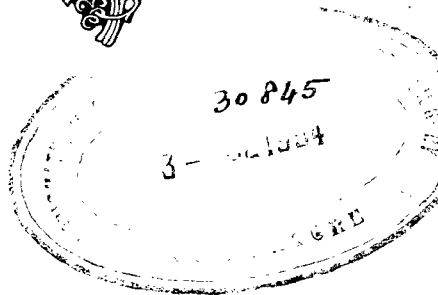


PRUNING IN SOUTH AFRICA

By

H. CLARK POWELL

PROFESSOR OF HORTICULTURE,
TRANSVAAL UNIVERSITY COLLEGE,
UNIVERSITY OF SOUTH AFRICA, PRETORIA



CENTRAL NEWS AGENCY LTD.
JOHANNESBURG.

PRUNING IN SOUTH AFRICA

PUBLISHED BY
CENTRAL NEWS AGENCY LTD
BOX 103 JOHANNESBURG



PRICE — 3/-

PREFACE

In the accompanying booklet an attempt has been made to present the problem of pruning fruit trees in a simple and concise way in order that it can be followed by the commercial fruit grower and the amateur gardener who has only a few trees.

A few years ago a large proportion of the fruit growers of California, and subsequently in other areas, changed from heavy annual pruning, consisting largely of heading back many branches, to the so-called "long pruning" system. The latter method consists solely of thinning out superfluous branches and the resulting tree tends to become very open, tall and straggling.

The writer is very much opposed to any pruning practice that entails severe heading back and is equally opposed to "long pruning" under climatic conditions such as obtain in South Africa and particularly in the summer rainfall areas. A compromise between severe heading back and "long pruning" has been found to be most successful. No heading back is done, except in unusual cases, but long growths are shortened in to laterals.

This system is well worth a thorough trial by every grower of fruit trees.

H. CLARK POWELL.

Pretoria, 1929.

CONTENTS

	PAGE
I.—Introduction	I
II.—Pruning Young Trees	4
III.—First Spring Pruning :	
Whip type : Apples, Pears, European Plums, Cherries, Prunes	9
Branched type : Peach, Almond, Apricot, Japanese Plum	10
IV.—First Dormant Pruning :	
Whip type : Apples, Pears, European Plums, Cherries, Prunes	10
Branched type : Peach, Almond, Apricot, Japanese Plum	12
V.—Second Dormant Pruning :	
Whip type : Apples, Pears, European Plums, Cherries, Prunes	12
VI.—Subsequent Pruning of the Young Tree	14
VII.—General Aspects of Pruning	14
VIII.—Pruning the Apple	21
IX.—Pruning the Pear	25
X.—Pruning the Peach and Nectarine	27
XI.—Pruning the Japanese Plum	30
XII.—Pruning the Apricot	33
XIII.—Pruning the Almond	34
XIV.—Pruning the Cherry	34
XV.—Pruning the Quince	35
XVI.—Pruning the Fig	36
XVII.—Pruning the Persimmon	36
XVIII.—Pruning the Orange and Grapefruit	37
XIX.—Pruning the Lemon	40
XX.—Pruning Tools	41
XXI.—Fruit Thinning : Apples, Pears, Peaches and Nectarines, Japanese Plums, Apricots, Almonds, Cherries, Quince, Fig, Citrus Fruits	41
XXII.—Purchase of Nursery Trees	45

I.—Introduction.

The pruning of deciduous fruit trees is a practice that is very old, but it is a subject upon which comparatively little experimental work has been done until recently. An increase in the general knowledge of plant physiology has led to a better understanding of the fundamental principles underlying pruning.

This booklet is written for the fruit grower and is more of a practical than a scientific nature as the fruit grower is interested more in the method of carrying out a certain operation rather than in the underlying reasons for so doing.

Pruning has been defined as ¹“the art of modifying the natural habit of the fruit tree in order to secure fruit in greater abundance, more regularly and of better quality than would otherwise be the case.”

Pruning is by no means the most important item in the production of large quantities of first-class fruit. Factors such as climate, texture of soil, cultivation, moisture supply, pest and disease control and others are of equal or greater importance. Pruning must be considered merely as one of the inter-dependent points which regulate fruit production. Unless all these function at their optimum, the best results will not be obtained.

Although a considerable amount of writing has been done on the subject of pruning, most of the experimental work can be disregarded as the factor of individual tree variation has not been given sufficient attention. Variation between trees, and consequently between plots, is considerable,

¹W. P. Tufts, “Pruning Young Deciduous Fruit Trees,” Univ. California, Ag. Exp. Sta., Bul. 313, 1919.

and may be due to inherent factors within the tree, the root stock effect on the scion or to differing environment. The latter factor is undoubtedly the most important of all.

No two people ever prune similarly. Variations exist from very light thinning out to severe thinning out and heading back. Not only are there various *systems* of pruning, but each tree must be pruned somewhat differently from others. As such is the case, it is most difficult to lay down any definite rules regarding the details of pruning. An understanding of the general principles of pruning should be useful to the commercial fruit grower and to those who have small home orchards.

Plants form carbohydrates and sugars by drawing carbon dioxide from the air and water from the soil. This reaction takes place in the leaves in the presence of sunlight and is termed photosynthesis. Minerals taken up by the plant are of no use until they have been changed to organic compounds in the leaves. The first growth of the tree in the spring, when new shoots, leaves and blossoms appear, is made largely at the expense of stored food accumulated in the plant during the preceding summer and fall. When the early spring growth has ceased, the plant stores up a portion of the plant foods manufactured in the leaves. Such factors as soil fertility, pest control, soil moisture and others, directly affect the rate of manufacture and utilization of the elaborated plant nutrients and thus directly affect fruit production. Pruning is also an item directly affecting the manufacture and utilization of the plant foods and therefore has a direct effect on fruit production.

The formation of fruit buds is generally accepted as being the result of an abundant accumulation in the tree of carbohydrates formed during late summer and fall of the year preceding the particular year in which the crop is produced. Factors leading to an increase in the rate of manufacture or to a partial reduction of the rate of utilization of the carbohydrates will therefore result in the formation of more fruit buds than would otherwise be the case.

Pruning is carried out with the following objects in view : ²

- (1) To produce a vigorous, mechanically strong, healthy tree.
- (2) To secure a well-shaped tree for convenience and economy in orchard management.
- (3) To distribute the fruiting area well over the tree.
- (4) To secure fruit of good size and quality.
- (5) To regulate the annual succession of crops in order to obtain the maximum crop compatible with good fruit.

The operation of pruning is dwarfing in direct proportion to its severity. Various experiments have been carried out that show this very clearly. Examples need not be quoted here. Suffice it to say that the unpruned tree will always attain greater size than the pruned tree but, because of the objects just mentioned, pruning is essential.

Before considering any details of pruning, let us consider the manner in which the various species bear fruit.

The apple and the pear bear the major portion of their crops terminally on spurs, which will remain productive for eight to ten years and, in some cases, even longer. Pruning of these two fruits should therefore be directed to creating spurs and then maintaining them in a vigorous condition.

Almonds, apricots, and Japanese plums bear the major portion of their crop laterally on spurs and long shoots. The spurs usually do not live more than three years.

Peaches, grapes and figs bear fruit laterally on long shoots of the previous season's development. With these fruits it is necessary to provide for the annual replacement of much more wood than is the case with the apple and the pear.

Most fruits produce a small portion of their crops in a manner different to that in which the major portion is

²W. P. Tufts, "Pruning Bearing Deciduous Fruit Trees," Univ. California, Ag. Exp. Sta., Bul. 386, 1925.

produced. The apple, for example, carries most of its crop terminally on long-lived spurs, but may also carry some fruit laterally or terminally on long shoots of the previous season's growth.

As the different species of fruit trees bear in different ways, it follows that the pruning of each species must be different.

II.—Pruning Young Trees.

When a tree is transplanted from the nursery to the orchard, a large quantity of its roots are lost. The remaining roots are not sufficient to supply an optimum quantity of plant food to the growing points above ground. A direct correlation exists between the size of the top and the size of the root system. If a portion of the root system is removed, it follows that a portion of the top should also be cut away to compensate for the loss of the roots and so to maintain the correct proportion between the top and the roots. The remaining buds will receive more plant nutrients than would otherwise be the case, there being fewer of them and the supply of food from the roots being limited.

The height at which the young tree should be headed varies with individual preference, but the general tendency in South Africa is for a low head, from 12 inches to 30 inches from the ground. Low heading does not cause the main limbs to develop in such a way as to interfere with cultural operations. The main limbs arise from a low-headed tree at a sharper angle than they do from a high-headed tree. Low-headed trees are more economical to handle in regard to pruning, spraying and picking than are those headed higher. Further, because of the shading of the trunk caused by low heading, there is much less danger from sunburn with the low-headed tree. Under the hot conditions of South Africa, sunburn of the trunk and main limbs can be a serious factor. Wind injury is less serious with low-headed trees. Strong prevailing winds occur in all parts of South Africa at one time or another during the year.

The selection of the main scaffold branches is an important step. They should be of such a number and be so placed as to enable the tree to carry large crops of fruit without breakage. From three to five scaffolds should be chosen, well spaced around the trunk and well spaced up and down the trunk, as is shown in Figs. 1 and 2. A vertical distance of about six inches should be the ideal distance between the branches. Two scaffolds should not be chosen, because of the subsequent danger due to splitting. When more than five scaffolds are chosen there is danger of crowding and the tree must be headed quite high in order to secure good spacing of these scaffolds.

Immediately after the young tree has been planted and pruned, it should be whitewashed in order to protect it from sunburn. If whitewash is not used, the trunk should be wrapped with pieces of newspaper.

Certain trees, such as the peach, almond, apricot and Japanese plum, usually form side branches in the nursery and, if properly spaced, these can be used for the formation of a head when the tree is planted.

Apples, cherries, pears, European plums and prunes make a single whip-like growth in the nursery and the only pruning given to these at the time of planting is to cut them back to the height at which it is desired to form the head, 12 inches to 30 inches. This presupposes the planting of one-year-old trees.

Many fruit growers are of the opinion that heavy pruning of young trees is advisable. This point has been emphasized by many writers in the past, even recently. The latest experiments have shown this theory to be a fallacy and it is now recommended that the young tree be given as little pruning as can be done consistent with proper shaping of the tree. The following figures illustrate the effect of heavy versus light pruning : ³

³W. H. Alderman—E. C. Auchter West Virginia Ag. Exp. Sta., Bul. 158, 1916.

Influence of Amount of Pruning and Size of Young Apple Trees.

