best since it has astringent qualities and keeps away insect and

fungoid pests. The properties show tanin and Amyl presence.

Besides being a food organic material phosphates and N. are available for plants. Thus this manure is valuable.

It is applied in Feb./March—30,40 lb.—Later litre or dried grass is spread round about the trees during the summer time or even earlier in November to December This is an essential practice in saving wash-off of soil erosions.

Soon after rains—October or so—there is also the practice of spreading new and fresh soil around the trees—once in 4 years. This is generally done to effect better conditions for irrigation and to encourage plant-food. In certain places 2/2½' layer of fresh soil is available and care is taken to avoid main water drains which need to be kept clean. This operation is locally called "Nigte" नीगते

The routine being:—

- I year—repairing water channels and rows. Replenishing soil.
- II Year—Manuring operations.
- III ,, —Repairing water channels.
- IV ,, —Manuring.

V Year—Repairing rows and replenishing with fresh soil.

Thus it is seen that the proper yield depends upon manuring and after-treatment of soil. There is always a demand for lime phosphates and potash and hence seasonal soil-treatment and management are essential parts of a successful grower.

Yield—Soon after 5/7 years time fruits appear. From the 10th year they bear profusely. There are about 500 transplants per acre and every tree yields about 300 nuts—Suparies during Nov. to January. The total yield per acre being 2½ khandi or 50 maunds.

The raw fruits are taken down and boiled after removal of upper coverings. These are dried for 3/4 days in the sun. Every evening these are covered in order to protect them from dew and discolouration. Fresh lots are boiled in the same water and thus those that are raw receive colouration due to reddish water being used over again. In certain cases lime or bark of the Ayen-tree is added to improve the colour of the nuts.

The nuts cost 6/8 Rs. = 1 maund = 29lbs.

These plantations are common in Konkan regions of Bombay. A few parts of Shriwardhan are famous for Supari gardens. These prefer sandy-loam condition of soils and yield heavy.

They are protected from wind on the West and from the sun on the South by planting cocos nucifera (**माढ**) on the borders.

Types: I. **तुरट सुपारी**

II. **मोहाची सुपारी**

III. A few possess yellow or red or thin or thick coverings while others may be longish in form or rounded.

Diseases and pests :—

(a) The fruits when raw are destroyed in large numbers by animal pests, such as squirrels and kites.

(b) “**KOLEROGA**”—

This is a fungoid disease. During the rainy seasons fruits show mould and diseased conditions and fall by wind. This is found to be excessive in valleys. The best remedy is Bordeaux Mixture.

I Cu_2So_4 4-5 lbs. ... This is mixed with

II **रान** (Soap). ... 2 lbs.

Lime ...	5 lbs....	Soda ...	... 1 lb.
Water ...	12 glls.	Water	... 1 gal.

This mixture of solution (I and II) has adhesive properties and is best during the rainy season. This has eradicated the disease from the Mysore and Kanara districts.

(c) STERILITY—

The leaves are small and even fruits are wanting. This is pathological phenomenon and no insect or fungoid agency is responsible. Most of the growers either cut off such trees or leave them alone. This may be due to negligence in manurial or soil treatments or even due to excessive water logging conditions.

This tree can be utilized just like *cocos nucifera* and the stems may be used as rafters for houses. In some places they could be hollowed out and used for drains. The fruits are extensively used for chewing purposes and colouration.

Cocos Uncifera (नारल)

These are known to grow in the tropics. Originally they were natives of the Cocos Islands near the sea-side or Java. Sumatra had these first and later they spread out to other countries.

In olden literature the varied names given to this fruit-tree derived their origin from fruits coming from the South regions like Ceylon and there is evidence to show and trace its introduction into North countries like Malabar and Coramandel. This tree has been held sacred, due to its varied usefulness, both in Hindu religions and social ceremonies.

The cultivation of trees was only recently taken up—30-40 years ago. It is extensively grown in the Phillipine Islands and nearly three-quarters of the commercial outturn is found there.

Coconut and its oil is used in Germany and France. It is also found in Dutch East Indies, Straits Settlements, Phillipine Islands, Ceylon, India, Zanzibar, Malaya State, Nicobar, Lakadive and Maldive Islands.

In India—Travancore, Malabar Coast, Madras, East Coast, Karwar West Coast, Konkan etc.

have these on a large scale. In Kathiewad, Jamnagar and Bhavnagar States these grow also. Near Badami in a place like Banshankari these are found in large numbers.

Cultivation.—Here sandy, warm and well drained soils are best. The water is available at 5-6' depth. The climate is cold and humid. The trees are planted close and there is always danger of mice crawling from tree to tree. And even the crowns are seen hollowed out by Heminopterous insects.

Near Godavari every tree is capable of bearing nearly 200 coconuts.

There are 2 types of trees chiefly found:—

(1) Commonly cultivated and (2) Moha type—This has sweeter fruits.

Fruits

Greenish Covers.

Yellowish. „

Reddish. „

A few are round in form while others are longer in size.

Some of these possess a thick kernel while others have a thin kernel and also the proportion of oil contents varies.

conuts are planted during the rainy season. This also saves irrigation during the summer time.

In case of summer tides and excessive marine water flowing in, trees show yellow colouration and retard in growth.

The trees need earthing up or are destroyed when young.

This earthing up operation saves their rootlets and makes sweet water available. It also saves fruit dropping in advanced cases.

In Gazni or sea-reclaimed soils trees bear early—even within 5 years time and yield copiously upto 25-30 years, later deteriorating for want of manurial and soil treatments. Akin to such plantations one finds them growing by the river sides of Kale, Aghnashini and Ganga-wali rivers in the Kanara district.

The plantations from the ordinary soils bear fruits slowly and take 7-8 years time. Those growing in laterite soils are even slower and take some 10 years to bear. These, however, improve with alluvial soils.

The pits may be 3 cu. ft. In the beginning no manure is given. The plants are planted to remain 9" above soil level. In places like Gokarn the pits are still deeper.

In Konkan these are planted during the winter season; people in Travancore apply ashes and salt while planting. The nuts are also besmeared with common salt in order to protect them from termites. It is also a common practice to apply ashes and salt mixtures to the growing parts and this is said to ward off a hemipterous insect.

The trees should be planted out at a respectable distance of 25-30'. In certain parts these are closely planted and later years show crowded conditions of the crowns—this shuts out light and air and the plantation has a sickly appearance. They need to be protected from wind and local trees like those of *Karunj Undi* and *Bhend* which serve best as wind-belts.

The coconut tree bears 12 leaves in 12 months of the year and every leaf has an auxiliary bud. In certain cases some of the buds may go sterile and only 6-7 may remain healthy. The fruits grow seasonally and the development of the internal kernel depends largely upon climatic conditions and manurial treatments. Heavy rains, cold or unusual heat, are some of the factors retarding growth of the normal fruits.

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The dwarf variety of trees throw out crown-leaves soon after planting out in their permanent places, *i.e.*, 8 months or so. The common variety takes 12-15 months' time.

One "Niyor Geding" shows small and yellowish type of leaves and the fruits develop within 9 months of the appearance of the buds. In certain trees it is found that heavy fields deteriorate after a year or so due to unsteady soil and climatic conditions.

