

A Warning To Fruit Growers

¶ All fruit growing enthusiasts are hereby informed that Messrs. FRED TAYLOR & Co. are the only authorised agents of Messrs. JOHN BRUNNING & SONS, Somerville Plant Nurseries, Victoria, Australia, and are the direct importers into Ceylon of grafted fruit trees from the world-famous Somerville Nurseries.

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¶ It has been brought to our notice that several importers of fruit trees in Ceylon are describing their stocks as "Bunning's" for obvious reasons.

¶ Very often what happens is: firms and individuals book orders and pass them to the so-called Nursery Dealers and Nursery Jobbers abroad, whose one aim is to make the biggest profit. The latter buy trees from anywhere and everywhere. Very often they do not make any distinction between a grafted tree, a seedling or a cutting. Naturally the "bargain lots" they secure contain 80 to 90% of rejected grafts, seedlings and cuttings.

¶ The Somerville Nurseries are under agreement with us exclusively to ship their trees to us. It is therefore absolutely impossible for any firm or individual to get a better selection than those sent to us.

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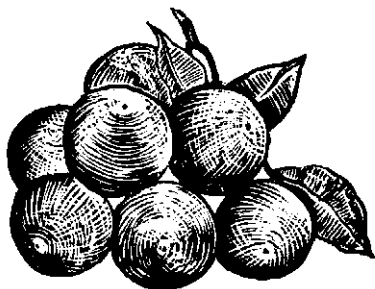
FRUIT CULTIVATION

IN

CEYLON & S. INDIA

BY

FRED. TAYLOR



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PREFACE

THIS handbook contains practical ideas on Fruit Cultivation. I have attempted to give the benefit of successful experience in other countries in simple form to Orchardists in Ceylon and South India.

Though direct references are made to conditions in Ceylon, conditions in South India being similar to the conditions in Ceylon, interested cultivators in South India will find my suggestions as useful as Horticulturists in Ceylon.

True wealth can be derived only from primary arts of production like agriculture. This book is intended to stimulate and direct practical agricultural production in Ceylon and South India.

The difference between this book and others on the market, consists in the following fact: the writer of this book is on the spot and will supplement with personal direction and guidance the hints and suggestions which are found in these pages.

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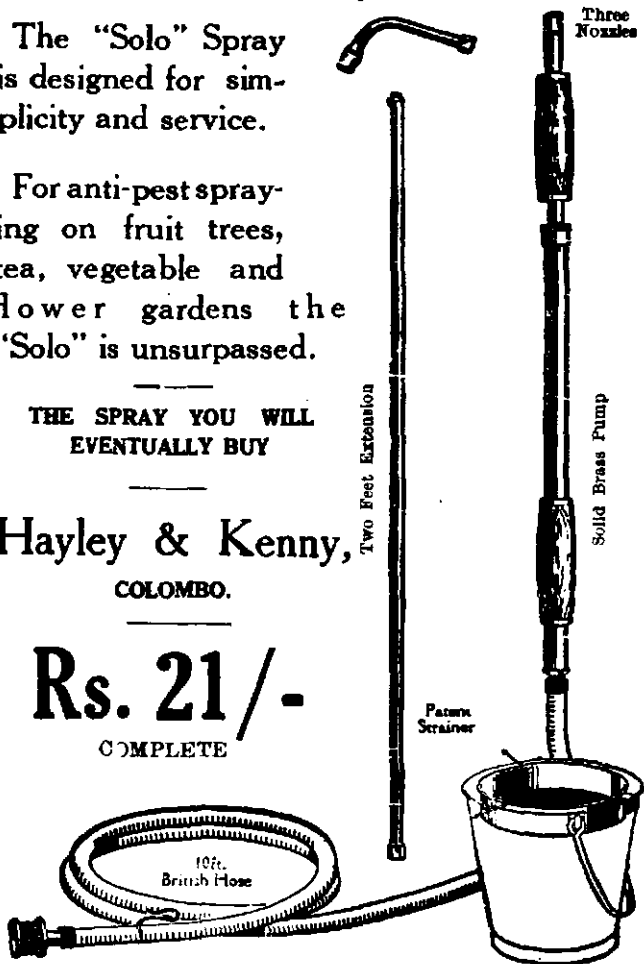
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Fruit Cultivation is to be a
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FRUIT CULTIVATION

IN

Ceylon and South India

CHAPTER I

Ceylon's Possibilities in Fruit Production

THE following chapters mainly deal with the cultivation of fruit trees. I wish to offer this book to the Ceylon public as my contribution to the economic reconstruction of the Island. The industries of Ceylon being mainly agricultural, it is in the interests of Ceylonese to multiply and increase both the quantity and quality of agricultural produce.

The best method of increasing the prosperity of this country under the present circumstances is to increase Ceylon's agricultural produce. Import of goods which Ceylon cannot or does not at present produce is inevitable. I am trying to be of service to the country in all possible exports as well as all necessary imports.

The supply of plants and seeds of the best quality and modern labour-saving agricultural

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implements is an essential part of the economic forward movement which must now be launched in the permanent interests of the inhabitants of Ceylon. What I say about Ceylon will apply with equal truth to South India and to other countries where similar climatic and economic conditions prevail.

At the request of several planters in Ceylon and South India, I have imported into these countries several varieties of fruit trees from Australia. Nearly 10,000 fruit trees have already been imported and distributed in Ceylon and South India.

The varieties included orange trees, grapefruit trees, and grape-vine trees, as well as fig trees, apple trees, and pear trees. I have been asked to prepare a handbook containing directions which will help the successful cultivation of these fruit trees. The demand for these trees is increasing and the reason for the demand is clear.

The reason is to be found in the present economic condition of Ceylon. Of the major industries in this country the tea industry is just paying its way; the coconut industry is struggling for existence; the rubber industry is worse than non-paying. Under these circumstances some industry has to be introduced which will take the place of the sinking industries.

IN CEYLON & S. INDIA

I am in a position to say that no country in the world is more suited for the cultivation of fruit trees than Ceylon. I am able to make this statement not merely because I have had several years of experience in fruit cultivation in Australia. I have also had the good fortune to travel over the world a good deal. This is my fortieth visit to Ceylon, and I have been studying the conditions here continuously. Everyone who understands anything of soil or climate will admit Ceylon's pre-eminent suitability for agricultural production.

But what use has been made of the wonderful possibilities of this Island? What attempt has been made to introduce scientific fruit cultivation as a paying proposition?

This is the best opportunity to make such an attempt. There is no doubt that the attempt will be a success. The methods that have succeeded elsewhere must succeed in this country. The natural conditions are most favourable. What is required is enterprise, organisation, and well-directed energy.

The Customs returns for the year 1931 show that fruits, fresh, dried, and preserved, imported into Ceylon in that year amounted to Rs. 1,129,854 in value. All this money could have been retained in the Island if a few thousand acres were put under systematic fruit cultivation.

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In Australia we have, after all, nearly 81,000 acres under apple trees. We produce nearly 173,000 tons of apples per year. We have about 17,000 acres under pear trees. We produce nearly 31,000 tons of pears per year.

In Ceylon we have 16,000,000 acres of land. An extent of 13,000,000 acres is yet uncultivated. Of the cultivated land 500,000 acres are under rubber which is not paying. If 50,000 acres are put under fruit trees Ceylon will be self-supporting as regards her fruit supply. I shall show later that there is an immense market for Ceylon's surplus fruit produce. Not to speak of other countries, there is the big continent of India at her door. In 1930 India imported nearly Rs. 18,500,000 worth of fruits from foreign countries. There is no reason why India should not produce all that she needs in the way of fruits. But if India does not produce enough, why should not Ceylon supply ?

I am sure the people of Ceylon realise this opportunity : hence the increasing demand by planters for fruit trees of good stock. I am now resident in Ceylon. Several others besides me have been drawn to this Island by the exquisite charms of its landscapes and the salubriousness of its climate. It is my intention to make my stay here beneficial to the inhabitants of this Island.

IN CEYLON & S. INDIA

Success in the cultivation of fruit trees will depend not only on the employment of plants of good stock suitable to local conditions, but also on the selection of proper site, provision of necessary drainage, proper methods of planting and pruning as well as the vigilant control of plant pests and diseases. In the case of certain fruit trees the securing of suitable cross-pollination is essential to bring about the maximum production of fruit of good quality. I shall refer to this later.

I am prepared to give personal directions and suggestions which I think will be useful to persons in India or Ceylon who wish to take seriously to the cultivation of fruit trees, whether as a cottage industry or as a commercial proposition. To demonstrate the possibilities of the export trade in fruits in Ceylon, we have, by arrangement with the P. & O. Company, sent to Australia last season several shipments of Ceylon mangosteens. Very favourable reports have been sent to us of these shipments, especially from Melbourne. We have thus initiated the export trade in Ceylon fruits. More will be done this year.

I wish to say two things more in this Chapter. First, I shall refer to the achievement in fruit production by South Africa. It is only very lately that South Africa took to fruit cultivation in spite of conservatives who

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said that Australian fruit trees would not grow in South Africa. But South Africa is now only second to Australia in supplying fruits to the London market. In 1907 South Africa sent 3,000 cases of apples to the United Kingdom. In 1925 she was able to send 1,000,000 cases. Experts predict that in 1940 South Africa will be able to send out 10,000,000 cases.

It must be remembered that Ceylon has an advantage over South Africa or even Australia in having easier access to the big fruit markets of the world. The same may be said of some of the Indian ports. As for the fertility of the soil and other advantages there is no comparison with Ceylon. For the present Ceylon must concentrate on at least the production of fruits for local consumption.

The other matter to which I wish to refer is the natural conservatism of people which makes them reluctant to venture on any enterprise. When rubber trees were first planted in Ceylon, there is no doubt that some conservatives must have had their misgivings about the success of the enterprise. To-day rubber plantation is too much of a success. Even restriction of production has failed to give relief. Yet credit must be given to the pioneer.

In about 1789 Capt. McArthur started wool growing in Australia with three male

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sheep and five female sheep. Probably the Diehards in Australia did not think much of the venture. What was the result? In 1799, ten years later, we had in Australia 2,457 sheep. In 1842 we had 6,300,000 sheep. In 1925 we had 90,000,000 sheep. The quantity of wool gathered in Australia in that year was 685,000,000 lbs. The quantity is yet increasing. Wool growing to-day is the country's chief source of wealth. The income earned by Australia from wool in 1928 was nearly £71,000,000.

Scientific fruit growing can be made the chief source of Ceylon's wealth. There is no investment in Ceylon to-day which will yield better returns. The possibilities will appear more and more as one reads the following Chapters.

CHAPTER II

Fruit Cultivation as a Paying Investment

IT is clear that Ceylon does not produce enough fruits for her own consumption. There is an immense market for Ceylon fruits in England if Ceylon can produce fruits of good quality in commercial quantities. Let us consider the position of the fruit market in England.

In 1904 the consumption of apples per head of population in the United Kingdom was 14 lbs. ; in 1924 the consumption of apples increased to 23 lbs. per head. In 1904 the consumption of oranges per head of population in the United Kingdom was 15 lbs. ; in 1924 it was 18 lbs. per head. In 1904 the consumption of bananas per head of population was next to nothing ; in 1924 it had increased to 30 fruits per head. Taking the consumption of fruits as a whole in Great Britain, in 1913 the imports into Great Britain amounted to £15,000,000 in value ; in 1924 it increased to £45,000,000 in value. What is the reason ?