Variety.	Type of Pruning.	No. of trees.	Height (in feet).	Spread (in feet.)
Stayman	Heavy ..	24	7.32	5.29
"	Moderate ..	19	7.89	5.52
"	Light ..	19	9.50	5.75
Rome	Heavy ..	13	7.45	3.68
"	Moderate ..	8	8.18	4.17
"	Light ..	11	9.16	4.23
Gravenstein ..	Heavy ..	17	7.43	4.05
"	Moderate ..	7	6.83	4.19
"	Light ..	10	8.94	4.34
Stark	Heavy ..	19	7.57	5.17
"	Light ..	4	10.79	6.83
York, Grimes and Rome ..	Heavy ..	7	9.55	4.85
"	Moderate ..	5	9.73	6.17
"	Light ..	6	10.50	7.10

Other data could also be quoted to show that the pruning of the young tree is dwarfing in direct proportion to its severity. In particular, the work of Tufts in California and Reinecke in South Africa bears out this statement.

The open-centre or vase-shaped tree is the one recommended for South African conditions. It consists of heading back the young tree at the time of planting. The removal of the centre shoot causes the development of lateral growths, three to five of which are selected and allowed to develop equally. The only disadvantage of this system is that the scaffold branches may be allowed to arise too close together. Later, when the tree is mature, this results in the formation of a pocket or basin in which water collects and predisposes the decay of the wood. Should the top be kept too open, as is sometimes done, sunburn of the main branches may occur.

The central leader form of tree is not used in South Africa. In this system the centre shoot is not headed back, but

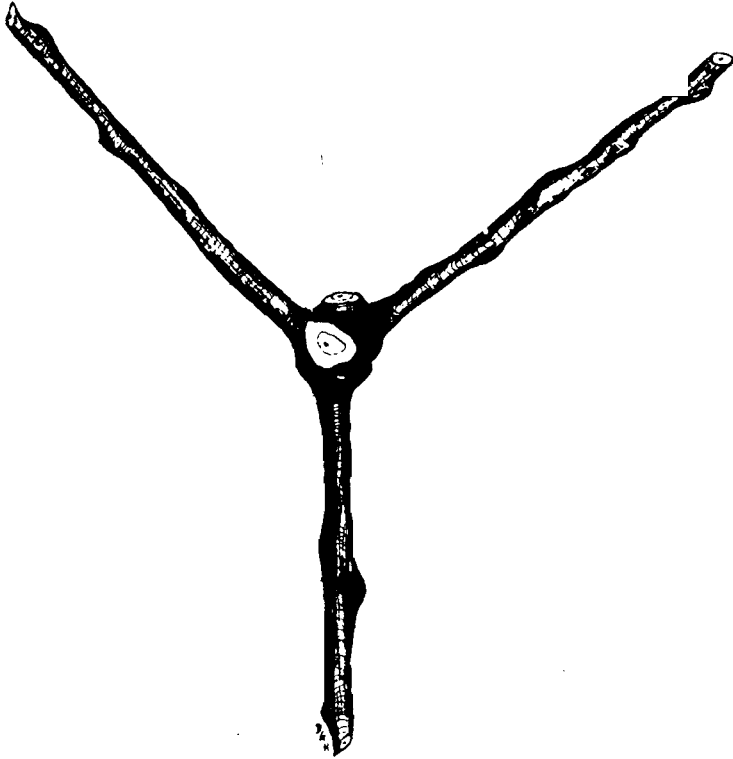


FIG. 1.—Showing the manner in which the main scaffolds should be equally spaced around the trunk of the young tree.

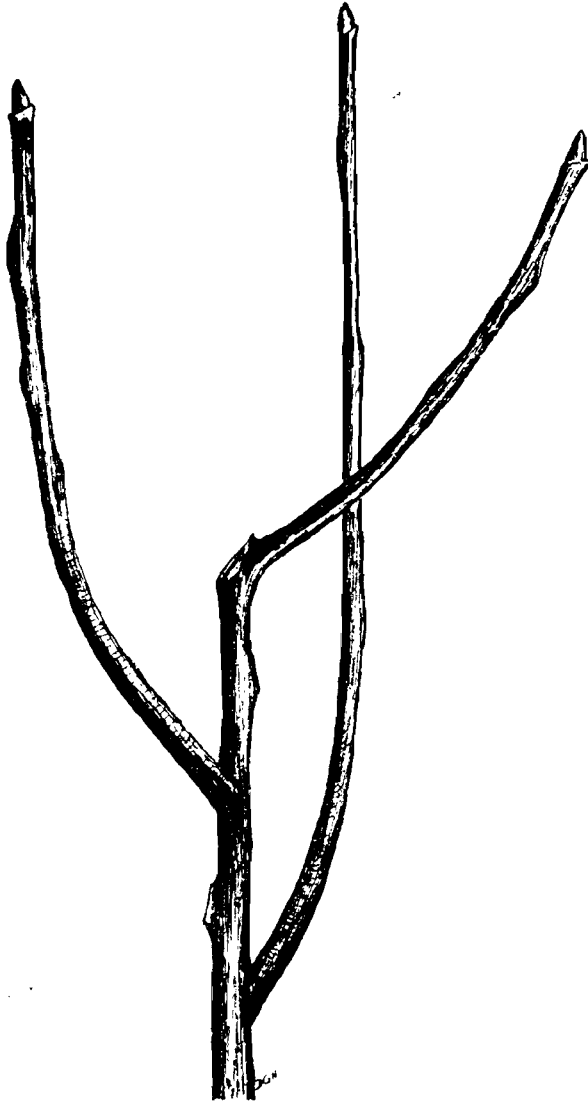


FIG. 2.—Showing the manner in which the main scaffolds should be well distributed up and down the trunk. If possible, about six inches should be left between each one.

is allowed to grow unchecked. This results in a high-headed, pyramid-shaped tree.

The modified leader tree is a combination of the two types just mentioned. The central shoot is allowed to develop for five or six feet or even more, and is then checked. The object of doing this is to secure wider spacing of the scaffold branches. As they are distributed over such a wide distance, it is possible to leave more scaffolds than is the case with the open centre type. This system of tree training is advantageous in that it tends to develop a very strong head. Unless the first scaffolds arise within about 15 inches of the ground, there is a danger that the trunk may become sunburned.

III.—First Spring Pruning.

Whip Type—Apples, Pears, European Plums, Cherries, Prunes.

In the spring following planting, the young tree will throw out many lateral shoots, in most cases more than are desired. Considerable time will be saved and a better tree will be secured if attention is given to the tree during the spring and early summer. When the lateral shoots have reached a length of about four inches, the selection of three to five of them as scaffolds or main branches should be made. As previously mentioned, they should be well spaced up and down the trunk and evenly spaced around it. (See Figs. 1 and 2). Those shoots which are selected as permanent scaffolds should not necessarily be chosen for their vigour, but should be chosen because of their location on the trunk. Should two shoots arise at a point where only one is desired, the other one should be carefully removed, taking care not to injure the remaining one.

The superfluous shoots should not be entirely removed, but should be pinched back rather severely in order to leave a rosette of leaves at their base. The object of this pinching back of unwanted shoots is two-fold. The rosettes of leaves

shade the trunk and thus aid in preventing sunburn. As leaves are the source of manufacture of elaborated plant nutrients, it is obvious that the more leaves there are on a tree the greater will be the manufacture of plant food, and the greater will be the development of the tree.

The young tree should be given attention every month during its first growing season. It may be necessary to re-pinch some of the growths that were previously tipped.

The scaffolds should remain untouched during the first growing season. This system requires continual attention and care on the part of the grower, but will result in the development of a stocky, well-shaped and sturdy little tree.

Should one scaffold develop more rapidly than the others, thus causing an unbalanced tree, it should be tipped lightly in order to allow the other scaffolds to catch up to it.

Branched type—Peach, Almond, Apricot, Japanese Plum.

Those trees that have formed side branches in the nursery (peach, almond, apricot, Japanese plum) are pruned somewhat differently from those that merely form a single, whip-like growth. When lateral growths are formed in the nursery, the scaffold branches can be chosen when the tree is pruned immediately after planting. The tree should be cut at 24 inches to 36 inches from the ground, which will make the head from eight inches to 18 inches high, the height of head referring to the distance from the ground to the lowest scaffold branch.

Choose from three to five scaffolds, well spaced around the trunk and also up and down the trunk. Branches other than these scaffolds should be removed. The chosen scaffolds are not cut back. The trunk and scaffolds should be whitewashed immediately following this initial pruning.

IV.—First Dormant Pruning.

Whip type—Apples, Pears, European Plums, Cherries, Prunes.

The first dormant pruning is given in June, July or August of the year following planting. If carefully treated during

the months following planting, the young tree should have three to five scaffold branches and some intermediary twig growth.

The small twigs that develop as a result of the spring pinching of undesired laterals may or may not be removed at this stage. Any growths between the scaffolds, other than small twigs that will not develop further, should be cut away. The cut should be made close to the trunk in order that no stub will be left. Water-sprouts frequently arise in the vicinity of a stub and the presence of the stub prevents proper healing of the wound.

It has been recommended frequently that at this pruning the scaffold branches should be headed back heavily in order to secure branching and stockiness. The writer does not favour heavy heading back of the scaffolds at any time. Should the scaffolds be cut back to six inches to eight inches, as some advise, the secondary scaffolds that arise from these main branches will be much too crowded when the tree is older.

As previously mentioned, pruning is dwarfing, and heavy heading of the scaffolds will retard the development of the tree. The following figures⁴ show the effect of cutting shoots back to varying lengths :

Length of shoot after cutting back, in in.	6"	12"	24"	36"
Weight of shoot and side shoots (relative)	100	179	310	562
Thickening of the shoot (relative)	.. 100	114	117	129

Thus it is quite evident that heavy cutting back does not produce a stockier branch and that maximum development is secured through light pruning. Results of various other experiments could also be quoted to substantiate this point.

Light heading back of the scaffolds at the first dormant pruning is recommended in cases where the scaffolds have made good growth. If a long scaffold is left unpruned, secondary scaffolds may arise too far out from the main

⁴ Bedford and Pickering, "Science and Fruit Growing," 1919.

trunk. Head back the scaffolds to 18 inches to 24 inches in length, if they have made more than this growth.

Should the scaffolds have made less than 24 inches growth during the previous season, they should be left unpruned. To cut back such short growths as this would mean crowding of the secondary scaffolds.

Branched type—Peach, Almond, Apricot, Japanese Plums.

The trees in this group will have had their scaffolds chosen at the time of planting and after a year in the field will have developed many lateral growths. On each of the three to five scaffolds two secondary scaffolds should be chosen and other laterals should be removed. The two secondary scaffolds should be chosen in such a way that one will be at the terminal of a main scaffold branch and the other six inches to ten inches below the terminal. They should be on opposite sides of the scaffold and should not be close together. The ideal arrangement of main scaffolds and secondary scaffolds is shown in Fig. 3. The secondary scaffolds are left untouched unless they are very long, in which case they are lightly headed back.

Should any of the secondary scaffolds tend to grow more rapidly than the others, they should be checked by pinching out the tender growth at the tips. An effort should be made to keep the trees as symmetrical as possible.

V.—Second Dormant Pruning.

Whip type—Apples, Pears, European Plums, Cherries, Prunes.

