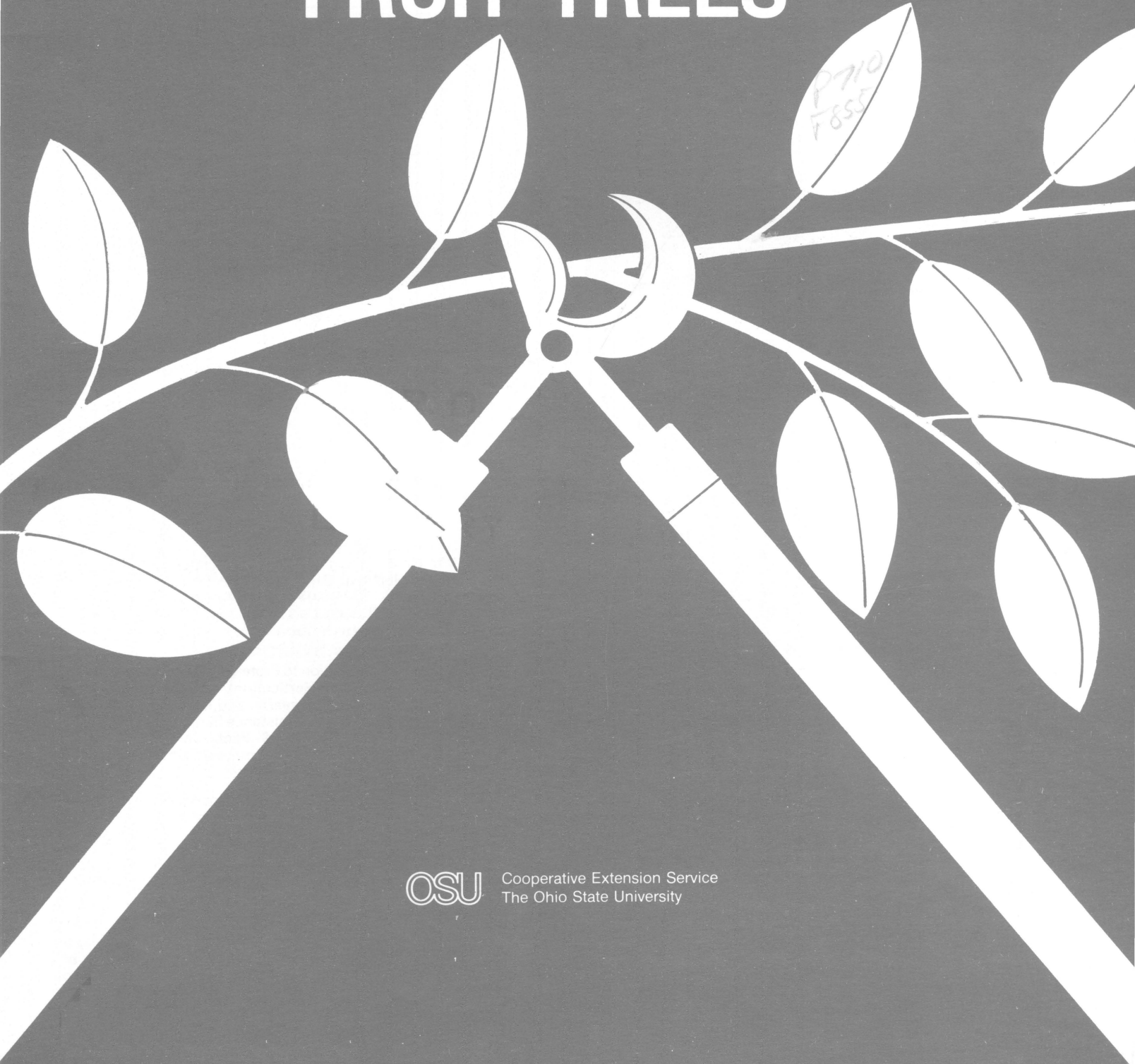


TRAINING AND PRUNING FRUIT TREES



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Training and Pruning Fruit Trees



Fig. 1: This tree has been trained to a central leader system that exposes the maximum amount of foliage to optimum light intensity.

The objective of training and pruning a fruit tree is to develop a strong framework that exposes a large amount of the leaf surface to optimum light conditions. These practices facilitate production of the greatest yield of fruit of desirable size and quality while maintaining the tree in an efficient, compact structure for many years. The annual pruning of fruit trees not only aids the development of strong flower buds and highly colored fruit but also allows better penetration of pesticides for control of insects and diseases.

The amount and quality of fruit produced by trees are determined by the relationship between vegetative and fruitful growth exposed to sunlight. Moderate vegetative growth is necessary for a large, functional leaf surface and new bearing wood. Pruning is a major contributor in removing unfruitful wood, maintaining pro-

ductive wood and exposing leaf surface to sunlight.

Training practices should be directed toward the most efficient tree shape and to develop and maintain a small, compact, efficient tree that can make maximum use of sunlight (Figure 1).

A tree that is pyramidal in shape exposes a greater percentage of the total leaf surface to adequate sunlight.

The area of a tree receiving less than 30 percent of full sunlight is less fruitful and produces smaller fruit of lower quality and firmness, and unsatisfactory color. In efficiently spaced plantings, a major objective of the pruning program must be the restriction of height and the spread of the tree's branches to minimize the shade the tree casts on itself and nearby trees.

Training and Pruning Principles

Growth Processes

Certain growth responses occur when trees are pruned, no matter what training and pruning system is used. The overall size of the tree and the relative size of the pruned limb is reduced by pruning, although growth near the cut is stimulated. All leaves on a tree contribute carbohydrate necessary for growth, and any pruning reduces leaf surface. Generally, the more severe the pruning, the greater the dwarfing effect and the greater the growth stimulation in close proximity to the cut.

To balance growth stimulation over the tree when

pruning older trees, many smaller cuts are more desirable than a few larger ones. Old trees in low vigor can be pruned more heavily than younger and more vigorous ones of the same kind. Fruit trees that initiate flowers on one year wood and have large fruits such as peaches respond better to heavy pruning than types that set flowers on older spurs or have smaller fruits like the cherry. It is not wise to use heavy pruning to avoid fruit thinning because yields will be reduced. Pruning a young, non-bearing tree always delays the production and decreases early yields. With young trees, prune only enough to train the tree. Every unnecessary cut is an economic loss.

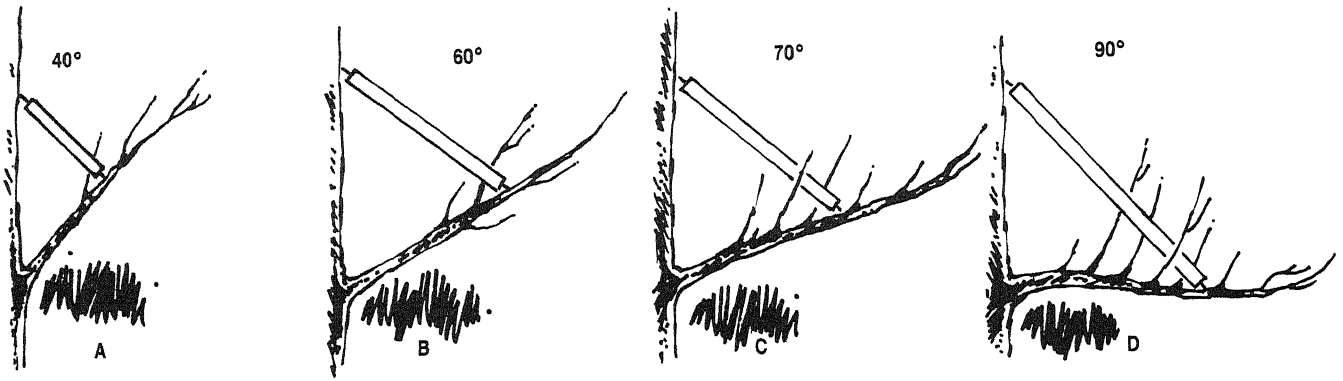


Fig. 2: The use of spreaders for apples and pears increases sunlight exposure for flower bud formation. (A) shows limb is not spread enough, (B) shows proper spreading to 60 degrees from vertical with desirable

side branches, (C) shows that at 70 degrees spread, more upright shoots form, and (D) shows that at 90 degrees, excessive upright, unproductive shoots are produced.