The reason is the increasing appreciation of fruits as the most wholesome article of food.

FRUIT CULTIVATION IN CEYLON & S. INDIA

This is particularly seen in the case of grape-fruit. Grape-fruit has come to the front in recent times as an article of food on account of its value as an appetiser and a digestive. In 1920 the imports of grape-fruit into England amounted to 13,000 cwt. ; in 1924 the imports increased to 78,000 cwt. It must be remembered that England produces only 25 per cent. of her demand for fruits. All the bananas she consumes she gets from outside. England produces only a small proportion of the apples and pears she needs. The position is the same as regards her supply of oranges.

Is it not possible for Ceylon to supply England with £5,000,000 worth of fruits out of the £45,000,000 worth of fruits which England consumes every year ? Cannot South India capture part of this trade ? So far as Ceylon is concerned it looks absurd for the Ceylonese to keep 13,000,000 acres of their land uncultivated and to buy every year about Rs. 50,000,000 worth of rice from outside. An additional reason for increasing fruit production in Ceylon is the fact that it is advantageous to decrease the consumption of a large proportion of starchy food like rice by the Ceylonese and to encourage the consumption of a larger proportion of wholesome food like fruits.

This Chapter is concerned with the question : Is fruit cultivation a paying investment ?

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Let us consider the capital that has to be invested and the returns that may be expected in relation to some specific varieties of fruit trees.

The orange and the grape-fruit may be considered together. The cultivation of these fruit trees in a scientific manner, so far as I can see, has not been carried on to any satisfactory extent in Ceylon. The possibilities are tremendous. The quality of the fruit will primarily depend on the right kind of fruit trees that are planted. I insist that none but budded or grafted trees should be planted in an orchard. I will refer later to the selection of fruit trees for planting. For the present let me give some figures as regards the possible returns from one acre of orange trees or grape-fruit trees.

Properly planted, one hundred of these trees can be grown in an acre of land. The produce from an orange tree or a grape-fruit tree which is full grown is 400 to 1,000 fruits per year. Taking 600 fruits as an average, the 100 trees in an acre will produce 60,000 fruits per year. I have seen oranges and grape-fruits grown in Ceylon on Australian grafted trees. These fruits are as good in quality and flavour as any produced in Australia or California. At 10 cents each 60,000 fruits per acre will give an income of Rs. 6,000 per year. Even at Rs. 3,000 per year per acre

the cultivation of orange and grape-fruit in Ceylon is to-day the best possible investment. The grafted fruit trees that we import will bear fruit in two years and will yield profitable crops from three years onwards.

The prospective planter should take into account catch crops that can be raised while the fruit trees are growing. Catch crops can be raised in an orchard for three years from the time of planting of the fruit trees. There are certain parts in Ceylon, both in the hill country and in the low country, where potatoes will grow well. Potatoes give a harvest within four months after they are planted. A good harvest of potatoes per acre will be ten tons. The seed potatoes for an acre will cost from about Rs. 30 to Rs. 50. A maximum produce of twenty tons per acre has been recorded. Even taking the yield at five tons per acre and the price of potatoes at Rs. 8 per cwt. one harvest of potatoes per acre will amount to Rs. 800. There is nothing to prevent a cultivator from raising two or three harvests of potatoes per year by careful cultivation. Other local catch crops may be raised in an orchard in place of potatoes. Whether as a cottage industry or as a commercial proposition fruit growing to-day is a most attractive investment.

Besides orange trees and grape-fruit trees other fruit trees that can be cultivated as a

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paying proposition in Ceylon are mangosteens and mangoes. To be a commercial success they must be cultivated in commercial quantities. It is necessary to select the best varieties and perpetuate the same by budding and grafting and systematic cultivation. Figs and peaches will grow well in Ceylon. But their commercial importance is not so great as that of apples and pears.

Apples and pears are usually called temperate fruits. But if they are cultivated in the proper way they will grow and produce fruits of the best quality in most parts of Ceylon. It is a question of selecting the proper varieties of trees and adapting to local conditions the methods that have succeeded elsewhere under less favourable circumstances. Hundreds of our grafted apple and pear trees have been planted in Ceylon and scores of trees are already bearing fruit. I will point out later the defects in the present methods of cultivation. Here a few figures may be given to show the commercial possibilities of the cultivation of apple and pear trees in Ceylon.

As a matter of fact Mysore has taken a step in advance of Ceylon in the matter of cultivation of apples and pears in commercial quantities. Mr. George Brunning, one of the proprietors of the Somerville Plant Nurseries in Australia, who paid a visit to Bangalore in

December, 1932, has reported that the orchards of apples and pears in Bangalore are doing remarkably well. In one orchard of nearly six acres where 600 apple trees were planted five years previously, according to the information gathered by Mr. Brunning, the income for the year 1932 was Rs. 7,500. There is no doubt Mysore will yet improve. Why can't Ceylon do better ?

About 100 apple or pear trees can be planted per acre. In certain types of soil the number may be reduced to fifty trees per acre. The cost of fifty plants and of cultivation will be about Rs. 175 per acre. The grafted fruit trees from the Somerville Nurseries will bear fruit in two years and will be in full bearing in five years after they are planted. In Australia full-grown apple or pear trees have been known to produce a maximum of eighteen cases of fruit per year, each case containing from 150 to 200 fruits, according to size.

Let us presume that we get only a third of this estimate, viz., six cases per tree. The cost of a case of apples or pears in Ceylon is from Rs. 8 to Rs. 13. Let us calculate at the modest rate of Rs. 6 per case. The fifty trees will give 300 cases per acre. At Rs. 6 per case the return per acre per year will be Rs. 1,800. Catch crops may be raised for the first three years in an orchard of apples and pears as well

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as in an orchard of oranges or grape-fruits as previously mentioned.

Then, there is the cultivation of the grape vine. Grape vines have been cultivated in a half-hearted manner in some parts of Ceylon. The fact is they will grow in most parts of Ceylon. The soil will have to be selected. If the soil is not suitable it can be made suitable. If the necessary ingredients and chemicals are not to be found in the soil, such ingredients and chemicals can be put into the soil as will be pointed out later. The expense is negligible compared to the possible returns.

The planting of an acre of grape vines will cost under Rs. 200. The yield will be more than Rs. 2,000 per year in less than five years. The poor man need not invest much money. A few trees carefully planted and cultivated in a small plot of land can give him more than the necessaries of life. One advantage that fruit cultivation has over the cultivation of other crops is that fruits need not always be sold ; they can be consumed.

I have said enough to show that fruit cultivation can be made a very paying proposition in Ceylon. I have also suggested the possibilities of the same in India. I shall now proceed to deal specifically with the planning, the completion and the maintenance of an orchard.

CHAPTER III

Selection of Fruit Trees

IN the cultivation of fruit trees one important point that can never be too much emphasised is the selection of suitable trees for planting. The laws of heredity, among animals or plants, operate with inevitable certainty. Good stock means good off-spring. A planter's success as an orchardist will primarily depend on the selection of proper varieties of fruit trees to plant.

This is not a matter that can be ignored. Planting healthy vigorous trees means giving them capacity to live, to resist disease and to bear fruits of good quality. Investment on reliable trees of good stock is the best investment an orchardist can think of. If the trees are of poor quality all other expenditure on an orchard is wasted money. Bad trees cannot produce good fruits. Plants which have been brought up under expert supervision in a nursery with a reputation may cost a little more. But they will give better returns.

It may be asked: Why not plant trees from the local nurseries, at least in so far as existing fruit trees in Ceylon are concerned? Why import fruit trees?

The fruit trees in the nurseries of the most progressive fruit-producing countries of the

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world are the result of generations of experience and the selection and perpetuation of stocks which are reliable and valuable for their fruit-bearing quality. By planting trees from the best nurseries of the world the Ceylon orchardist straightaway gets the benefit of the experience and efforts of planters in other countries. It is only practical wisdom to do so.

The fruit trees which I recommend to planters in Ceylon are from the Somerville Nurseries in Victoria. These Nurseries have been established for the last sixty-five years and are well-known throughout the world. India, South Africa, Palestine and Tasmania have obtained their pedigree plants from them. No better trees can be obtained by Ceylon planters or by planters of any other country. I shall be glad to assist Ceylon orchardists to select those varieties of trees that will adapt themselves easily to local conditions and bear fruit in Ceylon soil. The same assistance will be rendered to planters in South India.

I have already insisted that none but grafted or budded trees should be planted in an orchard. Only grafted trees can produce fruits true to type. Grafting or bud-grafting seems to be very little known in this country. Some parts of India appear to be a little more advanced. Local fruit trees can be improved in their fruit-bearing qualities by grafting

superior stock on them. Seedlings and plants grown from cuttings will grow no doubt, but, to make them produce fruit of high quality, they must be grafted as I have indicated.

I have observed that imported fruit trees that have been planted in Ceylon in the past were too young. Fruit trees that are imported from colder countries into Ceylon must be at least two years old. If they are too young and delicate they will obviously be unable to help themselves in a new environment. On the other hand, a tree that is old enough for the purpose will have sufficient vitality to withstand the hardships of the long travel and will have strength left to acclimatise itself to the new conditions and produce good fruit. The fruit trees from the Somerville Nurseries are always more than two years old when they leave the nurseries. This is a distinct advantage.

Before I proceed to discuss the selection and preparation of land for planting, I wish to point out that fruit growing is not a matter for the capitalist only. The capitalist's possibilities are great. But the owner of every cottage and homestead must grow at least a few fruit trees. It is up to every householder to have his own fruit and vegetable garden, however small it may be, and to make himself independent as regards the necessaries of life.

CHAPTER IV

The Selection and Preparation of Land

ONE question that is often put to me is : What sort of land is suitable for the cultivation of fruit trees ? As regards fruit trees like orange trees which are indigenous to the Ceylon soil, planters easily agree that they will grow in certain kinds of Ceylon soil. As regards Australian fruit trees, like apples and pears, certain preliminary facts have to be stated.

Some planters are carried away by the idea that Ceylon is a tropical country and Australia is in the temperate zone and, therefore, that plants of the temperate zone will not thrive in Ceylon. What are the facts ?

Australia has 3,000,000 square miles of land. Ceylon is 25,000 square miles in extent. Of the whole area of Australia one-third is altogether in the tropics. In other words, land to the extent of 1,000,000 square miles in Australia is within the tropics.

Take Queensland, one of our fruit-producing provinces. Queensland is mostly a tropical country. More than two-thirds of Queensland is between the Equator and the Tropic of Capricorn.

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The climatic conditions are similar to those in Ceylon, the balance of advantage being on the side of Ceylon. There are in Queensland miles and miles of plantations of tropical trees, like pineapples, bananas, oranges, mandarins, mangoes and papaws. This does not prevent Queensland from having orchards of apples, pears, plums, cherries, grape-fruits and strawberries.

I have already said that Ceylon has a more equable climate and better natural facilities than Queensland for the cultivation of all the plantations that are thriving in Queensland.

Ceylon has better rainfall than Queensland. As for temperature, the temperature in Queensland in the Summer is much higher than in any part of Ceylon at any time.

Take Victoria, another province of Australia. The annual rainfall of Victoria ranges from twenty to forty inches. The rainfall in several parts of Ceylon is much higher than the above average and is more evenly distributed throughout the year. The Summer temperature in Victoria rises to about 110° for some days. The temperature in most parts of Ceylon remains constant in Summer or Winter at an average of 80° F. My opinion is that most parts of Ceylon are suited for fruit cultivation. One has only to decide what special trees or variety of them will thrive best in each district.

