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and H. D. HOOTMAN



**MICHIGAN STATE COLLEGE**  
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# PRUNING YOUNG FRUIT TREES

By ROY E. MARSHALL, H. A. CARDINELL,  
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Aside from fire blight and winter injury, the length of life of apple trees in reasonably well sprayed orchards in Michigan is affected more by the spacing of the main limbs and the angles formed by these main limbs with the tree trunk than by any other factors. Many years before a tree's collapse, its usefulness may be impaired by poor spacing and weak angles. In avoiding this trouble, forethought is infinitely more valuable than remedial measures, which are often virtually impossible.

During the last ten years, experimental evidence has displaced many of the opinions formerly held as to the proper pruning for young trees. In particular, it has shown that the vigorous growth which follows heavy pruning is largely devoted to replacing what was taken away and the net gain is much less than it would have been had no pruning been done. The utilization of nitrogenous fertilizers promotes vigorous growth, and, at the same time, permits the retention of what had already been attained. Indeed, so far has the pendulum swung that apostles of no pruning are likely to overlook the very real need of utilizing pruning to direct growth into such channels that a sound framework will be developed.

This bulletin presents experimental evidence and observation gathered in Michigan on several varieties which are more or less common in the orchards of the State.

## The Effect of Pruning on Growth and Yield

The general effects of pruning are indicated in an experiment carried on at the Graham Horticultural Experiment Station at Grand Rapids. The trees used in this experiment were planted in the spring of 1919. They were all pruned in a similar manner at the time of planting. From 1920 until 1928, groups of nine trees of each of the five varieties were subjected to three pruning treatments: (1) no pruning, (2) light pruning, and (3) moderately severe to heavy pruning.

This was in no sense a tree training experiment. Each spring the heavily pruned trees were thinned sufficiently to avoid closely parallel, crowding and crossing branches and there was enough thinning and heading to prevent the development of sharp angled crotches. In fact a cut was made wherever there seemed to be a legitimate excuse for making it. As the trees became older, less heading was done. This treatment would not be regarded as severe by many growers because it was for the most part confined to an annual thinning out of the shoots produced during the preceding season.

The treatment for the lightly pruned trees was intermediate between no pruning and the so-called heavy pruning. During the first few years of the experiment, the amount (weight) of wood removed was about half that cut from the heavily pruned trees. As these trees became older larger branches were removed, and, finally, because of density and larger size, the prunings from the lightly pruned trees weighed more in some instances than those from the heavily pruned ones. The pruning was, nevertheless, light in proportion to the size and density of the trees.

The records for tree size (Table 1) were made in the spring of 1928, and the yields are totals per tree from the time the trees came into bearing up to and including the season of 1927.

**Table 1. The effect of severity of pruning on size and yield of apple trees. Growth measurements made at nine years from planting. Yields are totals per tree for the nine-year period.**

| Variety and pruning treatment    | Average size of trees        |                    |                    | Yield per tree (bu.) |
|----------------------------------|------------------------------|--------------------|--------------------|----------------------|
|                                  | Trunk circumference (inches) | Tree spread (feet) | Tree height (feet) |                      |
| <b>DUCHESS:</b>                  |                              |                    |                    |                      |
| None.....                        | 14.2                         | 13.8               | 16.3               | 2.9                  |
| Light.....                       | 13.7                         | 13.3               | 17.0               | 1.7                  |
| Heavy.....                       | 12.2                         | 11.4               | 15.5               | 1.1                  |
| <b>GRIMES:</b>                   |                              |                    |                    |                      |
| None.....                        | 15.3                         | 15.3               | 16.8               | 4.4                  |
| Light.....                       | 15.1                         | 14.8               | 16.4               | 4.9                  |
| Heavy.....                       | 15.6                         | 16.3               | 16.0               | 3.1                  |
| <b>BALDWIN:</b>                  |                              |                    |                    |                      |
| None.....                        | 17.7                         | 17.6               | 15.6               | 1.8                  |
| Light.....                       | 17.6                         | 16.5               | 16.2               | 0.5                  |
| Heavy.....                       | 16.7                         | 15.4               | 14.6               | 0.4                  |
| <b>STAYMAN:</b>                  |                              |                    |                    |                      |
| None.....                        | 16.8                         | 20.9               | 17.4               | 3.7                  |
| Light.....                       | 16.4                         | 19.7               | 17.2               | 2.8                  |
| Heavy.....                       | 15.0                         | 18.5               | 16.5               | 1.8                  |
| <b>NORTHERN SPY:</b>             |                              |                    |                    |                      |
| None.....                        | 17.3                         | 14.9               | 17.9               | 0                    |
| Light.....                       | 15.7                         | 12.4               | 16.6               | 0                    |
| Heavy.....                       | 14.1                         | 11.4               | 15.4               | 0                    |
| <b>AVERAGE OF ALL VARIETIES:</b> |                              |                    |                    |                      |
| None.....                        | 16.3                         | 16.5               | 16.8               | 2.6                  |
| Light.....                       | 15.7                         | 15.3               | 16.7               | 2.0                  |
| Heavy.....                       | 14.7                         | 14.6               | 15.6               | 1.3                  |

Of the five varieties listed in Table 1, Duchess, Stayman, and Northern Spy trees were materially dwarfed by pruning and the dwarfing was proportional to the severity of the pruning treatment. This is well brought out in Figures 1-4, showing 10-year-old Northern Spy trees pruned each year in varying amounts. The heavily pruned Baldwin trees were noticeably smaller than unpruned ones but light pruning did not result in trees appreciably smaller at the end of nine years. On the other hand, pruning has had no considerable effect on the size of Grimes trees at nine years of age. The Northern Spy trees had not come into bearing and showed the greatest differences in size due to



treatments. The portions of the unpruned trees above the point of origin of the lower branches were approximately twice as large as those of the heavily pruned ones. The averages for the five varieties show that the tree trunks of the unpruned trees were about 11 per cent larger at nine years of age than those of the heavily pruned trees. Furthermore, the average unpruned tree had about a 13 per cent greater spread and was 8 per cent taller than the average heavily pruned one.

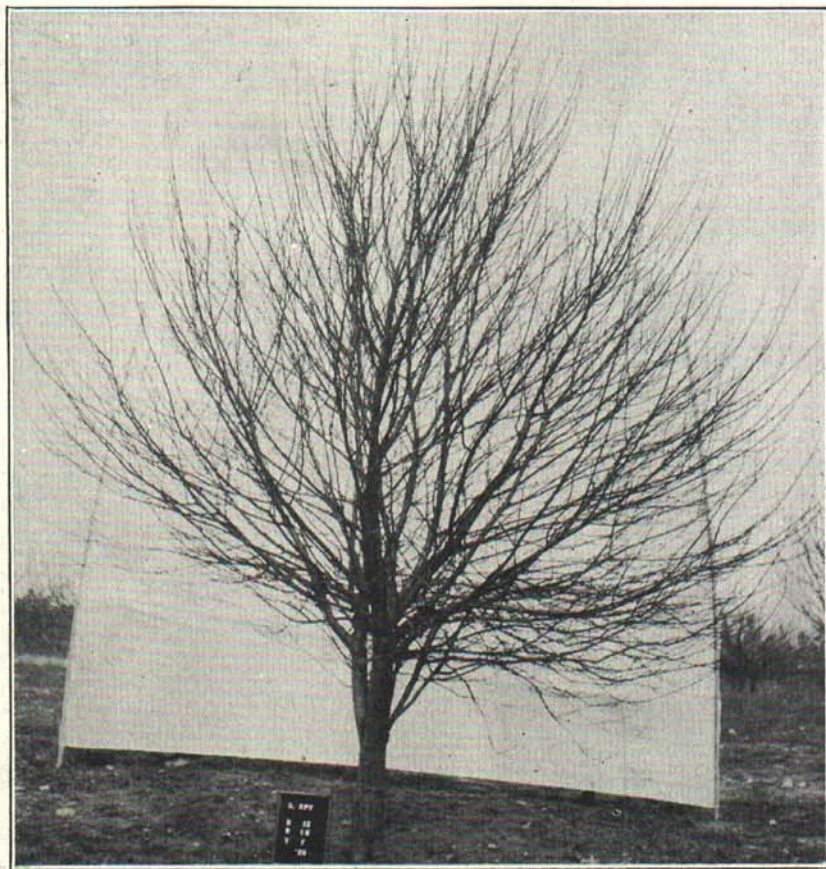


Fig. 1. A ten-year-old Northern Spy tree that has not been pruned except for a reduction of top at time of planting. Compare size with the trees shown in Figures 2 and 3.

All of the varieties except Baldwin and Northern Spy produced some apples during the sixth season in the orchard. Pruning did not delay the time of first fruit production but the unpruned trees yielded much more fruit than either of the pruned lots during the first several years of fruiting. The yields were inversely proportional to the severity of the pruning treatments, except in the case of Grimes. On the average, the unpruned trees at nine years of age have yielded twice as much



fruit as those heavily pruned and the yield of the lightly pruned trees was intermediate between those of the other two treatments.

In general, pruning of young trees may be expected to result in some dwarfing and this reduction in size will probably be proportionate to the severity of the pruning. Some varieties, however, such as Grimes, may apparently be pruned moderately without materially reducing either size of tree or yield of fruit during the early life of the orchard.



Fig. 2. A ten-year-old Northern Spy tree that has had light annual pruning. Compare with trees shown in Figures 1 and 4. This tree has not been "trained" and is not shown for the purpose of illustrating an ideal framework.

Mention should be made of the fact that pruning temporarily stimulates growth. This stimulative effect lasts until balance between root and top is reestablished. For the most part, this growth stimulation is evident in the immediate vicinity of the pruning cut. In reality, however, the tree is dwarfed in proportion to the severity of the pruning treatment because the new growth produced by the pruned tree is not

enough greater than that produced by the unpruned tree to compensate for what is removed in pruning.