At the time of the second dormant pruning, that is, in June, July or August, two years after planting, the secondary branches are chosen, in the manner outlined above for the branched type at the first dormant pruning.

This selection of secondary scaffolds of the apple, pear, European plum, cherry and prune can be expedited by

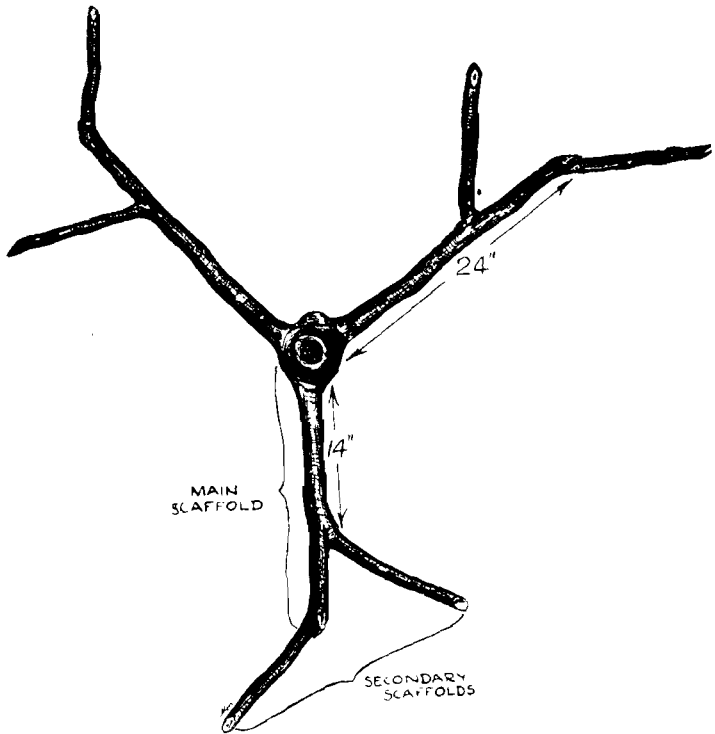


FIG. 3.—An ideal arrangement of main and secondary scaffold branches, seen from above.

selecting them in the spring following the first dormant pruning. When desirably situated ones are chosen on each main scaffold, other lateral growths are pinched back.

At the second dormant pruning, the secondary scaffolds will be found well developed and should be left untouched unless they are too long, in which case they should be lightly headed. Other lateral growths should be removed.

VI.—Subsequent Pruning of the Young Tree.

At the third and fourth dormant prunings, the trees in both groups should be thinned out and, if growing vigorously, some of the shoots may be headed back or cut back to laterals. Peaches, almonds, apricots and Japanese plums should carry a good commercial crop in the fourth year after planting. Apples, pears, European plums, cherries and prunes will bear a good commercial crop when from four to eight years of age.

Light pruning, such as has been discussed, will result in somewhat earlier bearing than is the case when young trees are heavily pruned. It also results in heavier bearing than would be the case were the trees to be heavily pruned. Numerous experiments show this to be the case. Among them may be mentioned those of Reinecke at Stellenbosch.⁵

VII.—General Aspects of Pruning.

Before taking up the question of pruning bearing fruit trees, it is well to consider some of the more general aspects of pruning and their effect on the trees.

Pruning may consist either of heading back or thinning out. Both have a totally different effect on the tree. Thinning out consists of the removal of an entire branch, shoot or spur, through cutting it back to a lateral. Heading back consists of the removal of only a portion of a branch, shoot or spur, leaving a portion from which new growths develop.

⁵ O. H. S. Reinecke, "Some Results of Pruning Experiments with Deciduous Fruit Trees," Stellenbosch-Elsenburg College of Agriculture Far. Bul. 2, 1928.

Heading back removes a larger proportion of new growth than does thinning out, as in heading back all long, new growths are either removed entirely or cut back, whereas in thinning out the long, new growths are either removed or left alone. As younger wood is richer than older wood in stored nutrient reserves, it follows that heading back removes a larger proportion of nutrient reserves than a thinning out of equal severity.

Spurs are usually formed from median to terminal buds, that is, from those buds located from the middle to the outer end of a shoot. Such being the case, it follows that heading back is not as conducive to spur formation as thinning out. Thus, with those species and varieties of fruit that bear on spurs, such as most varieties of the apple and pear, heading back of new shoots is a distinct check on spur formation and therefore on fruit production. With the peach, which bears on new growth, this heading back is by no means so injurious.

When a shoot is headed back it will be found that two to four new shoots will arise within six inches of the cut. Assuming that twenty shoots in a tree have been cut back and that from each two new shoots arise, the result will be forty new shoots. If these are headed back the subsequent year and two new shoots arise from each headed one, eighty new shoots will develop. The obvious result of this heading back is the formation of a dense top in the tree and shading of the interior. Fruit bud formation largely depends on the amount of carbohydrates available in the immediate vicinity of the particular buds. Unless there is abundant sunlight available to the leaves subtending the particular buds, the rate of manufacture of the carbohydrates will be greatly reduced and little fruit bud formation or differentiation will occur. Heading back causes shading of the interior of the tree and thus reduces the bearing area.

Thinning out does not cause the formation of as many new shoots as heading back, and thus will not cause shading out of the interior of the tree.

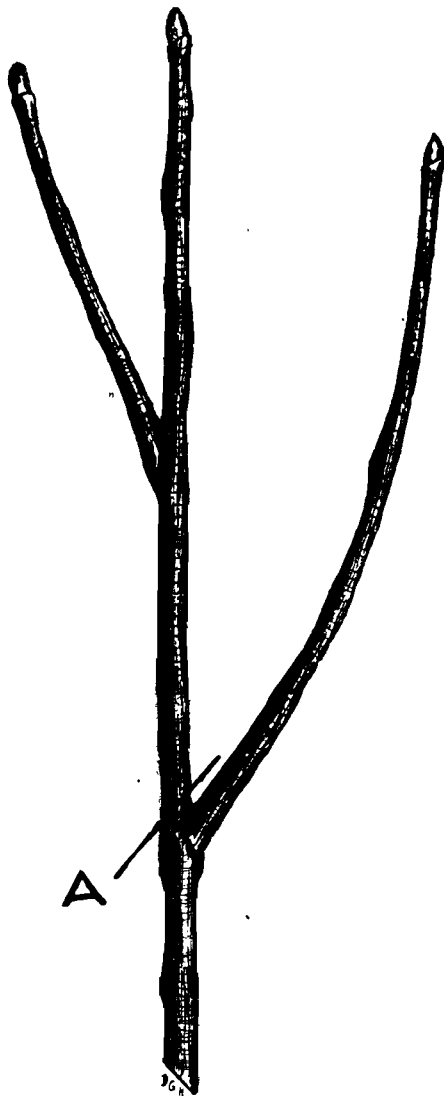


FIG. 4.—If the branch shown in this figure is thinned back at point A, the growth that will occur during the next season is shown in Fig. 5. This is a typical response to thinning out.

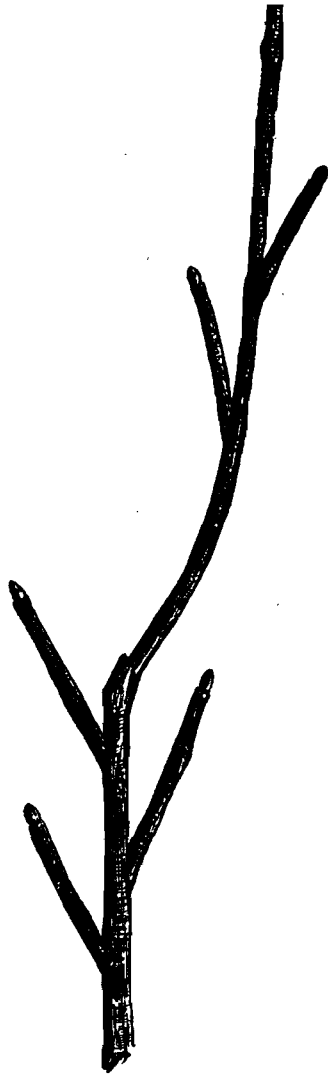


FIG. 5.—Typical growth and spur formation following thinning out. Compare this with Fig. 6, showing typical growth following heading back.

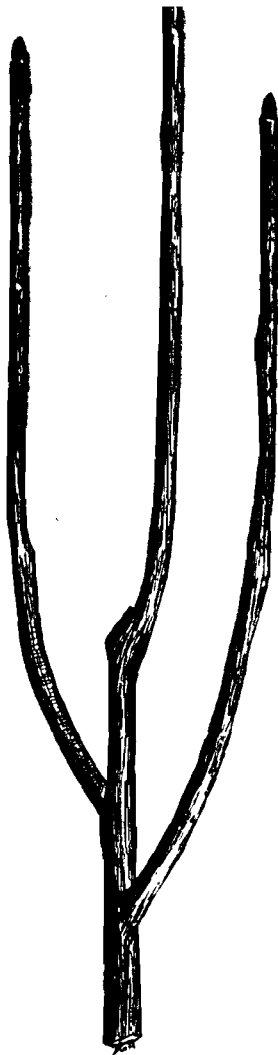


FIG. 6.—This shows the strong shoot growth occurring after a branch is headed back. The three shoots have arisen in close proximity to the cut. This results in more shading of the interior of the tree than is the case when thinning out is practised.

Heading back will lead to the formation of a compact, bushy tree, with the bulk of the fruit borne on the outer periphery of the tree, the interior being only partially productive because of shading. Thinning out will lead to the formation of a more spreading, open tree which will have its bearing area well distributed over the entire tree.

Typical responses to heading back and thinning out are shown in Figs. 4, 5 and 6.

One desire of the grower should be to create and maintain a large quantity of inside fruiting wood. If the top of the tree is allowed to become dense, either through heading back or insufficient thinning out, the reduction of sunlight in the interior of the tree will cause a marked reduction in the formation of fruiting wood. To create and maintain a maximum quantity of interior fruiting wood, no heading back of upright laterals should be followed and the top of the tree should be judiciously thinned out.

Uniform thinning of the top should be the rule and large openings should not be made. The removal of large branches tends to the formation of water-sprouts and the resulting "hole" may be the means of causing sunburn of the scaffold branches. Therefore, make numerous, well-distributed small cuts.

If a tree has been trained properly when young, the pruning to be given when mature will largely consist of making numerous small cuts. The removal of large limbs is a practice advisable only when absolutely necessary, as it causes the formation of many water-sprouts and leaves a wound that heals with difficulty. Pruning should consist of the removal of many small shoots rather than the removal of a few large branches, and careful training of the tree when it is young will make this possible.

Water-sprouts can sometimes be used to replace branches in the framework of the tree, but in general they should be removed when they arise.

Pruning does not directly affect the tree as a whole. The immediate response is felt only in the immediate vicinity of the cut. Thus, to stimulate the formation of fruit spurs

or to rejuvenate existing spurs, the pruning treatment should consist of making small cuts at the points where the effect is desired.