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Now we may consider the selection of a site for a fruit garden in general in Ceylon or South India. The ideal site for an orchard in this country will be one with a gentle slope towards the East, North-East or South-East. The idea is to give the fruit trees as much sunshine as possible, though it is difficult to avoid the sun anywhere in Ceylon. It must not be forgotten that the brilliant sunshine of Ceylon is the greatest asset we have for the success of fruit cultivation.

In selecting a site for an orchard the protection that should be given to the fruit trees against strong winds must be taken into account. Blasts of wind during the blossoming season may do much damage. The prevailing winds in Ceylon being the South-West and North-East monsoons, it is easy to anticipate them and protect the trees against them. The ideal thing will be to have an orchard in a sun-lit slope, naturally protected against wind. If there is no natural protection, walls or hedges will be advisable. Hedges may be composed of trees of some economic value, like cotton trees.

In selecting a site for an orchard, the nature of the soil must be examined. Fruit trees do best in soils and conditions peculiar to some extent to each kind. Generally speaking, the best soil suitable for fruit trees is one

which is fairly loamy up to two or three feet in depth with a well drained sub-soil. There are two kinds of soils which are unsuitable for fruit trees. With a little ingenuity and skill even these unsuitable soils may be made suitable.

The first kind of unsuitable soil is a water-logged, heavy soil. As I have said this soil can be made suitable. Drains must be cut so that the surplus water may be continuously led out of the soil. Drainage will prevent the water from being stagnant. As much moisture as is necessary for the plants may be retained in the soil. The surplus must be drained out.

The second kind of soil that is unsuitable for fruit trees is a light sandy soil. This soil may be made suitable by the addition of vegetable manure and by generous watering in dry weather. For improving poor soil, cow manure and leaf mould are very helpful. To improve light sandy soil, irrigation is an important factor.

I am surprised to find that windmills have not been installed in this country. The steady monsoons that prevail here may be used to operate windmills for the purpose of irrigation. The absence of windmills is a defect that has to be remedied. The co-operation of a few cultivators in the erection of a common windmill will be a common advantage to all of them. The cost of erecting a windmill is

negligible compared to the saving of time and labour and the permanent advantage to cultivation.

Whatever the nature of the soil may be, one thing necessary for successful cultivation is the previous preparation of the soil by digging or trenching or ploughing. The soil must be dug up to two feet or more in depth and the sub-soil turned up before cultivation. I shall be glad to give inquirers information and suggestions for improving or replacing the primitive ploughs and agricultural implements generally used by cultivators in this country.

In connection with the selection of a site for planting fruit trees I wish to refer to certain circumstances under which a cultivator cannot pick or choose his site. For instance, the site or land for the cultivator's home or kitchen garden is already chosen for him and it is there. The cultivator has to make the best use of the land or soil he has.

There is always room for a few fruit trees or a plot of vegetables. If a little prudence and thought are exercised much advantage can be gained. There is pleasure in cultivation even on a small scale, and there is profit. The remarks that have been made or that will be made as regards cultivation of fruit trees will apply to all conditions.

CHAPTER V

Planting

THERE are various points to be considered in planting fruit trees. Each variety of tree has to be treated according to its special needs. In this Chapter I propose to make suggestions which will be of general application. In the next two Chapters will be found observations on the cultivation of some specific varieties of fruit trees.

Before planting the ground has to be prepared. Remarks have already been made about ploughing, digging and trenching. The purpose of these preliminary steps is to turn up the sub-soil and to conserve whatever manure is in the soil as well as to aerate the soil.

On inspecting fruit trees in Ceylon I have observed in many instances that the trees have been planted too deep. In the case of grafted fruit trees the whole end and aim of grafting is defeated by planting the trees too deep. In planting grafted fruit trees care must be taken to see that the point at which the tree has been grafted is at least two inches above the ground.

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In this connection it is necessary to point out that grafting is done by bringing together parts of two different trees. In a grafted tree the part below the point of grafting is the stem of a hardy plant which has strong roots and is able to take abundant nutrition from the soil. The part above the point of grafting is the shoot of an actually fruit bearing tree.

It is the duty of the lower stem to take nutrition from the soil. It is the duty of the upper limb to bear fruit. If a grafted tree is planted with the point of grafting below the surface of the soil the purpose of grafting will be defeated. The grafted tree will not be true to type. The quality of the fruit will be seriously affected.

The distances at which fruit trees are to be planted will depend upon the variety of the trees, the space available, and other conditions under which the trees are planted. A fruit tree may be grown as a standard tree or may be trained as a bush or may be led up a trellis work as what is called an espalier or, as in the case of the vine tree, it may be trained to grow on a pandal. The selection of method will depend on the variety of the fruit tree, the commercial or ornamental purpose for which it is cultivated or the wishes of the planter. For commercial purposes it is enough for us to consider the planting of fruit trees as standard trees.

The first question that arises is : How many trees are to be planted to the acre ? I have already said that 100 orange trees may be planted to the acre. The same may be said of grape-fruit trees. A maximum of thirty feet apart will be sufficient for apple and pear trees. This general rule may be varied according to circumstances. As of practical use to the orchardist I give below a table of distances showing the number of trees per acre according to the distances at which the trees are planted.

If trees are planted —

30 ft.	apart	there will be	48 trees per acre
28	do	55	do
26	do	64	do
24	do	75	do
22	do	90	do
20	do	100	do
19	do	120	do
18	do	134	do
17	do	150	do
16	do	169	do

It is presumed that the land has been properly ploughed and dug up. When the soil is thus prepared, carry out the following directions with reference to each fruit tree you are going to plant : —

Measure off the required distances at which you intend to plant your trees. Dig the holes

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3 ft. by 3 ft. and 2 ft. deep. Mix the earth with two buckets of leaf mould, one large handful of lime and one bucket of cow manure. Mix well and fill in the hole. At this stage drive a peg or stake about three feet high to which you will attach the tree after planting by means of some banana fibre or a piece of soft rope. You will find that you will not get all the soil back into the hole. Bank up with what is left over, making the spot where you plant the tree about six inches higher than the level of the ground. Then plant your tree about six inches deep. Take care to see that the point of grafting is about two inches above the level of the soil. Tread firmly round the tree when planted so as to make the tree stand steady. The necessity to tread round the tree firmly cannot be too much stressed. The mound round the tree will settle down after subsequent rains.

In planting, special care must be taken about the roots. The small fibrous roots may be cut off. Unnecessary broken roots must be cleanly clipped with a sharp knife. The main roots of a tree that is planted must be spread out in the ground so that they may not overlap each other. This method has obvious advantages.

The peculiarities in the roots of each variety of fruit trees must be observed. For instance,

in the case of an apple tree, the main tap root grows to a side. In the case of a pear tree, the tap root goes straight down into the ground. In an orange tree there is a straight tap-root going downwards and other powerful main roots going sideways.

On account of the above facts, while planting an apple tree the main tap-root must be put in the direction from which the strongest winds in your district blow. In the case of a pear tree, the tap-root must be put straight into the ground. In the case of every tree all the smaller main roots must be spread out so as to make them hold the tree steadily when the planting is finished.

In the following two Chapters will be given suggestions on each variety of fruit tree which is of commercial importance.

CHAPTER VI

Special Notes on Orange Trees, Grape-fruit Trees and Vine Trees

IN this Chapter are contained special remarks about the commercial cultivation of three varieties of fruit trees which are already well established in Ceylon. The need is for the improvement of the quality of the fruits and production in commercial quantities.

Let us first deal with the orange tree. The original home of the orange appears to have been Asia, particularly China, Indo-China and India. From these countries the tree has been carried to Europe, America, and to Australia. In the latter countries there has been a continuous elimination of unsuitable varieties and a continuous selection and perpetuation of suitable varieties. The result is the flavour, the appearance, and the delicacy of the oranges that are put up for sale in the markets of Australia, America and Europe. Ceylon can produce oranges equal in quality to those of the above countries if she adopts the methods of cultivation which these countries have successfully adopted.

Among the important varieties of oranges are the Washington Navel and the Valencia

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Late. These are sweet varieties. Mandarin oranges have a rind which easily comes off at the slightest pressure. Seville oranges are mostly bitter and are used in making marmalade. The Seville oranges are distinguishable by the aromatic flavour of their rind. All these varieties are yellow in colour and will grow well in Ceylon.

In addition to supplying edible fruits of the most wholesome kind, the orange plant has most beautiful foliage and fragrant blossoms. It is the most desirable plant to grow round human dwellings. So are the other citrus trees to which reference will be made presently.

The orange tree grows freely and produces fruit abundantly where the temperature is high and the moisture is sufficient. It flourishes in any moderately fertile soil if well drained or irrigated. It can grow in any loamy soil varying from stiff to sandy. Vegetable humus and lime are necessary ingredients for a soil that is suitable for the cultivation of orange trees.

Orange trees may be planted twenty feet apart. The laying out of the orchard, the digging of holes for planting orange trees at regular distances, and the method of planting each tree in its place must be carried out as described in the previous Chapter. The ground between the trees must be kept clean, free from weeds, dug up and well stirred about once a

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month during the rainy season. This must be done without injuring the roots. The idea is to allow as much air as possible to enter the soil, and to help the soil to retain moisture.

Manuring may be done once a year. Sufficiently rotted cow manure is good. For further directions on manure reference may be made to the Chapter on the subject. A shallow pile of earth may be kept above the roots for about two feet round the tree to receive liquid or other manure. In Dry Zones orange trees must be frequently and abundantly watered.

How can we improve the quality of local oranges? In other words, what are the defects that we have to remove? The appearance of the local orange is not attractive enough. There are too many seeds and the seeds are too big. The skin and the pith in most cases are too thick. The remedy is the elimination of unsuitable species and the propagation of suitable ones. The general practice of planting seedling trees must be stopped. Seedless grafted orange trees, like the Washington Navel, must be imported. Budding and grafting must be carried on extensively. The world's best orange trees may be propagated in Ceylon by budding or grafting the former on reliable and hardy stocks in Ceylon. Pruning and balancing of trees are important matters to which detailed reference will be made later.

The local cultivator does not get sufficient returns from his orange trees because his fruits are of poor quality. Even those that are of good quality can be very much improved. Why is it that the imported oranges are sold in Ceylon at a minimum price of 10 cents each? It is a question of quality. If the local producer can put on the market fruits of the same quality as the imported ones, there is no reason why he should not get the same price. I have already pointed out that every year more than Rs. 1,000,000 worth of fruit produce is imported into Ceylon.

Apart from the growing local demand, there is the fact that in 1926 Great Britain imported 12,000,000 cases of oranges. At Rs. 6 per case, Great Britain's imports of oranges for the year 1926 were worth Rs. 72,000,000. Proper scientific cultivation, aided by the perpetual sunshine in Ceylon, must make Ceylon oranges superior to any produced in the outside world. Here is a chance for Ceylon orchardists with energy and enterprise.

Most of the remarks which I have made about the cultivation of orange trees will apply to other citrus plants like grape-fruit, lime or lemon trees. I have already shown how the consumption of grape-fruits has increased by leaps and bounds during the past few years. These trees are prolific bearers. Cultivators

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may expect profits which cannot be equalled by any other investment.