Green manuring:—In Karwar several experiments are being tried in cocconut plantations.

They have green-manuring. The plants being:

- (1) *Crotalaria Striata*.
- (2) *Tephrosia Candida*.
- (3) *Crotalaria Anagaeroides*.

These are planted towards the rainy season.

Crotalaria striata shows tall and vigorous growth; leaves are small and dense. This is free from any disease or insect pests.

It flowers within 8 months and is ready for cutting down by November or December. The pods ripen by January.

Tephrosia Candida.—These are ready by October to December for cutting down. They attain 4-5' in height and are grown in rows 6-8' apart. These may be cut in 2-3 instalments.

This is extensively grown for green-manuring purposes in Areca Catechu plantations. They are buried near about the tree trunks.

Crotalaria anagaeroides.—This has been only recently introduced from Ceylon and is faring well.

These plants are useful as green-manuring and the trees show improvement. They are also useful in heavy soils and add to the organic material and feed in soil.

In the Ratnagiri District dry grass is spread around the trees—while in certain parts people use F. Y. M. and salt (every tree may have 4 lbs.) during the months of August—September or every alternate year.

At Wengurla they have fish-manuring, while in some parts leaf-litre (Aula and Kuchela trees) is extensively used and it is said N. available per cent. is great.

Catch Crops.—It is economic to have:

Musa Sapientum (*केसी*), Carica papaya,

Ananasa Sativa, Coffee etc. as inter-crops.

In countries like Java, the Phillipines etc., the soil is ploughed twice in a year and the trees are left 3' apart while harrowing. Coconut trees have roots feeding only to the depth of 8/18" below ground level. The roots number 7000 to every tree, the average length of these being 17-18' and 3-4' below surface soil. Timely ploughings reduce the rootlets and also encourage penetration. This loosening of soil surface is highly recommended.

Manurial systems.—In certain parts coconut refuse and dried leaf and crowns are utilized in and for ground cover near the trees. This conserves moisture and prevents soil erosion.

In Madras they use F. Y. M. and in addition to this 6/7 lbs. fish manure is applied and this has given useful results. In Travancore they tried for every tree :

10 lbs. Groundnut cake
 20 lbs. Ashes
 2 lbs. Fish
 1 lb. Salt

and it has given sound results. A tree bearing 40 coconuts in the beginning proved to yield 90 fruits at a time.

In light sandy soils there is need of organic material and the artificial manures along with leaf-litre and fish have binding properties and thus improve the texture of soils.

On the Kumtha Experimental Farm they apply to every tree:

4 lbs. Bone-meal.

4 lbs. Undi cake.

1 lb. Sulphate of Potash and

1 lb. Salt.

Yield.—In plantations trees closely planted yield hardly 10 nuts per tree. In many parts it is, however, found trees yielding :—

7th Yr.—15 Cocoanuts

8 „ 25 „

9 „ 40 „

10 „ 60 „

50-60 „

4 Nuts = 2 lbs. kernels.

10 „ = $1\frac{3}{4}$ pints oil.

In local and country bullock-drawn mills there is nearly 30-50 per cent. loss of oil. There are recently many improved types of mills and

the best possible extraction done. In Kochin the purity per cent. age of oil is high. They also take care in the thorough drying of kernels beforehand.

The oil is extensively used in the manufacture of candle-wax, soaps and for eating purposes. It is also mixed in Cod-liver, Citronela oils etc. Coconut oil is used these days in the preparation of Vegetable Ghee which can be utilized in the Biscuit factories.

The French Government patronized both oil and ghee for the French troops and consequently it formed a paying by-product.

The residual cakes after the extraction of oil fetch value according to the oil per cent. remaining in them and the proportion of prices of kernel to extracted residue or cakes being 4-1 and the latter is highly economic for the feed of draft animals.

The water per cent. in sun-dried kernels being 9.

The water per cent. on smoking and dried being 12.

It is dried by steam in 15 hours' time, while the same quantity of kernels take 4 hours

for drying by hot-air process. The water per cent. is small.

Uses.—In the Phillipine Islands they extract cocoanut oil. The nuts require proper seasoning or they smell and the commercial value of the oil is lessened. It is also found that fresh and raw kernels spoil, and discolour the oil. The oldest fruits are reckoned to be best. Round about Ratnagiri fruits ripened are taken down and are not allowed to fall down. They make suitable cuts on the tree-trunks and thus lower down fruits by climbing.

Another use is “Nira” or juice or a fermented drink called locally “madi.” This is available by cutting off young buds before flowers or fruit set. This is an alcoholic drink and is extensively used in Karwar and Ratnagiri. The juice flows for 15-40 days and each tree is capable of yielding daily nearly 1.40 litres of the “madi.” In the Phillipines people have bamboos tied across the trees in order to facilitate lowering the pots. Daily fresh cuts are given and the juice is collected some three times a day.

In Goa it is utilized in the preparation of raw sugar. It is also useful in affecting polish to the mixture of cement and lime.

In Ceylon, Malabar, and Lakhadive Islands there are shelling and cleansing machines. It is stated, however, one man can cleanse 1000 at a time and it is economic.

The coverings are easy of extraction in saline solutions. These are later threshed and made into mattresses.

ROPE LENGTHS.

<i>Ceylon</i> .—40 fruits yield 6 lbs. of cover fibres	. . . . .
<i>Madras</i> .—18 fruits yield 6 lbs. of cover fibres	132' per 1 lbs. wt.
<i>Lakhadive</i> .—60 fruits yield 6 lbs. of cover fibres	220' per 1 lbs. wt.

There being no machines this by-product is not economically productive.

The tree is also useful in many ways.

The stems are used for thatching purposes and when hollowed out may be used for small drains.

The crown leaves are also useful for thatching purposes. These are also made into brooms.

The cocoanut fruit coverings are used in the preparation of small utensils, smoking hookas, buttons etc.

Diseases.—There are several pests and diseases, of these the following being important :

Bud-rot.—This is extensively seen in the Madras Presidency. There being two views—one that the causal agency may be fungus or it may be a bacillus.

(a) *Pythium Palmivorum.*

(b) *Bacillus Coli.*

Cuba, Jamaica, Trinidad, Madra, Ceylon, Portugal, and Africa are also affected with this deadly disease.

The young leaf turns yellow and droops down and slowly the whole of the crown gets affected. The tree smells and rots; the only effective remedy being eradication of such diseased trees.

(c) *Pestolozia Palmarum.*—Here the oldest leaf is affected with white blotches. The remedy lies in spraying with Bordeaux Mixture every 20 days or so.

(d) *Stem-Bleeding.*—This is due to *Thielaviopsis Ethacetica*. This is found in South Malabar and Ceylon, the symptoms being that a sort of reddish excretion oozes out of and underneath the bark and the tree gets reddish on one side and later black. This part rots and still gets darker in colouration. During the rainy season red excretion trickles down.

The remedy lies in destroying the part or boring holes 2' above the affected area. This saves the trees.

INSECT PESTS:

Beetles.