Pruning cuts should always be made in such a way that they will readily heal over. Stubs should never be left when a branch is removed. All cuts should be made perfectly even with the branch from which the shoot is cut, leaving no stub. Pruning cuts that are more than one inch and a half in diameter should be painted over with some wood preservative such as white lead paint or the various tar paints. This will prevent decay of the wood underneath. Grafting wax can be used for this purpose but is more expensive.

Summer pruning of young trees, which consists chiefly of a light pinching back, is recommended and has been previously discussed. The summer pruning of bearing trees is a practice that must be done very carefully or undesirable results will be obtained. It must be remembered that new shoots and leaves that arise in the spring develop from plant food reserves stored in the tree during the previous summer and fall. Should any of these be removed before they have begun to store up plant food, that food which was utilized in their growth will be a loss to the tree. If the summer pruning is done when external conditions are such that stimulation of growth takes place, the result may be an increase in the rate of manufacture and accumulation of carbohydrates. But if no increased growth follows the summer pruning, the removal of the shoots represents a dead loss to the tree.

The effect of summer pruning depends on its kind (heading back or thinning out), its time, soil and moisture conditions and its severity, and, as the effect is subject to so many factors, it is a practice that cannot be generally recommended. In the warm, summer rainfall areas of South Africa, where the fruit trees make very vigorous growth, it is possible that a moderate pinching back of growths over three feet in length may prove satisfactory in stimulating spur formation

and causing a greater storage of carbohydrates than would be the case otherwise.

The usual pruning of the tree should be done during the period when the tree is dormant and the leaves are off. In the southern hemisphere this period is normally in June, July and August.

In the development of any tree the position frequently arises where two shoots of equal length branch at the same point, forming a narrow Y-shaped angle. Such an angle is mechanically weak, and later, when the resulting branches are carrying a heavy crop of fruit, splitting of the Y-crotch will usually occur. Equal development of two such shoots and the resulting formation of a weak crotch can be stopped by cutting one back (either by heading or by cutting to a lateral if one is present) and leaving the other untouched. Unequal cutting of shoots of equal length will permit one to develop more than the other, with a resulting crotch that is mechanically strong.

The amount of pruning that should be given, as distinct from the type, varies with several factors, among which must be mentioned the species, the variety within the species, the area of the country (climatic conditions), and vigour of the tree. Pruning in the winter rainfall areas of the Cape, where the trees make much less annual growth than in the summer rainfall sections of the country, is much less severe than elsewhere. The severity of pruning will be discussed under the pruning of each particular fruit.

VIII.—Pruning the Apple.

There has been more written in regard to the pruning of apples than in regard to any other fruit. Much of the available literature recommends heavy pruning of both young and bearing apple trees. From recent experimental work it is evident that heavy pruning delays and reduces fruiting and dwarfs the tree. Light pruning and the formation of a strong framework should be the objects of the

pruner, as these two factors will give early bearing and enable the tree to carry heavy crops when it is mature.

The general pruning of young trees has already been discussed, but can be summarized herewith. Upon arrival from the nursery, the young apple tree should be one year old, the age dating from the time of grafting. It will usually consist of a single whip-like growth. This is cut back at the time of planting to 18 inches to 30 inches, and the young tree is whitewashed or otherwise protected from sunburn. When growth occurs in the spring and the new lateral shoots are about four inches long, from three to five are chosen as main scaffolds. They should be well distributed both up and down as well as around the trunk. These main scaffolds are left untouched and the others are pinched back to check their growth. The latter shoots will form rosettes of leaves that will aid in shading the trunk and also add to the supply of elaborated plant nutrients available for the tree. The little tree should be given attention once a month and any unwanted growths checked by pinching out the tender growth at the tips.

The following winter, the first year after planting, the first dormant pruning is given. The small rosettes that formed as a result of pinching back undesirably located laterals are usually removed at this time, but may be left for another year if desired. Should they be removed, the cut should be made clean, as new shoots will be thrown out at that point if a stub is left. Any growths between the scaffolds should be removed unless it is desired to leave the small rosette-twigs for another season.

Should the three to five scaffolds have made more than 24 inches growth, they should be cut back to 18 inches to 24 inches in length. Should they have made less growth than this, they should not be cut at all. The reasons for this have been mentioned previously.

In the spring following the first dormant pruning, selection of the secondary scaffolds can be made. Two should be chosen from each main scaffold, one arising at the terminal

point and the other about six inches nearer the trunk. This is done when they are about four inches in length. Those shoots which are not desired should be pinched back to an inch or two in length. Re-pinching may be required one or more times during the summer. Should one secondary scaffold tend to grow more rapidly than the others, it can be checked by a light pinching. Equal development of all scaffolds and secondary scaffolds should always be the aim of the fruit grower.

Two years after planting, the second dormant pruning is given. The secondary scaffolds should be well developed by this time and are left untouched unless they are too long, in which case they can be headed back to about 24 inches. Other lateral growths are removed, but small rosette-twigs, formed as the result of pinching back unwanted shoots, may be left.

It should be remembered that the young tree will come into bearing when there is a sufficient accumulation of carbohydrates to cause fruit bud differentiation. Once a satisfactory framework of the young tree has been established, the pruning should be as light as possible in order to favour carbohydrate accumulation. The pruning of the young tree, after the establishment of the scaffolds and secondary scaffolds, should consist of thinning out any superfluous branches. Diseased or injured limbs should be removed. When two limbs are growing closely parallel or are crossing, one of them should be removed.

Apples bear on short spurs that form on wood that is two years old or older. The fruit is borne terminally on these spurs and, consequently, any extension of the spur must be from a lateral bud. This results in a branched spur which is termed a compound spur. These spurs usually remain productive for eight to ten years, but may bear for a longer period. It is usual for individual spurs to bear in alternate years, although this is not always the case. As the spurs become older they tend to bear less regularly than when younger, probably due to increased competition

for light, moisture and food nutrients due to crowding. Heavy annual bearing is therefore a problem of securing the formation of an adequate number of spurs and retaining these spurs in a vigorous condition. Pruning is only one factor in maintaining this condition.

Vigorous spurs are always more productive than those which are less vigorous and spur vigour is more influenced by soil moisture and fertility than by pruning. Pruning is important in this connection, however, as it directly influences the amount of sunlight reaching the spurs. This directly influences the rate of manufacture of plant nutrients, a major item in the vigour of fruit spurs.

As previously mentioned, heading back results in the formation of a dense top and this should be carefully avoided. A bearing apple tree should have numerous small branches removed from the top in order to let abundant sunlight to the interior of the tree, where the fruit spurs should be carried. These branches should not be headed back, but should be removed entirely, being cut back to a lateral. Should a tree tend to become too tall, the top shoots can be shortened into laterals.

Thinning of fruit spurs is normally only required when a tree is quite old and has developed so many fruit spurs that shading is serious.

Many apple varieties tend to bear in alternate years. This tendency cannot be changed entirely by pruning and attention must also be given to general cultural practices. Apple spurs usually bear in alternate years and; if climatic or other conditions cause many of the spurs to fail to carry fruit in their normal year, a very heavy crop will be set the following year. In the second year, the crop will be very light. During the "off-year," there being little fruit on the tree, there will be a marked accumulation of carbohydrates in the non-bearing spurs, with a resulting heavy crop the following year. When the abnormally heavy crop is being carried, there is in the bearing

carbohydrates
"off-year"

LIBRARY

TNAU, Coimbatore - 3



during the next season. Once this alternate bearing becomes established it is difficult to break.

During the "off-year," when little fruit is being borne, the tree should be given a careful pruning during the dormant season and the pruning should be such as to invigorate the spurs when growth takes place. Branches in the top of the tree should be thinned out in order to admit abundant sunlight. Spurs should be thinned out and much-branched ones should be cut back lightly.

The following season, after the heavy crop has been borne, should see much lighter pruning. The object of the fruit grower should be to attempt to make the tree carry a heavier crop during the "off-year" and a lighter crop during the "on-year." Applications of quickly available nitrogenous fertilizers should be given about a month before the blossom of the "off-year" crop. There should be no application of nitrogenous fertilizers preceding the heavy crop.

Certain varieties, particularly the Rome Beauty and the Versfeld, tend to bear terminally on one-year-old shoots. As the trees become older, there is a gradual change to spur bearing. With the young bearing tree, if it be of this bearing habit, there should be no heading back of these young shoots. Should there be too many of them, thin them out.

IX.—Pruning the Pear.

Pears bear in the same manner as apples, the bulk of their fruit being carried on long-lived spurs that arise from wood two years of age or older. The pruning of the pear is therefore practically identical with the pruning of the apple.

Pear trees tend to make a more upright growth than apples, and hence it is very important to see that no crowding of the top occurs. Thinning out of some of the upright branches should be done.

The points previously mentioned in regard to apple pruning apply equally well to the pear.

The Caldwell system of pruning is particularly adapted to the pear. It was developed in California some years

ago and has proved very successful. It is being tried experimentally at the Transvaal University College, but the work has been under way for too short a time to enable the writer to make any definite recommendations. A description of the Caldwell system will be given, but the writer will not recommend it beyond saying that it is promising.

Upright, one-year-old shoots are tied down below the horizontal, the tie being made to any convenient point on the trunk or adjacent branches. At the first dormant pruning, three to five scaffolds are chosen, suitably placed, and are tied down. Any other laterals or strongly growing upright growths are cut away.

It will be found that new growth will arise just back of the bend and that abundant fruit spurs will form on the portion of the branch that is bent below the horizontal. In the winter of the next year, some of the vigorous shoots that pushed out back of the bend are thinned out, leaving one or two which are tied down as before. These will also form many fruit spurs below the bend.

The advantages claimed for the Caldwell system of pruning are that the tree develops a very strong framework, a larger bearing surface which is near the ground, and comes into bearing earlier than it would if pruned in any of the usual ways.

Branches that have been tied down and borne fruit for several years should be cut away as soon as it is seen that they are becoming unproductive through age.

The upright shoots are tied down during the dormant season and the ties should be removed about the middle of February. While the branches will rise slightly when the ties are removed, they should not go higher than a horizontal position.