We now come to the cultivation of grape vines in Ceylon. This has been completely neglected. In the dry regions like Jaffna grape vines are cultivated to some extent but not scientifically or on a commercial scale.

What is wanted for cultivating grape vines is sunshine. It is not necessary that the climate should be dry. The wet regions of Ceylon can cultivate the trees successfully. In the wet regions drainage will be necessary just as in the dry regions irrigation will be necessary. Most soils in Ceylon can be made suitable for the cultivation of grape vines. The great advantage in the cultivation of the vine is that it being a surface feeder, it wants a soil only about three feet deep. The necessary ingredients can be put into soil to the required depth of three feet.

It is fortunate that scientists have evolved a formula according to which the necessary soil for grape vines can be made up anywhere at pleasure. To make up the soil for planting each vine tree what has to be done is the following :—

Dig a pit six feet by six feet and three feet deep. Keep the pit clean of all earth that has been removed. Take five parts of rich turfy loam ; one part mixture of old lime rubbish,

broken bricks, and wood ashes ; one part broken charcoal ; one part of half inch bones. Mix the above together thoroughly and keep dry till you are about to plant. Fill the pit with the soil made up as above. The above made up soil meets every requirement of the grape vine tree, provided stagnation of water in the pit is prevented by drainage.

If the soil is naturally suitable for cultivation the size of the pit and the procedure to be adopted in planting will be the same as given in Chapter V. If it is not possible to make up the soil necessary for a vine tree according to the above formula I have prepared a special manure which may be mixed with ordinary earth to fill up the pit in which the tree is to be planted.

Vine trees planted on a commercial scale are usually grown up as bushes. Rows of them may be trained as fences. The practice in Ceylon appears to be to train them up a pandal. The first two methods help to economise space. If vine trees are grown as bushes it is easier to give them individual attention and to protect each individual tree against diseases or pests. Vine trees may be planted in an orchard twelve feet apart. Under the proper heading will be found some suggestions as regards pruning the trees and combating pests.

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In this connection I wish to emphasise the productivity of the vine tree which is very great. Take the United States as an example. In 1927 there were 700,000 acres under vine trees in the United States. The produce of grapes for that year was nearly 3,000,000 tons. The year's output was valued at \$65,000,000. There is the further fact that the warmer the climate the better it is for the vine tree. The possibilities of Ceylon in this direction are clear. Satisfaction in quality and quantity of production can be realised only through scientific cultivation.

CHAPTER VII

Special Notes on Apple, Pear and Other Trees

AMONG the temperate fruit trees that can be grown in Ceylon, the commercially most important are the apple and the pear. Peaches, plums, apricots and cherries are grown in some parts of Ceylon. Their commercial importance is not so great as that of apples and pears. I am prepared to give all necessary information and assistance to interested cultivators.

It is not necessary to refer to the question whether apples and pears will thrive in Ceylon. They are already growing in the hill country. The cultivation has been haphazard and amateurish. It is only very lately that serious cultivation of these trees has been started. One cannot speak of success when there has been no effort. There is at present a commendable awakening. There is a decided enthusiasm for agricultural production and fruit cultivation.

Fruit cultivation in the past in Ceylon could not have succeeded because Ceylon did not attempt to learn or to use those methods of successful cultivation which more progressive

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countries have learnt and used. Orchard planting on a commercial scale has not even been thought of. In the small plots of fruit trees which I have inspected, even the grafted trees which had been imported were in most cases, planted wrongly. The trees were allowed to grow wild. There has been no attempt at pruning the trees whatsoever. No thought has been given to plant-pests or diseases. There has been very little systematic drainage or irrigation of the so-called orchard. The profits and benefits which fruit trees will give a planter will be directly proportionate to the care and attention which the planter gives to the trees.

It is a hopeful sign that planters in the hill country and especially in the low country have already realised the possibilities of fruit cultivation. Of the many who have taken to the matter seriously, I may mention one planter, who has systematically planted apple and pear trees in twenty acres of land at Kadugannawa. The plantation consists altogether of grafted trees obtained from the Somerville Nurseries in Australia. The trees in the orchard are as healthy and vigorous as any in Australia.

Of the temperate fruit trees that may be planted successfully in Ceylon, the apple must be dealt with first. The apple is the most widely cultivated and probably the best known

fruit in the world. It can no more be called a product of temperate regions. Being a most adaptable tree, it is now flourishing under various climatic conditions, temperate, tropical or otherwise.

The apple will thrive in any well-drained soil with an admixture of lime in it. If the soil is poor it must be manured. The apple tree will flourish in dry areas provided there is a regular water supply. It has already been suggested that apple trees and pear trees must be planted at about thirty feet apart. The method of planting apple trees or pear trees will be as described in Chapter V.

As for varieties of apples which will suit Ceylon conditions, I may mention the Jonathan, Rome Beauty, Delicious, Yates and Dunns, these being some of the varieties which have proved capable of adapting themselves to a variety of climatic and soil conditions.

The cultivation of pear trees is similar in many respects to the cultivation of apple trees. The pear prefers a warm situation with a deep sub-soil which is thoroughly drained. What is called a calcareous loam is the best soil for the purpose. This means a soil which is a mixture of sand, clay, vegetable mould, and lime. It has been said by an authority on fruit cultivation that the pear is the fruit of fruits for connoisseurs and a splendid

collection can be grown in a comparatively small space.

Both apple trees and pear trees, as well as all fruit trees need pruning and training. Pruning and training of fruit trees have been ignored in this country in the past. For this reason a special Chapter is included in this book.

Peaches and Japanese plums will do well in most parts of Ceylon if the methods of cultivation recommended in this book are followed. The same may be said of apricots and cherries. Success will depend on the selection of suitable trees, on constant attention to the needs of the trees and vigilance in supplying them. What attention fruit trees require will be discussed in the next Chapter.

CHAPTER VIII

What Attention Fruit Trees Require

IN this Chapter I wish to direct the attention of the practical orchardist to some essential requirements of fruit trees.

I have already spoken of the selection of suitable varieties of trees for planting and of the selection and preparation of land. I have also briefly described the proper methods of planting and the distances at which fruit trees must be planted. I now proceed to refer to those positive facilities which should be given to a fruit tree so that there may be satisfactory growth and development.

For its growth and development, every tree needs air, sunlight, and moisture. It may be added that every part of the tree, every branch and twig, every leaf and flower and fruit of the tree needs sufficient air, sunlight, and moisture. These are the primary needs of the tree. But there are other needs too.

Every tree needs those special elements in the atmosphere and the soil which are necessary to build up its own peculiar fruits. Every orchardist ought to acquaint himself with those fertilisers and manures which modern science has discovered as suitable and beneficial to each kind of fruit tree. The best manures are

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usually the cheapest and the most easily procurable. Economy lies in the way of prudence. I shall refer to the subject of manures and fertilisers in a separate Chapter. For the present I am mentioning the subject since it is concerned with the growth and development of fruit trees.

One important matter in connection with fruit trees to which attention is not sufficiently directed in Ceylon is the question of plant-pests and diseases. Trees, like animals or human beings, are subject to diseases. There is a cure for every disease. Most diseases are preventable. Most diseases are due to neglect by the owner. The orchardist must be vigilant. He must discover the causes of diseases and promptly eradicate them. I propose to give a few useful suggestions on the subject in a later Chapter.

Plant-pests include insect pests and other organisms that damage the trees in any way. Weeds are in the nature of pests, because weeds hamper the growth of fruit trees and often damage them. An orchardist must be a perpetual enemy of weeds. The only thing to do with weeds is to root them out as often as they appear anywhere near the fruit trees. For helpful suggestions on combating other plant-pests, the reader is referred to a subsequent Chapter on Plant Pests and Diseases. There

are three other matters which I wish to emphasise in connection with the care and culture of fruit trees. The first is, pruning.

I have already stated that the art of pruning fruit trees seems to be almost unknown in Ceylon. Art perfects nature. The art of pruning fruit trees as practised by advanced cultivators of the present day is absolutely necessary to assist the trees in producing the best fruits of the highest quality. Scientific pruning is like scientific physical culture. Scientific pruning is a Master Key to success in fruit cultivation. On account of its importance, I am dealing with the subject under a separate heading.

Akin to pruning is another art connected with fruit culture, viz., the art of grafting. Grafting and bud-grafting have done wonders in the field of horticulture quite similar to the marvels of operative surgery in the field of medicine. There was one difference. Scientists and experimenters had a wider freedom in dealing with plants than with human bodies. Consequently the benefits to agriculture resulting from grafting and bud-grafting have been incalculable.

The final *sine qua non* of fruit cultivation is what I emphatically call *Cultivation*. Cultivation is a comprehensive term which embraces all aspects of fruit culture. Every aspect requires attention. What I wish to emphasise



AN ORCHARD OF FOUR-YEAR OLD APPLE TREES.
Note the cleanliness of the ground. A clean orchard means absence of weeds, avoiding vermin from the soil, fewer insects on the trees, more air for the roots, more moisture in the ground, better health for the trees and better fruit production. This can be done by systematic ploughing and hoeing.

is the digging, the forking and the tilling of the soil in an orchard generally and of the soil round each individual tree particularly. Tilling and turning up of the soil at least once in three months will be a tonic to the trees. This will put fresh air into the soil and will give the roots all the beneficial influences of a clean atmosphere. Tilling will kill the weeds and will keep vermin from the roots and from the trees.

I regard personal visits of the trees by the cultivator as part of cultivation. The orchardist's sympathetic inspection of the trees, his appreciation of their growth, even his admiration, will find a ready and grateful response on the part of the trees. This will be altogether to the advantage of the orchardist.

Considering the unequalled fertility of Ceylon soil and the luxuriance of all forms of vegetation in the country, it is most pleasing to visualize the immense profits Ceylon orchardists can obtain if, with their keen intelligence, they will make a determined effort to apply modern scientific methods to their agriculture and especially to their fruit cultivation. My remarks apply equally to the small cultivator and to the commercial planter.

In the future pages I shall deal more fully with the important topics which I have already sketched.

CHAPTER IX

Manures and Fertilizers

IN this Chapter I propose to give a few leading ideas about Manures and Fertilizers.

The orchardist is interested in manures and fertilizers only in so far as they increase the productiveness of his fruit trees. A progressive orchardist will always keep in touch with every discovery beneficial to his plants made by modern scientific inquiry.

Soils are rich or poor according to the absence or presence of plant foods. The three chief elements of plant foods which ought to be present in the soil in the right proportion and which will help the development of fruit trees are Nitrogen, Phosphoric Acid and Potash. It is the duty of the orchardist to supply the above to his trees in the proper proportion. The purpose of manuring is to give the trees these plant foods.

In dealing with manures I shall have to deal with three classes of manures: Organic manures, artificial manures, and green manures. I shall also have to make particular mention of lime on account of its special importance in the production of fruits and on account of

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its neglect by cultivators in Ceylon and South India. Artificial manures are otherwise called fertilizers.

Under organic manures is included what is called farm yard manure or stable manure. We may confine ourselves to cow manure since it is easily available in this country. Cow manure is generally used by fruit growers on account of its marked advantages. Cow manure not only contains nitrogen, phosphoric acid and potash which are the chief elements of plant food but, it also produces humus in the soil. Humus is a black manurial fluid which enriches the soil.