### Pruning of Young Trees Essential

In spite of the fact that pruning results, at least temporarily, in some reduction in tree size and bearing capacity, it must be regarded as an essential orchard practice because there is no other practicable method

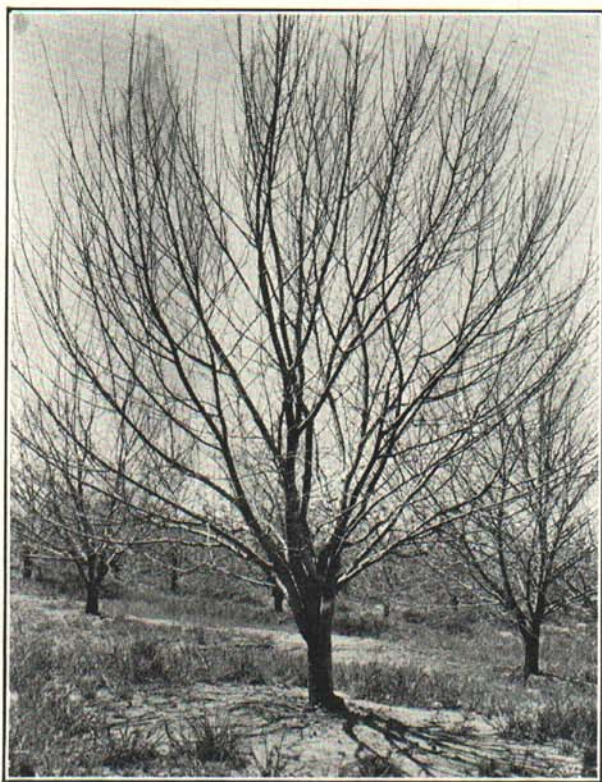


Fig. 3. Same tree as shown in Fig. 2 at 15 years. Very poor crotch formation resulting from failure to space scaffold branches properly. A good tree otherwise.

of developing a strong framework that will support the bearing portions of the mature tree in later years. Weaknesses which are likely to develop in untrained or improperly trained trees and methods of avoiding these weaknesses are discussed in the following pages. The grower, however, should constantly bear in mind that every pruning cut will tend to limit tree size and early fruit production. Therefore, the amount of pruning afforded young trees should be only such as is absolutely essential to the development of a strong framework. No other objective can be obtained by pruning the average tree during its first



five seasons in the orchard. As soon as the framework is satisfactorily established, pruning may be discontinued until the tree comes into full crop production, except perhaps for a limited amount of shaping incident to the correction of wayward growing tendencies. In case of doubt as to the proper treatment, it is always preferable to underprune rather than overprune.

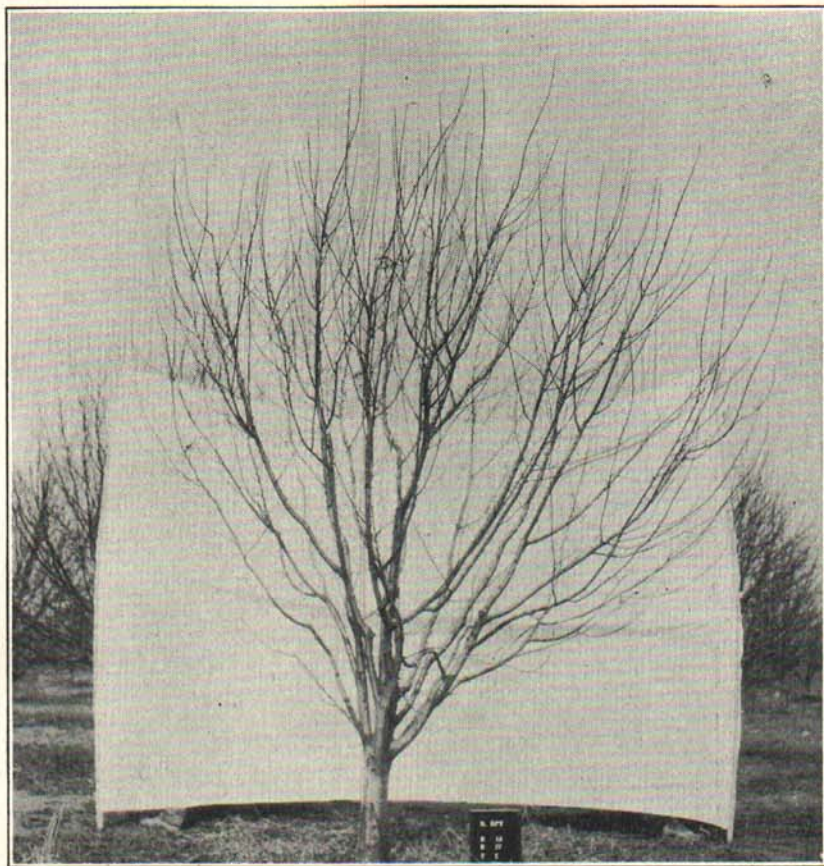


Fig. 4. A ten-year-old Northern Spy tree that has had comparatively heavy annual pruning from the time it was planted in the orchard. Compare with trees shown in Figures 1 and 2.

#### **Pruning the Nursery Tree at Planting Time**

When a fruit tree is dug from the nursery, a large part of the absorbing root system is left in the soil. This destroys the balance between top and root and, unless the top is pruned at planting time to reduce what would otherwise be a relatively large leaf bearing surface, the leaves may require more moisture than the greatly reduced root system can supply. The result may be the loss of the tree from drying out.



The survival of newly planted trees and the amount of growth made during the first season in the orchard is often proportional to the severity of the pruning treatment. The specific treatments for trees of each of the several species commonly grown in Michigan are discussed in other portions of this bulletin.



Fig. 5. Divided leadership too often results in a ruined tree.  
A sharp angled crotch usually results in a weak union.

### Heading Back Versus Thinning

Thinning or thinning out refers to the removal of an entire branch or shoot. Heading or cutting back refers to the removal of the terminal portion of a branch or shoot. These two kinds of pruning are followed by different types of growth response. When a tree or branch is thinned, the principal growth is from the terminal buds that remain, though of course there is some growth from lateral buds. Thinning



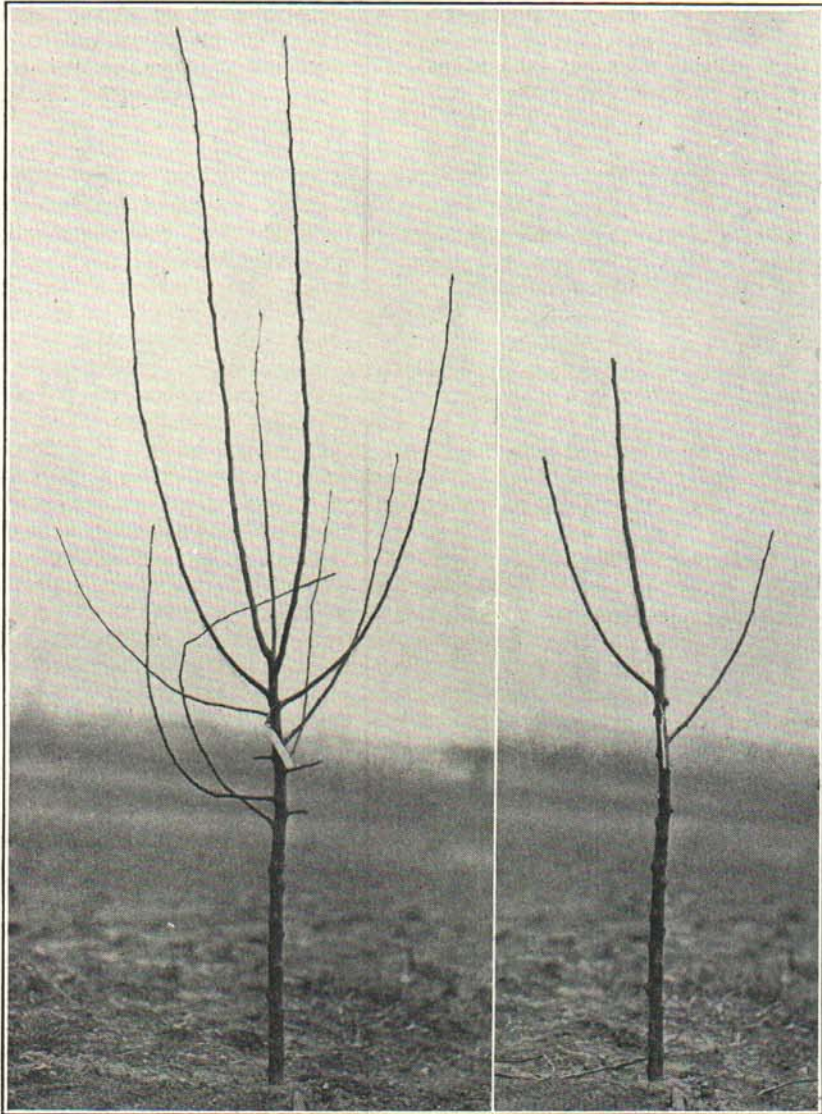


Fig. 6. A vigorous McIntosh tree before and after pruning. Only three of ten shoots were saved. One of the vigorous upright ones was selected for the leader and the other two as the lowest main lateral or scaffold branches. A greater number of scaffold branches were not selected because the lowest ones were too close to the ground and two of the higher ones formed sharp angles that might develop weak crotches. Even then the two scaffold branches selected originate closer to each other than is desirable.