Branches with an upright or vertical orientation are usually very vigorous. As branch orientation approaches the horizontal, less vigorous growth occurs and more buds form flowers. Branches bent to downward orientation make very little vegetative extension but often produce vigorous upright water sprouts (Figure 2). The use of limb spreaders to orient limbs 30 to 60 degrees from vertical utilizes this natural growth and fruiting response. Spreading reduces the vigor of shoots near the apex, increases the number of moderately vigorous shoots on the branch and encourages flower initiation.

In high density plantings, the weaker growth produced on horizontal branches is more easily controlled and results in improved light distribution in the fruiting canopy. Fruit set on horizontal branches is more consistent in yield from year to year. Less sunburn and limb rub will occur with fruit borne on horizontal rather than upright growth.

Fruit production and shoot growth compete with each other. Because the number of leaves and corresponding assimilates are limited in supply, shoot and root growth are reduced with heavy cropping. Therefore, fruiting helps control tree vigor, shoot growth and tree size. Thinning heavy crop loads allows more vegetative growth and insures flower initiation for return crops.

Seasons for Pruning

Most orchardists prune during the dormant season. At that time, other orchard operations are less pressing and pruning needs can be more easily detected. The best time to prune is early spring just prior to the beginning of active growth. During this period, wounds heal readily, the greatest amount of localized invigoration is achieved and flower buds are easily detected, enabling one to quickly determine the location and number of cuts. Dormant season pruning stimulates shoot growth.

Low temperature injury is the major risk with fall or early winter pruning in Ohio. Trees that have been pruned before severe weather are often seriously injured by sub-zero temperatures that may follow. Pruning in November and December can be more hazardous to trees than pruning in late February, March or early April.

Pruning during the summer when the trees are in leaf is more dwarfing than dormant pruning and is utilized only when a dwarfing effect is desirable. Trees less than three years of age should **not** be summer pruned.

Removal of active leaf surface in mid-summer before reserves are returned to the wood and root system results in reduced tree size the following year. Pruning in June or early July results in undesirable regrowth, while pruning in early August results in minimal regrowth. Pruning in early August has shown in studies in Ohio and elsewhere to improve fruit color and decrease cork spot (see summer pruning section).

Excessive summer pruning (removal of all terminal growth exceeding 10 cm length — about 4 inches) has resulted in yield reductions and decreased fruit size. In August when fruit is sizing, one can easily see the part of the tree that needs attention. Summer pruning is suggested only for trees that are too vigorous for their allotted space and not as a conventional practice.

Water Sprout Removal

Remove water sprouts in June and July when 6 to 10 inches long. Because hand removal by pulling eliminates many of the latent buds at the base of the shoot, this method is preferred to removal with shears. Removal of water sprouts at this time keeps the tree open and reduces the amount of dormant pruning later. Also, summer aphid problems are reduced when these succulent shoots are removed.

There are growth regulators that reduce terminal growth or inhibit water sprouts or root suckers. These should be used only at the proper tree vigor and proper time of year. Consult growth regulator recommendations in other Cooperative Extension bulletins.

Types of Pruning Cuts

All pruning cuts can be classified as heading back or thinning out. Heading back involves removing only a portion of a one-year-old branch, leaving another portion from which new growth can develop (Figure 3). A heading cut removes apical dominance where the growing tip produces hormones that control the number of buds that will grow, the length of these shoot and the angle they form with the limb. Heading cuts generally stiffen limbs and stimulate branches that have an upright character and narrow crotch angles. Heading back older wood promotes conversion of spurs into non-fruitful vegetative shoots.

Thinning out removes a shoot spur or branch entirely. Thinning cuts shorten branches, promote spur formation and improve light conditions in the tree, enhancing fruit production (Figure 4).

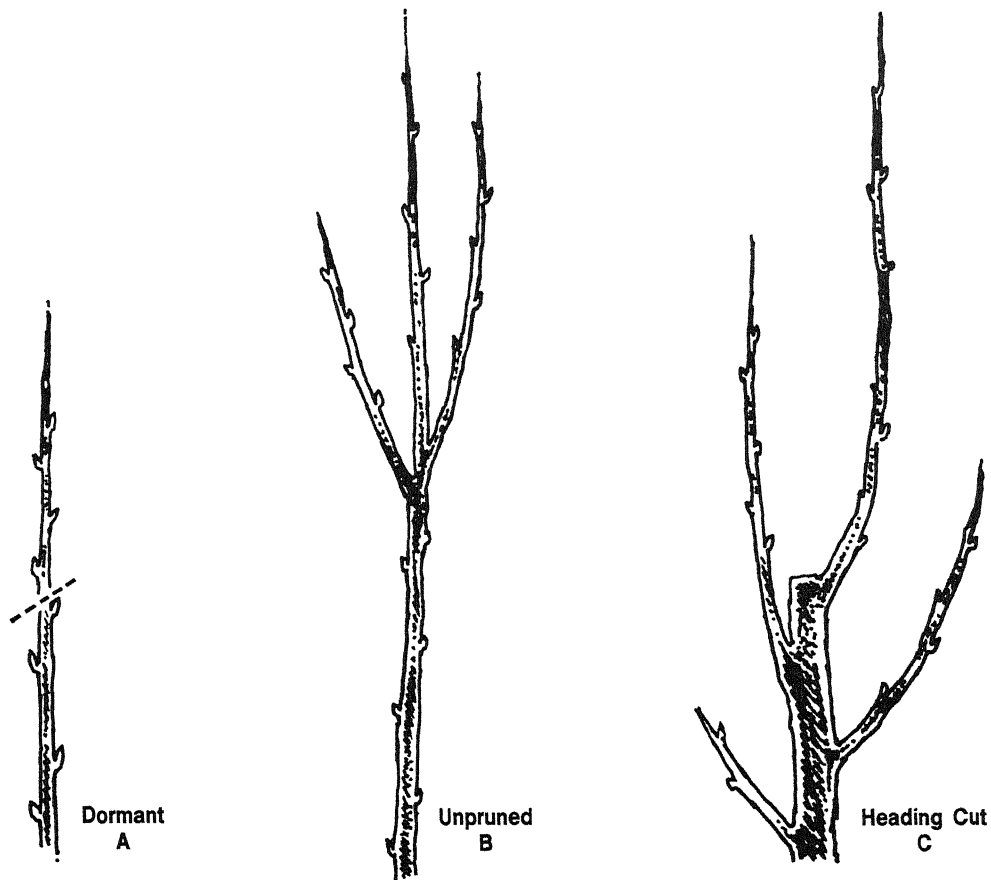


Fig. 3: If a dormant twig (A) is left unpruned (not headed), (B) fewer smaller branches will form. If dormant shoot is headed back (C), it forces buds to break that would not normally develop and thickens the base of the shoot.