(1) *Oryctes Rhinoceros.*

(2) *Rhynchophorus.*

These are found in rotting parts and stems and manures. The caterpillars are white with dark heads.

These are destructive both in the caterpillar stage as well as adult. The trees are stunted in growth.

The remedy lies in destroying the rotten parts and keeping the plantations clean. These may as well be destroyed in their young caterpillar stages found in manurial pits. In certain cases they may be extracted by wires out of their holes in the trees.

Insect Thosea Unifascia.—This pest is commonly found in the Andamans near Port-Blair.

Study has been done since 1922, on a plantation measuring 4,000 acres of land. The female insect lays about 100 eggs on the lower-

side of the leaf. The caterpillar has a yellowish band, is spotted and possesses stinging hair coating. This feeds voraciously on leaves and penetrates after 2 months into the crown leaves and even into the ground. The adult emerges out after 21 days or so. These fly about during the night—nocturnal and are harmless. The female is larger in size than the male insect. The life cycle continues for about 3 months and thus there are four generations in a year ; the adults appearing during March, June, September and December.

One insect—Braconid—is parasitic. It feeds on the caterpillars of *Rosea unifasia* but there is also the case of hyper-parasitism inasmuch as this Braconid is also fed upon by Chalcidoidea.

In certain cases, however, birds like Indian crows and mayinas devour these in large numbers. This insect is a native of the Andamans and when the trees are affected the ground is raked up and turned over--the caterpillars being exposed to the sun.

The only other remedy lies in destroying the affected leaves. These moths are attracted to light and could be captured in a tin of water and mineral oil.

There is also one animal pest—The Flying Lemur—which destroys and feeds upon them.

Mice.—Cocoanut trees may be protected by suitable tin-cans attached facing downwards on the stems—fixed at a distance of 4-6' apart.

Date Palm and its Culture

These are tropical trees grown throughout Arabia, Palestine, Mesopotomia and Sindh. A great import trade is being carried on down through the passes of Afghanistan to lower India.

Cultivation:—These prefer sandy loam and watery places and are found in abundance by the side of canals in Sindh. They are xerophytic and as such tolerate alkali soils. The oasis of Arabia are famous for lovely groves in the parching heat of the deserts.

Propogation:—2-5 year old seedlings are transplanted in April. It is found that one male tree in the amidst of a few females is sufficient to affect fertilization. Trees planted 12-15ft. apart, 70 trees per acre. It is better to apply F.Y.M. and castor at the rate of 10 tons of F.Y.M. and 400 Cape.

Propogation by suckers is fairly common and sub-irrigation water (20ft) is sufficient for adult plantations.

Flowerings:—Flowering after 4 years from the offshoots and bearing after 8-11 yrs. is com-

mon Flowers are of only one sex and not hermaphrodite. The inflorescences are enclosed within sheaths and split in due course of time. The fertilization is carried on by inserting male inflorescence at the branches.

Yield:—The yield varies according to set of fruits and condition of plantations. Each tree bears from 1/50 lbs and per acre 6/4000.

The price fetched being Rs. 3 per maund.

It is a noteworthy thing that there are very few inter-crops being taken, such as figs, grapes and pomegranate, especially by the canals or well irrigation.

Ananasa Sativa (अनानास)

Ananasa Sativa came originally from South America. This is also found in Brazil. It was introduced by the Portuguese in Bengal in 1594. Large consignments are shipped out of America every year and the fruit is seen to withstand the transportation well. At Singapore there are large plantations and canning factories.

Ceylon, Travancore, Malabar, Coromandal Coast and Bengal Provinces have these in large plantations. So also Goa, Sanwatwadi, Ratnagiri Dist., Kolaba, Rana, Amalsad grow them. Thus it is seen that this Ananasa Sativa prefers sea-side regions and cold and humid climatic conditions.

Light sandy soils, well drained and friable are mostly found.

This is seldom grown singly. It is found in suitable mixtures like those of Areca catechu, cocos nucifera and mangoes. In Bombay and near about people have taken up its cultivation near the railway.

In certain parts people have them in pots more as an ornamental plant. In the Bombay

Presidency it is not grown on a larger scale excepting at Amalsad.

It is grown from young buds (or corms?) growing near the stalk of the fruit. These are planted out in rows under shady places. They are planted 3' apart. The distance in between the rows is kept small—owing to the plants being heavy with fruits and this avoids uprootings and breaks. They take 2/3 years in bearing fruits.

They throw root suckers and the ground is soon seen to be covered up. During the rainy seasons they are given groundnut (or **पेरु**) cake manure—a basketful to each tree. Towards April and May these are irrigated.

They flower in January/February, and fruits are seen to set by June. They prefer shade all the year round.

There are several types of fruits:—

(a) The common type:— possesses thorns on leaf.

(b) Que-pine:—possesses no thorns on leaf and besides the fruits are more delicious.

(c) Queen Pineapple.—

These are also grown in Konkan but due to marketing and canning facilities they are wasted and are even uneconomic. The Annanasa plantations need encouragement.

There are no serious pests or diseases.

Anacardium Occidentale (काजू)

This tree is a native of West Indies and South America. It was introduced into India by the Portugese.

It is extensively grown in Mexico, Peru, and S. States of America and E. Coasts of Africa. In India it is found on the coasts of Karomandal, Krishna Mangalore, Kanara, Gowa, Sanwatwadi and Ratnagiri Districts. These are also seen in Dharwar and Belgaum Districts.

The fruits utilized are generally the stalk ends and the proper fruits being the welldeveloped seeds.

These are red or yellow in colouration and taste sweet.

In the Karwar Districts the juice of the fruits is utilized for medicinal purposes. They are extensively grown in Malwan District and it is from here that large quantities of seeds are sent for further treatment.

Sweetmeat dealers use these in the preparation of a sweet called "Kajugar." The seeds are fried in earthenware pots with a bottom hole.

Generally 1-1½ lbs. of seeds are taken at a time and fried. While heating, a small quantity of oil flows down and keeps the fire aglow. The kernels are thus removed within 10-15 minutes. The smoke is deleterious and encourages coughs and also injures eye-brows. Seeds : Kernels : 30 : 25. The kernels are utilized for the manufacturing of oil and seems superior to olive-oil exported from Europe.

In certain parts the seeds are dried in the sun and later threshed and coverings removed. The oil extracted from these coverings is used for purposes of increasing the toughness of ropes, planks, submerged in waters, and painting wood. The oil is deleterious to human skin.

Soils.—These trees are found growing in the lighter types of soils—lateroites and sandy loams along the coastal regions. Belgaum, Dharwar, Malwar and South Malhad grow these extensively. The seeds are planted in pockets of rocks and thus are sheltered from rain and wind.

These could be transplanted when ¾ years old in their permanent places. At Kumtha, Honkar etc. these are regularly irrigated for the 1st year. They attain great heights in the districts

of Malwan, Dharwar but not so in Thana or Konkan regions.

Uses—The latex from the trees is utilized for the manufacture of varnish applied to library books and this preserves them from insects and moulds.

The fruits are valued for eating purposes, and are useful in certain chronic diseases, (महारोग)

Diseases.—There are no serious pests and diseases.