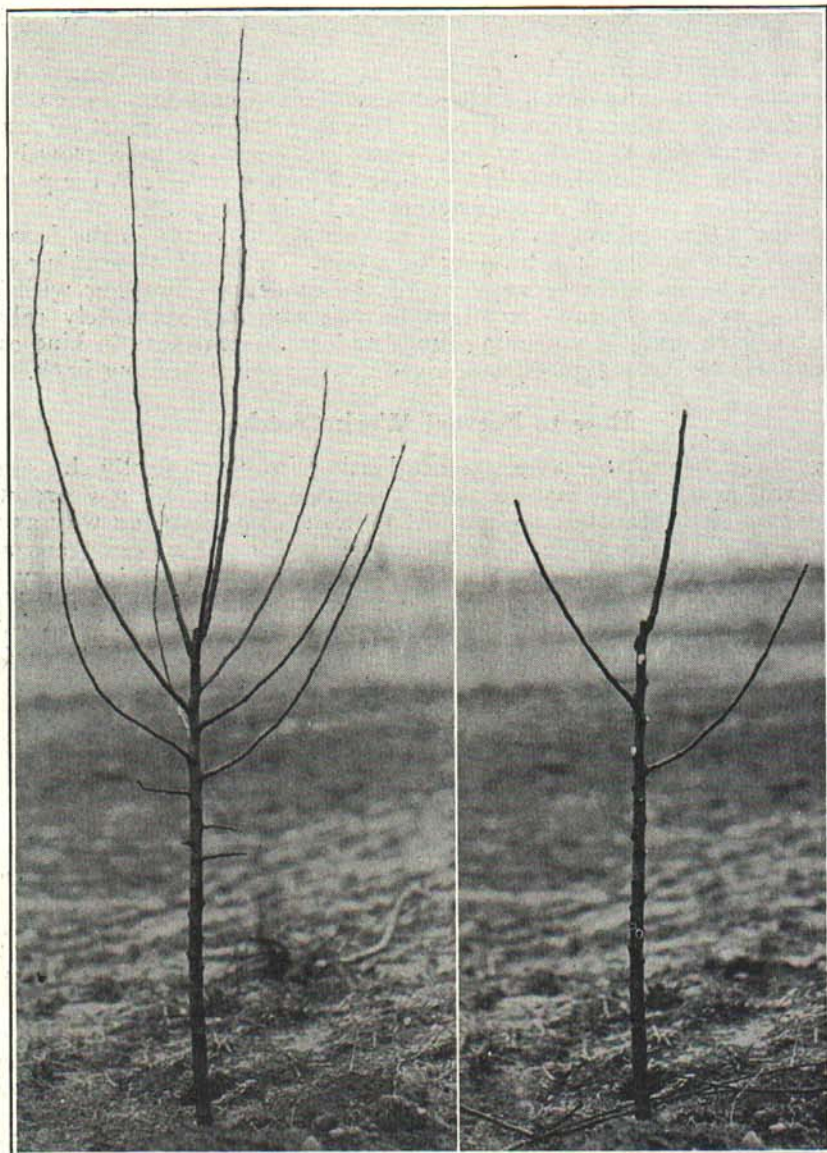


Fig. 7. Two wide angled laterals are selected to form the lower scaffold branches with as much space between their points of origin as is possible. The leader is left a little longer than the lateral shoots. In this case the leader should have been left a trifle longer.



encourages the development of a more permanent and extensive fruiting system.

When a shoot is headed or cut back, several lateral buds immediately below the cut usually develop into shoots. This results in a more dense top than characterizes thinned trees. Heading, however, must be practiced to some extent in the young orchard to force out new growth at desired points. When shoots longer than 20 inches are left in the young tree, legginess and lack of compactness is likely to result.

Cutting a branch back to a lateral or side shoot results in the formation of fewer shoots than heading to a bud. This kind of pruning can sometimes be made to serve some of the objects of heading without resulting in a dense top. It might be more or less accurately called thinning back, as it is a pruning more or less intermediate in kind and in response between typical thinning out and typical heading back.

### **How to Prevent Weak Crotches**

Two branches of the same size originating from practically the same point will usually give rise to about the same amount of new growth. When two such branches are permitted to develop in such a way as to form a Y or sharp angle, a weak crotch is formed unless steps are taken to strengthen it (Figure 5). This is due to the tendency to develop layers of bark between the two branches instead of bridge wood. Sharp angled crotches of this type are almost certain to split under the strain of heavy crops of fruit or heavy winds. Wide angled crotches are stronger and seldom break (Figure 7).

Heading back or shortening one of the two will dwarf that one so that it becomes a lateral or side branch of the one that is pruned less severely.

### **Where to Make the Cuts**

The pruning cuts made in removing a limb or in cutting a leader back to a lateral or side branch should always be made as close to the branch to be saved as is possible. Close cuts heal more rapidly than those in which stubs are left. The shears should be used in such a way that the cutting edge is next to the parent branch or the one that is to be saved, and, with limbs more than a half inch in diameter, a thin bladed saw is preferable.

When shoots are cut back, it makes little difference whether the cut is made very close to a bud or some little distance above it. If the cut is made close to a bud, the shoot developing from it will grow more nearly in line with the direction of growth of the parent branch than will be the case where a short stub is left, but this is of little practical importance except possibly with trees one and two years old. Some advantage in desired spread may be gained when pruning horizontal branches by cutting shoots back to outside buds or even to upright buds.

### **When to Prune**

Young trees should be pruned in late winter or early spring. The cut surfaces are less likely to dry out than when the pruning is done in the fall or early winter. When pruning is delayed until the bark loosens, tearing of the bark is likely to retard the healing of the wounds

by several years. Under Michigan conditions nothing is gained by pruning young trees during the summer, except as recommended for young peaches. Furthermore, summer pruning usually results in further dwarfing of the trees.

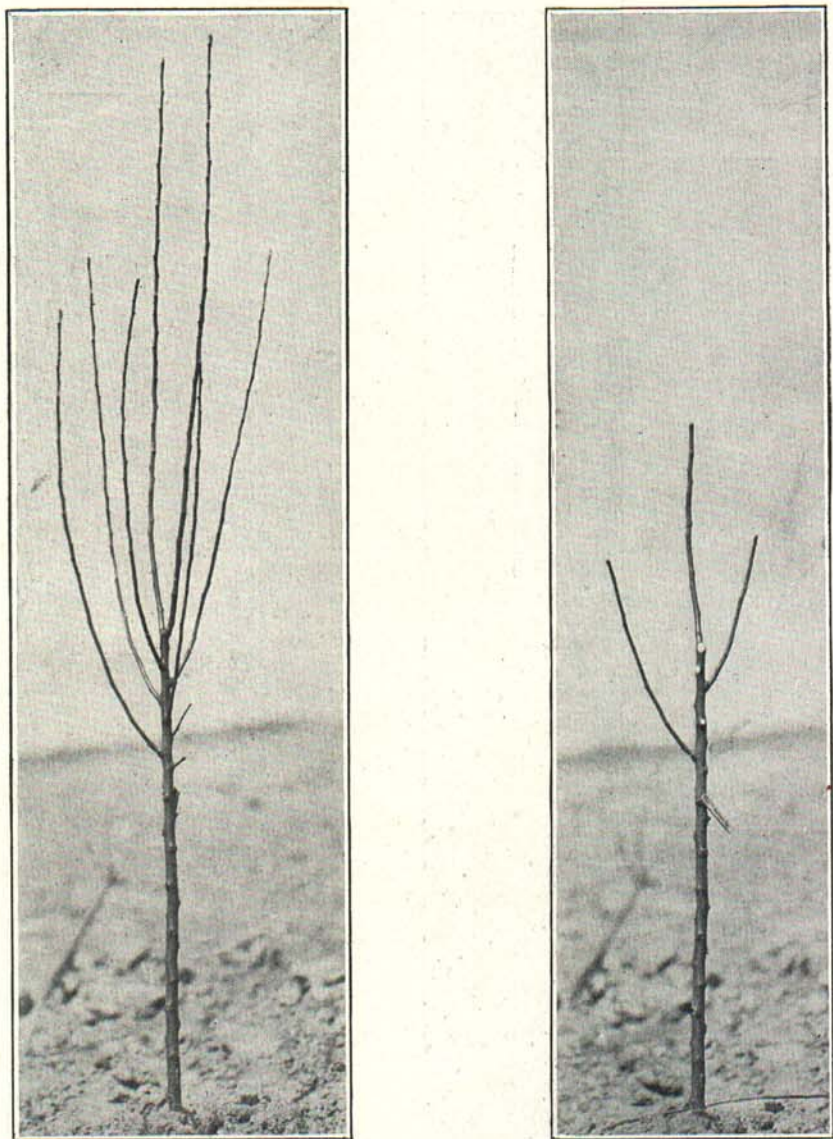


Fig. 8. A Northern Spy tree (grown two years in the nursery) from which four shoots were removed to obtain a satisfactory spacing for strong angle frame work branches.



### Types or Styles of Training for Young Trees

A number of different types or styles of training for young trees have been employed in recent years. The most satisfactory type is that which, through experience and investigation, has proved to combine necessary strength of framework and openness. The basic principles