Cow manure or farm yard manure improves all classes of soil, but especially loose sandy loams or light soils. Sandy soils need more manuring than other soils. The quantity of manure to be used will depend on the nature of the soil and on the variety of crops to be raised. Too much manure is as bad as too little manure. The orchardist must observe the needs of his plants and supply the required quantity with caution and judgment.

A few points about the proper use of manure have to be emphasised. Cow manure or farm yard manure must be well rotted before being used in an orchard. Manure should not be wasted by spreading it all over the orchard. It is sufficient if it is spread

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over the root-feeding areas. Root-feeding areas will be about three feet round each tree. It is enough to apply cow manure once a year to the trees. The proper time to manure the trees will be when the leaves have fallen off and wintering has begun. Manure should be ploughed in or evenly buried round the trees before they begin to bloom again.

When stable manure cannot be procured in sufficient quantities, it becomes necessary to use artificial manures or fertilizers. Artificial manures in general use are combinations, in varying proportions, of substances containing the elements of nitrogen, phosphoric acid and potash. The proportion in which these elements are used will depend on the composition of each soil and the special requirements of each variety of fruit trees in the orchard.

To save trouble for local fruit growers I have prepared a special manure for fruit trees in Ceylon. The orchardist who knows the subject and has studied agricultural chemistry can make the necessary manure to suit his special needs.

The quantity of artificial manure to be used will vary from two pounds to three pounds per tree according to circumstances. Artificial manure is easily assimilated by the trees. For this reason it is generally applied prior to the flowering stage. The land is first ploughed,

then the fertilizer is spread over the root-feeding areas and is harrowed in. When artificial manure is used it must be, as far as possible, supplemented with green manure. Green manure will supply the necessary humus to the soil.

I now come to green manures. Green manure means manure supplied to the fruit trees by specially selected nitrogenous plants grown in the orchard for the purpose. Green manure has the effect of consolidating loose sandy soil and will prevent the nutritious elements in the soil from being washed off by heavy rains. Green manure plants are able to collect nitrogen from the atmosphere and give it to the soil.

To obtain crops for green manure it is advisable to grow between fruit trees leguminous plants such as peas, beans, and vetches. Other suitable green manure plants can be easily selected. Green manure plants should be allowed to grow till they are in full bloom. Then they must be ploughed into the soil.

A suitable time for sowing the seeds for green manure crops will be just after the fruits have been gathered. This method will give the cultivator sufficient time to plough in the green manure before the fruit trees begin to bloom again. Green manure must be buried to a depth of four to six inches. Inexpensive

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ploughs suitable for the purpose can be easily obtained.

The necessity for the use of lime in fruit-growing does not seem to be sufficiently realised by Ceylon orchardists. The influence of lime on fruit trees is most remarkable. Investigations have shown that in soils rich in lime, fruits appear earlier and fruit buds are more robust than in soils deficient in lime.

Light sandy soils are made more cohesive by lime. It does even more good to clayey soils. When fruit trees are grown in heavy clayey soils, it is necessary to give frequent dressings of lime; lime makes the soil light.

Some virgin soils may contain lime in sufficient quantities to enable the trees to grow and bear fruit satisfactorily for some years. But when the original supply of lime is used up, it becomes essential to give a dressing of lime to sweeten the soil. Acid soil is bad for fruit trees. It may perhaps be useful if I mention a simple chemical test for ascertaining whether a soil is acid or not.

To make the test, cut a slit with a knife in the moist earth. Place a strip of blue litmus paper in the slit and close the earth against it. Take the litmus paper out after a few minutes, when it will have become moistened. If it has turned pink or red, the soil

is acid. The redder the colour of the paper, the more acid is the soil.

The putting of lime into the soil will remove the acidity. The quantity of lime to be applied to the soil will depend on the degree of acidity of the soil. I now proceed to give some directions as regards the application of lime to the soil.

The quantity of lime to be used for each application will vary from 10 cwts. to 2 tons per acre according to the degree of acidity of the soil and according to conditions of drainage. Lime may be used in three different forms, viz., quicklime, slaked lime and ground limestone. Slaked lime is most commonly used as manure by orchardists. Ground limestone will be as good if easily procurable. It has been found by experience that it is better to have frequent light dressings of lime than to have heavy ones at long intervals.

The tendency of lime is to sink in the soil. For this reason a warning has to be given to the orchardist; when you have spread the lime evenly over the soil with a shovel, do not plough it in: harrow the lime in lightly and leave it alone.

Another point about which caution is necessary is the following: don't spread lime when there is stable or farm yard manure just put in the soil; the lime in close contact with

the freshly scattered manure spoils the good effects of the manure. The best plan is to use farm yard manure and lime in alternate years. If it is thought advisable to apply both farm yard manure and lime in the same year, wait a short time after the farm yard manure is buried and then give the soil a dressing of lime and harrow it in.

I may add that if applied as above to the soil, lime will benefit not only apple trees and pear trees but will improve the quality of all citrus fruits, like oranges, mandarins, lime-fruits, and grape-fruits. In fact, a careful observation of local conditions will show that the best fruits in Ceylon are produced in those districts where there is a satisfactory admixture of lime in the soil.

CHAPTER X

Pests and Diseases of Plants

WHAT is disease ? So far as the orchardist is concerned, disease is any condition of his fruit trees which affects injuriously their capacity to produce fruits of the proper quality and quantity.

The orchardist is concerned with the health of his trees because health is a condition under which his trees will bear fruits of good quality and quantity. Anything which is opposed to the health and fruit-production of his trees is an enemy against which the orchardists must wage constant warfare. Before discussing important classes of plant diseases, I wish to mention some factors which are opposed to the health of fruit trees.

What are the things that are opposed to the health of fruit trees ? The presence of injurious chemicals in the soil may endanger the health of the trees. Excess of heat or excess of cold may affect the trees prejudicially. Absence of sufficient light may dispose the trees to disease. Excessive humidity of the atmosphere may facilitate the development of certain plant diseases. Thus the first group of

factors that prejudice the health of plants consists of unsatisfactory conditions in the physical or chemical surroundings of the trees.

Ill-health of trees may be also due to unsatisfactory internal physical condition of the trees themselves. If a tree is the offspring of unhealthy parents or ancestors or if it has contracted some disease in the nursery, it cannot be expected to be healthy when planted in an orchard. Hence the necessity to select absolutely healthy trees for planting. Some special varieties among apple trees or orange trees, or pear trees have proved themselves capable of resisting disease. These special varieties must be selected for planting.

I do not propose to discuss further the above factors which lead to ill-health in plants. If the suggestions given in the previous Chapters are carried out, most of the chemical or physical factors which are injurious to plants can be eliminated very considerably.

In this Chapter I shall give practical directions for preventing and eradicating three classes of plant diseases which are preventable and which can be eradicated. If the orchardist will carefully keep in mind the three distinct classes which I am going to mention, he will be able to diagnose the diseases easily and cure them effectively.

I will deal, one by one, with the three groups of plant diseases to which I wish to draw the especial attention of every orchardist.

The first group consists of diseases caused by a distinct class of insect pests which are called jaw-feeders. The orchardist must learn to identify them. If he can identify them, he will be able to eradicate them. Why are these insect pests called jaw-feeders ?

Jaw-feeders are insects which have strong jaws. They eat the leaves, bark and fruits of trees. They feed themselves with their jaws. You can make them out by the holes they make especially on the leaves. They chew and swallow the eatable parts of the plant.

An example of a jaw-feeding pest is the caterpillar. It eats the leaves, bark and fruits of a tree. It feeds itself with its jaws. Other examples of jaw-feeding insects are grasshoppers, locusts and leaf-eating beetles. Root-boring insects are jaw-feeders. So are codling moths that attack apple trees, the pear slug which damages pear trees, and fruit flies which are injurious to all fruit trees.

I wish to emphasise the necessity of classifying plant pests. The classification is important because the method of treatment varies according to the classification. Before I proceed to the next group of plant pests,

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let us consider the best method of protecting fruit trees against jaw-feeding insects.

The jaw-feeding insects come to the trees to eat the leaves or other edible parts of the tree. The most effective method of getting rid of them is to kill them at the time of their eating. For this purpose we make a spraying solution of which the basic constituent is arsenate of lead. With this solution we spray the trees. The jaw-feeding insects which are on the sprayed trees or which attempt to eat the sprayed leaves meet their death on the spot.

While we are trying to destroy the pests, we must not hurt the tree. For this reason the spraying solution against these pests is so made that while it eliminates the pests, it does not injuriously affect the tree. The percentage of arsenate of lead used in the spray is so little that the subsequent fruits will not be in the least affected in their wholesomeness as human food.

Let the orchardist, then, remember this practical suggestion which is followed in all orchards over the world, viz., that the spray which he must use against jaw-feeding insects must contain arsenate of lead or a similar stomach poison as its chief ingredient. The strength of the solution may differ as used against different varieties of jaw-feeding

pests. The main ingredient will remain the same.

I now come to our second group of pests. The orchardist must understand their characteristics. This class of pests consists of insects which are called suction-feeders. Suction-feeding insects have long slender mouth-pieces. You can notice them while they are feeding themselves. With their slender mouth-pieces these insects penetrate the leaves, bark and fruits and suck the juices out of them.

Examples of suction-feeding insects are plant bugs. Other examples are spiders. To the same class also belong all forms of aphides, moth eggs, red mites, thrips, and what are called scale insects. The orchardist will make out these insects from the marks of sucking left on the leaves, bark and fruits of the tree. It is essential to be able to identify them.

What is the best way of controlling and eliminating this class of insect pests called suction-feeders? We must remember one significant fact: insects breathe through tiny pores in the body. These pores are called spiracles. If these pores or spiracles are covered or closed up for a considerable time, the result will be suffocation of the pests. For this purpose the best device is spraying the insects with a suitable oil.

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It has been found by experience that a spray of which petroleum oil is the chief constituent will effectively cover and penetrate the breathing pores of these insects and by suffocating them, eliminate them from the fruit trees. The wise orchardist will learn to identify this class of pests called suction-feeders and will use against them the above kind of antidote which I have indicated and which is easily procurable.

The third class of plant diseases, to which I have to draw the attention of the orchardist, is the class called fungus diseases. What are fungus diseases? Fungus diseases are diseases caused to fruit trees by parasitic growths that are found on the fruit trees. These parasitic growths are called fungi. Fungi are very low forms of plant life. They are similar to primitive marine growths like sea-weed. These parasitic growths are so simple in their structure that they are not divisible into root or stem or leaf. But the damage they do to plants is immense.

An example of a fungus disease is the mildew which is often found on fruit trees. Other examples are: Various diseases called rots, like Brown Rot, Black Rot, and Bitter Rot; diseases called rusts like the Coffee Rust which devastated Ceylon Coffee Plantations in the middle of the nineteenth century; and

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diseases like the leaf curl of peach trees, the sooty mould of orange trees, and the black spot of vine-trees. The parasitic and vegetative nature of these diseases will be easily recognised and identified whenever they occur on the fruit trees.

I wish to draw special attention to fungus diseases because they are very prevalent in Ceylon. I have seen fruit trees specially in Bandarawela and Nuwara Eliya covered with fungus diseases. If we are going to keep our fruit trees free from these diseases, we must discover their predisposing conditions and apply preventive methods.

What are the conditions which facilitate the development of fungus diseases? Humid atmosphere aids the growth of fungus diseases. This is particularly true of the wet districts of Ceylon. Another factor that assists the prevalence of these diseases is dense foliage. Dense foliage deprives parts of the tree of sun light and fresh air. Sun light and fresh air are two of nature's best disinfectants. In the absence of sun light and fresh air, fungus diseases are bound to thrive.