In North Kanara trees suffer from certain stem and root borers. The excreta is seen outside the holes; the only effective remedy being to uplift roots and effect clean plantations.

Trees may have sterility and in certain seasons lose blossom. This is due to:—

- (1) Edaphic factors in certain parts, and
- (2) Mildew or fungoid disease,

In the latter case spraying with Cu So_4 is recommended.

Ber Culture (Ziziphus Jujuba).

Classification

- (1) Soofi midthi.
- (2) Soofi khati.
- (3) Wild Ber.

These are three varieties found locally all over the Deccan plain. It is hardy and almost xerophytic in character. The fruits vary in size and differ in taste from area to area.

It grows from seedlings scattered by wind and birds. It tolerates heavy rainfall as well as resists drought. Alkali soils grow this comfortably.

Propagation.—The domesticated varieties have lost their immunity to various diseases and insect pests. It is well worth propagating these subtler varieties on wild stock by means of budding. The operation is delicate and needs careful preservation from heat and evaporation.

It bears within three years after it has been budded and remain bearing for 60 years under proper cultivation and manurial conditions.

Pruning.—The older and dried branches need pruning from time to time as it promotes healthy shoots and fruit buds.

The Lac industry of Bengal is built on these plantations and the insects have found *Z. Jujuba* a suitable host.

Planting.—These could be planted 7-10 ft. apart, 40 plants an acre—each returning an aggregate income of Rs. 45-65.

Insect pests: Fruits.—Drupes or berries are rendered practically useless by caterpillars and moreover their collection is tedious and cumbersome from the branches. The soil below should be ploughed and harrowed or they are injured and thus lose market value.

Remedy: (1) Trapping by light.

(2) The attacked fruits may be destroyed.

Fragaria Vesca (स्ट्राबेरी-इष्टापुरो)

This is originally found in the N. regions of America and Europe. It is also found in Chilli

In India it is generally found in summer resort places like Kumaun (Himalayas), Kashmir, Nepal, Brahmadesh, Saharanpur, Ceylon, Bengal etc. In Bombay proper it is found in Mahabaleshwar where the temperature ranges from 60/67° in November and nearly 90°F during March/May. Here the rainfall is 250". Altitude 4,500'. It is recorded that it was due to the Chinese that this was introduced there in the year 1820. In 1896, due to the heavy rainfall of 401", most of the seedlings or plants were destroyed.

It was then from Saharanpur and Bangalore that fresh suckers were brought in and planted and the present cultivation is the result.

Cultivation.—Soon after the rains the soil is prepared, harrowed and irrigation channels prepared.

They are planted in rotation to Cabbage and Frenchbean every alternate year.

Rows 10×12' or 12×12'.

Suckers planted at $1/1\frac{1}{2}$ ' apart.

These are manured with F. Y. M. if the same crop is being continued without any rotation.

In the beginning of the rains no inter-culture or weeding is done as this conserves soil and plants from erosion.

The irrigation is done regularly—the first being after 6 days of plantation, and by January every alternate day.

Fruits set after 3 weeks of the appearance of the flowers on the plants. In certain areas leaf-tips are removed in order to encourage profuse and healthy flowers, and this is done once in a fortnight.

During flowering time, animals are let in to encourage side suckers and also to manure the plants with urine and fœces.

Fruits appear in April/May. These are taken out in a raw condition if the marketing centres are far—packed in leaves and dry grass. For purposes of local markets they are ripened on plants and plucked in the early mornings. These are sweet to the taste and delicate to touch.

By May new shoots appear and towards the rainy season these are placed on higher level rows or are even replaced in places of shelter in houses. It is found that old suckers have better fruit-bearing capacity than new ones.

These were tried in Lonavla but experiments failed during recent years.

Types and Varieties—

Lacstone.

Dunlop.

Marshall.

The Lacstone variety was introduced from Dehra Dun. They have fared well and bear larger fruits. Ten fruits of this variety weigh equal to 25 fruits of the Bangalori type. They are also found to fetch higher prices.

As regards Dunlop and Marshall types—both are from America. Sen Dunlop is, however, heavier in yield. Fruits are round and flavoured. The Marshall variety has failed and seems sterile so far.

Garcinea Indica (कीकंब)

These are natives of Kurg, Wayenad, etc., and are also found in the districts of Ratnagiri, Goa and Karwar. In certain parts, however, they are found in gardens.

Garcinea seeds are useful in the extraction of a certain type of oil and the extraction is found to be 30 per cent. It is called Kokum-oil.

There are two ways of extracting the oil. In certain parts, the external coverings are removed and the kernels are boiled in hot water and allowed to cool down. The oil is seen collected into the upper layer; later it is cooled down into small pill formations.

In other parts, people extract the oil by almost the same process as above but it differs slightly. The seeds are crushed and kept in water over-night. The oil thus saturated above is filtered out, while the rest of the residue is again churned. This process seems to give pure oil.

This oil has medicinal value and properties. It is useful for cold and sore hands and feet.

This may also be utilized in the preparation of candles etc.

The fruit coverings are useful as (अमसुल). In April ripe fruits are taken and the seeds are separated, saturated with water and kept aside. The fruit coverings are also saturated and dried in the sun and this process is repeated 4/5 times before being put out for the mart. The commercial product is black. This is extensively practiced at Malwa, Goa etc.

The fruit is used for pickles and in other home preparations of chutni and vegetables. The Garcinea juice is valued as a drink and can be kept in bottles for days. At places like Kumtha, Karwar etc. there is a white type of Garcinea. This has medicinal properties and is useful in dysentery, but these are rare in black types.

Nephilium Lichi (लीचो)

This is ornamental and bushy in appearance. It is a native of China and was introduced into Bengal during the 18th century. During present times it is extensively planted in Bengal, Lucknow, Allahabad, Saharanpur, Durbungah, C. P. and the Punjab.

In the Bombay Presidency it is planted on a very small scale. In Gujerat where the climatic and soil conditions are favourable, there is a possibility of planting with success. They bear good yields in parts of Jamnagar. In Poona, however, heavy black soils are deliterious to growth.

Propogation:—By gooty and grafts.

These are also propogated by seeds but take a long time. At Lucknow and Cawnpore they practice gooty in June/July and the plants are ready for separation by October. Next June they are planted out and root freely during the 3rd year.

January :—Manuring with F. Y. M. and leaf litre.

February:—Flowers are set and

April, May:—Fruits.

The fruits are reddish in colour but later turn brown. They have small pimples on the covering. A few fruits show smooth skin. The juice from the skin is white and acrid in taste.

The Chinese have a great liking for these and the fruits are extensively exported to Europe and England, but they lose flavour and taste in the process of dessication.

Eriobotria Japonica; Loquat (लीकाट)

This is also a native of China and Japan and grows to the height of nearly 10'. It is green and ornamental.

In India it is found in North India, Cawnpore, Lucknow, Allahabad etc. It could be grown in many parts round about Poona but seems a shy bearer.

In Gujerat where the soil is light, and porous, they grow in abundance.

Propogation:—By seeds, cuttings, gooty and grafts.