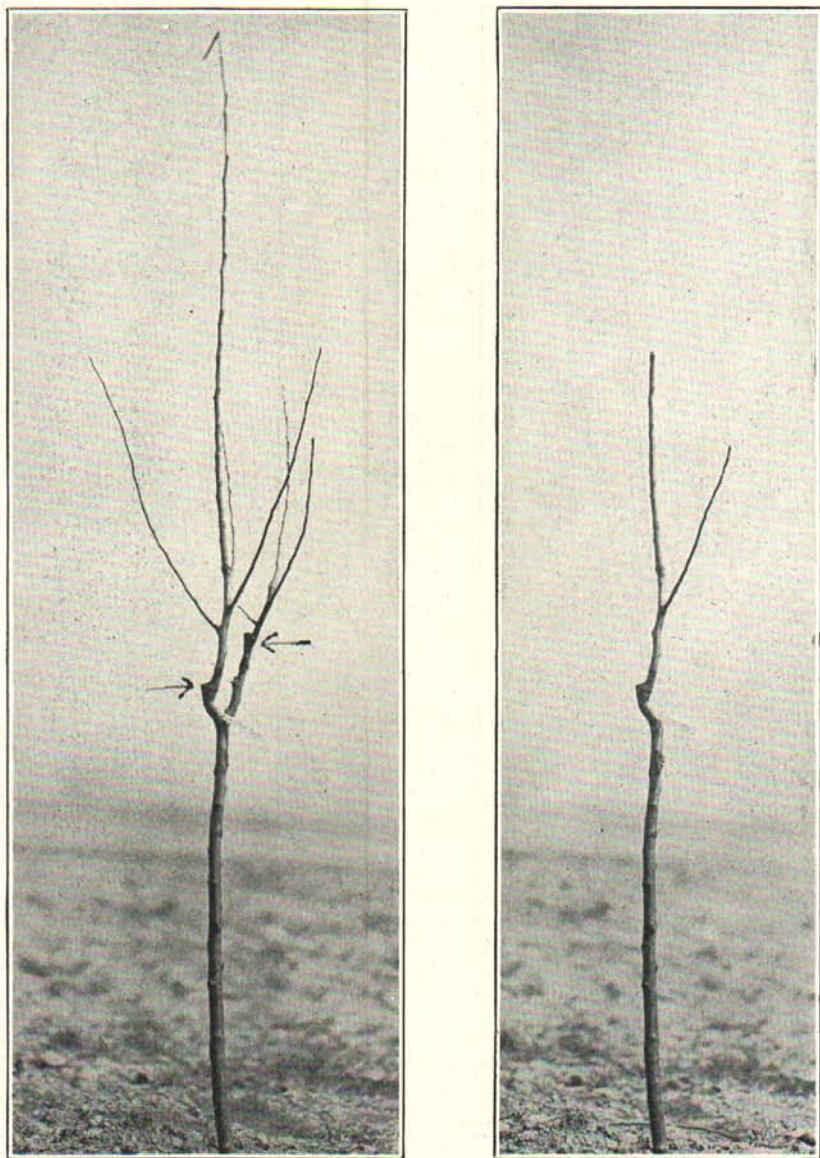


Fig. 9. This Grimes tree was top grafted twice in the nursery but one of the grafts was removed to prevent the possible development of a weak crotch

of this type of training, with slight modifications, are now being practiced in nearly all of the important fruit producing districts of America. It is generally referred to as the "modified leader" system, though it is sometimes called the "delayed open-center" type of training. This latter term not only serves to designate the system but is more or less explanatory of the procedure employed in training the tree.

A properly developed modified leader tree is one with a central trunk or axis, along which a number of main lateral or scaffold branches arise. These scaffold branches are as evenly and symmetrically spaced along and around this central leader as is practicable for the species, the variety, and the individual tree. It is not a two or three story tree nor is it a tree with a leader like that in some coniferous species.

Modified leader trees have well formed crotches, are low and spreading, and have a moderate number of main lateral or scaffold branches. The crotches are strong because they develop at wide angles with the leader and wide angled branches form strong shoulders. The trees are low and spreading because the lower branches of the tree are allowed to grow more and are therefore longer than the higher ones.

The writers recommend the modified leader type of training for all of the tree fruits grown in Michigan. The methods employed in developing this general type of tree will differ, however, with the different species. It is therefore necessary to discuss each kind separately. The training of the apple tree will be discussed in more or less detail and then such differences as seem essential for the proper development of trees of other kinds will be presented. Consequently, the grower of pears, peaches, cherries, or plums is urged to study the principles involved in pruning the apple before referring to the section which deals with the practices for the particular kind of fruit in which he is interested.

### HOW TO DEVELOP THE APPLE TREE

In the development of the modified leader apple tree, the grower should have in mind a tree in which one to three, usually two, permanent scaffold branches are selected each year for three or possibly four years. The lowest of these branches should be 26 to 30 inches from the ground and the others should be distributed along the trunk so there is at least six inches between their points of origin. **Furthermore, one branch should not be directly above or directly opposite another.** Balance between these several branches is necessary to develop them properly as main or scaffold branches.

The grower may buy one-year branchless trees or two-year ones from the nurseryman. For the purpose of this discussion, it will be assumed that the trees are the one-year whips. If the trees are two years old the grower will use the methods described for the one-year-old **orchard** tree for the pruning at planting time. Unless otherwise stated, the ages used in this bulletin will be from time of setting in the orchard.

**Pruning at Planting Time**—After the one-year-old nursery tree is planted, it should be cut back at 33 to 36 inches above the ground. The lowest scaffold branch will then develop six to ten inches below the point of heading, or 26 to 30 inches above the ground. Any side branches



that the newly planted yearling tree may have developed in the nursery should be removed. This pruning at planting time serves a double purpose: (1) it tends to balance the top with the nursery pruned root system and, (2) it determines the height of the head of the tree.

**Pruning the One-Year-Old Tree**—During the first season of growth in the orchard, the branchless tree referred to in the preceding paragraph will develop several shoots. One or two growing from the top-most buds will generally grow nearly upright and will attain a height a few inches greater than the others. Shoots further back from the tip will generally arise at wider angles from the tree trunk (Figures

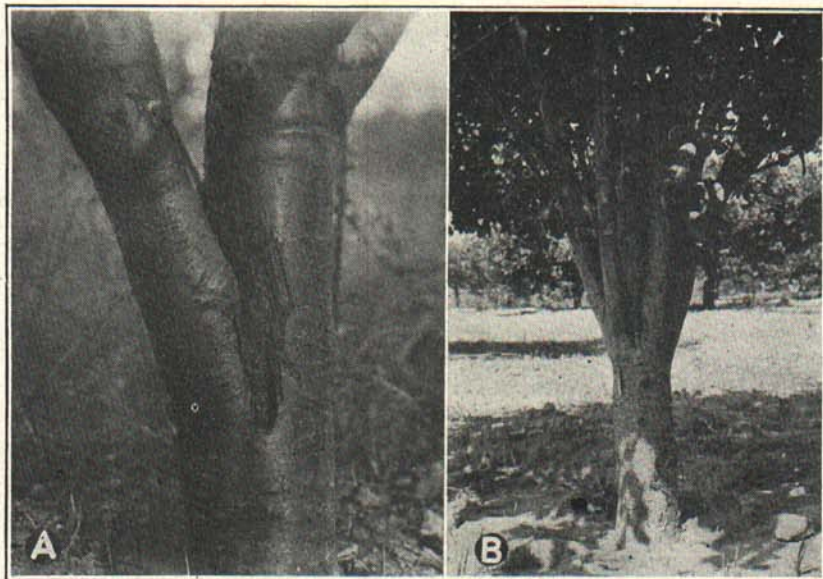


Fig. 10. (A)—A narrow angle between a main branch and the trunk may induce winter injury in the most vital part of a limb system.

(B)—An untrained Northern Spy tree. The main lateral branches are likely to girdle or choke out the leader.

6 and 7). The number of new shoots produced varies considerably with varieties. Thus Northern Spy will produce several shoots while Maiden Blush usually develops very few shoots.

When the tree is pruned in the following dormant period, one of the shoots that grew from the tip buds of the tree should be retained as the leader or central axis from which scaffold branches will be saved a year later. Along with it one or two of the lateral shoots should be kept as permanent scaffold branches (Figures 6 and 7). Care should be exercised in their selection. As previously stated, the lowest one should originate 26 to 30 inches above the ground. None should be saved that form angles of less than 45 degrees with the tree trunk or central leader. This usually means that shoots developing from buds near the tip, except the one saved as a leader, must be removed (Fig-



ure 7), and, frequently, the lowest limbs are comparatively weak and must give way to a higher limb which is larger and more vigorous. Furthermore, if a second scaffold branch is saved it should not originate closer than six inches to the point of origin of the other and it should be at least one quarter of the way around the trunk from the first one. These requirements may place such restrictions upon the selection of a second scaffold branch that only one can be saved at this pruning.

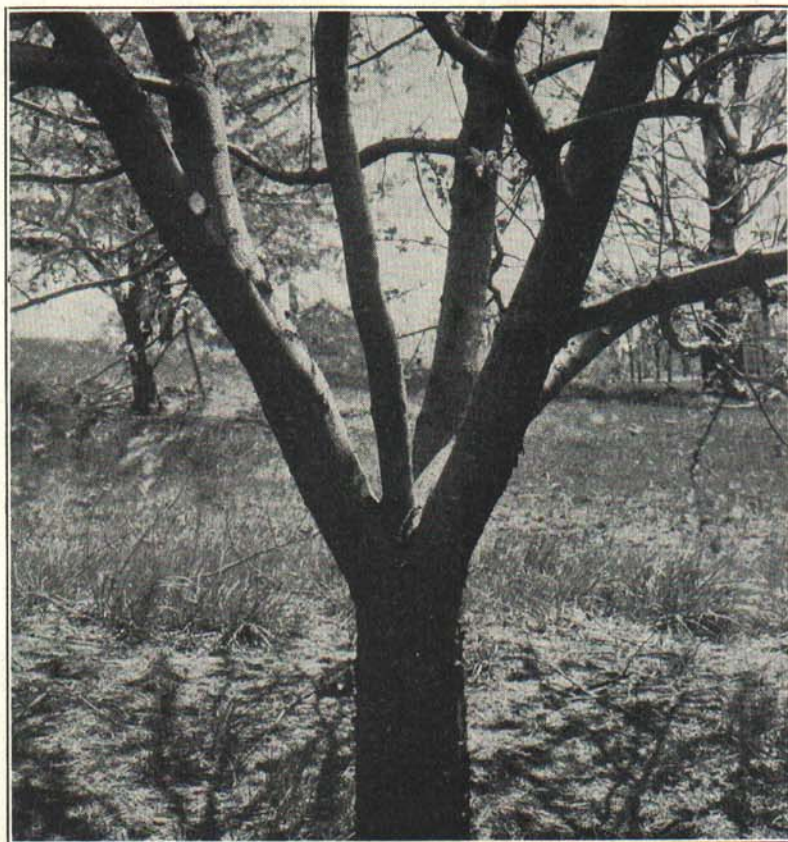


Fig. 11. The leader arising from the center of this tree is gradually being starved or choked out by the outer branches. The leader might have been maintained had the outward growing branches been spaced along it.