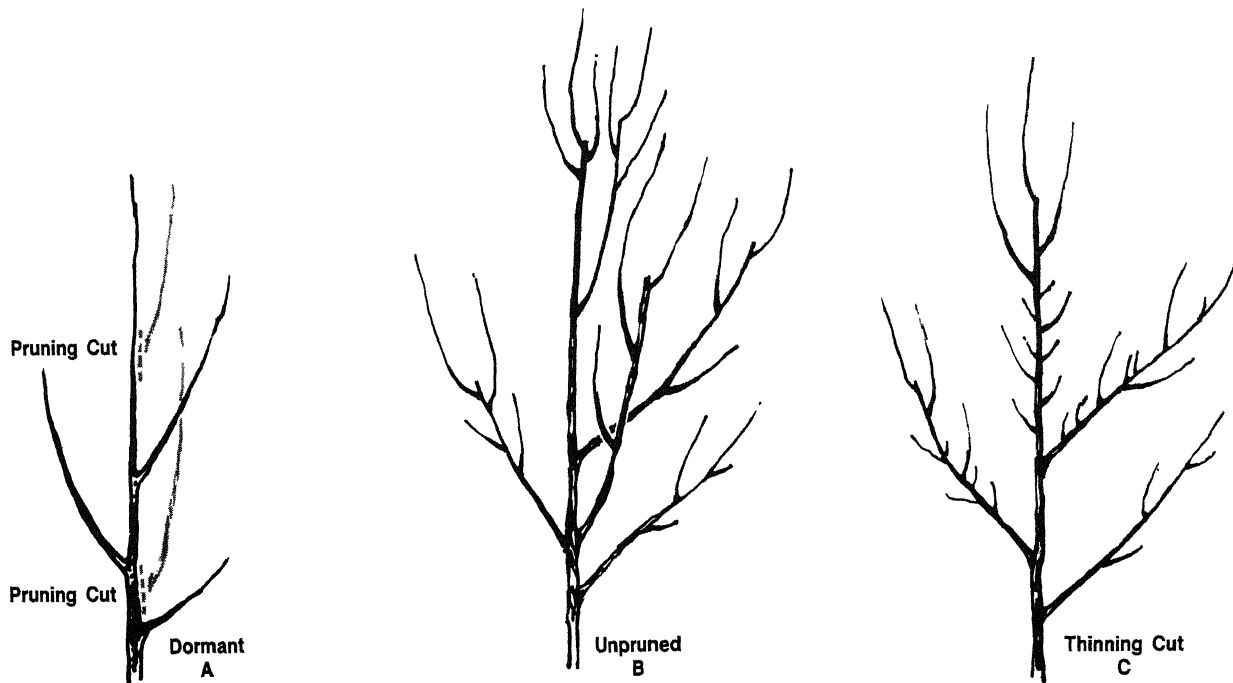


Fig. 4: In the dormant season, a branch (A) is shown being pruned, while (B) is the result of an unpruned, unthinned branch and (C) is the result of one year later after pruning and shows improved sunlight penetration and fruiting spur formation.

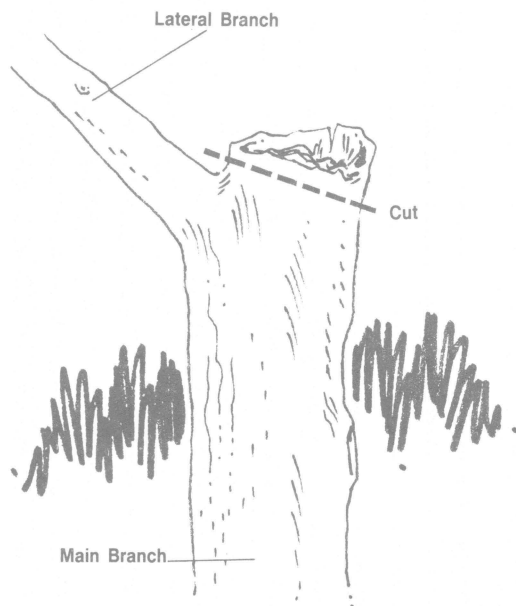


Fig. 5A: A cut above a lateral must be made at the proper place to avoid decay or splits.

Making the Cuts

Make all cuts with correctly adjusted, sharp tools. Such tools give clean, smooth cuts. When removing a

branch, make the cut close to and parallel with the supporting limb. When heading back to a lateral, place the cut so it continues in the direction of the lateral branch. Stubs do not heal and may start decay. If the cut is too close to the point of lateral attachment, the branch is likely to split out (Figure 5A).

When using shears, place the blade against the supporting limb to ensure a smooth, close cut. The cut can be made easier by pushing slightly downward on the branch in the direction the cut is being made. Never wiggle the shears through a cut, as this makes a ragged wound that will heal slowly and may damage the shears by bending the blade.

To remove a large limb with a saw, do so with three cuts. First, make an undercut one to two inches deep about 8 to 10 inches from the base of the limb or main stem. Then cut from above, starting the second cut two or three inches farther from the base of the limb than the undercut. Thus, the limb will fall without tearing the bark down into the supporting limb or main stem. Remove the short stub with a close cut made against the supporting limb.

Wound Dressing

Although once popular, there is no particular advantage in applying a dressing to wounds. If a wound dressing is used, preferably it should contain an asphalt base. Paints with lead or zinc are not satisfactory. Wound dressings containing bordeaux mixture may injure the cambium and interfere with natural healing processes. The same is true of creosote paints.

Training and Pruning Systems

Central Leader System—Young Trees

At planting time, head back trees with no lateral branches (feathers) at 24 to 27 inches from the ground or 30 to 34 inches, if mechanical harvesting is intended (Figure 5B). Trees with branches should have laterals removed below 18 inches and be headed to a strong spur or bud about 16 to 17 inches above the first scaffolds. Remove broken laterals and reduce branches to four. These should be positioned around the tree vertically. A long lateral should be headed back to one-half or one-third of its length, if it is smaller than a pencil ($\frac{1}{4}$ inch) in diameter. Do not head back strong laterals on vigorous cultivars. If the tree is not well lateraled, remove all weak wood and treat it as a whip. Spur type Delicious form laterals just below the heading cut. It is important that the heading cut be made just above the area where scaffolds are wanted.

The central leader system of training apple trees provides sunlight to all parts of the tree. The best results of central leader training are obtained when a new orchard is planted. This method of training is recommended regardless of rootstock, interstem, plant spacing or harvest method.

First Season

During the first growing season, make leader selection in early summer. Any shoots with narrow crotch angles that are to be retained can be spread with hardwood toothpicks, clothespins or short wire spreaders (Figures 6 and 7). Insert clothespins when growth is three to six inches long and green at the base by snapping it around the central leader and forcing the shoot

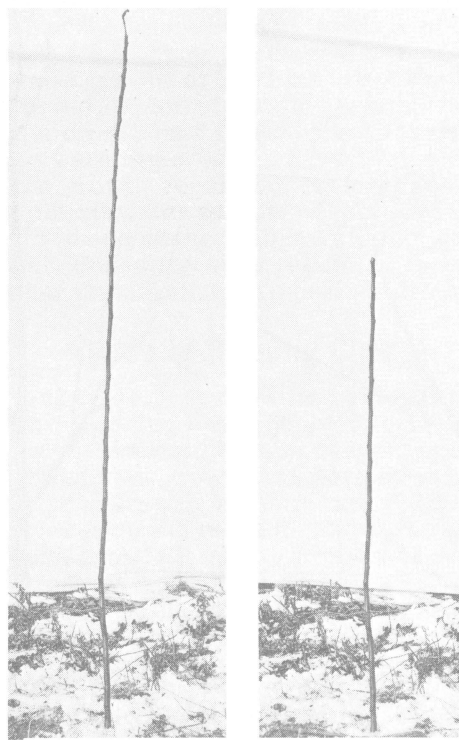


Fig. 5B: One-year apple whip after planting (left); same tree after cutting to 24 inches in height (right).

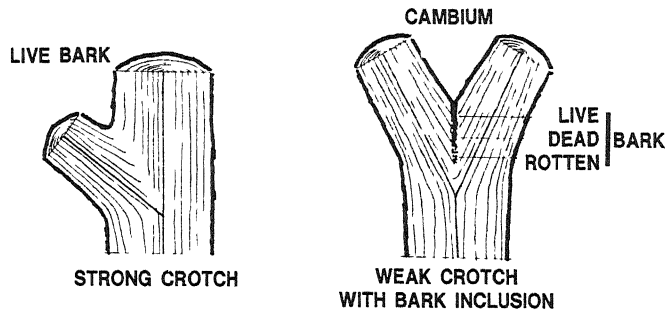


Fig 6 Wide crotch angles insure strength. The angle of crotch at left is wide. Note thickness of successive layers of wood laid down by cambium in this crotch angle. At right, angle at crotch is narrow. Bark in the crotch angle comes together before the crotch is filled with woody tissue. A narrow crotch is weak, splits with overloads and is often associated with winter injury.

to an angle of 90 degrees from vertical. This spreading will reduce the growth of the lateral shoots 10 to 15 percent, promote dominance of the central leader and promote use of vigorous shoots that normally would result in narrow crotches and would not be usable. Remove clothespins four weeks after insertion to avoid girdling. Select four main scaffold limbs for most cultivars. In spur type apples, five well positioned limbs may prove practical for the first scaffold tier only. Remove as little leaf surface as possible. Allow all shoots above 18 inches to remain the first growing season, removing the unnecessary (below 18 inches) and competing shoots during the dormant season. This procedure produces the largest root system and the best growth in the second season.