The principle underlying the Caldwell system is that the constriction caused by bending the branch causes a hindrance in the movement of elaborated plant foods downward. Thus, those nutrients that were elaborated in the portion of the branch beyond the bend will tend to

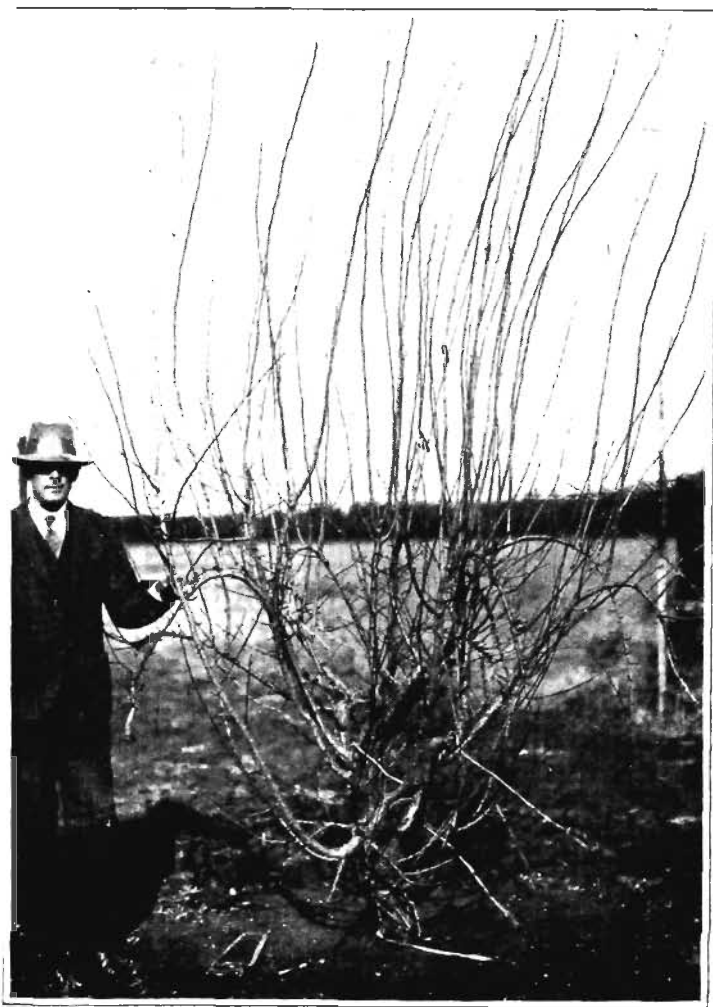


FIG. 7. - Formosa Plum before pruning. The branches that were tied down last year are clearly shown. Note the large number of shoots that arose at the bends. Many of these should be thinned out and the balance should be tied down as shown in Figure 8.



FIG. 8. —Formosa Plum after being pruned according to the Caldwell system. The fruit spurs that formed on the tied branches last season are clearly shown.

accumulate there. This accumulation of carbohydrates in the branch beyond the bend results in maximum formation of fruit spurs.

Reference to Figs. 7 and 8, showing a Formosa plum before and after tying, show the details mentioned above. Fig. 7 shows the unpruned tree. The branches that were tied down the previous season are clearly shown. Fig. 8 shows the same tree after many of the upright growths have been thinned out and the balance have been tied down.

That this principle of tying down branches is not a new one can be seen in many early horticultural works. The espalier system of training has been used many years in Europe and is, *in principle*, somewhat like the Caldwell system. In Volume 1 of the "Transactions of the Horticultural Society of London" (1812), page 237, appears the following statement by Mr. John Maher, F.H.S., ". . . the shoots pushed from those pruned trees, as might have been expected, were uncommonly vigorous, such as the French call *gourmands*, often from three to five feet long, or more. About the end of June, or a little sooner and later, according to the growth of the branches, I applied oval balls of grafting clay toward their extremity, sufficiently heavy to incline them downwards in a pendulous direction. The sap being thus diverted from its natural mode of ascending and descending, every bud almost became a blossom bud, and in several trees this disposition to produce blossom buds was carried down to the very lowest spurs on the stem and thicker branches."

The trials mentioned by Mr. Maher refer to apples and pears.

X.—Pruning the Peach and Nectarine.

The peach and the nectarine fruit in the same way and the pruning of both can be considered together.

The peach bears fruit laterally on shoots and twigs of the previous season's growth. The fruit may be borne singly or doubly, and in the latter case the two fruit buds will

be separated by a leaf bud. As the peach bears on wood of the previous season's growth, it is essential that an ample supply of new growth be secured each year.

When a shoot has borne fruit, it will not bear again. Thus the fruiting wood of the peach tends to form farther and farther away from the main branches each year.

The training of young peach trees has previously been discussed but can be summarized again. When the young tree is planted out from the nursery it will be found to have many side branches. From three to five are chosen as main scaffolds and the balance are cut away. Should the main scaffolds be over 24 inches in length, they may be shortened to about 18 inches in length. If they are under 18 inches to 24 inches in length, they should be left alone.

In the spring following planting, choose two secondary scaffolds when they have grown out about four inches, pinching back the others.

At the first dormant pruning, a year after planting, shorten the secondary scaffolds to 18 inches to 24 inches. If they have not made this growth, leave them alone. Thin out laterals other than the secondary scaffolds. There will probably be too many lateral growths, in spite of the spring pinching, as the peach is very prone to develop many lateral shoots. Should all of these shoots be allowed to develop, the tree will be much too crowded in a year or two.

The tree should be thinned out every winter until it comes into bearing and any excessively long shoots should be cut back to laterals. The object of the fruit grower should be to keep the interior of the tree open and to allow for maximum growth of the branches. The interior should not be kept too open or sunburn of the main branches will occur.

Bearing peach trees should receive careful annual attention. To neglect pruning even for one season is very injurious. Omission of pruning can frequently be done safely with apples and pears, but with the peach it is most important that the trees be pruned every year. Owing to the rapid development of many lateral shoots, the top of the tree becomes very dense and the resulting shading of the interior

causes most of the fruit to be borne on the outer periphery of the tree. Careful thinning out is therefore of great importance.

It is a common practice to prune peach trees when they are in bloom, and this is particularly to be recommended for the amateur fruit grower with only a few trees. On large commercial plantings the labour situation may render this unfeasible. Some peaches bear throughout the length of long thin shoots. Others may only bear on the upper portion of such shoots. To head all thin shoots back to half their length might therefore be satisfactory with some varieties and disastrous with others.

Severe heading back of strongly growing laterals is commonly practised with the peach. This results in the development of many vigorous shoots and consequent shading of the interior of the tree. The fruit-bearing area is forced farther away from the main branches each year. The writer favours a less drastic form of pruning and suggests that the following procedure be adopted.

The top of the tree should be well thinned out, cutting back numerous shoots to strongly growing laterals. The remaining shoots should be cut back to small laterals and thus will be left somewhat longer than the others. Thin fruiting shoots borne on the interior of the tree should be cut back to about 12 inches. If they are left longer, the weight of the fruit borne near the tips will cause breakage and the fruit will not reach good size if breakage does not occur.

Fruiting shoots that are branched should be cut back to small laterals, and if several laterals exist back of the point where the cut is made, they should be thinned out. Shoots that grow downward should be left untouched, or shortened if they are too long, as they are very strong and usually most productive. This cutting back of fruiting shoots is one means of thinning the crop and securing fruit of a better size than would be the case if the shoots were not thinned out and cut back.

If a peach tree is not pruned for two or three seasons, the centre becomes very bushy and fruit is only produced on the outer periphery of the tree. When fruit is borne in such a manner it is subject to sunburn and wind injury and is more expensive to pick than fruit that is carried lower down in the interior of the tree. A neglected peach tree gradually becomes more and more unproductive and produces very small fruits.

When it is desired to bring a neglected peach tree back into commercial production, many of the interior branches must be cut out, thus allowing ample light to reach the centre of the tree. The remaining branches should be cut back to laterals arising from old wood. All cuts must be made clean and no stubs should be left.

A large branch may be removed without danger of splitting if the cut is made as shown in Fig. 9. All dead and weak wood should be cut away. A good commercial crop will be produced two years after the rejuvenation pruning and a fair crop will be borne the first year following the pruning.

XI.—Pruning the Japanese Plum.

European plums are only grown in very limited quantities in South Africa as they do not do as well as the Japanese plums. As this is the case, the pruning of European plums need not be discussed.

Japanese plums bear on short spurs and laterally on one-year-old wood. The spurs bear from five to eight years and the bulk of the crop is borne on these spurs.

If a peach tree is not pruned for two or three seasons, the centre becomes very bushy and fruit is only produced on the outer periphery of the tree. When fruit is borne in such a manner it is subject to sunburn and wind injury and is more expensive to pick than fruit that is carried lower down in the interior of the tree. A neglected peach tree gradually becomes more and more unproductive and produces very small fruits.

When it is desired to bring a neglected peach tree back into commercial production, many of the interior branches must be cut out, thus allowing ample light to reach the centre of the tree. The remaining branches should be cut back to laterals arising from old wood. All cuts must be made clean and no stubs should be left.

A large branch may be removed without danger of splitting if the cut is made as shown in Fig. 9. All dead and weak wood should be cut away. A good commercial crop will be produced two years after the rejuvenation pruning and a fair crop will be borne the first year following the pruning.

XI.—Pruning the Japanese Plum.

European plums are only grown in very limited quantities in South Africa as they do not do as well as the Japanese plums. As this is the case, the pruning of European plums need not be discussed.

Japanese plums bear on short spurs and laterally on one-year-old wood. The spurs bear from five to eight years and the bulk of the crop is borne on these spurs.

The training and pruning of young trees has been discussed. They are headed somewhat lower than the apple, about 12 inches to 18 inches from the ground.

The pruning of the bearing tree varies somewhat with the variety. With such varieties as the Santa Rosa, Wickson, Formosa, Gaviota and Kelsey, which make a compact, upright growth, an effort should be made to spread them out. Varieties such as the Satsuma and Burbank make a spreading type of growth and the necessity for thinning

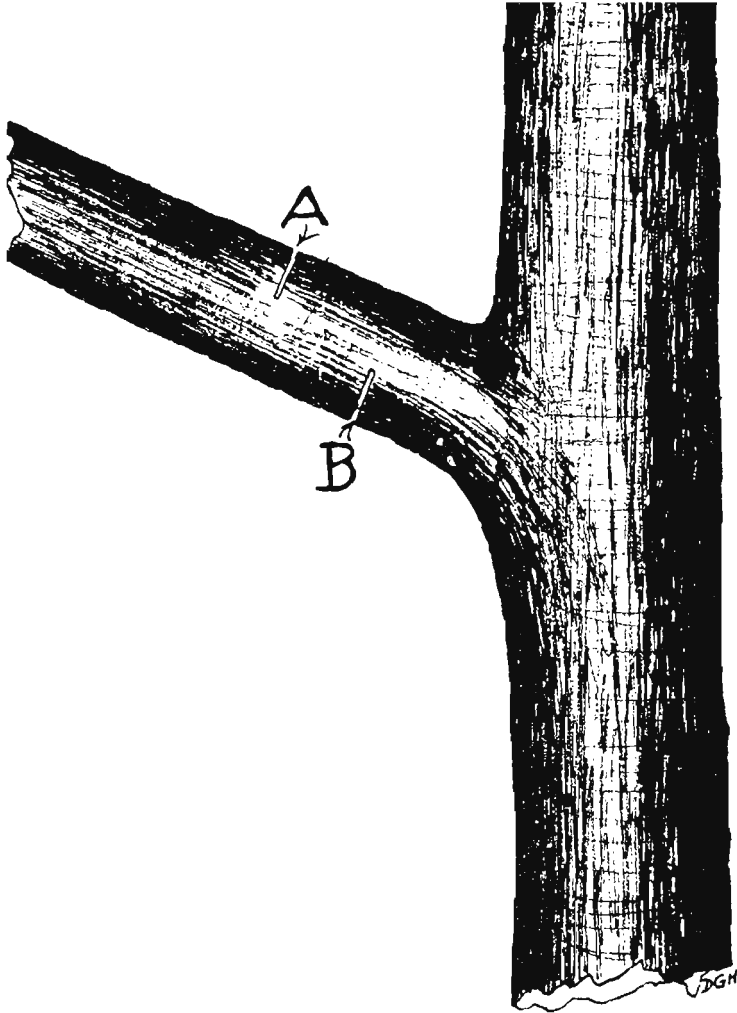


FIG. 9.—In removing a large branch the first cut should be made at B, the branch being cut partially through. Then the branch is cut off at A and no splitting will occur. When the branch has been cut off at A, the remaining stub should be cut away evenly with the trunk or branch from which it arose. The wound will heal over readily if it is made cleanly.

out upright laterals is not as important as with the other type of plum.