**A mistake very comonly made by growers in an endeavor to save two or three scaffold or main lateral branches each year is that of allowing two branches to develop opposite or nearly opposite each other, or to save three shoots originating from adjacent buds. This situation is likely to lead to more or less girdling or choking of the leader and finally the leader may be completely outgrown by scaffold branches (Figures 10-B and 11). Proper spacing of the scaffold branches**



**along the central axis avoids this difficulty and permits the balanced development of all scaffold branches of the tree.**

In case of some varieties, the branches that have been selected to begin the framework of the tree must be headed at such points as will provide secondary branches at desirable locations and maintain the proper relationship or balance between limbs.

**The leader should not be left longer than 18 to 22 inches or a "two-story" tree and legginess may result. Heading the leader much shorter**

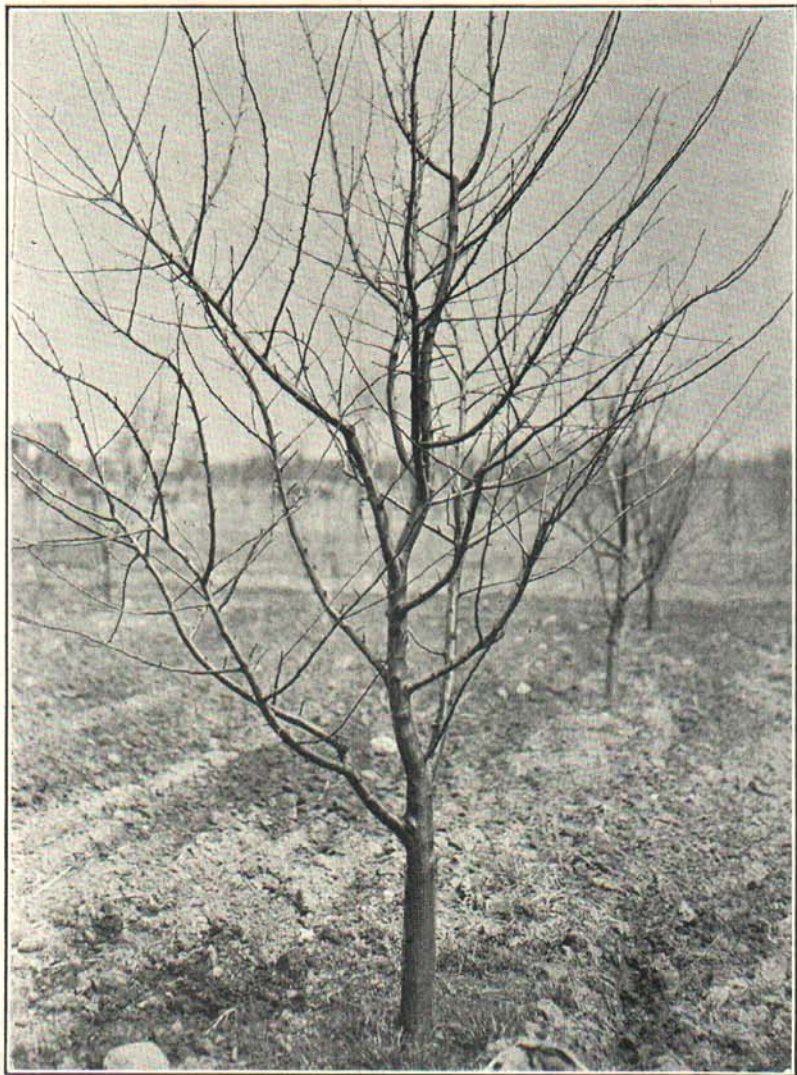


Fig. 12. Good scaffold branch spacing in a six-year-old Delicious apple tree.

results in either a crowded framework or the saving of too few scaffold branches the succeeding year.

Furthermore, the scaffold branches should be left at least 18 inches long or rebranching will occur too close to the tree trunk. These scaffold branches must never be left longer than the leader unless the points of origin are low or the shoot growth is weak.

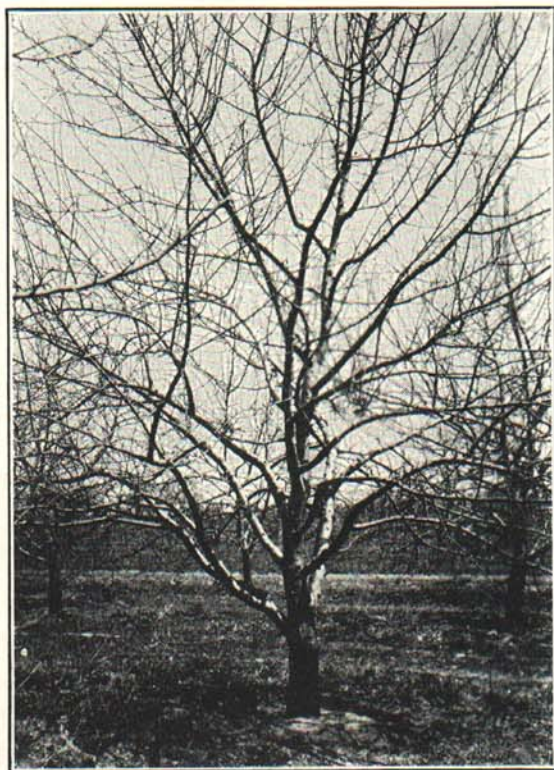


Fig. 13. A 12-year-old Delicious tree with good spacing of scaffold branches. Note that the oldest (lowest) scaffold branches have been kept in proper balance with the rest of the tree. Same tree as shown in Fig. 12.

The ideal place to cut back the leader is about 18 inches from its point of origin. The lateral or scaffold branches should be cut so that they are four to six inches shorter or lower than the tip of the leader when the former are held in an upright position (Figure 6). Greater difference between the length of the leader and the scaffold branches is likely to result in the leader outgrowing the latter and finally the lateral branches may cease to be actual scaffold branches. If the laterals are left longer than the leader, they are likely to outgrow it and the goal in training is defeated. **This proper balance between the leader**



**and the scaffold branches is very important in the successful development of modified leader trees (Figures 12-13).**

It is not uncommon for the tree to produce less than 18 inches of growth during the first season in the orchard. In such cases, no tipping or heading back is desirable and the grower must allow a second year for the tree to produce enough growth to permit cutting at points below which rebranching is desired. The grower should consider this as a year lost in the development of the tree framework and he should take steps to improve the growing conditions.

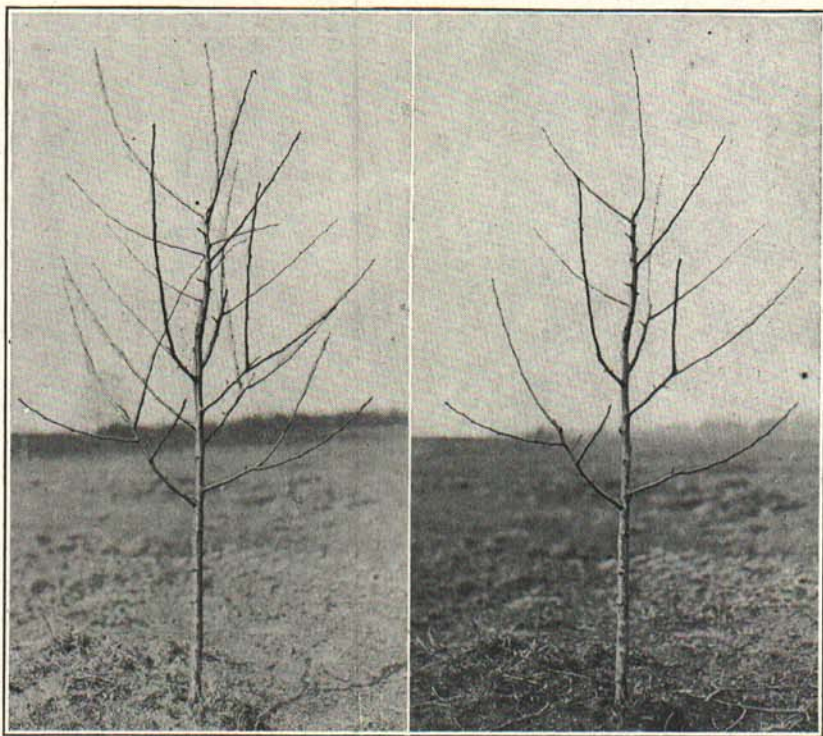


Fig. 14. A two-year-old pear tree with excellent spacing of lateral branches. One or two of these laterals may be eliminated after another one or two season's growth. The full quota of scaffold branches may be obtained in a shorter time with the pear than with the apple.

**Pruning the Two-Year-Old Tree**—During the second season in the orchard, a growth response similar to that of the first season will probably be obtained from each of the two to four branches. When the tree is pruned the following spring, at two years from planting, the leader is treated in a manner similar to that of the previous year. The shoot developed from the topmost bud of the leader should be selected to continue as the leader. It should be headed back to 18 to 20 inches if it has made more than that amount of growth. Then two or possibly three of the shoots which developed from the leader or central axis are



selected as additional permanent scaffold branches. Strength of crotches and distribution along and around the central axis or leader must again determine which of the several shoots will be saved as the scaffold branches for the permanent framework. These should be headed if the average level of their tips when placed in upright positions is less