Damaged Tree—First Year: If mechanical or rodent damage has occurred, the damaged area can be removed and the tree cut back to three or four buds above the union during dormant season. In mid-June, select the strongest upright, treat it as a whip and head back dormant the following spring. If the same thing occurs during the fall or winter, the same procedure is recommended. During mid-summer select one leader and remove any limbs below 18 inches.

Second Season

During the dormant season, head back central leader 18 to 20 inches above the uppermost scaffold to initiate the second tier of branches (Figure 8). If limbs developed at the point where the second tier should begin, do not remove them unless they are more vigorous than the one below. In general, scaffold branches in non-spur type apples should **not** be headed back in dormant season after the second growing season. However, spur type and cultivars with blind wood (Quinte, Rome, Tydeman's and Granny Smith) can benefit from heading back and this should be done two weeks after full bloom. Remove shoots that develop on the trunk between the first and second tier or those in excess of four scaffolds (Figure 8).

Spreading of branches should be done at bud break during the first two weeks of the growing season when branches are most flexible. This reduces breakage and gives the greatest benefit (most flower buds) from the altered position (Figure 9). Spreading of branches is necessary even though clothespins were used the first season. Spreaders¹ can be removed two to three weeks after bud break and reused in higher tiers the following

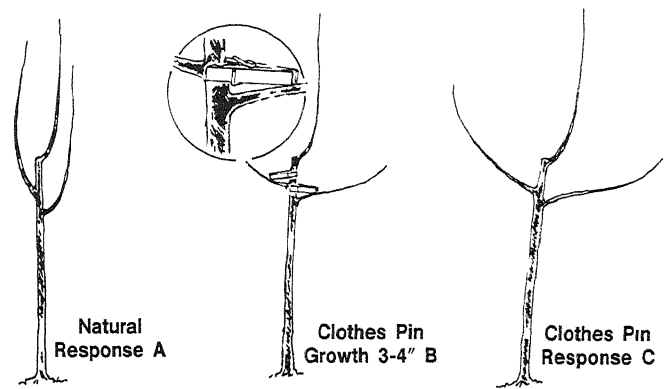


Fig 7 If tree is not trained (A), narrow crotch angles result and limbs break under heavy fruit load, (B) clothes pins used after planting when shoots are 3 to 6 inches long increase strength and expose limb to sunlight, (C) branches are stronger, exposed to sunlight, and central leader quickly becomes dominant when clothes pins are used.

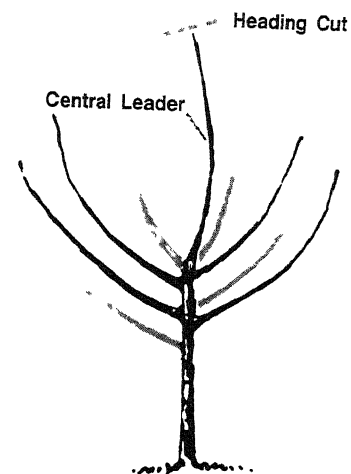


Fig 8 One-year old apple tree with lateral branches and central leader. The central leader should be headed to above first tier.

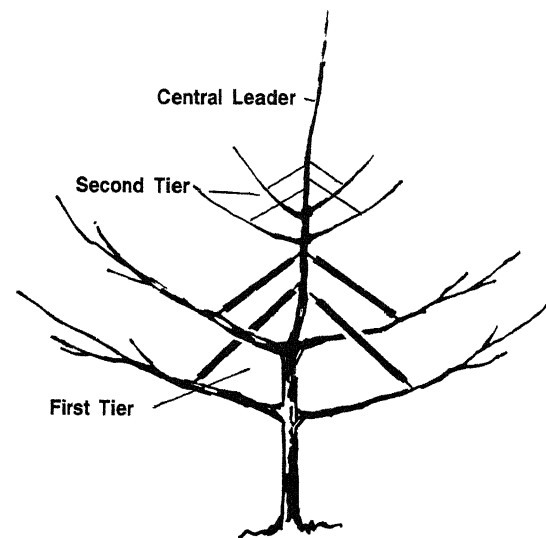


Fig. 9. Two-year-old apple tree with wooden and metal spreaders. All limbs in first tier are spread with wooden spreaders and second tier with wire spreaders.

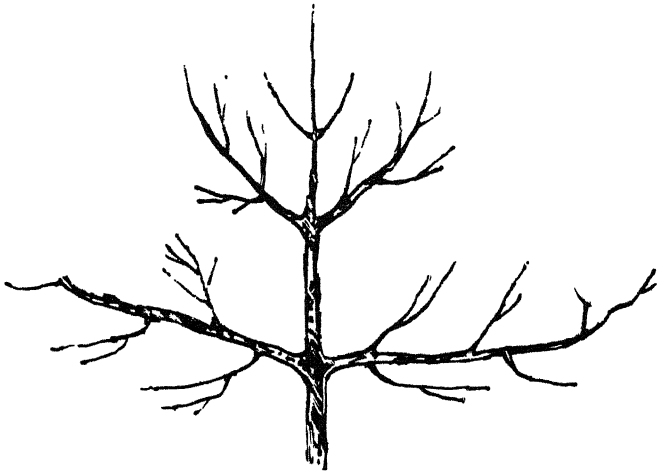


Fig. 10: Drawn cross section of a central leader tree in which the lower branches have been allowed to assume an upright, strong growing position. Corrective pruning cuts are made as shown.

year. However, spreaders must remain a minimum of four to six weeks if put into the tree three weeks after bud break to achieve the same benefit. Tree limbs will not be damaged by spreader points.

The central leader of some cultivars of two-year-old trees may not be strong enough and will bend out of the vertical position where spreaders are used improperly. Under these conditions, spreading may be delayed until the third season but not delayed to the fourth season because limbs might become too stiff or vigorous. Thus, tying down branches with rope or twine may be necessary. Spreading is particularly necessary for spur type Delicious and other cultivars with upright growth habit.

For structural strength and reduction of winter injury, wide crotches are more important with trees on vigorous rootstocks. All narrow angles should be removed or spread as one-year-old branch. Thus, training is important during the first few growing years.

Third and Later Seasons

Training and pruning during succeeding years should continue to allow the central leader to develop and to select scaffold on the third or fourth tier. Lower scaffolds must be longer than higher scaffolds. Remove unnecessary branches. There is always a one-year-old section at the top regardless of age of the rest of the tree. Moving downward, there are two-year-old, then three-year-old or older tiers or layers. Remove strong growth and keep the weak, particularly in the top of the tree. Avoid heading any one-year-old shoot, except the central leader, in the dormant season.

When the tree is as tall as desired, all one-year lateral branches should be removed from the leader and the branch forming the central leader should be cut in half. This will maintain the terminal of the leader in a vigorous vegetative condition and tree height can be maintained at the established level. Because of its central position, the top will rapidly grow new terminal shoots.

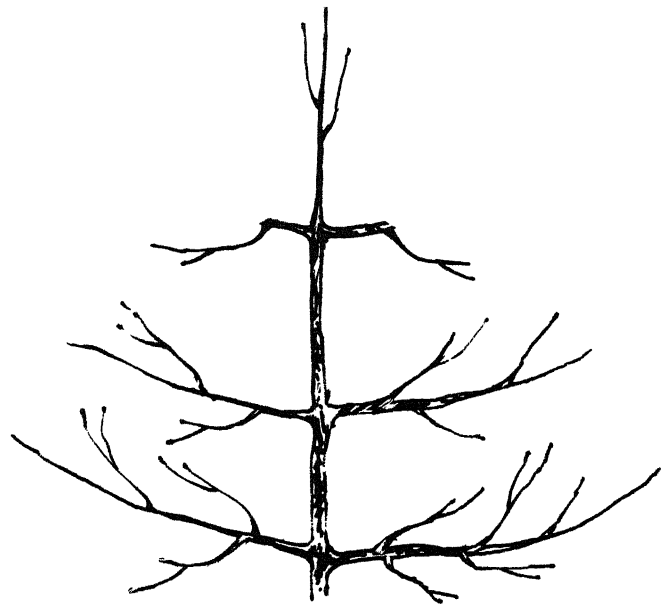


Fig. 11: Drawn cross section of a central leader tree in which the top whorl of branches has been allowed to overgrow the lower whorls. Corrective pruning cuts are marked.