Many plums will be found to make long, straight and upright shoots that are very subject to wind injury. In many parts of the country, particularly in the summer rainfall areas, these shoots may reach a length of four to five feet. Many of these will be unbranched. Should these strong shoots be headed back, two or three new ones will arise from the immediate vicinity of each cut and thus the number of shoots in the top of the tree will be greatly increased. The resulting shading of the interior of the tree is very undesirable.

Long shoots arising from the top of a plum tree should be treated carefully. If they are longer than two feet they should be shortened into laterals. If they are unbranched, leave them alone for a year. A few should be thinned out, cutting them back to the lower branch from which they arose. At the next dormant pruning those shoots that were left uncut will be found to have thrown out numerous fruit spurs on half to two-thirds of their growth. One or more laterals will have developed and the shoot should be cut back to one of these laterals.

This thinning out of strong shoots and cutting the others in to laterals the following year, will encourage abundant spur formation and prevent excessive shading of the interior of the tree. Japanese plums frequently tend to carry too much fruit, with the result that the size of the fruit is small. As large-sized fruits are desired it is usually necessary to do some spur thinning. Numerous slender growths can be shortened in to about half their length. If they are branched, cut them back to a small lateral. When too many are carried, a few can be removed entirely. The short, thick spurs, which are one to three inches in length, should not be cut back. If too many are present, a few should be removed.

Clean cuts should be made in all instances, as water-sprouts arise readily from small stubs that are left by careless pruning.

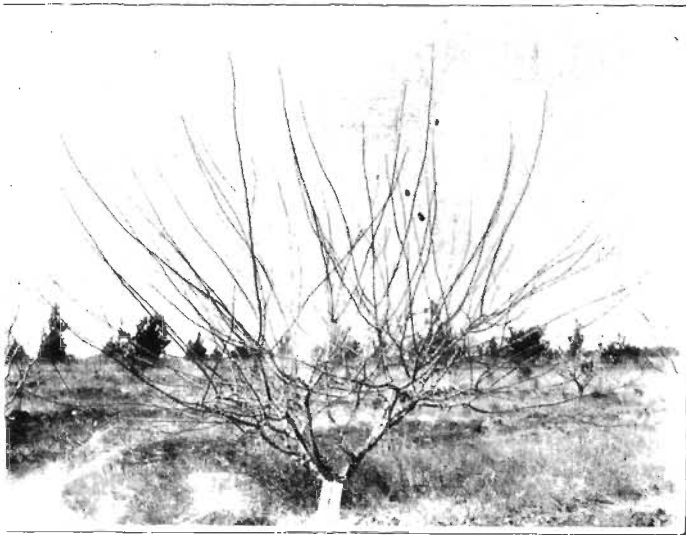


FIG 10.—Typical growth of the apricot following heading back. Many of these long shoots should be removed and others shortened in to laterals.

XII.—Pruning the Apricot.

Apricots bear mainly on short spurs that live about three years. A small proportion of the crop is carried laterally on wood of the previous season's growth.

More pruning is necessary with the apricot than with the Japanese plum, because the spur system is shorter-lived and its frequent renewal must be provided.

Under the climatic conditions in the Transvaal, the apricot tends to make very vigorous and lengthy growth during the summer months. This should be avoided and can best be done by cutting these long shoots back to laterals. The heading back of such vigorous growths would merely result in the development of two or three more in the place of each one that was headed back. When a shoot is cut back to a lateral, this stimulation of new shoot growth does not take place and spur formation results.

In cases where the apricot is making less than 12 inches of new growth each year, a certain amount of heading back is advisable. Such cases are the exception, and not the rule in South Africa, and would rarely occur with young trees. Hence, the general object with the apricot should be the encouragement of spur formation. This is best done through a moderate thinning out in order to allow sunlight to reach the interior of the tree. Those shoots that are not thinned out should be shortened in to laterals. Should no laterals have developed on a particular shoot, leave it unpruned for one season. This will cause the development of laterals and the shoot can then be shortened into one of them.

The resulting growth following moderate heading back is shown in Fig. 10. Many of these long shoots should be removed by cutting them back to the branches from which they arose. Some can be shortened in to laterals, but there are several in this particular instance that must be left to develop laterals during the next year. When they have done so, they can be shortened in to these laterals.

There is usually no necessity for thinning fruit spurs.

XIII.—Pruning the Almond.

Almonds bear laterally on short spurs and, to some extent, on one-year-old wood. The spurs remain productive for about five years.

The usual pruning of bearing almond trees consists mainly of a thinning out of the top to prevent shading out of the interior of the tree. Sufficient new growth must be developed to provide for a complete renewal of the fruiting wood every five years. Very long growths should be shortened to laterals and the small shoots should be thinned out. Fruit spurs should not be touched.

Should an almond tree not bear at the time that it should come into bearing, usually at five to six years of age, the trouble may be due to lack of pollination or too vigorous growth. Most varieties of almonds are self-sterile and, in order to set fruit, must be pollinized with pollen from some other variety. Some varieties are also inter-sterile and will not cross-pollinize. Several varieties should be planted together. In some areas climatic conditions are such that the almond makes such vigorous vegetative growth that fruiting is later than it should be. If this is the case, the pruning should be as light as possible and should consist solely of thinning out. Heading back would merely stimulate further growth and defeat the objects of the grower.

XIV.—Pruning the Cherry.

Cherries bear fruit mainly on short spurs that are productive for ten years or more. A small proportion of the crop may be carried at the base of vigorous growths of the previous season's development. As such is the case, the pruning of the sweet cherry is more like that of the apple and pear than like that of any other of the other fruits which bear on short-lived spurs or on new wood, as is the case with the Japanese plum, apricot and peach.

The object in pruning the young sweet cherry is to secure a strong framework and this is done in the manner previously

discussed under the pruning of young trees. As the development of cherry branches comes from terminal buds, and as lateral growths are not readily formed, there is a tendency for the cherry to form long, unbranched shoots. Some heading back may be necessary to counteract this growth habit. Once the framework of the tree has been well established, there should be a change from heading back to the mere removal of surplus growths by thinning out.

With bearing trees, the side growths tend to develop into fruit spurs, vegetative growth occurring only from terminal buds of the shoots of the previous season's growth. This should be avoided by heading back some of the upright laterals, otherwise the tree will become, too tall.

Pruning of bearing cherry trees consists, therefore, of light thinning out and some heading back in order to prevent the tree from becoming too tall.

XV.—Pruning the Quince.

Quinces are grown in South Africa chiefly as hedge plants and not in the usual orchard formation.

The quince is usually not pruned at all as it is grown primarily for the development of a hedge. Grown in such a way it produces some fruit, but if judicious pruning were followed, the quantity of fruit would be materially increased, and the value of the hedge, as such, would not be reduced.

The quince bears terminally on leafy shoots that arise laterally from wood developed during the previous season. As this is the case, the pruning of the quince should consist of thinning out surplus shoots. Severe thinning out will result in an open formation of the plant and the value of the hedge will be reduced, although fruit production will be increased. In order to compromise between maximum production of fruit and the full value of the plants as a hedge, it is recommended that moderate annual thinning out be practised.

XVI.—Pruning the Fig.

The fig in South Africa is usually not grown as an orchard fruit, but for the most part is planted in house gardens and along water furrows. Normally, the fig produces three crops a year, the first being borne laterally on wood of the previous season's growth and the second and third crops being borne laterally on wood of the current season's growth.

The fig is commonly developed with a low head and the normal selection of the framework branches is followed. Too low heading should not be followed and no branches should arise less than 24 inches from the ground. The fig tree borer (*Phryneta spinator*) causes serious losses in many fig plantings. The larvae gain entrance to the trunk near the surface of the ground. The chief control measure is to put fine wire netting^m around the trunk for a height of 24 inches. If branches arise below this point, it is very difficult to protect the tree against the ravages of the borer.

After the formation of the framework branches during the first two years, the annual pruning should consist of moderate thinning out of the top in order to admit sunlight, the removal of interfering branches and the removal of injured branches. All cuts should be cleanly made to a lateral and no stubs should be left. Heading back should not be done as it results in excessive shading of the interior of the tree.

XVII.—Pruning the Persimmon.

The Kaki or oriental persimmon is not grown to any marked extent in South Africa. Plantings usually consist of a few trees in household gardens. The quality of this fruit, and the ease with which it can be grown, warrant more extensive planting than has been the practice.

The pruning of young persimmon trees closely follows the method previously discussed. If the main scaffold branches have made very rapid growth at the end of the first year, they should be cut back to 18 inches to 24 inches,

in order that the secondary scaffolds will develop from the proper place. After this second dormant pruning, the pruning should consist solely of removing undesirable and crossing limbs and the checking of any laterals that outgrow the others. This latter point can be attained by pinching back the tender growth.

Mature persimmon trees bear fruit laterally on wood of the current season's growth. Pruning must aim at the provision of ample wood growth and this is accomplished by moderate thinning out of the top. Heading back should not be done, as it would result in excessive shading of the interior of the tree and resulting death of the interior fruiting wood. This, in turn, would result in the tree bearing fruit well out on the lateral branches and breakage would occur, as persimmon wood is very brittle.

XVIII.—Pruning the Orange and Grapefruit.

Evergreen trees, as a rule, require a minimum of pruning and this is particularly true of the citrus fruits. Growth and bearing habits of the orange and grapefruit are so similar that, with regard to pruning, they can be considered together.

When the young tree is planted out from the nursery it may or may not have the head already formed, but in most cases the head will have been formed in the nursery. Should it not have been formed in the nursery, the small whip-like tree should be headed back at 24 inches to 30 inches and it should be immediately whitewashed or protected from sunburn in some other way. Newspaper or grass wrappings are satisfactory for this purpose.