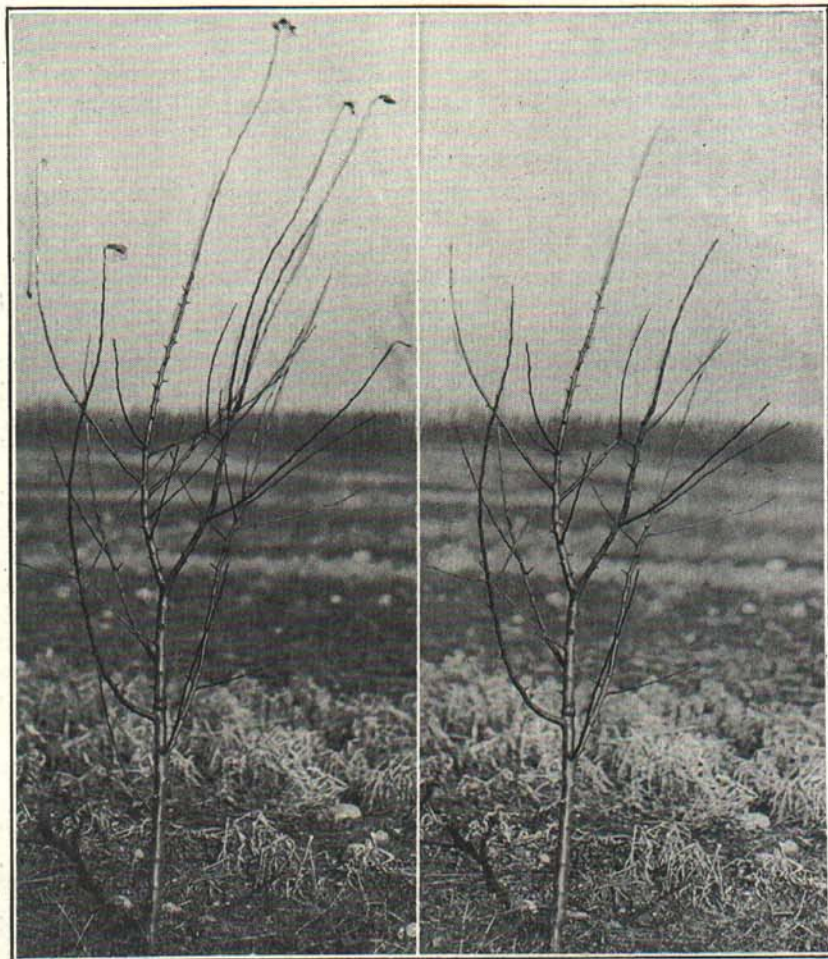


Fig. 15. A two-year-old apple tree, before and after pruning, that is growing in an exposed situation. Note how it has been balanced by the pruning.

than four to six inches below that of the tip of the leader. Heading back at this pruning, however, is seldom necessary except with the top-most laterals.

The branches that were saved to form permanent scaffold limbs the previous year will have rebranched, forming secondary shoots or



branches. The secondary shoot developing from the end bud should usually be saved to form the midrib or assume the leadership of the scaffold branch. There should be a leader for each scaffold branch. Not more than two or three additional secondary branches should be saved and they should originate closer to the trunk. Heading back is not necessary unless they are longer than the leader or midrib branch of the scaffold. With some varieties, however, a tipping of the leader may be advisable to increase the number of shoots formed the succeeding season. In other words, each scaffold branch is pruned much as though it were a young tree of that age. These several points are well illustrated in Figure 14, which shows a two-year-old pear tree of rather spreading habit, before and after pruning.

This is an important period of tree training and mistakes made at this time are not easily rectified. The several parts of the tree should be in balance after pruning. If the lower scaffold branches are left too long, they will outgrow the upper portions of the tree. The more common mistake, however, is to leave them too short in relation to the upper portions, resulting in a dwarfing and finally in their elimination as scaffold branches, in which case a high headed tree eventually results.

In many orchards, the shape of the trees is likely to be influenced by prevailing winds. Such trees should be pruned less on the windward than on the leeward side. Precaution should be taken to save the branches growing near the horizontal plane rather than the upright ones. Cutting to outside buds on the windward side and to inside or topmost buds on the leeward will also aid in developing a balanced tree (Figure 15).

Short growths that may develop in the interior portion of the tree should be saved except that spurs developing along the central leader and on laterals near the leader should be removed to prevent fire blight gaining entrance to the trunk of susceptible varieties. If these shoots develop into vigorous branches that tend to make the center of the tree thick and brushy, they can be removed a year later.

**Pruning the Three-Year-Old Tree**—Additional scaffold branches may usually be chosen after the tree has completed three seasons of growth. The method of selection is similar to that previously described. With spreading varieties like McIntosh and Rhode Island Greening, it is sometimes difficult or almost impossible to develop new scaffold limbs after the first two or three years. It is unlikely that heading back will be necessary unless here and there a branch has outgrown its neighbors. Furthermore, the relative amount of thinning out should be less than that of the previous years.

Pruning at this time is largely done to encourage the formation of additional branches and to prevent the tree from becoming unbalanced. The grower should particularly see that the lower scaffold branches are maintained in a strongly vegetative condition. The pruning should be heavier on the side of the tree away from the prevailing winds. Any tendency to develop weak crotches must be corrected. Short growths, "hangers," and fruit spurs should be saved. Remember that time of fruit production, yields, and size of trees are largely determined by the amount of pruning practiced at this time.



**Pruning the Fourth and Succeeding Years**—A sufficient number of scaffold branches should have been selected to form the permanent framework of the tree previous to this time so that it is unnecessary to encourage the further development of the leader. It is seldom necessary to suppress or remove the leader, because most of our commercial varieties do not naturally carry a leader longer than five or six years. The only pruning necessary is that which is done to keep the established scaffold branches properly balanced with one another allowing none to outgrow the others, and to remove the water-sprouts and an occasional crowding or crossing branch. The grower should also destroy narrow angled crotches on the scaffold branches in favor of newer, better angled limbs. Heading back is very seldom necessary.

During the ensuing years, the grower should make only such pruning cuts as seem absolutely essential to maintain the proper balance between different parts of the tree. In fact, many trees should not be touched with pruning tools from their fourth season in the orchard until after they have come into bearing. Too little pruning is preferable to over-pruning after the main framework has been established. Keep in mind that pruning of the young tree is only for the purpose of developing a strong framework.

Although the modified leader type of tree is recommended, attempts to rebuild trees to this type after some other system or lack of system has been employed for two or three years are not recommended.

### PRUNING THE PEAR TREE

The young pear tree should generally be trained and pruned in a manner similar to that recommended for the apple. Pear trees show a strong tendency, however, to assume a more upright habit of growth than apple trees. It is therefore advisable to cut to outside buds and to outside semi-horizontal or oblique lateral branches whenever feasible. This is illustrated in Figure 16. As with the apple, it is important that proper balance of growth be maintained between the leader and the scaffold branches. The grower should aim to avoid sharp angled crotches throughout the tree, though experience shows that pear crotches are somewhat less subject to splitting than those of the apple.

Because of the upright growth habits of some pears, it is a common practice in certain districts to cut back rather severely to prevent the tree from becoming too high. This practice is seldom successful in attaining the end sought, because cutting back is usually followed by the growth of a number of nearly upright shoots from points near the place of cutting. The practice merely dwarfs the tree and limits fruit production without resulting in any improvement in spread. Thinning out rather than cutting back should be the type of pruning practiced after the framework is established. If the tree is becoming too high, cut the leader or midrib branches back to outward growing lateral branches. Fewer new shoots will develop and spreading with little addition in height will result. The first crops spread the tree naturally and it is futile to attempt to force spreading by means of severe and unnatural pruning treatments.

For varieties susceptible to fire blight, blossom spurs developing along or within a foot of the central leader should be removed.



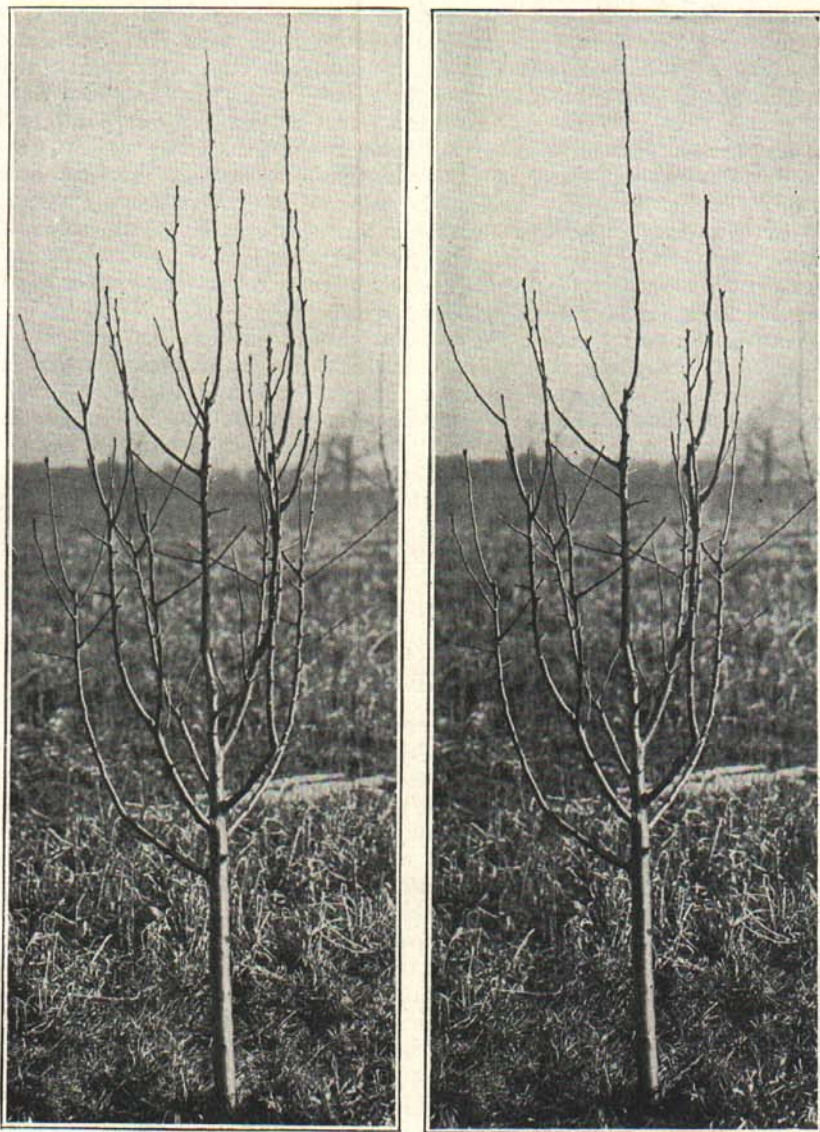


Fig. 16. A three-year-old pear tree, before and after pruning. Note that one of the laterals, which has started to outgrow the leader, has been checked by heading back. There has also been an attempt to spread the naturally upright-growing top by cutting back to the more spreading laterals.