Keep these shoots small and in horizontal position. Branches that curl at the end should be cut or spread again (Figure 10). This helps greatly in maintaining tree size at a given level, as well as reducing the shading of lower branches. Summer pruning is particularly beneficial in containing upright growth in the top of the tree.

Reshaping Improperly Pruned Trees

Improperly pruned trees produce fruit of poor color, size and quality. They reduce effectiveness of growth regulators and pesticides.

The best stimulator of tree performance is uniform sunlight penetration in to all parts of the tree. The central leader (conic) shape has extreme importance. Branches of adjacent trees should not overlap and the height of the tree should not exceed the spread of the tree. Once height is obtained, effort is required to restrict the top of the tree and maintain it so as not to shade the lower parts of the tree, as described in third and later seasons (Figure 11).

It is more effective to remove entire branches than to do extensive detailed pruning in vigorous tops of trees. Although production may be reduced by the removal of limbs, the productivity of lower branches will be maintained. Fruit on lower branches is easier to care for and harvest.

As trees grow older, an increasing number of thinning and heading cuts are needed to maintain tree size and shape. Also, the amount of branch thinning may need to be increased to permit development of good bearing wood throughout the tree.

Remove dead, diseased or damaged branches annually, regardless of tree age. Likewise, remove water sprouts each year, except for the occasional one needed for developing new bearing surface. The best time to remove water sprouts is in early summer when they are soft and succulent. At this time, they can be rubbed off with a gloved hand. If done after sprouts become woody at the base, shears will be necessary to prune them off. If removed in the summer, water sprouts seldom grow

¹ Spreaders can be made from $\frac{1}{2} \times \frac{1}{2}$ inch pieces of wood with number six finishing nails (or box nails) with heads removed and pointed. Most spreaders are 9 to 12 inches long but some 18 inches or longer may be necessary.

back or if growth does occur, it will be small. Any water sprouts remaining on a tree can be removed during dormant pruning.

Heading of one-year-old wood stimulates vegetative growth and must be avoided, except for the central leader. The only exception is where sunscald may be prevalent and a water sprout with four to six buds could be headed.

Older spurs that have become weak may need to be removed. In trees such as Delicious, long branches may bend downward. Head back to a branch so that it tends to go slightly upward (Figure 10).

Trellis System — Supported Trees

With the advent of size-controlling rootstocks for fruit trees and high density plantings, growers have developed a renewed interest in trellis supports for fruit trees. This is especially true with apple cultivars on the most dwarfing rootstock, M9. Trees trained and secured to wire trellises have been established in commercial as well as home plantings. This method of growing apples can accommodate from 400 to 600 dwarf trees per acre, depending upon planting distances. Most other rootstocks result in growth that is too vigorous for economical trellis training or are not adaptable to Ohio soils.

The trellis may be constructed for three to six or more wires, depending on vertical spacings of the wires and the ultimate height desired. In most instances, the wires are spaced 18 to 24 inches apart vertically with the bottom wire 18 to 24 inches from the ground. The height of the top wire is determined somewhat by the harvesting method to be used. If all picking is to be done from the ground, the top wire would be six feet from the ground. If a picking platform or short ladders are anticipated, it could be 8 to 10 feet from the ground.

The cost of available posts of the desired length would be a determining factor. Posts to carry the wires may be set before or after planting the trees with the line posts spaced 35 to 45 feet in the row and located halfway between trees. End posts should be anchored. The wires, usually No. 9 galvanized or three to four mm monofilament (not recommended for spur type Delicious), should be in place and secured firmly to the posts by the middle of the first growing season.

First Season

Training begins at planting. If no branches are present near the bottom wire, head the tree at the height of the bottom wire or four inches below, in the case of Delicious (Figure 12). This will induce branching just below the wire. The uppermost new shoot usually grows in an upright position and assumes the position of a central leader. At least two other shoots will arise below this one. The two most suitable branches are tied loosely (plastic ties) to the bottom wire as soon as they are long enough, one in each direction. Any other shoots are cut back to short stubs. In tying a shoot to a wire, do not bend it downward to a level that the tip is at a lower level than the point of attachment on the trunk. To do so greatly retards extension shoot growth. The shoot will be in the best position when the tip is a few inches higher than its base. Also, this position is less likely to induce vigorous risers on the scaffold (Figure 12). Growth of the uppermost shoot should extend well beyond the second wire by the end of the first growing season.

Second Season

During dormant pruning the next spring, head back this central stem at a point just below the second wire. Branching will occur just below the cut. Tie two of the lateral shoots, as they develop, to the second wire — one in each direction. Train the uppermost shoot to the central leader position. For production efficiency, it is important to cover the trellis with fruiting wood as quickly as possible. If possible, it is best to bend by tying shoots that compete with primary laterals rather than delay fruiting by pruning. The branches trained to the lower wire need little pruning the second year, other than to maintain terminal growth and to prevent vigorous upright shoot growth. Strong upright growth is headed back severely so as to contain it well below the second wire.

Third and Later Seasons

Pruning during the succeeding years of training will be similar to that described for the second year until the basic framework is complete.

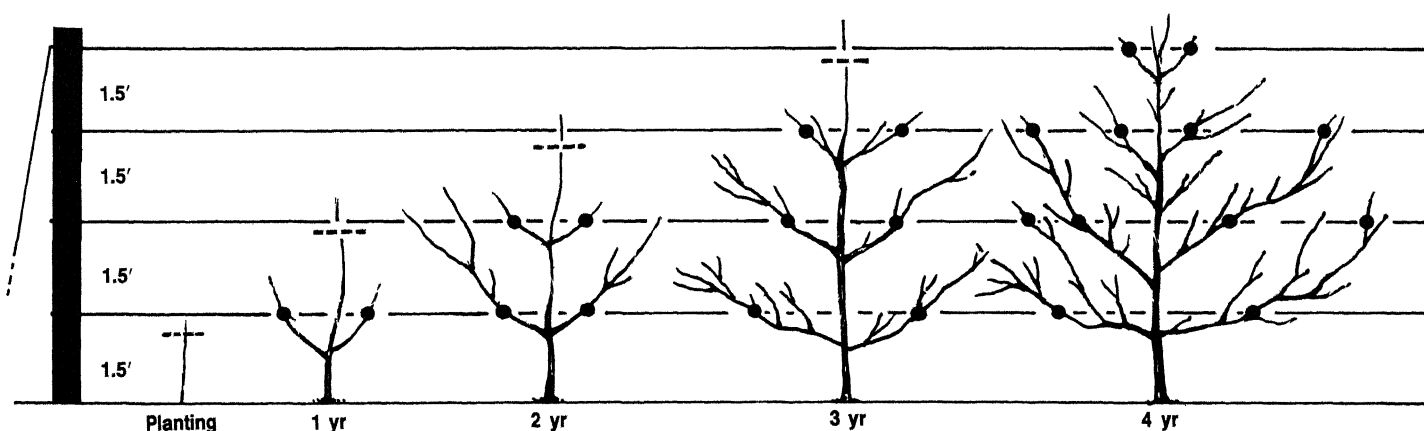


Fig. 12: In a trellis system, the tree at planting is headed below the first wire and the first, second and third season is headed below the

second, third and fourth wires, respectively. Tie branches to wires at points indicated with dots.



Fig. 13: Water sprouts, left, can be easily removed at this stage in summer by rubbing them off with a gloved hand. Large pruning cuts, center, cause heavy water sprout development, especially in the tops of trees. These are removed or severely headed back in dormant pruning,

if not rubbed off in summer. Older trees, right, can develop productive wood throughout the tree if proper training and pruning procedures are followed annually. Light in the center of the tree is essential for productive spurs.