One satisfactory method of reducing fungus diseases is scientific pruning of the trees. Scientific pruning of the trees will prevent the growth of dense foliage. Scientific pruning will help to distribute the branches in such a

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way as to give every branch enough sun light and fresh air. The benefit to the healthiness of the trees will be very considerable.

Both to prevent and to cure fungus diseases various sprays are used by progressive orchardists. These sprays have as their chief ingredients, sulphur, or lime and sulphur, or lime and copper sulphate. Sprays are usually diluted in necessary quantities of water. Powder sprays are also sometimes used. I have already insisted on the necessity for an orchardist to diagnose the various classes of plant diseases so that he may be in a position to treat them intelligently.

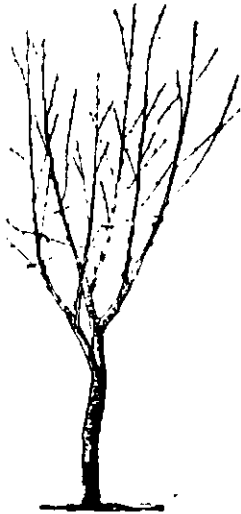
There are various other methods of destroying or controlling plant pests and diseases. I wish to mention one method which is a simple and natural method. For example, in the case of the codling moth which attacks apple trees, there is a bird called Codling Moth Bird which, if allowed to live in an apple orchard, eats up the codling moths. There are various other birds which are being brought up by orchardists for the sake of protecting their fruit trees against insect pests. In Ceylon the bird called Lady Bird must be encouraged to live in an orchard.

In this Chapter I have suggested methods of controlling plant pests, which are easy to understand, practical in application, and

effective in results. I have given certain fundamental ideas which will help the business-like orchardist to study and understand the needs of his trees and to supply them. Fruit cultivation is becoming an absorbingly interesting science. It is also a growing art. I have already pointed out that it is a very lucrative art too.

PRUNING OF FRUIT TREES.

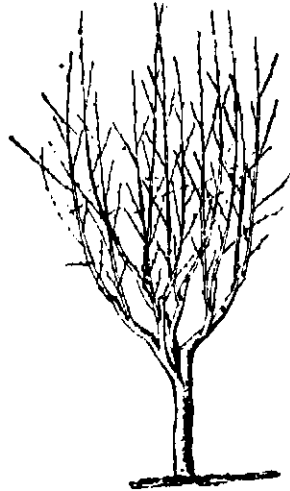
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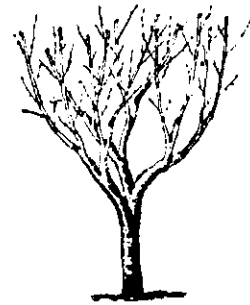
Growth made
after First Year
of Planting.



Second
Year
Pruning.



Growth after
Second Year
Pruning.



After Third
Year
Pruning.

CHAPTER XI

Pruning of Fruit Trees

I HAVE already remarked that there is very little attempt at scientific pruning of fruit trees in Ceylon. The luscious fruits of the present day are as much due to skilful pruning as to any other art employed by the modern cultivator.

The art of pruning is a highly specialised art. Till the orchardist masters the art himself, it is advisable for him to employ the services of a specialist with experience and skill. The art of pruning is such an important factor in successful fruit cultivation that I have thought it necessary to direct the attention of the orchardist to some of its essential aspects.

What is the use of pruning? First of all we shall consider a matter which is plain and clear to everybody. Suppose there is on your fruit tree an injured or dried or worn-out branch. If you leave that useless branch on the tree, it may develop beetles, or insects which may endanger the other branches. It is a prudent thing to cut off that unnecessary branch and save the other branches of your

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tree. This, in a small way, is pruning the tree.

Let us take another situation. Suppose you find on your fruit tree too many branches, each interfering with the growth of the other. You also notice dense foliage which prevents sunshine, light and fresh air from reaching major portions of the tree. As a consequence, you observe that in the shelter and gloom of the thick foliage fungus diseases, like mildew or sooty mould, are appearing. What should you do ?

A sensible thing to do is to cut off some of the congested branches so that the remaining ones may grow in health and without over-crowding. It will be an act of common-sense to remove some of the superfluous foliage so that every part of the tree, every branch and twig and leaf may receive sufficient sunshine and light and fresh air. Here is another need for the art of pruning.

Suppose an observant orchardist sees too many fruit spurs on one branch of his fruit tree. He anticipates that the fruits will be so many that the branch will not be able to bear their weight or receive sufficient nutrition to help all the fruits to develop to full size. What is the best procedure ? He ought to eliminate, by judicious pruning, some of the fruit-bearing spurs. This plan will

improve both the quality and the size of his fruits.

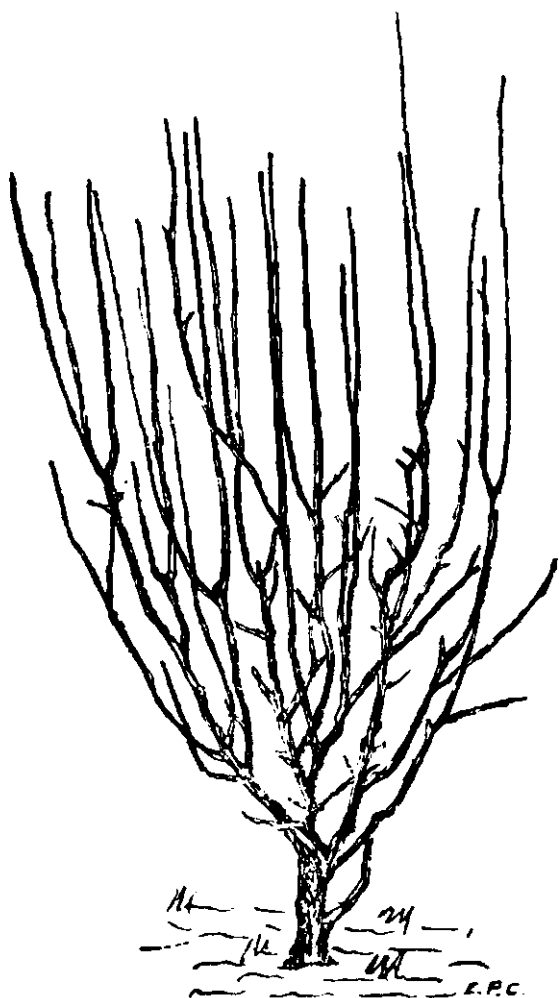
We will presume that there is in your orchard a rather old orange tree. After several long dry seasons or several exceptionally wet seasons, the tree is full of wood growth. Probably it has not been pruned or balanced for years. It bears no fruits or next to nothing. If there are any fruits, they are very inferior. What can be done with this tree ?

If the tree is sound at the collar and sound at the main roots renovation of the tree is possible by pruning. The unserviceable branches must be cut down and the tree skilfully balanced. The tree can thus be given a new lease of life and a new term of fruit production. If it is found advisable to cut back such trees to the stumps, the renovation may be supplemented by budding.

The best results from any method of renovation can be achieved only by liberal cultivation, irrigation, and prudent use of artificial manures. Renovation of trees wants expert guidance. I am of opinion that most of the older fruit trees in Ceylon, on account of sheer neglect and excessive development of wood growth, are in need of renovation as suggested above.

One cause of the failure of a tree to produce fruits is the vigour of the top growth. If

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A Fruit Tree with good framework gradually built up by pruning having fruit spurs evenly distributed and giving light, fresh air and sunshine and nutrition to all branches and spurs, making a well-balanced fruit tree.

the root system of the tree is reduced, its fruit production may be increased. How can this be done? Experienced gardeners prune the roots of rank-growing unfruitful trees. They expose the roots for some days to sunshine and air. After covering up the roots they cultivate the trees. The pruning of the roots in such cases stimulates the trees to bear fruits.

What, then, are the uses of pruning? By pruning we remove injured or worn-out parts of a tree. By pruning we reduce wood growth or stimulate it when necessary. By the same method we can control fruit bearing or stimulate the same when needed. So far as the whole tree is concerned, we can modify the form and structure of a tree so as to make it fit for the purpose of fruit production under varying circumstances. I have also pointed out that renovation of fruit trees is possible by pruning.

I have pointed out in the previous Chapters some aspects of fruit cultivation which have been neglected in Ceylon. There has been the same neglect in the art of pruning. What has been the result?

There has been excessive wood growth in most of the Ceylon fruit trees. There has been a deterioration of fruit quality. On account of the trees being allowed to grow to inconvenient heights in this country, the fruits cannot be picked quickly or safely from the

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trees. For the same reason the trees are not sufficiently able to withstand the blasts of strong winds. Any future pruning or treatment for diseases has also been made more difficult.

It is thus evident that the special needs of Ceylon in the matter of pruning are the employment of pruning for the reduction and control of wood growth as well as for the modification of the form and structure of the fruit trees. I shall deal with these two points in particular.

What quantity of wood growth does a fruit tree require? A fruit tree needs a strong, short stem and a well-balanced wood structure sufficient to bear the weight of the fruit-bearing branches and twigs and also to withstand the blasts of winds. Any surplus wood growth must be checked. The aim of an orchardist is not wood growth. The sole purpose for which a cultivator grows fruit trees is fruit production. The growth of wood must be subordinated to the growth of fruit.

Modifying the form and structure of a fruit tree is a very important function of pruning. I wish to lay special emphasis on this point. There is an ideal form which every variety of fruit tree must ultimately take. The orchardist must have clearly in his mind the ideal form which his fruit tree, when full

grown, must assume. Having this ideal shape in his mind, he must build his tree, by careful pruning and balancing year after year so that the tree and its structure may more and more closely approximate to the ideal form.

What is the ideal form to which an orchard tree must approximate ? If the plan is understood, the execution may be easy. All authorities are agreed that an orchard tree must be short-stemmed and sturdy. They also agree that the ideal shape is one "varying between a broad-based wine-glass and an inverted cone," according to the natural tendencies of the variety to which the fruit tree belongs. The shape of a wine-glass or inverted cone means that the branches should spread out in circular form round the stem so that the broadest part of the whole tree, including the branches and the leaves, may be at the top.

In the case of orange trees the ideal shape to achieve is "a dome-shaped umbrella" with a canopy of foliage over the dome and down the sides. The stem, as pointed out, should be short and the main arms stiff so that the tree does not spread upon the ground when laden with fruits. As regards the vine-tree, the shape into which commercial vine-trees must be trained is that of a bush, though other forms too are practised.

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This ideal form may be achieved by yearly pruning and balancing of the trees. Let us now consider the balancing of a tree. The term balancing is used with particular reference to citrus trees. Apple trees and pear trees in addition to regular pruning, like vine-trees, need also balancing. For this reason the topic may be considered in general.

The structure of the branches of a tree is similar to the structure of its roots. While dealing with planting I have insisted on the necessity of spreading out the main roots so that the tree might be steady and well balanced. It is necessary to balance the tree further by spreading the branches evenly in various directions outwards from the main stem. The balancing will have to be done by cutting out superfluous branches or shoots in directions where there are too many of them, and also by stimulating the growth of branches and shoots in directions where too few of them are found. The balancing and pruning must be done so as to bring the tree to the required ideal shape to which I have referred.