## PRUNING THE PEACH TREE

The basic principle of a fairly large number of scaffold branches originating from points well distributed along and around a central axis is also recommended for the development of the framework of the peach tree. This is for the purpose of avoiding crotch injury and the splitting down of limbs. The methods employed in attaining this type of tree, however, differ considerably from those described for the apple. The leader of a peach tree cannot usually be continued above the place of heading at the time of planting. All of the scaffold or main lateral branches must therefore be located below that point. Furthermore, the permanent scaffold branches cannot be selected until the tree has made one season's growth in the orchard.

When the one-year-old peach tree comes from the nursery it usually has a number of lateral or secondary branches. After the tree is planted in the orchard, the writers recommend the removal of the lateral branches originating within 18 to 20 inches of the ground. The leader or central axis of the tree should then be cut back to a height of 36 to 40 inches. All of the laterals or side branches originating between 18 to 20 and 36 to 40 inches from the ground level are left and all are cut back to stubs about two inches long (Figure 17). A few of these stubs may not grow but the stubs protect the leaf buds borne between the stub and the leader.

During the early part of the first growing season in the orchard, the shoots which develop from these stubs or growing points should be thinned out to form a well balanced tree and to encourage the remaining shoots to make more growth during the season. The following winter or early spring, the pruning should consist of further thinning the shoots to five, six, or possibly seven of the more vigorous ones which are to form the permanent scaffold branches. The shoots selected for this purpose should be evenly spaced along the leader and no adjacent shoot should be located directly above another. The trees should then be balanced by cutting back the stronger growing branches to the length of the weaker neighbors. Because of the fact that those located near the tip of the leader are likely to make more growth than those lower down if headed to similar lengths, it is advisable to leave the lower ones slightly longer (Figure 18).

During the early part of the second growing season, any additional growths originating from the leader should be rubbed off so as to encourage the development of strong growing scaffold branches. The head and form of the tree is now established and pruning during the next couple of years should be from the standpoint of preventing too heavy bearing for the size of the tree. Such heading should be practiced as is necessary to keep the several scaffold branches from outgrowing one another. There should be some thinning out and the heading back should be for the most part to outward growing laterals. Figure 19 shows fairly typical two-year-old peach trees before and after pruning to the type that is here recommended.

Severe heading back of the young peach tree usually results in a dense top and shading out of fruit buds along the basal portions of the shoots. Growth should be regulated through the early sowing of cover crops



and by other cultural practices so that the average annual shoot length is about 18 to 24 inches rather than longer. Comparatively little heading back will be necessary in young orchards that produce moderate growth.

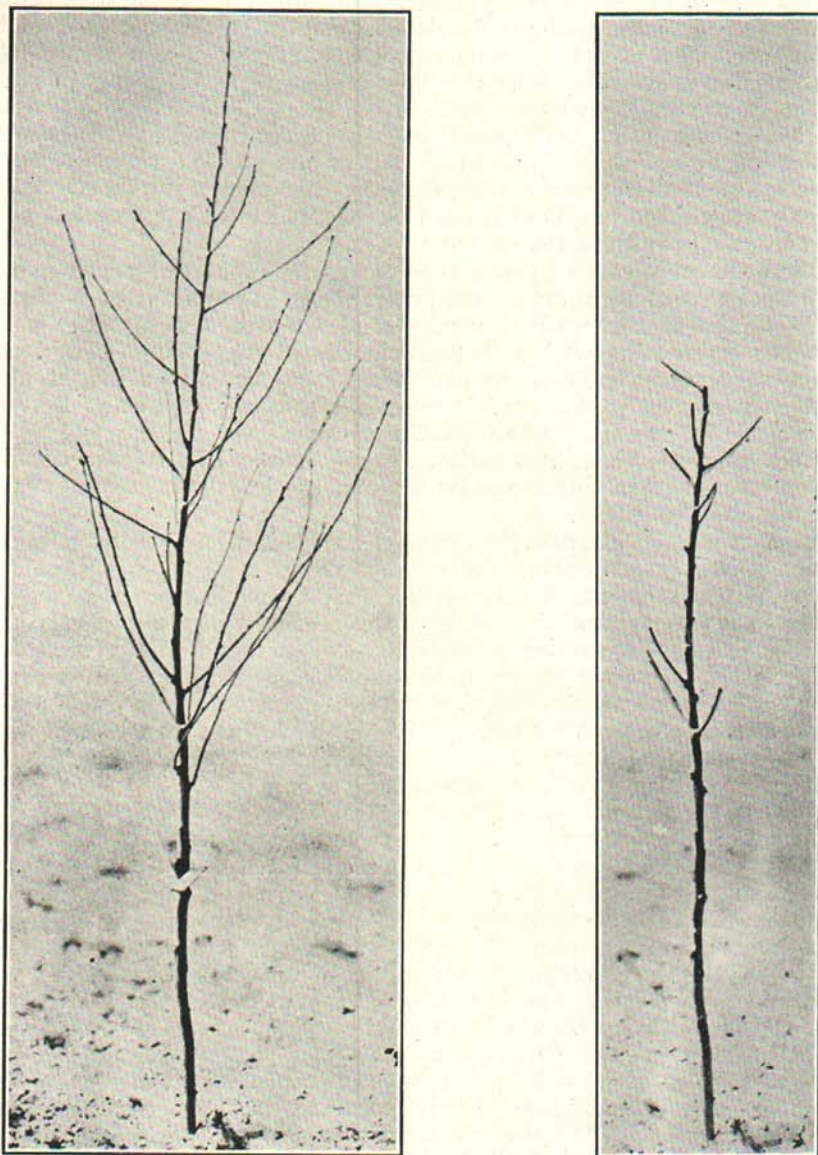


Fig. 17. A one-year-old nursery peach tree before and after pruning at time of transplanting to the orchard. The peach tree does not naturally continue a leader after the original one is cut back. The tree is cut back at about 40 inches from the ground and all secondary or lateral twigs not closer than 18 inches to the ground are cut back to two or three buds.

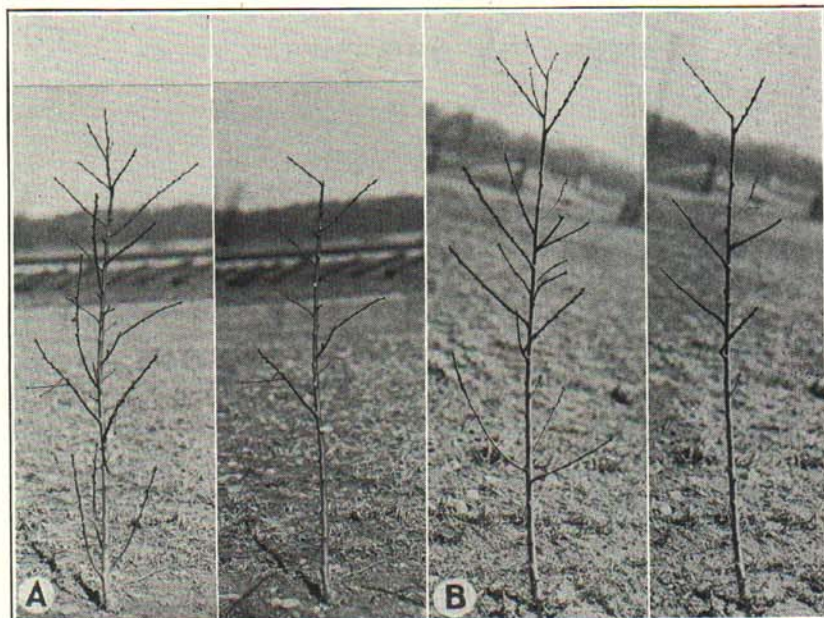


Fig. 18. (A)—A peach tree one year after planting in the orchard. Note that some of the laterals have originated from the stubs left the previous year while others have arisen directly from the trunk.

(B)—A one-year-old peach tree. These trees (A and B) produce little growth during the first year in the orchard but during this season they become well established and capable of producing vigorous growth the second year in the orchard (Figure 20).

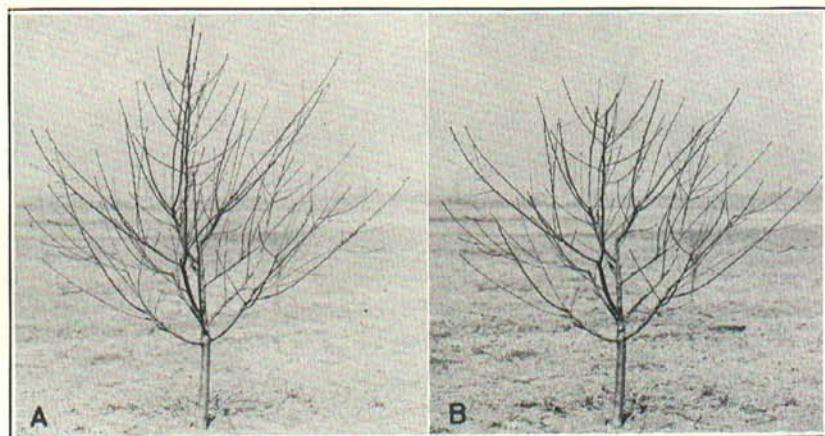


Fig. 19. (A)—A two-year-old peach tree before pruning. Note the distribution of scaffold branches along the central axis. The central axis or stem has made no attempt to elongate above the place where it was cut back two years previously as is the tendency with apples.

(B)—The tree shown at (A) after pruning. The pruning treatment was very light and consisted in thinning out and cutting back to outward growing secondary shoots.