The seed-grown plants show a smaller yield and besides the fruits have a larger percentage of seeds. The trees grown by cuttings during the monsoon seem healthy and vigorous. These are manured with F. Y. M. in January or so.

In the Deccan they could be grown in gardens, as the trees are ornamental and the flowers scented.

These flower in February and set fruit by May. It is sour-sweet in taste. The fruits have seldom more than 1/2 seeds in them.

Grewia Asiatica: (फालसा)

These are found growing wild in India. In the Deccan and Maharashtra they are rare. In Surat, however, they are commonly grown.

Propogation :—By cuttings

These are planted out at a distance of 8' or so.

In February light thinning of side branches is done and the main stem is slightly burnt with dry grass and leaves. This encourages side branching and fruits.

The fruits are ready during the months of April and May and are relished by Gujaraties. They also prepare a drink—it is cool and delicious.

In Poona and round about, however, there is no mart.

· Coffea Arabica: (बुन्द काफ़ी)

This was originally found in Africa, Abyssinia, Mozambique and Angola. It was taken to Arabia and later into Europe. In Arabia it is termed "Kawá" and most probably is derived from the province of Kafa in Africa. Arabians are extensively fond of this drink and use it whenever guests are received. The fruits (बुन्द) are dried, crushed and used as coffee.

There are 3/4 types of these :—

(1) *Coffea Bengalensis*.—This is Bengalian type and is inferior in quality.

(2) *Moka or French*.—This has its leaves, flowers and fruits smaller in shape and size. Small yield but rich in quality.

It is being introduced into the Bombay Presidency.

(3) *Coffea Liberia*.—This type has a larger sort of seeds and is also rich in flavour. The plants are easily planted and even prefer lower altitudes.

(4) *Coffea Arabica*.—This is found in Bombay, the fruits having 1/2 seeds only. Those

having one seed seem larger in size and round. The flavour is rich.

This is extensively planted in Brazil, Venezuela, Guatemala, Mexico, E. Indies, Costarica, Ceylon etc.

It is near about seaside places and is found growing at the altitude 1/5000', temperature-60/80°F and rain below 150''.

In the Bombay Presidency it is not planted on a large scale. It is however, found in Konkan and Belgaun. Coffee from India and Jamaica is well known.

On the whole coffee soils need rich organic material or the plants are weak and unhealthy.

These plantations require continuous waterings and need frequent soil and manurial treatment. Wind-belts and protection from sun-light are essential.

Propogation:—By seed.

Seeds are hand collected from 8/10 year old plants, saturated with moisture and planted soon after. The soil is well prepared, manured and made into suitable rows. These are planted at 9'' apart and 2'' deep in rows. They need protection from the sun and plenty of irrigation. They take three weeks to sprout.

The seedlings are transplanted at 7' apart and have *Erythrina indica* (पिंगार) posts as supports and trees as shelter. In the open these fruit copiously, spread wildly, and are capable of harbouring many diseases.

F. Y. M., bone-meal, oil cake, or pouderate is given as manure. Every year trees are dug around. In Ceylon every $1\frac{1}{2}$ year old plant is nipped at the growing point and this operation encourages side branching, the yield depending upon the length of these side branches.

Trees yield when about 3 years old and fruits set after 6 months of the appearance of the blossom.

Diseases.—There is a newly introduced beetle pest on Coffee-fruits in Mysore. This is a native of Central Africa and feeds copiously on wild coffee. It was introduced in Java in 1909, in Brazil 1918—from the provinces of Uganda, Kenya etc.

The first appearance in India was in 1927 when most of the coffee-fruits were bored through; the only natural and effective remedy being the introduction of a parasitic insect feeding upon these beetle pests of coffee-fruits.

Eugenia Jambolana (जांभूब)

This is commonly found in India. It prefers waterside places and is propagated by seed.

It could even be grown by methods of budding and grafting.

It is generally planted by nallas, rivers and rivulets.

These flower during the month of March and set fruits towards the rainy season.

Eugenia Malaccensis (मलाका जांब)

The word Eugenia is derived from the name of the Prince "Eugene" of Savoy.

This tree is a native of Malaya. It is an ornamental tree, and the leaves are large in size. The flowers are red and large and the fruit attains the size of a guava. This is commonly found round about Bombay, and suburbs.

Eugenia Jambos (गुलाबी जांब)

This must have come from the E. Indies and resembles E. Jambolana in most respects. This tree prefers hot climatic conditions.

It is propagated by gooty and seed.

The fruits are pink or whitish in appearance, and are ready by the rainy seasons. It is wholesome but not commonly used as table-fruit.

Prunus Persica (समालू-पोच)

This has been known to the Chinese for ages. Recently it has been cultivated in England, America, Iraq (Mesopotamia) Iran and Afghanistan.

In India it is extensively grown in the N. W. Province and borders of Peshawar, Punjab and in the Himalayan Valleys. Calcutta, Rajputana, and Selam Districts have this fruit. In the Bombay Presidency—Sindh, Hyderabad, Mahabeshwar and Panchghani—4378' altitude—have it on smaller scales. It is planted more as an ornamental tree and is many times devoid of fruit.

At places like Indore and Nasik it flowers profusely and in certain seasons—May—sets fruits.

In Panchghani the soil is rocky, red and porous. Rain 60/80''.

These are propagated by seed and cuttings and it is found that the latter method is economic and has given better results.

They are transplanted towards the end of September-October at a distance of 10/12' apart.

In May—every alternate year—root lifting and exposing may be done.

These shed leaves soon after the rains and flower in August-September, and also in certain seasons in March or so. They take 6 months nearly to set fruits.

F.Y.M. or leaf-litre is extensively utilized as manure.

It is found that large plantations are not possible in places like Mahableshtar and Panchghani due to irrigation—water being at considerable depths in the wells.

Anona fruits (सीताफल, रामफल, माहुतीफल, मामफल)

These species of fruit trees are commonly found in America in hot climates. *Anona squamosa* and *Anona reticulata* have been introduced into this country for some time and are found growing wild round about the villages.

Anona squamosa.—This tree prefers dry and tropical climates. They are extensively found in the Deccan. In the Deccan Hyderabad and the Province of Tandur they grow in large numbers and are sent out to Bombay.

At Bhavnagar and Jamnagar some of the oldest plantations—80 years—are still to be seen. In certain parts round about Poona these trees are planted along with and in rows of *Punica granatum*.

They are grown from fresh seeds and are transplanted out at a distance of 12/14'. *Anona Squamosa* prefers light soils along slopes of hills.

Flowers appear by April and May. These are copiously irrigated towards August in the case of dry spells of the monsoon.

The fruits are valuable and economic, used mostly during the racing seasons both at Poona and Bombay. There is one more variety of fruit, yellow in colour and seems sweet and well flavoured. The trees prefer lighter soils, dry conditions and can well be managed with little capital.

रुमफल *Anona reticulata*.—These are grown in the Deccan and Konkan.

They prefer shady places and are generally found near about irrigation-channels and where there are water facilities.

मारुतीफल *Anona Cherimoliya* resembles above species. of trees.

The fruits are also similar in appearance.