It may be useful to give here a few facts that must be kept in mind in balancing or pruning a fruit tree. The more vertical a shoot is, the stronger will be its growth. On the other hand, the more horizontal a shoot is, the more fruit it is likely to bear. For this

reason in the ultimate structure of the tree we should try to bring about more horizontally inclined shoots and branches than vertically inclined ones.

There is another fact which should not be forgotten. When several shoots are growing at various levels of the same tree, the top-most shoots absorb the most sap out of the tree. It therefore becomes necessary to nip off the top shoots so as to direct more nutrition to the shoots in the lower levels of the tree. The result will be an even distribution of the available nutrition to all parts of the tree. The balance of the tree will thus be maintained.

What is the best time for pruning fruit trees? Apple trees and pear trees are usually pruned when the leaves have fallen and the trees are dormant. At this time the pruner can see the position of each branch, spur or bud, and weigh its present use or its future value. In the case of orange trees and grapefruit trees, the pruning and balancing of the trees are usually done when the period of active growth has begun. Grape vines are pruned before the blossoming season begins.

In the case of apple trees and pear trees besides the pruning in the dormant season, another pruning is done after the trees have blossomed to get rid of superfluous shoots. At all seasons superfluous shoots, called water

shoots, which spring from the bottom of the trees should be pinched off. Some water shoots may be allowed to grow if it is found necessary that they should be developed for the purpose of balancing the tree.

I wish to give one final suggestion as regards pruning. Pruning means causing wounds to the tree in some way or other. Wounds of any kind are injurious to the tree. A clean wound caused by a sharp knife heals more quickly than a wound by a less satisfactory knife. For this reason, just as a careful surgeon keeps his instruments clean and neat, the pruner must always keep sharp and clean the knife, the pruning shears and the saw which are the three implements normally used in pruning.

It is impossible to give in this Chapter all the details as regards the method of pruning of each variety of fruit trees or of each individual tree. I have given the main principles. I have emphasised the important bearing which pruning has on successful fruit cultivation. The specific acts of pruning may differ according to the needs of each variety of trees or of each individual tree. But the main principles will hold good always.

CHAPTER XII

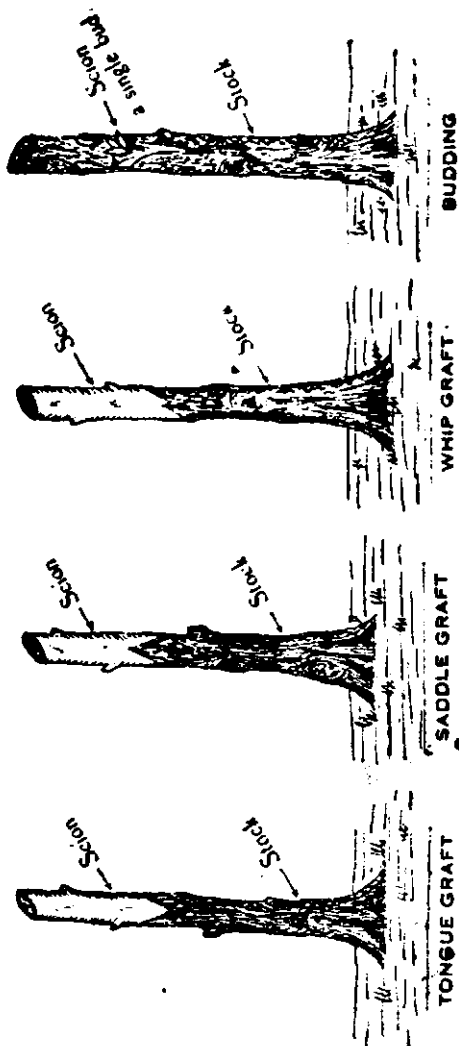
Budding and Bud-grafting of Fruit Trees

I HAVE insisted on the economy and advisability of planting grafted trees in an orchard. It may be said that grafting of fruit trees is a matter with which the nursery man is concerned and that the fruit grower must be satisfied if he can get suitable trees from a recognised nursery.

But it is necessary for an orchardist to understand why grafted trees should be preferred to other trees for planting. The orchardist must understand the basic principles of modern grafting and bud-grafting for another reason: I shall show presently how the health and strength and fruit-bearing qualities of trees, that are already established in an orchard, can be improved by grafting.

What is grafting? A grafted tree is composed of two parts. The top portion is the bud or spur or shoot of a fruit-bearing tree: this is called the scion. The other portion of a grafted tree is the stock or stem of another plant: this is called the host.

GRAFTING



It may be asked: Cannot a tree flourish better on its own roots? What is gained by grafting part of a tree to another tree? In other words, what are the uses of grafting?

Plants may be grown from seeds. They may also be grown from cuttings. Seedlings and cuttings take a very long time to bear fruit. But grafting accelerates the bearing of fruit. The reason is clear. The grafted part having been taken from an actually fruit-bearing, mature tree, the grafted tree is able to bear fruit without much delay.

There is another difficulty with seedlings and trees grown from cuttings. Their fruits are rarely true to type. The original tree from which the seeds or cuttings were taken may have borne fruits of good quality but the fruits of the seedlings or the cuttings undergo variations due to climate or soil.

One great advantage of grafting is the assistance it has given to orchardists to perpetuate a definite variety of fruit. Let us take an example: the Navel orange is an excellent example. It has an attractive appearance. It has good flavour. It is sweet. It is seedless. The Navel orange possesses many advantages over other varieties of oranges.

A rapid and sure method of propagating this most desirable variety of orange was wanted. A method was at hand. That method was

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budding and bud-grafting. The stock used was the rough lemon or citron which was a hardy variety. The original home of the Navel orange was Brazil. In a comparatively few years the Navel orange has spread all over the world. It was all due to the art of grafting.

There is another purpose for which grafting has been found serviceable. It has been found that if apple trees or orange trees or grapevines are grafted to certain sturdy stocks, they are able to resist disease. For example, apples in Australia are grafted on to "Northern Spy" stocks. This variety of apple is very resistant to the attack of woolly aphis, which is a plant disease.

A striking illustration of the use of grafting in mitigating the ravages of disease is seen in the European vine. A disease called phylloxera was causing much damage to European vineyards. The gradual grafting of European vines to American stocks has nearly wiped out this disease. American stocks are very resistant to this disease.

Grafting may also be used to modify the stature of a plant. I have already said that tall fruit trees are difficult to manage. One may desire to have dwarf apple trees or pear trees or orange trees. The practice in Australia, to achieve this object, has been to graft apple trees to the stock called "paradise" and to

graft pear trees to the stock called "quince." The same method may be applied in Ceylon to orange trees which can, with advantage, be shorter.

Fruit trees have their own preferences as regards site, soil and climate. Grafting is useful for the adaptation of varieties of fruit trees to various soil types. It has been found by experience that if peaches are to be planted on heavy soil they must be grafted on to plum stock. If plums are to be planted on heavy soil they must be grafted on to peach stock. In England, if apricots are to be planted in chalky districts they are grafted on to almonds.

I have above summarised in brief some of the advantages that can be derived by planting grafted trees in an orchard. The facts stated in the previous paragraphs will show the necessity of selecting proper grafted trees for planting in an orchard. I shall now proceed to show how the art of grafting and bud-grafting can be utilised for increasing the health, strength, vitality and fruit-bearing capacity of trees that are already established in an orchard.

In fact all the services which modern operative surgery has done to increase the health of human beings, and which veterinary surgery has done to increase the efficiency of animals are similar to the services rendered

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to the health and hygiene of plants by pruning and grafting.

I have already referred to the renovation of old trees by pruning. This is similar to the rejuvenation of human beings and animals by surgical operations. I have also pointed out that pruning of trees for renovating them must be supplemented by grafting or bud-grafting.

Merely cutting an old tree back will not renovate it. What has to be done is as follows : The tree to be renovated should be cut down to within six or twelve inches of the point at which the main arms fork out from the trunk of the tree. The cuts should be covered with a thick coating of grafting wax which will prevent the drying out of the cut surface. Copper nails or tacks are usually driven into the cut surface. If the cut surface is fairly large, copper wire gauze may be nailed over the cut with copper tacks. This is to prevent rot infection. In addition to the above an application of an antiseptic spray, like Bordeaux Mixture, is necessary.

When the new growth begins in the next sprouting season, bud-grafting is done on the main arms of the tree that has to be renovated. It is not necessary to cut back all the main arms of a tree at once. Some arms may be cut and bud-grafted in one year, the other

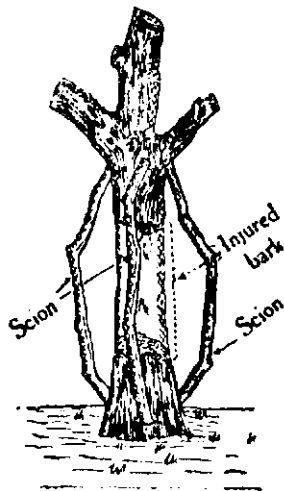
arms may be similarly treated in the following year. I need not add that bud-grafting consists in using a single bud as the scion to be grafted on to the host branch or tree.

When a fruit tree is partly damaged and a cleft or breach is formed in the bark of the trunk, how is the cavity or breach to be filled and how is the trunk to be repaired? This is done by bridge-grafting. The treatment is similar to the skin-grafting performed by modern surgeons on human beings or animals.

Before the injured trunk of a tree is bridged by grafting, the injured parts should be cleaned and the deceased parts cut away. The scions or the cuttings to be used for bridge-grafting or for bridging the gap in the trunk, should be a little longer than the injured part that is to be bridged. One end of the scion is grafted at the bottom-end of the injury; the other end is grafted at the top-end. Then the scions are securely tied and covered with wax or clay. In the course of time the cavity gets filled up with living tissue and the trunk will be as healthy as if there was no injury whatsoever.

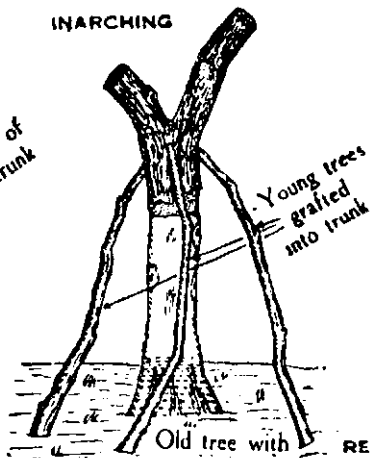
Bridge-grafting will be successful provided that the barks of the tree are sound on either side of the cleft which is to be bridged. Bridge-grafting is best done in the budding season.

GRAFTING

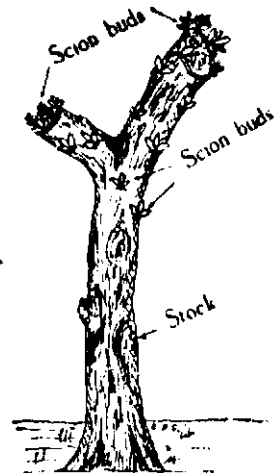


BRIDGE GRAFTING

INARCHING



Old tree with
Root system injured



RENOVATING OLD TREE
BY BUD-GRAFTING

I may mention another direction in which grafting helps the orchardist to maintain the efficiency of his trees. I refer to what is called Inarching. Inarching of trees is similar to the infusion of blood into human patients as practised by surgeons.