When the central leader reaches the top wire, one of two procedures may be followed. The leader may be bent in one direction and tied to the top wire. Then, when a lateral shoot develops below the bend and becomes large enough, it may be secured to the wire in the opposite direction. The other procedure is to head the leader just below the top wire. When new lateral shoots develop, tie the two uppermost to the top wire, as soon as they have sufficient length, extending each in opposite directions. The latter method gives a little more assurance of adequate branches for developing into scaffold branches.

As the arms or scaffold branches touch those of the adjoining tree, an overlap (10 to 20 percent) may be desirable to insure all portions of the trellis are covered with fruiting wood. Each year, after the fruiting wood covers the trellis, pruning should be limited to thinning out to insure good sun light penetration. Extra scaffold shoots left in during the early years should be removed gradually over a three to four year period to permit no more than one primary scaffold per side per wire. Prune side branches lightly with thinning cuts to maintain the desired three to four feet width of tree row.

Mature plantings in the trellised hedge-row system require only a moderate amount of annual dormant pruning. It is often helpful to go over the planting in August each year and remove excessive or unwanted shoot growth.

Summer Pruning

Apple

The primary use of summer pruning is to control tree size. Added benefits are increased sunlight and spray penetration, improved fruit color and reduction in cork spot. It should be used only on vigorous four-year-old or older trees. Summer pruning retards growth while dormant pruning invigorates tree growth. Summer pruning also increases sunlight on spur leaves to make stronger spurs and flowers in the interior of the tree for the next year's crop (Figure 13).

The apple tree begins growth from reserves established the previous season and produces new leaves. A reduction of leaf surface reduces tree growth. Regrowth is greatest when cuts are made early in the sea-

son in June and declines through the season. It is minimal in August, particularly with a full crop. Regrowth is greatest when cuts are made in one-year wood and least when cuts are made to a spur in two to three-year wood. In August when fruit is sizing, one can easily see the part of the tree that needs attention. Pruning in August has shown little influence on flower density or fruit set, but pruning in June can increase fruit set.

Generally no more than 10 to 20 cuts on a six to eight-year-old tree should be made, if deleterious effects of summer pruning such as reduced fruit size and soluble solids are to be avoided. Finish summer pruning by mid-August. Summer pruning after mid-August is not recommended.

Mechanical Hedging

Apple

Hedging by machine is completed between July 15 and August 15 and is a relatively recent practice used in apple orchards to quickly reduce tree height and spread. Special equipment is available. However, hedging is not a method of selective pruning; consequently orchards that have been so pruned still need detailed pruning in the dormant season by hand or power shears. If such detailed pruning does not follow hedging, the trees will grow denser and more bushy on the periphery. When this happens, light penetration is reduced, resulting in poor color and smaller crops.

Hedging combined with a good annual selective pruning program can result in important time and labor savings. If hedging is utilized to lower tree height significantly in a single year, the cut surface on large limbs should be painted with one-percent NAA sprout inhibitor in latex paint to avoid excessive watersprouts. Thus far experience has been mostly with hedging during the dormant season. An experiment at the Research Center indicates that summer hedging in August worked well on Golden Delicious but produced very undesirable effects on Melrose. Until more information is obtained, be careful when summer hedging apples.

Peach

Recent research in the midwest shows that peach trees can be efficiently dwarfed by hedging (mechanical cutter bar) new growth during the growing season.

This technique permits planting peach trees 7 to 12 feet in the row and 15 to 18 feet between rows. The trees are maintained at these spacings by mechanically hedging the new growth in half in mid-June. The regrowth that normally occurs is hedged in half again in mid-July. These recommendations are based on Redhaven and later maturing cultivars. Earlier cultivars should receive the second hedging after harvest. Begin hedging the sides during the second growth season and hedge the tops when they reach a height of seven to eight feet. A 20 degree slope or angle of the cutterbar when hedging tree sides develops a slightly narrower topped tree that permits adequate light for fruiting in the lower part of the tree. Maintain tree spread no wider than five to eight feet and tree height no higher than 8 to 10 feet. Trees in this management system should be trained as a palmette (fan shape) with a central leader and two primary scaffolds in the lower tier that are developed in the row. Remove growth that is oriented toward the row middle. Two to three limbs per side, 18 to 24 inches apart normally are sufficient to fill the canopy. Trees should be thinned lightly (dormant pruning) annually to maintain an open canopy. Dormant pruning must follow summer hedging to thin out excessive branches and promote uniform bearing.

Cherry

In order to increase cherry yields, growers have planted trees 14 by 18 feet and trained them to a central leader with seven to nine scaffolds. Summer hedging on these trees usually begins during the third or fourth growing season with the mower bar set similar to that for peach hedgerows. The most appropriate time appears to be 45 days after full bloom of tart cherry. Just as with peach, summer hedging must be followed by dormant pruning to thin out dense growth, particularly the top of the tree, to improve light penetration.

Pruning Apple by Growth Habit

Cultivars respond differently to pruning and training due mainly to differences in growth and fruiting habits. Growth habit refers to the overall growth pattern of the tree, including the degree of branching, branch orientation (upright or spreading) and crotch angle. Fruiting habit refers to the overall pattern of fruiting and includes fruit position on the ends of long or short shoots, age of spurs producing most of the crop and location of the crop on the scaffold limbs.

There are four types of apple trees and styles of pruning.

Type I includes the spur types, characterized by Starkrimson Delicious and other spur types that tend to form few laterals on main scaffold limbs. The dominance of the central leader is quickly lost unless shoots intended as scaffolds are trained by spreading. Heading cuts that force "would be spurs" into vegetative extension shoots are needed in the early years to develop laterals on the primary scaffold system. Due to the sparse branching habit, several more scaffold limbs may be needed per tree to adequately fill the allotted space.

Fruiting occurs on numerous short spurs that are long-lived, thus it is not necessary to prune this type as much to renew fruiting wood as it is with trees with other growth habits. The zone of fruiting tends to remain close to the trunk as long as this area is exposed to sufficient light for flower initiation.

Recent evidence indicates that the high coloring Delicious strains do not need as much light for adequate fruit color development as many other cultivars. However, fruit quality, as indicated by pressure and soluble solids, is reduced under low light conditions and for the fruit quality factors, adequate light penetration should be maintained.

Type II trees are characterized by most standard habit or non-spur strains of Delicious. Branching is more frequent than in Type I and there is a greater tendency for the fruiting zone to move away from the trunk. The trees have an inherent tendency to develop narrow crotches, so spreading techniques are beneficial. Type II trees may develop too many medium-size branches, resulting in an overly dense canopy, unless wise removal of excess branches is carried out. A rule of thumb is to allow no more than four scaffolds per tier with 18 to 24 inches between tiers. Also, these trees are prone to produce an abundance of watersprouts, which are removed by pulling when six to seven inches long in June-July. More thinning cuts into younger wood are required to induce spurs and retain the fruiting zone in the tree interior.

Type III cultivars, characterized by standard habit Golden Delicious and Empire, tend to be spreading with wide crotches and frequent branching. Cultivars of this type tend to bear early with most of the fruit on spurs and shoots that, generally, are one to three years of age. Golden Delicious tends to have brittle wood. Thus, crotch angles must be chosen carefully and trained early. Also, branches are thickened by heading cuts in order to support the early crops. Jonathan also falls in this classification but differs slightly in that it develops dense, fine growth that requires detailed thinning to maintain productivity and good fruit color throughout the tree. The fruiting zone on cultivars in this classification tend to move rapidly away from the trunk to the outside of the tree.

Type IV trees are the tip bearers and are characterized by Rome Beauty, Ruby, York Imperial and Tydemans Red. They tend to have upright main scaffold limbs with narrow crotches and frequent branching. Weeping terminal habit develops due to much of the crop being produced on the ends of previous years' shoots. The lower half of many shoots is devoid of leaves or fruit. On vigorous young trees, delayed spring pruning can induce laterals in this branch region that normally would be bare. There is a strong tendency for the fruiting wood to move toward the extremities of the branches. It is important to use many small thinning cuts at the branch extremities to insure a high percentage of fruit spurs in the one to three year class. It is a mistake to begin pruning branches of these cultivars from the trunk outward, as this practice will result in large amounts of blind wood.