Anona reticulata fruit shows markings of the network of the veinlets on the skin-cover of the fruit and is mellow to touch, while the *Anona Cherimoliya* fruit is superior in taste.

This species also grows in light type of soils and requires less irrigation and manurial treatment, and needs every encouragement.

A Cherimoliya is originally a native of Peru and is also found in Mexico, Jamaica, Madeira, etc. It is exported to New York and London.

In India it is grown from seed and cuttings
In America it is propagated by cuttings and also
by methods of budding.

They are planted at a distance of 15/18.'

A. reticulata and *A. Cherimoliya* fruits are
ready by February May.

मामफल *Anona Muricata*.—This species is
smaller and bushy in growth and looks ornamental.
The fruit is large in size and has protuberances.
It is sour in taste and possesses a strong smell.
It could be used in the preparation of a drink or
Sherbat. This is a native of the West-Indies and
the drink is extensively prepared in Cuba.

All the above species belong to America and
are grown from seed and cuttings—they could
as well be grown by the methods of budding. A
Cherimoliya is very common there—here in
India it is not largely introduced and is seldom
found.

The methods of propagation by cuttings and
budding are highly recommended.

Chrysophyllum Cainito (स्टरि अँपल or ताराफल)

Chrysos = Gold.

Phyllum = leaf.

Hence the word Chrysophyllum comes into vogue due to the yellowish tinge underneath the leafsurface.

This is a native of Cuba and is also called star-apple tree.

In the Bombay Presidency they grow to the height of 20/25' and are found as road-side trees. They are ornamental trees—the lower side of the leaves being velvety, hairy and slightly coloured.

The fruits are larger in size than chikoo fruits and show star-like radiations on a transverse section. There are 4/5 large seeds, while others are either small, flattened or even sterile, sugar content being 4½ per cent.

They are ornamental and serve as roadside trees even in light or rocky soils.

Artocarpus integrifolia (फणस)

These trees are found in the forests of Sannhadri Mountain. They are grown in Jamaica, Brazil, Mauritius, Ceylon and India, especially by the sea-side. In the Bombay Presidency—Kolaba, Thana Southern part of Surat, Mellad etc. these also grow along with cocoanut and Areca Catechu. They are mostly found in clumps near about old villages and prefer light lateroite soils.

They are partial to arid and humid climates.

Propogation.—They are propogated by seed. They need fresh and light loamy soils. Occasional manuring with bone meal is recommended. They bear fruits in 6/7 years' time.

These could also be propogated by grafting but this is seldom practised.

The fruits appear on main trunks and branches. The male and female flowers give rise to these fruits after fertilization in December. The fruit weighs 6 lbs. or so. They smell strongly and are eaten when ripe. Raw fruits may be utilized for vegetable purposes.

There are two types of fruits :—

(1) *Kapiya*.—One capable of being cut with a knife and is freely separated in different parts.

(2) *Berka*.—This could be broken even with the hand and the separated parts are mellow and soft.

In certain parts, however, one finds qualities of both of these types of fruits combined in one fruit only. These are sweet and delicious in taste.

The fruit is utilized in very many ways. It is powdered, seived out to thin consistency and boiled with water—this leaves it in flat pancake form on drying. It could as well be dried and bottled to save it from becoming mouldy.

It is also used along with rice flour and the mixture is boiled and dried. This serves as a substantial starchy food for 3/4 months of the summer season.

The tree measures from 15/20' in diameter and is capable of bearing nearly 50 fruits during the season. In Konkan, however, the number of fruits may even be 60/500. The timber is utilized for making tables, chairs and cupboards and for building purposes. It is hard and durable. The trees are useful and valuable and need extensive cultivation.

Artocarpur incisa: Bread Fruit tree (भाजोचा फणस-भाकरीचे झाड)

Bread-fruit trees grow extensively in the South Sea Islands, Ceylon and Madras. They are also found in Konkan. These trees are akin to *A integrifolia* but bear larger leaves with margins cut. These again are of two types :—

One of them is solely utilized for vegetable purposes, while the ripe fruits are useless.

The seeds are sown from the ripe fruits.

The other type of Bread-fruit tree is used in the preparation of cakes and flour. They are cultivated from suckers or side-shoots.

Artocarpas Lakoocha (लव)

This also belongs to the *Artocarpus* family. They are found in Konkan.

No one plants these by intent.

The fruits are smaller and are sour to taste.

Averrhoa carambola (कमरंग-कभरक- करभर)

This is more an ornamental tree. It is named after an Arab Physician—"Averoce"—who lived at Kadoa. (He published Aristotle's works in the Arabic language.)

These fruits are extensively used by the Mohamedans during summer seasons.

Propagation :—By seed.

The fruits have five zigzag streak-markings and are extensively used in the preparation of pickles.

Averrhoa Bilimbi (बिलिंबी-बिंबल)

This is also an ornamental tree, and grows extensively in Konkan.

Propagation :—By seed.

Fruits :—Fruits are sour and used in the preparation of pickles.

Mimusops hexandra (खिरणी-रायण)

Mimo = Monkey.

Opus = Face.

The flowers of *Mimusops hexandra* have monkey-like appearance and hence the name.

These are extensively grown in the Bombay Presidency and bear resemblance to बकुली-trees. In Gujrat especially they are planted by the road side.

Soils :—Light, sandy loam and even near about coastal regions—these grow easily. Dry climatic conditions like those in Nagar District are favourable.

Propagation :—By seed.

Fruit :—Fruits are ready in April-May. Gujrat has a special liking for these fruits. They are very sweet in taste.

They are preferable as road-side trees since they require less care and besides are evergreen. They are also slow growers. The fruit is useful during famine and dry spells.

This may be used as stock-tree for Chikoe (*A. Sapota*) and is also sold at a lower rate but is not highly recommended.

Dureo Zibethinus (डूरिञ्चन)

These are natives of Tenaserim and Malaya and have been recently introduced into Brahmo-desh and Ceylon.

Propagation :—By seed.

Fruits :—These are strong smelling like those of *A. integriolia*. People from Ceylon and Brahmadesh like these very much.

Some attempts were made to introduce them into the Deccan but they failed owing to unfavourable conditions.

Morus Alba (तुत)

These trees are natives of Iraq and are useful as wind-belts. The timber is utilized for building purposes.

A great industry of sericulture or silk is in existence there as the leaves are used for rearing the silk-insects.

They were also planted recently in Europe. In India they can easily be introduced as they are capable of growth in any conditions of soil or climate.

Propagation :—By cuttings. Fresh, healthy cuttings produce healthy trees bearing heavy blossoms and a good type of fruit.

They could as well be grown by ‘budding’. The healthy buds are easily taken off and are implanted on fresh stock-branches. The T. slit process is commonly practised.

Fruit.—(a) White
(b) Black

There are two types of fruits, white and black. Both are long in form and shape. The white type turns to a yellow colour when ripe and can easily be dried. The black one remains black when ripe but can not be dried.

Tuti plantations are highly recommended.