### PRUNING THE SOUR CHERRY TREE

A modified leader type of tree, intermediate between that recommended for the apple and the peach, is the most desirable for the sour cherry tree because it results in a stronger head and less splitting of crotches. The hazards of establishing a young cherry tree are many. Buds that have started to swell at the time of planting are easily injured. Well grown, carefully handled trees that retain most of their buds and whose buds are still dormant can be pruned more severely than trees which have buds injured by rough handling. The amount

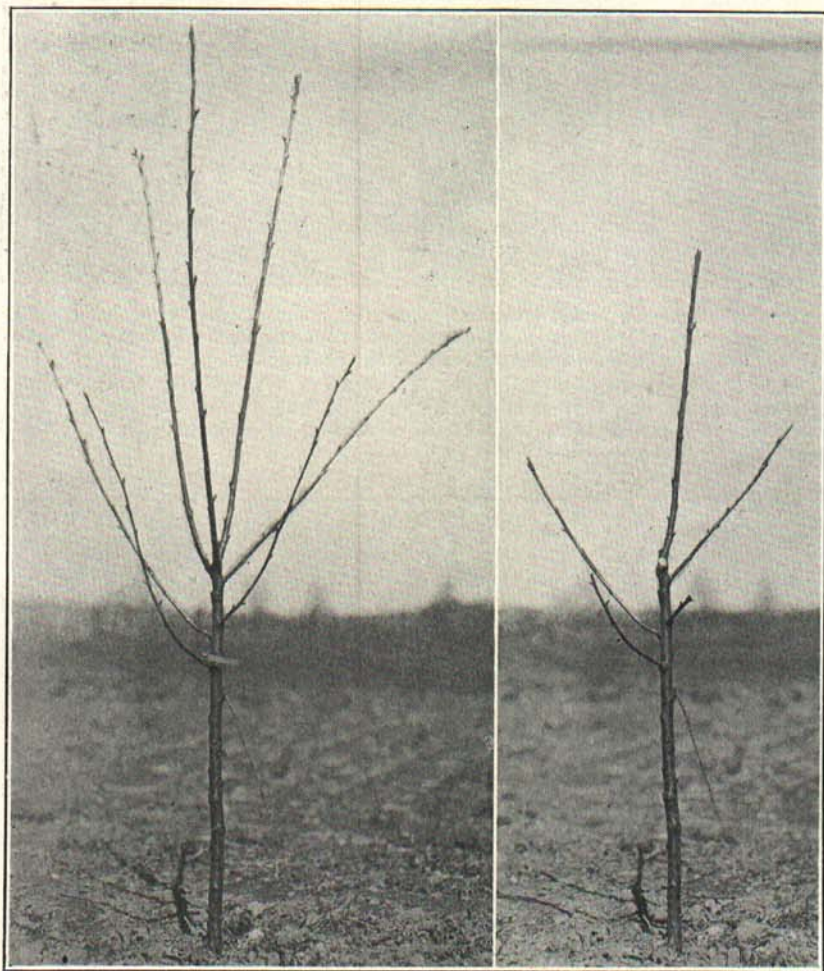


Fig. 20. Attempts to train a sweet cherry tree as one would an apple or pear usually results more or less disastrously because cherry buds are easily killed. The number and location of live buds will determine the length at which lateral branches should be cut.



and kind of pruning of the young cherry tree at planting time should be determined by the number and location of its buds.

The one-year-old nursery tree usually has a number of lateral or side branches. If these lateral branches are low, their removal is generally advisable. However, pruning to a whip is seldom necessary or advisable unless there are a number of strong well-distributed buds on the trunk that will practically insure a well balanced top. After planting, the tree should be pruned—leaving the leader eight or ten inches longer



Fig. 21. (A)—A sour cherry tree near the completion of the first season's growth in the orchard. The lateral branches were cut back to about six inches at planting time. Note the formation of additional laterals from the upper portion of the central axis.

(B)—A sour cherry tree in its second season of growth in the orchard. The distribution of scaffold branches is not ideal but a strong, well balanced tree will result.

than any of the scaffold branches. More lateral branches can be left than will be required for permanent scaffold branches when the tree is fully established. These scaffold limbs should be cut back to six to eight inches in length if this leaves some buds on each branch (Figure 20).

One or two years after planting, when the tree has become established, the superfluous scaffold branches can be removed. Three or four



wide angled ones should be saved as permanent scaffolds, with the lowest about 20 inches from the ground. The three or four branches selected should be spaced along the trunk so that they will not tend to girdle or choke the leader and thus keep it from growing as fast as the selected scaffold branches. This is a point of particular importance in training the cherry. Scaffold branches should be selected so that not more than two of them are close together and so that no adjacent ones originate from the central axis directly above another. The pruning at this time will be mostly a thinning out of some of the superfluous branches not required as scaffolds. No heading back is necessary unless the growth has exceeded 20 inches or unless some branch is outgrowing the others. Even in the latter case it is more satisfactory to suppress

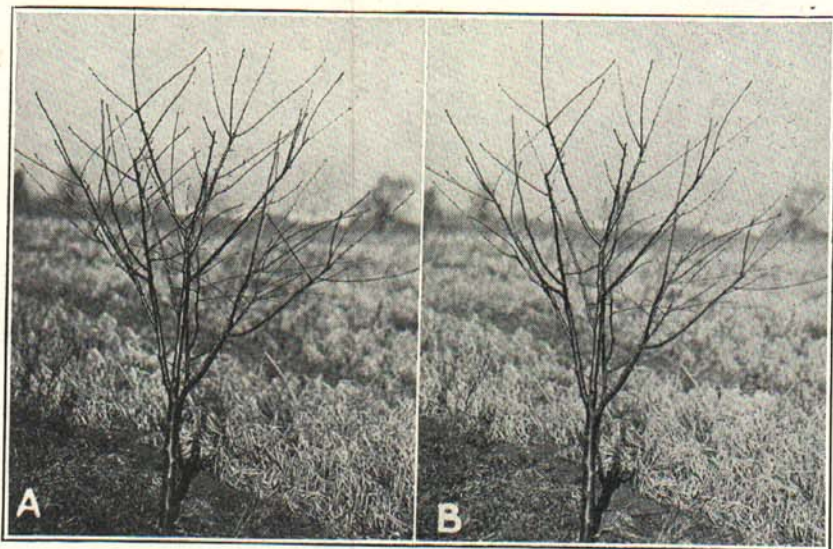


Fig. 22. (A)—A two-year-old Montmorency cherry tree before pruning. Compare with (B).

(B)—A two-year-old Montmorency cherry tree after pruning. Compare with (A). The pruning has consisted entirely in a removal of some of the superfluous branches. No heading back has been required.

the stronger growing branches by removing some of the laterals arising from them.

When the sour cherry tree is two years old, it will probably have three or four established scaffold branches. Six or seven of these main branches distributed along about three feet of central axis or leader are advisable if it is possible to secure them. Therefore, another selection of scaffold branches to complete the framework of the tree is necessary before the tree enters the third season in the orchard. Again, no heading back is necessary except to maintain balance between main branches. There is a tendency for the lower ones to outgrow the upper branches unless proper balance is maintained by slightly heavier pruning of the lower ones. This pruning need not necessarily be heading

back as any kind of pruning that removes part of the potential leaf systems will produce the desired results. Some of the crowding, secondary branches may also be removed at this time. This is well illustrated in Figure 22.

After the tree is three or possibly four years old, little pruning is advisable. The framework is presumably established and pruning must be designed to maintain the proper balance between the scaffold branches. The leader should not be allowed to grow faster than the scaffolds, in fact, it becomes a main or scaffold branch rather than a leader after the full number of permanent lateral branches are selected.

### PRUNING THE SWEET CHERRY TREE

The young sweet cherry tree should be trained in much the same manner as the apple, except that less heading and perhaps more thinning out are advisable. The shoots should not be headed unless the growth of a portion of the tree is likely to destroy balance between parts and the problem cannot be satisfactorily handled by thinning.

### PRUNING THE PLUMS

The type of training recommended for the apple tree is in general satisfactory for the European plums. This group includes such varieties as Arch Duke, Grand Duke, Monarch, Bradshaw, Green Gage, Italian, Gueii, and others. The trees may, however, be headed so that the lowest scaffold branch is about 20 inches from the ground. In general, a less

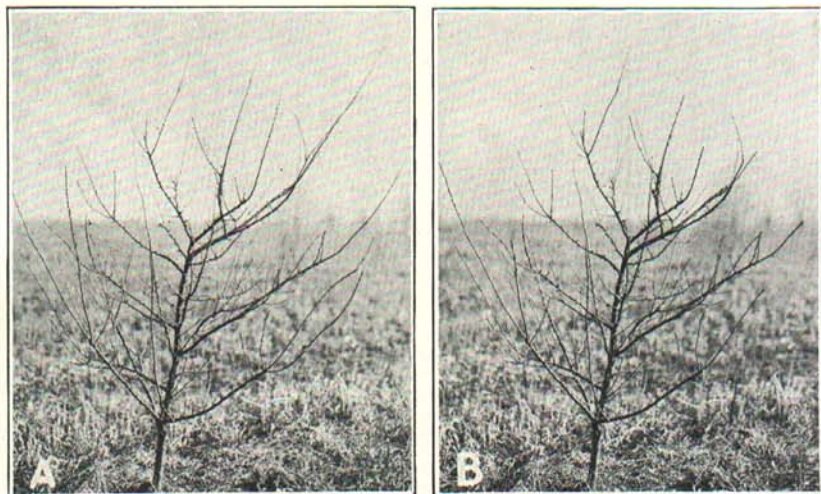


Fig. 23. (A)—A young Burbank plum tree before pruning. It is growing in a somewhat exposed situation and is showing a tendency to become one sided.

(B)—The Burbank plum tree, shown in (A), after pruning.



severe pruning should be practiced than with the apple. Heavy heading back usually results in long upright growths and a high and dense top; hence, heading back, when advisable, should be light.

Varieties of Japanese plums such as Burbank have growth habits similar to those of the peach and the type of training described for the peach is recommended for them. Some of these Japanese varieties, as for example, Burbank, are comparatively "rangy" growers and more or less corrective pruning is necessary in order to develop and maintain a well-shaped top. Figure 23 illustrates what is meant by this corrective type of pruning.