When the young shoots have grown out about four inches, three to five should be chosen as main scaffold branches. They should be well distributed up and down the trunk and around the trunk, as is the case with deciduous trees. The general tendency is to allow the scaffolds to arise too close together, which results later in crowding and the formation of a "pocket" in which water will collect. Very

low heading of citrus trees is not advisable because the pendulous habit of growth results in much fruit being lost through coming in contact with the ground. The writer favours heading the young tree at 30 inches or even at 36 inches.

Following the selection of the main scaffold branches, the only pruning that should be done is to thin out superfluous branches and to remove any that are not suitably situated. When two branches arise from the same point, or where two branches cross one another, one should be removed. This thinning out should be done at least every three months during the first year after planting and from then onward should be done at least twice a year. Careful training of the young tree is important and will result in the development of a well-formed, mechanically strong tree.

No shoots should be allowed to develop below the bud union.

Orange and grapefruit trees frequently bear a few fruits during their first and second years in the field. This is particularly true of the grapefruit. For the first two years these fruits should be removed before they become larger than walnuts in order that the young tree may utilize all available plant nutrients for vegetative growth. A well-grown, vigorous orange or grapefruit tree can be allowed to carry a small crop during its third year. If the three-year-old tree is not well-grown and strong, it should not be allowed to carry any crop.

Bearing orange and grapefruit trees require very little pruning. A well-grown tree assumes a more or less spherical shape and fruit carried on the lower branches may be injured by coming in contact with the ground. In order to avoid this, all branches should be removed to a height of 18 inches after the crop has been picked. The branches should be removed by "under-cutting" them to a lateral, and no stubbing back should be done. This removal of low-hanging branches facilitates and increases the efficiency of fumigation. The "skirting" or cutting away of branches to a height of three feet is not recommended and, fortunately, is not

carried out extensively. It results in a marked decrease in the potential bearing area of the tree.

Diseased, injured, crossing or interfering branches should be removed. Any branches partially killed by scale should be cut away. In removing a branch, regardless of the reason, it should be cut back to a lateral and no stub should ever be left as they heal over with difficulty, if at all, and form a source of entrance for wood-rotting organisms.

Trees only a few years of age will occasionally send up long, vigorous shoots. This is particularly true of the Valencia variety. If one of these arises, it can be shortened to a lateral. It should never be cut back for a half or one-third of its length because at the point where the cut is made, two or three vigorous shoots will arise and the position becomes worse than before. This does not occur when the shoot is cut back to a lateral. Should five or six of these vigorous shoots arise in the top of a young tree, they should be left untouched. The object of pruning back a single one is to preserve the symmetry of the tree. If several shoots arise in this way, there is nothing to be gained by removing them.

When water-sprouts arise (strongly vegetative shoots arising from the interior of the tree), they should be removed, unless they are wanted for filling in a gap. In case they are not desired, the removal should be done when they are still comparatively small, otherwise much energy of the tree will be wasted.

Dead wood on the interior of a mature orange or grapefruit tree will drop of its own accord if left alone. Many growers prefer to remove this worn-out fruiting wood. Whether the pruning out of the fine, dead fruiting brush is beneficial or not is doubtful, when it is present only in a normal amount. Should it be excessively abundant, it should probably be pruned away.

Pruning of all citrus trees can be done at any time of the year, except when they are in one of their periods of active growth. One of the most satisfactory times is in the winter immediately following harvesting of the crop.

Should the crop not be picked until September, October or later, the pruning can be done after that time at the first period when the trees are more or less inactive.

XIX.—Pruning the Lemon.

The treatment of young lemon trees is the same as for young oranges and grapefruit, the object being to secure a strong framework and maximum development of the young tree.

The effect of severe pruning with any citrus varieties is to cause a reduction in the yield for two or three years following the pruning. The recovery of a tree following heavy pruning depends on the age of the tree, the variety, the severity of the pruning, and soil and moisture conditions.

Lemon trees frequently send up long, vigorous shoots from the top of the tree. Should fruit be borne at the ends of such shoots, they will bend downward and will be very subject to wind injury and sunburn. In cases where such shoots are more than four feet long, it is advisable to cut them back to a lateral. If no lateral is present, leave the shoots until a lateral develops and then shorten them in. To head back these growths would be a serious mistake, as several shoots would arise from the vicinity of each cut and the top of the tree would become thicker than ever.

Diseased, interfering, injured and crossing limbs should be removed, and beyond this, very little pruning of the lemon is recommended. Low-hanging branches may be cut up to 18 inches, the cut being made to a lateral in all cases. It must not be expected that the lemon tree will make as symmetrical and compact a tree as the orange or grapefruit. Its natural habit of growth is to form an open, somewhat straggling type of tree.

Old lemon trees that are not forming sufficient new wood to maintain high production should be given a moderate annual thinning out in order to encourage the development of new wood.

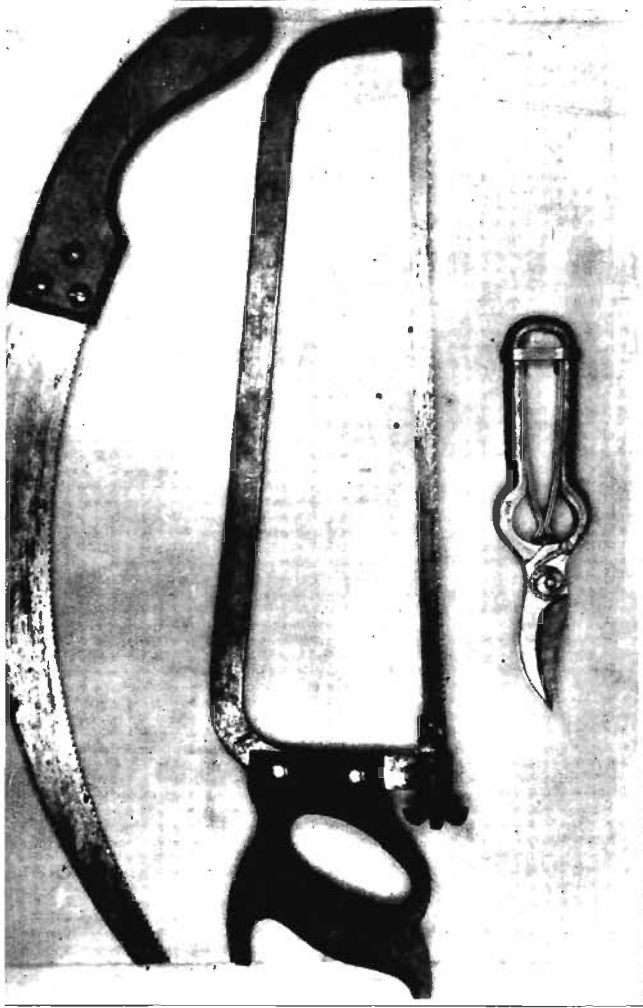


FIG. 11. Pruning tools. From top to bottom: Curved pruning saw, California pruning saw, Reiser hand shears.

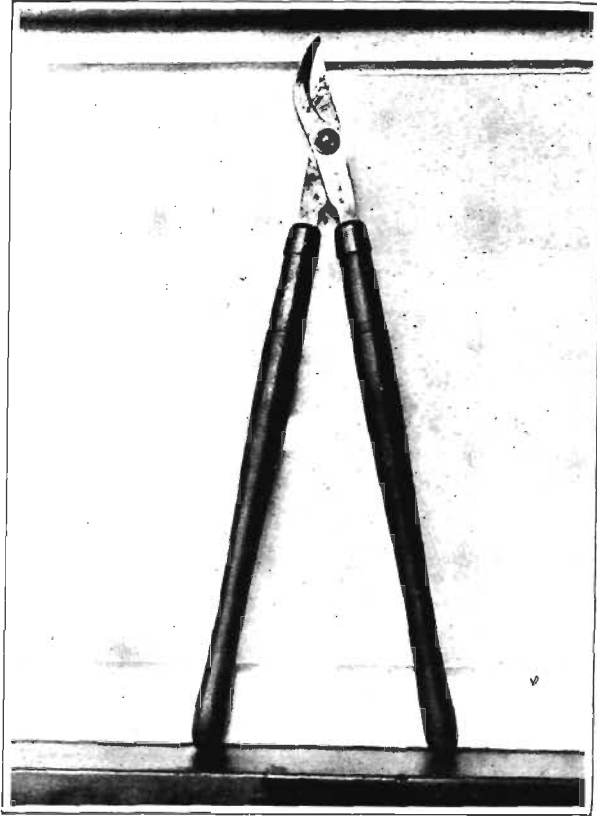


FIG. 12.—Long-handled pruning shears.

XX.—Pruning Tools.

In Fig. 11 are illustrated the recommended types of pruning implements. The long-handled shears shown in Fig. 12 are very useful and should form a portion of the equipment of every fruit grower.

The best hand shears are made by Reiser (Switzerland). They are more expensive than other makes, but will be found much more satisfactory in every respect.

The California pruning saw is a most useful implement for cutting large limbs, particularly when the cut is to be made in a position that is difficult to reach. The blade can be turned in any direction, independently of the balance of the saw.

The curved saw is useful and may be preferred by some to the California pruning saw.

XXI.—Fruit Thinning.

Thinning of many of the deciduous fruits is an essential orchard practice if maximum quality is to be obtained. Thinning of fruit is a practice intimately connected with pruning, but with the average small grower it has been given little attention. Trees which carry a large crop of fruit are unable to bring this fruit to the best market size, and under-sized fruit is always heavily discounted on the market. An unthinned tree may or may not produce a greater weight of fruit than a thinned tree depending on the amount of thinning given the latter tree. In any case, there is no question but that the *value* of the fruit on the thinned tree will be much greater than that of the fruit on the unthinned tree. The grower is much more concerned with the value of the fruit than with the actual quantity of fruit. Thinning also reduces the cost of handling the crop, as there are fewer fruits to pick, grade and pack.

The first step in fruit thinning is during the winter pruning of the trees. At this time there can be some reduction of bearing wood, if the condition of the tree warrants it.

It is with this object in view that the shortening of long shoots of the peach and plum is recommended.

Hand thinning of blossoms is not advisable, aside from its being a costly operation, as the amount of bloom is no indication of the amount of fruit that will be set. Late frosts may cause severe blossom injury. Unfavourable climatic conditions may cause an abnormally heavy dropping of the blossoms and very young fruits. Should thinning be done before danger of fruit drop is over, it may result in a crop that is much too light.

Thinning should be carried out when the usual fruit drop has occurred and before hardening of the fruit pits. The fruit will be just under the size of walnuts at this time.

The distance to be left between each individual fruit varies with the species, variety, size, age and vigour of the particular tree. A strong, healthy spur can carry more fruits than a thin one not in a vigorous condition.

Thinning Apples.

Apples frequently develop clusters of fruits, and when this occurs only one fruit should be left where each cluster formed. Compound and long spurs should not be allowed to carry fruits closer than four to six inches apart. With large-fruited varieties, such as the Ohenimuri, the distance apart should be six inches.

Thinning Pears.