Suppose there is a severe injury to the trunk of your fruit tree. Suppose also there is no healthy bark below the injury down to the roots. How is sufficient nutrition to be sent up the damaged tree? This is done by planting, close to the trunk, a young tree or cutting of the same variety as the damaged tree, and then grafting the stem of the young tree into the trunk of the injured tree at a point above the injured portion.

All the nutrition taken by the young tree will be sent into the injured tree. This method of supplying nutrition to a fruit tree is called Inarching. Two or more young trees may thus be inarched to one injured tree. The young tree or cutting to be used for inarching may be planted in the dormant season near the injured tree. The inarching may be done in the subsequent budding season.

The substantial assistance which the modern arts of grafting and pruning can give to a fruit grower can be shown by reference to an actual case. In 1922 an unsatisfactory apple tree was renovated in an orchard in

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Tasmania. The renovation was done by cutting back the main branches. Bud-grafting was carried out high on the main branches. A considerable number of scions was grafted on each limb. The scions were of a variety different from that of the tree that was renovated.

There was a quick change-over of varieties in the tree. The result was that in 1927, according to the report of the Government Department, there were 28 cases of apples on the tree. These at 150 apples to the case would amount to 4,200 apples on the one renovated tree.

The above facts just show what possibilities there are in scientific fruit cultivation. I have not described in this Chapter any technical details relating to the art of grafting. Nor have I described the implements or materials necessary. Various methods of grafting are used for various purposes. I have mentioned bud-grafting, bridge-grafting and inarching to indicate the directions in which the art of grafting will be useful to the cultivator.

The workman is made by working. The art of grafting can be learnt by personal observation of the actual practice of the art. A few minutes' demonstration in this case will be more helpful than pages of description. I

am prepared to render all assistance I can in this matter and in every respect of the orchardist's activities.

In conclusion we may say in the words of Mr. J. M. Ward, our Government Superintendent of Horticulture in Victoria:—"We have the physician or surgeon to tend the human being, the veterinary surgeon to tend the diseased animal, so, why not have the tree surgeon to look after the welfare of trees—to practise what we may call tree-surgery."

CHAPTER XIII

Cross-pollination of Fruit Trees

I AM often asked the question : “ Why don't my trees bear fruit ? ” This question is put by planters who have fruit trees which are at present adult and full grown but produce no fruit. What is the reason ? Have the trees, like modern human beings, learnt methods of contraception ?

I have already referred to the poor quality and quantity of fruit production in this country. I have also pointed out some of the causes. The scope for improvement in methods of planting, pruning, grafting, manuring and the control of pests and diseases has been indicated.

In this Chapter I wish to deal with a really fundamental cause for the non-production or poor production of fruits in Ceylon. This subject touches the very origin of fruit growth. The subject I refer to is called Pollination of Fruit Trees and, more especially, the Cross-pollination of Fruit Trees.

I need not emphasise the obvious proposition that the fusion of male and female elements are necessary for the propagation of species among plants, animals, or human beings.

Among plants this is done by the contact of the male elements of flowers called pollen grains with the female parts of flowers called stigmas. This process is called pollination of flowers.

It has been clearly proved by modern scientific investigators that fruit trees have their own tastes and preferences as regards pollination. Just as some persons decidedly prefer to make matrimonial unions in their own family or in their own caste and others choose to do so outside their caste or even race, so fruit trees have settled inclinations in one way or another. If the orchardist is to succeed, he must take note of these preferences and act accordingly.

What are these preferences? With reference to pollination fruit trees may be grouped under two classes. The first class may be called Self-pollenising trees. The other class may be called Foreign-pollenising trees.

In the self-pollenising trees the pollen grains are transferred from flowers of one tree to flowers of the same tree or to flowers of another tree of the same variety. For example, orange trees and grape-fruit trees are said to be self-pollenising trees. In the same block of land the same variety of orange trees may be planted. Pollination will take place among flowers of the same variety. There will not

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be any difficulty in fruit production on the score of pollination. It is so with grape-fruit trees.

Foreign-pollenising trees, on the other hand, are those in which pollination of flowers takes place seldom or never except by means of pollens from a tree of another variety. For instance, if apple trees of the "Scarlet Nonpareil" variety are planted by themselves in a block of land, sufficient pollination does not take place and the trees do not bear fruit. The orchardist must ask himself the question: What am I going to do under the circumstances?

We shall take another example. If plum trees of the variety called "Satsuma" are planted by themselves in a block of land, they may grow well and be healthy, but they rarely bear fruit. In the same way if pear trees of the variety called "Keiffer" are planted by themselves in a block of land, their fruit production is very poor and unsatisfactory. How have scientific cultivators got over the difficulty?

It is clear that the above variety of apple called "Scarlet Nonpareil," the variety of plum called "Satsuma" and the variety of pear called "Keiffer" are foreign-pollenising trees. The solution consists in planting trees of other suitable varieties of trees by the side of these trees. Then pollination will take place. Fruit production will follow.

We must remember that flowers of apple trees of any variety cannot pollinise the flowers of plum trees or pear trees; nor will the blooms of plum trees or pear trees pollinise apple trees. To make a foreign-pollenising variety of apple trees, like the "Scarlet Nonpareil" produce fruit, we have to plant by their side another variety of apple trees. The same procedure must be adopted in the case of plum trees or apple trees or other trees which are not self-pollenising.

Let us say an orchardist is going to plant an acre of "Scarlet Nonpareil" apples. To make them produce fruit, between every two rows of this variety he must plant one row of another variety of apple trees, like "Yates." If he is going to plant an acre of "Satsuma" plums, to make them produce fruit he must plant between every two rows of this variety another variety of plum trees, like the "Santa Rosa." In like manner, if he plants an acre of "Keiffer" pear trees, he cannot expect any appreciable fruit production unless he interplants another variety of pear trees, like "Howell," in the above manner.

Two or three or more inter-pollenising varieties of fruit trees may be planted in the same orchard. The majority of trees may be of the variety chosen by the planter for economic or other reason. By means of the

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above method of planting all the varieties selected will pollinise each other. The result will be that all the trees will bear fruit.

In interplanting fruit trees for the purpose of cross-pollination, some important points have to be remembered. The pollinising varieties which are planted side by side must blossom at the same time. Otherwise the purpose of interplanting will be obviously defeated. We must also see that the pollinising trees that are planted in the orchard are varieties which have a sufficient number of blossoms and produce abundant quantities of pollen.

There is another important factor that ought to be taken into consideration. Plants, like human beings, have certain natural sympathies and antipathies towards each other. For this reason the pollinising varieties of trees that are planted in an orchard must have a natural affinity or attraction towards each other. For example, it has been demonstrated that plum trees called Japanese plums will not help the pollination of European plum trees. On the other hand, European plum trees appear to be equally disinclined to help the pollination of Japanese plums. Nothing will be gained by interplanting the two varieties.

Among apple trees "Jonathans" often bear fruit if planted by themselves in an orchard.

But interplanting of a suitable variety in an orchard of "Jonathan" trees has increased fruit production. "Jonathans" and "Rokewoods" are good inter-pollenisers and they get on well together in the same orchard. "Yates" and "Delicious" can be interplanted among "Jonathan" trees with profit.

I have already said that citrus trees, like orange or grape-fruit, are self-pollinising and different varieties of them need not be interplanted. The advantage of interplanting and inter-pollination have been conclusively proved mostly with reference to apples, plums, pears and figs. There is no reason why the same principle should not hold good in the case of several other varieties of trees, including fruit trees that are indigenous to Ceylon.

The facts stated in this Chapter give one clear reason for the poor quantity of fruits borne by apple trees and pear trees which have been planted in the past in Ceylon and of which complaints have been made. In my opinion the one clear reason was the ignorance of the necessity, or the negligence of, interplanting and cross-pollination of the above varieties of fruit trees. I have already pointed out other reasons.

I now proceed to give the orchardist some supplementary suggestions in connection with Fruit Cultivation.

CHAPTER XIV

Supplementary Suggestions

IDEAS are institutions. In these pages I have attempted to give ideas and suggestions to convince the reader of the abundant profit and pleasure that can be derived from fruit cultivation. It is the man or woman with intelligence and education that will understand the recurring problems of agricultural production. When the problems are once understood, solutions will be easy and success is sure to anyone who is determined to succeed. It is to such persons that the suggestions in this book will be most valuable. In this Chapter will be found a few supplementary observations which I feel obliged to make.

First I wish to refer to the co-operation of honey-bees in fruit production. The advantage of interplanting of fruit trees and cross-pollinisation have been described in the previous Chapter. To effect cross-pollination the assistance of honey-bees in an orchard is extremely valuable. Bee-keeping, according to modern methods, will thus be doubly useful to the orchardist. Apart from the direct profit which the orchardist can make from the honey made by the bees, the orchardist can secure

the other advantage which is to be derived by keeping the bees busy among his fruit trees during the blossoming season. One colony of bees has been reckoned to be sufficient for an acre of mature fruit trees.

A herd of cattle may be an advantage if kept near an orchard. There is the obvious danger of the cattle damaging the growing trees. The danger can be avoided if the animals are kept at a safe distance in an effective enclosure. Having at hand a collection of cow manure which costs nothing to the orchardist is a question of economy, but every time the safety of the fruit trees must be the orchardist's chief concern.

I have referred to the sum of Rs. 1,129,854/- as the value of fruits, fresh, dried and preserved, imported into Ceylon in 1931. This figure represents the cost of the fruits as declared to the Customs authorities by importers in Ceylon. Does this figure indicate what the imported fruits actually cost to the consumers in Ceylon? If an importer has paid Rs. 6/- for a case of oranges, he may sell it to the Ceylon public at Rs. 9/- or more. Thus the actual sum that went out of the pockets of the Ceylon public for imported fruits in 1931 must be more than Rs. 2,000,000/-. Scientific Fruit Cultivation will help the retention of this sum in Ceylon.

FRUIT CULTIVATION

I have emphasised the possibilities in the export of fruits from Ceylon. Since the previous Chapters were written, the Bombay Fruit Growers' Association, encouraged and assisted by the Government, has taken a step ahead of Ceylon. A shipment of 60,000 mangoes has been sent to England. Arrangements have been made for fortnightly shipments of a similar quantity for two months. I have alluded to the Rs. 18,500,000/- worth of foreign fruits which India herself imported in 1930. While appreciating the progressiveness of the Bombay Fruit Growers' Association, it is high time that Ceylon planters formed a vigorous and energetic Fruit Growers' Association of their own and increased the prosperity of their own country. If Ceylon will not venture on competition, co-operation is possible.

There is no reason why Ceylon should not win even in competition. The pre-eminent facilities and advantages which Ceylon has in fruit cultivation have been noted in the previous Chapters. The Director of Agriculture in Gold Coast mentioned the fact of Gold Coast being nearly thirteen days by steamer to England as an advantage which Gold Coast has over South Africa and Australia for the export of fruits to the London Market. He mentioned this fact to encourage the cultivation of grape-fruits in Gold Coast for purposes

of export. Ceylon has similar advantages and many more.

It only wants the determination of every individual orchardist in Ceylon and the united effort of all orchardists in the Island to make fruit cultivation one of the chief sources of the country's prosperity and wealth. South India, consisting mainly of a vegetarian population, will be benefited by increasing the production of an extremely wholesome food like fruit and can follow in the wake of the Northern provinces not merely in supplying local needs but also in the export of fruit produce. Any person who has studied local conditions in this Island must, however, admit Ceylon's unique position in the matter of fruit-production.

CHAPTER XV

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