Fruit Preserve & Preservations

Fruits are perishable goods and hence knowledge of vicinities to markets, transport facilities and timely yet seasonal productions of fruits are some of the essential factors to be taken into consideration. Mangoes, oranges and pomegranate fruits last longer, while figs and guava are delicate and often perish soon. Preserves and canning of fruits is a science by itself and needs education, economics and capital. The negligence found on the railway is also accelerated by careless packing of fruits by the gardeners themselves and naturally the market value is lessened.

The raw materials and by-products from fruit trees and the surplus and out of season stock of fruits need immediate disposal at minimum loss of profits to the horticulturists in the countryside.

Mango and orange fruits can be canned and preserves made on large commercial scales if suitable factories are established at convenient centres in the Bombay Presidency, both with the private and Government enterprises and finance. The Agricultural Department is doing its bit in establishing district and rural uplift committees and helping the cause of fruit culture through suitable propaganda and drive in the villages.

Dr. W. Burns, D. Sc. the present Agricultural Adviser to the Government of India and Agricultural Commissioner and Prof. G. Cheema, Horticulturist to the Government of Bombay have spared no pains in introducing the home products in European markets. Their untiring zeal and energies have been ever so much appreciated by the public that several Fruit Growers' Associations have sprung up lately throughout the Presidency.

It seems, however, that scientific knowledge, capital and industrial outlook are still neglected by the rural population in the presidency, and hence a great deal of work in connection with the fruit culture, canning and preserves has yet to be done in the near future.

Banana Preserve

This fruit is extensively utilized for eating purposes, and not a few varieties are used as vegetables. It is found in large quantities throughout the cold and summer seasons in the local bazars.

Banana preserve can be made using any of the varieties such as Rajapuri, Welchi, Soneri and Sonkale. The fruit ought to be ripe and healthy in appearance. Any black skin patches or over-ripe and soft condition of the fruits are to be discarded at the first sight.

After peeling the skins, the fruits are cut into convenient pieces and washed in cold water. The pieces are then left into thin syrup of sugar and adequate quantities of water kept lukewarm over moderate fire. It is often advisable to make incisions on the fruit pieces before immersion into the sugary solution.

When the preserve becomes of a viscous sort and syrup absorbed in, it is removed from the fire and kept into well sterilized bottles.

Jack Fruit Preserve



These fruits are found along the sea coast and mountain regions. In the Bombay Presidency they grow in Mahableshwar vallies, Kolaba, Thana, Mallad, etc. Raw fruits may be utilized for vegetable purposes. They smell strongly when ripe and generally weigh 6 lbs. each. These are of two kinds—Kapiya and Berka. Kapiya type of fruits are easily cut with knife and capable of being freely separated in different parts, while Berka ones are soft and mellow and could be broken even with the pressure of the hand. They possess thick and warty skins. The fruit is utilized in very many ways. It is powdered, seived out to thin consistency and boiled with water.—this leaves it in flat pan cake form on drying. It could as well be dried and bottled to save it from becoming mouldy. It is also used along with rice flour and the mixture is boiled and dried. This serves as a substantial starchy food for three or four months of the summer season.

For preserves—The fruit ought to be ripe and strong smelling. The tender and mellow flakes are cut open, seeds removed and washed thoroughly in cold water for about ten minutes. Later they are boiled to just the right point, till they appear soft and transparent.

The flakes thus softened are gently pricked with fork and put into lukewarm syrup. It is supposed to be ready (Jack fruit flakes 1 lb. and sugar 1 lb.) when the right consistency is acquired. It is removed from fire and cooled. The preserve is transferred into air-tight wide-mouthed vessels and sealed.

Guava Preserve

11 00000000 100

Most of the orchards are found in the tropical regions and need scientific handling in their ultimate yield production and disposal. The fruits are glutted into markets and get mouldy due to untimely and premature harvests. Canning and preserves of these fruits seem indispensable in many parts of the Bombay Presidency - as the latest knowledge and application, modern canning machinery along with its many advantages have brought this section of horticulture to the forefront.

Fruits with few seeds, succulent and flavoured pulp, brilliant and yellow peel are best for the preparation of preserves.

They are cut into convenient pieces, skin peeled off and washed with cold water. Incisions are made with a fork and later dipped into lime solution over night and washed under tap. They are boiled in water till they become soft in consistency and later transferred into syrup (sugar 3 lbs. and water 4 lbs.).

The whole lot is kept boiling over gentle fire till the syrup gets thickened. It is removed from fire and sealed up in bottles while it is still hot.

The ultimate success of the final product of the preserve depends much upon the care taken in

keeping up the fruit pieces intact instead of mashing them up in the various stages of its preparation.

The quantities taken being:—

Guava 2 lbs.	Lime 2 oz.
Sugar 3 lbs.	Salt 2 oz.
Water 4 lbs.	

In foreign countries great impetus is given to this industry. There is a great demand for guava and other fruit preserves abroad and the products find ready markets. It is encouraging to note that the various district and village uplift committees in the Bombay Presidency are carrying on propaganda and holding fruit canning and preserve exhibitions every year.

Dry Date Preserve

These are extensively grown in Arabia, Mesopotamia, Sindh. The fruits are delicious and keep long. A great import trade is being carried on through the passes of Afganistan to lower India.

The fruits—tender, healthy-looking with bright, red lustre—are sorted out, washed and boiled in water for about twenty minutes. They are then put into thin syrup and kept over gentle fire till the consistency of the sugary solution is improved and then powdered cardamom minor and cinnamon are strewn over to improve the flavour and taste.

They are put into sterilized bottles while still hot.

The proportions of the different ingredients being as follows:—

Dates (dry)	2 lbs.
Sugar	2 lbs.
Cardamom minor	1 oz.
Cinnamon	1 oz.

It is said the preserve has medicinal value in as much as it serves as a laxative and tonic for adults and improves the general tone of the body.

Grape Preserve

Viticulture is coming into vogue practically in Baluchistan and western parts of the Bombay Presidency. There are several varieties of grapes such as Fakdi (Muskat of Alexandria), Sahebi (Decons superb), Kishmishi (seedless variety), Bhokri (red coloured or Abi), Gosani, etc., and these could be given trials on commercial scales.

In the preparation of preserves care should be taken to select choice varieties and if possible seedless types. Fruits ought to be plumpy, ripe and free of any sort of blemishes. Greenish white, amber coloured fruits enhance the commercial value of the preserve.

Fruits are washed in cold water and cleansed. They are carefully put into thin syrup of sugar and kept over gentle fire till the sugary solution gets absorbed into the fruits and becomes viscous. The preserve is cooled and finally sealed up into suitable glass jars or bottles.

Great care is to be exercised in handling the half matured fruits throughout the washing and heating processes as there is often possibility of mashing them up into a paste. This preserve is

Mango Preserve

Mango is grown in East and West Indies, coastal areas of Konkan, Goa and in the Nawabshah district of Sindh.

Semi-ripe fruits are taken down and stored in wheat or rice straw. The ripe fruits are wrapped with moss and oil papers in order to effect proper temperature, moisture and cool and dry conditions. In places like those of Bombay and Karachi the storage of fruits with the aid of the latest appliances serves to tide over marketing and shipping encumbrances

Ripe mangoes can be bottled with saline solution with proportions 8-9 lbs. : 100 of sterilized water (sp. gravity 1.04).