Pruning Different Apple Cultivars

Cortland

Cortland trees develop many small branches of which many need to be removed annually. This requires detailed pruning. Removal of slender, underhanging branches is very important as these produce poor-colored fruit and shade other branches and fruit. Larger branches may be thinned out by distributing several small cuts, beginning at the end of the branch and working to its base.

Delicious

Delicious and its various strains possess an inherent tendency to develop narrow crotches. Such crotches frequently developed bark inclusions that contribute to a weakened tree structure. Therefore, spreading, de-shooting and corrective cuts, to space the most desirable branches along the trunk of young trees, are important procedures during the second to fourth years. Braces can be developed from intertwining water sprouts to help strengthen weak crotches.

Delicious may develop too many medium size branches, resulting in over dense trees, unless wise removal of excess branches is carried out. Because this cultivar is planted primarily for fresh sale for eating, sufficient annual pruning is necessary to produce a high percentage of attractively colored apples. This means that trees must be kept reasonably open to permit entrance of sunlight. Removing small diameter and underhanging branches from both the interior and the periphery of the tree will allow light to enter.

Delicious has a somewhat precarious fruit-setting habit. Detailed pruning may improve the set of fruit. Fruit thinning is important with Delicious to secure a high percentage of large, well-colored fruit, particularly if pruning has not been properly done. Trees are also prone to produce an abundance of water sprouts. The best time to remove these is as they develop early in the growing season.

Empire

Trees of Empire have wide crotch angles and develop a rather dense spur system. This cultivar tends to be a very early bearer, consequently it is desirable to develop trees of Empire because of this cultivar's early cropping tendency. Thus, care must be taken to remove fruit from the leader in the early years, particularly from the two-year-old section. On older trees, renewal pruning may be needed to reduce the number of older spur systems and induce vegetative growth in the canopy interior.

Golden Delicious

This cultivar is an early bearer. Consequently, tree form should be developed as early as possible. It is not difficult to develop a strong, well-shaped scaffold system on this cultivar.

Golden Delicious has a tendency to develop weak, narrow-angled crotches but much less so than that of Delicious. It is, therefore, necessary to develop a framework with wide-angled crotches. Developing branches often become long and with the first heavy crop of fruit, they break because the wood of Golden Delicious is rather brittle. Pruning annually and keeping all branches within reasonable lengths is essential.

Jonathan

Trees of Jonathan naturally develop a dense fine growth. Unless properly pruned, bearing trees become thick and shading occurs throughout the tree. Jonathan does not respond well to heading back cuts, thus detailed thin wood pruning and branch spacing is essential to good fruit size and color throughout the tree. This cultivar tends to be small fruited. If good commercial size fruits are to be produced, careful attention must be given to pruning practices.

Heavy pruning of Jonathan increases the hazards from fire blight, a disease to which this cultivar is very susceptible. It may also reduce fruit color. Nitrogen fertilizer should be restricted on Jonathan in order to improve fruit color and to reduce fire blight susceptibility. The heavier the pruning, the less nitrogen should be applied.

Lodi

Lodi is similar in growing habit to Yellow Transparent and should be pruned in a similar way. This cultivar tends to set fruit heavily in alternate years, especially on the smaller wood in the center of the tree. Fruits produced in the shaded interior are usually of inferior size, green in color and mediocre quality. Therefore, annual detailed pruning in the interior section is necessary to remove most of the thin wood that produces the interior fruit. Branches in the outer portions of mature trees also need annual thinning out and some heading back of long branches.

McIntosh

The McIntosh cultivar naturally produces scaffold branches with reasonably wide-angled crotches, thus resulting in a spreading-type tree with many secondary branches. Therefore, considerable branch thinning is necessary to permit thorough spraying.

McIntosh tends to produce fruit spurs throughout the tree similar to Franklin and Golden Delicious. Pruning to keep the tree open is important to producing well-colored fruit of good size.

Melrose

Melrose naturally develops a structural framework intermediate between its two parent cultivars, Jonathan and Delicious. It tends to form crotches of a somewhat wider angle than Delicious but narrower than those of Jonathan.

A relatively large number of medium size branches develop as the tree reaches bearing age. These are larger than those found in Jonathan but slightly thinner than those developing in Delicious. Consequently, pruning of the maturing tree requires removal of a number of these branches throughout the tree. This will permit entrance of sufficient light to encourage proper development of the attractive red over-color which Melrose fruits can have.

Fruits of this cultivar tend to become over-size, so proper coordination of fertilizing, thinning and pruning is necessary.

Rome Beauty

Trees of this cultivar and relative strains are characterized by many slender branches that cause much shading. Therefore, they require considerable thinning. Each large branch is best pruned as a unit from the tip to the base. The cuts are distributed as evenly as possible and weak wood is removed.

A common mistake in pruning bearing Rome Beauty trees is to start at the base of a large branch and prune outward, removing all the bearing surface for a considerable distance. This leaves a long stretch of barren wood with a cluster of unpruned bushy twigs at the end. If the full crop potential is to be gained, special care must be given to the placement of thinning-out cuts on all strains of Rome Beauty trees.

Stayman

This cultivar tends to develop many rangy, rather large branches. Consequently, heading back and proper selection of primary and secondary branches are necessary on young trees. As a mature tree, Stayman is an open grower that requires removal of few large branches. Corrective cuts, when necessary, should be made to avoid double leaders and weak crotches.

Stayman, especially if slow growing, develops some sharp-angled crotches. Making corrective cuts to eliminate these structural weaknesses before the branches attain large size is desirable. If necessary, water sprouts can be intertwined between weak crotches to make a natural brace and strengthen the framework. Because Stayman is an open grower, much of the pruning can be done with lopping shears. Small cuts, well distributed, give a large food supply to the remaining fruit spurs.

Turley

Turley, similar to Stayman, is a Winesap seedling and should be pruned similar to Stayman.

Yellow Transparent

Trees produce many branches and may become very dense. When the main branches are well spaced, weight of the fruit spreads the tree quite satisfactorily. Very little heading back to outward growing laterals is needed if enough large branches are removed in pruning. Small cuts, well-distributed on branches that are left, help improve fruit size. The amount of thin-wood pruning is necessarily increased as trees grow older.

Yellow Transparent is greatly benefitted by pruning as well as by early fruit thinning. Because it is difficult to sell small fruits, both pruning and thinning are needed in a relatively high degree to improve size of this cultivar and to aid in overcoming biennial bearing. Avoid over-pruning because it induces succulent growth that is quite susceptible to fire blight disease.

Pear Trees

Train pear trees to a central leader system as you would apple trees. Practice very light pruning on bearing pear trees. Even moderate pruning may induce development of water sprouts and fast-growing terminal growth. This type of growth is very susceptible to fire blight infection.

Pruning cuts may be restricted to branches that severely rub each other and to water sprouts as they appear. In all cases, confine cuts to limbs of small diameter. Heading back of terminals should be done only as the tree becomes too high. At this stage, heading back to a lateral branch should be light and cuts made in the smaller diameter wood. Usually, it is not necessary to prune pear trees each year because new growth is not heavy or vigorous. However, examine trees to determine if pruning is necessary.

During dormant pruning, remove all fire blight infected branches. Blight cankers can be detected by their dead, blackened and sunken appearance. Blighted terminals are blackened and often retain the dead leaves through the winter. Remove the diseased portion four to six inches below the obviously injured part.

Remove water sprouts, short growths and spurs on the trunk and base of scaffold branches prior to blooming. This will eliminate possible blight infection of flower-

ing points at the terminal ends of these spurs and short growths, thus preventing blight development that could girdle the trees.

Peach and Nectarine

Open Center System

This training system involves pruning techniques that result in the development of three to four scaffold branches arising near each other on the trunk. Prune all scaffold branches to encourage equal size in development, equal spacing around the trunk and, where possible, scaffold branches arising at a point 18 to 24 inches from the ground.