Pears also tend to bear in clusters and should be thinned out in the same manner as the apple. The fruit naturally tends to enlarge somewhat better than the apple and two to three pears can be left where each cluster forms. With large-growing varieties, such as the Kieffer and Bosc, it is advisable to leave three in a cluster, but with small to medium sized varieties, such as the Winter Nelis or Forelle, two are sufficient.

Thinning Peaches and Nectarines.

Thinning of the peach is of extreme importance if large-sized fruit is desired. There is very little demand for under-sized peaches for fresh consumption, drying or canning, and as the peach responds readily to thinning, it should be done thoroughly.

Peach "doubles" should either be removed or left; they should never be split. Whether they should be left or removed depends on the proximity and quantity of other fruits. If a single peach is only two inches from a "double," the latter can be removed. If there are sufficient single peaches on the tree to give a good crop, "doubles" should be removed. Peaches should be thinned out to six to eight inches apart. If soil, moisture, fertility and climatic factors are satisfactory, this will ensure the development of large-sized fruit.

Nectarines usually do not set as much fruit as the peach, but in cases when they do, the thinning should be carried out as with the peach.

Thinning Japanese Plums.

Japanese plums commonly set a very large amount of fruit and if all are allowed to develop they will be of small size. Large-sized fruit is desired with the plum and thinning is essential to secure this.

Japanese plums should be thinned out so that three to four inches separate them when the thinning is completed.

Thinning Apricots.

Apricots also respond very well to thinning. They should be thinned out to three to four inches apart on strong shoots and short spurs of one or two inches in length should only be allowed to carry a single fruit.

Fruits that set toward the end of long shoots should be removed, as the presence of fruit toward the end of a long

shoot will cause it to bend outward too much. Even though breakage of the branch may not occur, the fruit is exposed to the direct rays of the sun and is very liable to sunburn. Fruit toward the base of long shoots is thinned in the usual way so that three to four inches separate each one.

Thinning the Almond.

No thinning of the fruit is practised with the almond or any of the other nut fruits.

Thinning the Cherry.

No thinning of the fruit is practised with the cherry.

Thinning the Quince.

No thinning of the quince is recommended. When it is grown in hedge formation there should be no tendency to over-produce.

Thinning the Fig.

No thinning of the fig is desirable.

Thinning the Japanese Persimmon.

When any variety of persimmon tends to over-bear, it should be thinned moderately. Clusters of fruit should be reduced to one or two fruits.

Thinning Citrus Fruits.

Thinning of oranges and lemons is a practice that is not recommended. The removal of fruits on one- and two-year old trees is advisable, but is hardly to be considered as thinning.

Grapefruit trees bear in clusters and very heavy clusters should probably be thinned out somewhat. The market demand, however, is for a medium sized grapefruit rather than for a large-sized one and the question of thinning clusters depends largely on the vigour of the tree. A strongly growing tree will probably size up its fruit with no thinning, whereas a weak tree might not. Thinning is therefore a practice, in the case of the grapefruit, that must be left to the judgment of the individual grower.

XXII.—Purchase of Nursery Trees.

For the small fruit grower, the purchase of nursery trees is more satisfactory than the growing of them himself. Nursery work is a specialized business and when carried out conscientiously by an expert, the results are bound to be more satisfactory than when the work is done by a novice, no matter how well-meaning the latter may be.

At least two years are required for the production of a nursery tree ready for planting in the field and for the average small grower this saving of time through the purchase of trees is an important consideration. An experienced fruit grower who wishes to extend his plantings, or a large company developing land, can grow nursery trees successfully, but in the majority of cases it is advisable for the prospective grower to procure his trees from an established nurseryman.

There are various factors to be considered in the purchase of nursery trees as there are in the purchase of any other article. Young fruit trees may be good, bad or of indifferent quality, and as the future success of the orchard depends largely on the character of the trees it comprises, it is of the utmost importance that the very best trees available be secured.

All living organisms have inherently different rates of growth. If a thousand seedlings of any species are planted, it will be found that some grow more rapidly than others, even though environmental conditions are similar. Slow-growing trees will never become as large as those which

grow more rapidly and hence will never be able to carry such heavy crops of fruit.

When a block of nursery trees reaches a certain age, those which are large enough are sold first and the smaller ones are allowed to remain for a year or two years more, depending on their size, before they are sold. At the end of two years from budding or grafting, a further lot of the trees will have reached saleable size, but it took them two years to reach this size, while the first trees reached this size in a single year. The planting of an orchard with comparatively slow-growing trees is obviously an undesirable practice.

The purchaser should specify trees that are one year old from the time of budding or grafting, as the case may be. If a tree is old enough for sale at the end of one year, it is *prima facie* evidence that it is a rapidly-growing, vigorous tree. When one-year-old trees are planted, the grower can be certain that he is not getting any slow-growing, stunted trees that will never thrive, even though they be given the best of treatment and environment. Further, one-year-old trees stand the shock of transplanting better than older trees.

With apples, pears, European plums, cherries and prunes, the head of the tree is not usually formed until it is in its second year, and as such trees as one-year-olds are merely whips, the grower can form the head in any manner he wishes, if he purchases them when they are one year old.

Medium to large one-year-old trees should be specified and small trees should be avoided, for the reasons given. Second or third grade trees are very liable to be under-sized because they are inherently slow growers. The saving of sixpence a tree when the initial purchase is made may mean a loss of a pound or more a year when the trees come into bearing. The very best nursery tree is by far the cheapest in the long run.

A two-year-old nursery tree will not bear any sooner than a one-year-old tree. When four- or five-year-old trees are transplanted, they will bear a little earlier than is the case

when very young trees are planted. The planting of comparatively old trees may be satisfactory for the householder who is planting his back garden, but it should never be done by the commercial fruit grower. Old trees may be of a slow-growing nature and their scaffold branches may not be established according to the desire of the planter.

The distance of the source of the trees is immaterial as trees can be packed in such a way that they can be successfully transported for long distances. The trees should be purchased from the most reliable nurseryman, regardless of his distance from the planting site.

Order medium to large one-year-old trees and secure them from the most reliable nurseryman possible, because, to a large extent, the inherent character of the trees will determine the future productivity of the orchard.

*Summary of Fruit Bearing and Pruning.*⁶

Fruit.	Location of Fruit Buds Considered at time of Winter Pruning.	Suggested Pruning Methods.
Quince ..	Terminal on leafy shoots, arising from previous season's growth.	Thin out surplus shoots.
Apple .. Pear ..	Mainly on spurs that bear 8-10 years or more. Infrequently on one-year-old spurs and shoots.	Light annual pruning. Thin out surplus shoots and remove interfering branches. Little or no heading back. Preserve spurs.
Peach .. Nectarine	Laterally on twigs and shoots of the previous season's growth.	Heavier pruning than with other fruits. Shorten main branches to laterals, thin fruiting shoots to maintain ample new growth. Shorten long fruiting shoots.
Apricot ..	Mainly on short, straight spurs that bear about three years. Lightly on long one-year-old branches.	Shorten main branches to laterals and thin out top to admit sunlight to centre. Leave fruit spurs as long as they are productive.
Japanese Plum ..	Mainly on short, straight spurs and some laterally on one-year-old branches. The spurs remain productive 5 to 8 years.	Very similar to the apricot. Thin out top and centre, cutting back to laterals. Shorten long one-year shoots that will carry fruit.
Sweet Cherry.	Mainly on short spurs of older wood and near base of vigorous new wood of previous season's growth.	Thin top and occasionally head back strong laterals. Remove interfering branches.
Almond ..	Laterally on short spurs and on one-year-old wood. Spurs remain productive about five years.	Thin out the top by cutting back to laterals. Thin small shoots on interior of the tree.

⁶ Adapted from table by F. J. Crider, "Pruning Fruit Trees in the Southwest," Univ. Arizona, Ag. Exp. Sta., Bul. 118, December, 1926.

Summary of Fruit Bearing and Pruning—continued.

Fruit.	Location of Fruit Buds Considered at time of Winter Pruning.	Suggested Pruning Methods.
Fig	First crop laterally on wood of previous season's growth. Second and third crops laterally on current season's growth.	Very moderate thinning.
Persimmon	Laterally on wood of current season's growth.	Moderate thinning of the top and removal of interfering branches.
Citrus Fruits	On shoots of the current season's growth.	Removal of interfering branches and low branches to height of 18 inches. Removal of diseased and injured limbs.

Bibliography.

1. W. P. Tufts, "Pruning Bearing Deciduous Fruit Trees," Univ. Calif., Ag. Exp. Sta., Bul. 386, April, 1925.
2. W. P. Tufts, "Pruning Young Deciduous Fruit Trees," Univ. Calif., Ag. Exp. Sta., Bul. 313, October, 1919.
3. H. B. Terry, "Pruning of Deciduous Fruit Trees," Union of S.Af. Dept. Agric. Bul. 5 of 1921, May, 1921.
4. F. J. Crider, "Pruning of Deciduous Fruit Trees in the Southwest," Univ. Arizona, Ag. Exp. Sta., Bul. 118, December, 1926.
5. R. E. Marshall, "Pruning Fruit Trees," Mich. State College, Sp. Bul. 118, October, 1922.
6. Niswonger-Olney, "Pruning Fruit Trees," Univ. Kentucky, Ag. Exp. Sta., Circ. 92, March, 1921.
7. O. H. S. Reinecke, "Some Results of Pruning Experiments with Deciduous Fruit Trees," Stellenbosch-Eisenburg Coll. Agric. Far. Bul. 2, June, 1928.
8. W. H. Chandler, "Results of Some Experiments in Pruning Fruit Trees," Univ. Cornell, Bul. 415, January, 1923.
9. R. W. Hodgson, "Pruning Citrus Trees in California," Univ. Calif., Ag. Exp. Sta., Bul. 363, May, 1923.
10. Shamel-Pomeroy-Caryl, "Pruning Citrus Trees in the Southwest," U.S. D.A. Far. Bul. 1333, June, 1923.
11. E. J. Wickson, "California Fruits," Pacific Rural Press, 1919.
12. J. H. Gourley, "Text-book of Pomology," The Macmillan Co., 1922.
13. Duke of Bedford-S. Pickering, "Science and Fruit Growing," The Macmillan Co., 1919.
14. Gardner-Bradford-Hooker, "Fundamentals of Fruit Production," McGraw-Hill Book Co., 1922.
15. R. A. Davis, "Fruit Growing in South Africa," Central News Agency, 1928.
16. L. H. Bailey, "The Pruning Manual," The Macmillan Co., 1923.
17. J. E. Coit, "Citrus Fruits," The Macmillan Co., 1915.
18. H. H. Hume, "The Cultivation of Citrus Fruits," The Macmillan Co., 1926.
19. W. H. Chandler, "Fruit Growing," Houghton Mifflin Co., 1925.
20. John Maher, "Some Remarks on Pruning and Training Standard Apple and Pear Trees," Transactions of the Horticultural Society of London, vol. 1, p. 237, 1812.