There is need for useful propaganda and knowledge of transport packing and lastly canning and the preparation of various preserves. The latest drive in this direction has been promulgated by Dr. W. Burns and Prof. G. Cheema, Horticulturist to the Government of Bombay. They have issued vernacular pamphlets in conjunction with the members of the Fruit Marketing Committee, Bombay, instructing various fruit producing centres on the production of superior fruits and their final disposal.

There are several types of fruits such as Malgoba (Madras), Fernandis (Goa), Pairi and Alphonso, Cowasje Patel etc

Select mangoes that are healthy and free from any skin diseases. They are peeled carefully and cut into convenient pieces. Incisions are made by fork and the pieces are put into lime solution for about a couple of hours. Later they are washed and mixed with salt and again kept aside for some time. They are now washed with hot water and boiled till they become soft and mellow.

Put them in sugary syrup while the latter is cold, with an adequate amount of water. Cook the mango pieces till the syrup becomes thick and viscous, removing scum if any, from time to time.

Desi Mango Preserve

The proportion and quantities of the various ingredients being:—Sugar—4 seers.

Salt—2 oz.

Lime—4 oz.

Green mangoes—2 seers.

It is essential to note here that soon after final cooking is over the preserve may be kept aside before sealing the same in bottles in order to see if any fermentations, set in. If it shows any signs of fermentations boil the syrup with the mango pieces over again till the preserve looks thick in consistency and seal it in clean and sterilized bottles.

Fazli Mango Preserve

In case of Fazli mango preserve the process is almost the same as above, excepting a little variation in the ingredients utilized. Here almonds, pistachio nuts and raisins are liberally used even in the preparations of preserves on commercial scales.

Cut mango in suitable sized pieces and wash them in cold water. After soaking them in lime water, wash and cook them till they are soft and mellow.

They are then put into thin syrup with sufficient amount of water and boiled. When the syrup is thoroughly incorporated into the pieces, it is put into bottles, and sealed up tightly in order to preserve the contents for a long time.

Sometimes the fruits are cut half-stuffed with almonds, pistachio nuts and raisins after removing the stones. Tiny threads are wound around them to save the fillings from spilling out. Incisions are then made and the whole process as referred to above is carried out with greater care and precision.

The quantities being:—

Lime—2 oz.

Sugar—1½ seers.

Green mangoes.—seer

The mango fruits should be hard, green and healthy, looking free from cuts or bruises, or they are easily mashed up in cooking process.

The mango preserves last for a long time.

Pine-apple Preserve

These were first introduced by the Portuguese in Bengal in 1594. At Singapore there are large plantations. Ceylon, Travancore, Malabar, Goa, Sawantwadi, Ratnagiri, Kolaba and Amalsad have pine-apple plantations.

In Singapore the pine-apple canning factory of Messrs. Sin Heng and Company turns out 5000 tins of pine-apples in one day and ships abroad to various parts of U. S. A. and Europe.

There are several types of fruits, such as the common type, que-pine, queen pine-apple, etc. Most of these are wasted away or prove to be uneconomic due to marketing or canning facilities.

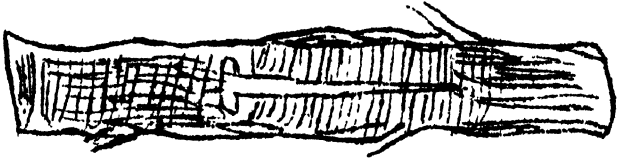
In the preparation of preserves only sound and healthy ones are selected. The tops and thorny leaves and the warty skins are removed and the whole fruits are cut into suitable and convenient sized pieces. These are laid on trays and sugar sprinkled upon and put away into the sun till there is liquid saturation of the sugary solution.

These are placed over fire and cooked without water for 3 to 4 days and then introduced into thin syrup. The preserve is removed from fire when the syrup attains proper viscous condition and poured

into sterilized bottles and sealed. The preserve thus prepared is delicious and lasts long.

Regarding the quantities:—

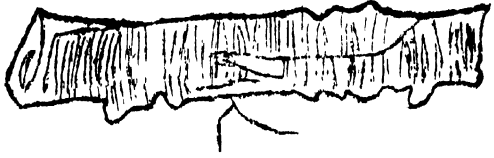
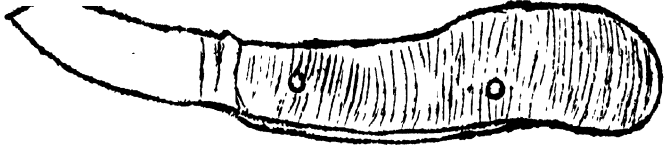
Equal amounts of sugar and pine-apples in weight may be taken (sugar 2 lbs., pine-apple 2 lbs.)



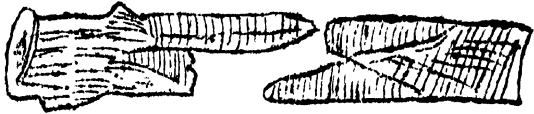
Budding

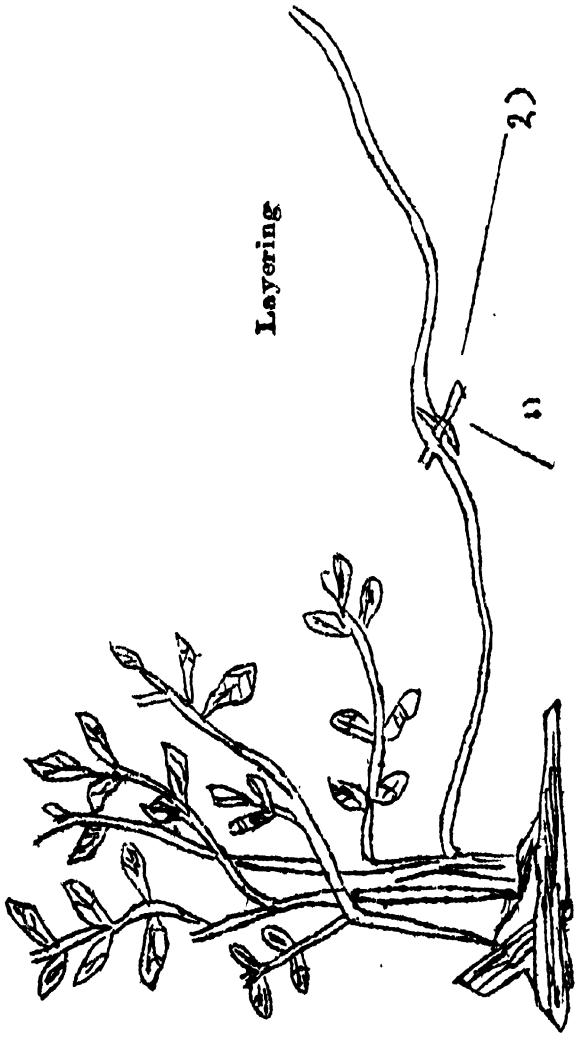


Grafting knife



Tongue-Graft





Layering

- (1) Slanting cut towards the root-end
- (2) A small peg inserted in the cut to save the portions from adhering.