All kinds of fruit trees can be trained to the open center system, but this system is especially adaptable to peach and nectarine trees, however, the steps can be applied to other fruits as well.

In peach and other trees trained to this system, the primary scaffold branches produce wide angle crotches with the trunk. These trees possess a high degree of winter hardiness in the framework. Preferred crotch angles are 60 to 90 degrees. Bark and wood tissue in and around narrow crotches are usually susceptible to sub-zero temperature injury, especially if such crotches have considerable bark inclusion. Winter injured crotch areas are more susceptible to disease infection such as peach canker and insect invasion, as in the case of the lesser peach tree borer. Branches with bark inclusions associated with narrow crotches often split out when under a heavy fruit load.

Time of Pruning

Delay pruning of peach and nectarines until the danger of severe freezes is past. Generally, pruning should be done from mid-March to early April. It should not, in normal seasons, be delayed so long that buds might be knocked off in the pruning operation. If severe winter temperatures have been experienced, delayed pruning may be especially beneficial. By delaying pruning, one can avoid the removal of buds that have survived. Winter injured flower buds can be identified in late winter or early spring by the characteristic dark centers when cut in cross-section. Wood that has been injured by low temperature will appear "wrinkled" or withered and when cut will show a brown layer of tissue under the bark. Such wood can be easily detected and removed by early spring.

The immediate objective of this training method is to prune the tree in a manner that will induce growth of branches to form wide angles with the trunk. Steps in the pruning procedure are as follows:

At Planting: Head the 1-year-old tree to a height of 24 to 28 inches (Figure 14—see p-14). It is possible that the tree will have one or two branches already started that could be used as primary scaffold branches. If so, head these back so that only two or three buds remain on each. Preferably, such branches should arise from two to four inches below the point where the tree was headed. Remove all other branches. If no laterals suitable for scaffold branches are present, then remove all branches.

June of First Year: By early June, most buds on the tree will have developed into leaf rosettes or growing shoots. The most vigorous shoots usually arise from the uppermost three or four buds on the trunk and often

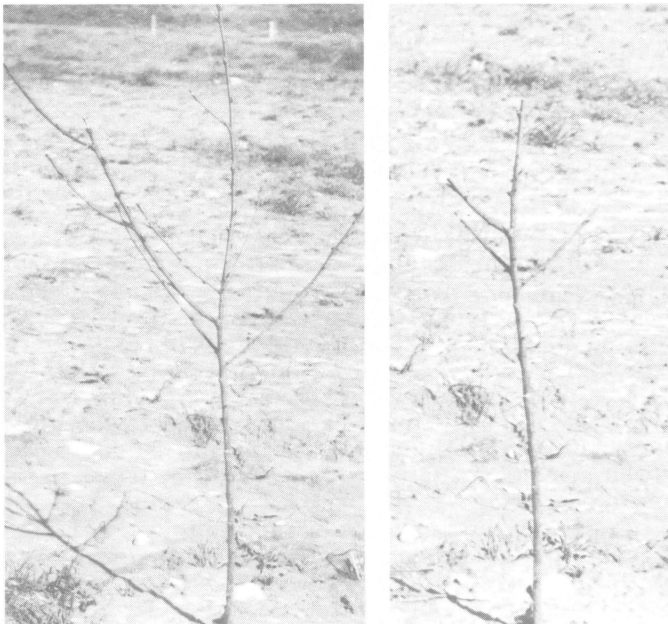


Fig. 14: Peach tree at planting to be trained to the open center form, left. Right, the same tree after pruning to leave 3 wide angle branches for scaffolds and a 2 to 3 inch stub in the center.

form much narrower angles with the trunk than do the lower shoots. Thus, they are often unsuited for developing into the tree framework. If shoots with such narrow angles are shortened to two or three inches, the less vigorous shoots below them but with more desirable angles will be induced to grow more vigorously. If no shoots exist below those headed back, this severe pruning usually will cause buds to break and shoots to develop below them. From these can be selected the shoots to develop into the primary scaffold branches.

Four lateral shoots generally are selected to develop into the primary scaffold. Some trees may develop only one suitable shoot the first season, while others may have several. Head back severely, leaving only a few inches of growth. Remove any shoots arising below the selected scaffold branches (Figure 15). If one of the shoots left for a scaffold is overly vigorous and tends to dominate the tree, shorten it to bring it into balance with the other branches. The best framework results if all the scaffold branches grow at about the same rate.

It is necessary to go over the trees again three to five weeks later. At this time, over-vigorous shoots may need cutting back again to maintain balance of growth. Should additional scaffold branches be needed to complete the framework, these can be selected at this time.

Spring of Second Year: While the trees are still dormant, preferably in March, additional pruning cuts will be necessary for the training process (Figure 16). At this time, those branches remaining in the center above the primary scaffold branches should be cut back. Only short stubs should remain from which a small cluster of shoot growth will develop in the center of the tree the second season to help maintain the open center. Remove any growth below the scaffold branches at this time. Any growth arising on scaffold branches within 6 inches of the trunk or on the trunk should be removed at this time.

If, for some reason, the three or four primary scaffold branches could not be selected the previous June, they may be chosen at this time. Remove all branches below



Fig. 15: Summer pruning of a peach tree in June of the first year. Left, before pruning and right, removal of unwanted shoots and heading back shoot growth on stub in tree center.



Fig. 16: Left, the same peach tree as in Figure 14 in the spring of the second year; right, after pruning. Note the center stubby growth remains.

the scaffold branches and cut those above to short stubs, as explained previously.

Avoid cutting the main scaffold branches unless necessary to maintain balance in the tree. If one scaffold



Fig. 17: The center, stubby growth is headed back so as not to compete with other growth of the tree.



Fig. 18: Peach tree in third year before pruning (left) and after pruning (right).

fold branch dominates the tree, head it back to a size proportionate with the others. It is necessary to have all scaffold branches continue growing at about severely the same rate in order to maintain a well-balanced tree.

June of Second Year: Shoots arising from the stubby growth above the scaffold branches should again be severely cut back (Figure 17). Remove any growth arising from the trunk below the laterals. It may be necessary to do light pruning on scaffold branches in order to maintain tree balance.

Center Stubby Growth: If the tree has grown enough to “shade out” the center stubby growth, prune it out completely. Should the stubby growth in the center still exhibit vigor, prune it back severely and leave it for another growing season.

Other pruning normally needed is corrective pruning. Remove branches with very poor crotches, growing through and across the tree and those that are broken or show severe insect or disease injury. Moderate heading back of branches is necessary in order to maintain a balanced, open center tree form.

Removing Non-Bearing Parts: After the third season’s growth, the permanent shape of the tree should be well established. Dormant pruning during this period consists of light heading back where needed and removal of damaged as well as undesirable branches (Figure 18). Only sufficient pruning need be done to maintain the tree within desirable size limits. As trees begin bearing, the weight of crops will open and spread the trees.

Pruning Mature Peach and Nectarine Trees

Annual pruning of bearing trees is essential to the production of fruiting wood and high yields of quality fruit. Flowers of these trees are formed only on terminal growth, thus proper pruning will aid in the production of good fruiting wood. This becomes particularly important as the trees become older. Pruning the bearing tree must also be done to help in pest control and to provide for favorable light conditions throughout the tree.

Pruning Procedure: Peach and nectarine trees that have reached bearing age require annual heading back and careful thinning out (Figures 20, 21, 22 and 23 — see p-16). In addition, all damaged or diseased wood should be removed as well as that growing in an objectionable direction. Also, remove hangers, branches that grow downward, and branches that interfere with the movement of equipment through the orchard. In general, trees should be pruned to the extent that fruit can be harvested handily from the ground. When thinning out of branches is done, distribute cuts over the tree so as not to leave a cluster of twigs at the ends of branches.

The “horse-tail” effect can be avoided when pruning proceeds from the tip to the base of each scaffold branch.

Vigorous, upright sucker growth frequently develops in peach and nectarine trees. It is most abundant following severe pruning or loss of large limbs. Such growth may reach five or six feet and may present a special problem. Most suckers need to be removed completely during dormant pruning, but a few may remain for developing into new fruiting wood. These are headed back to an outward lateral branch with some

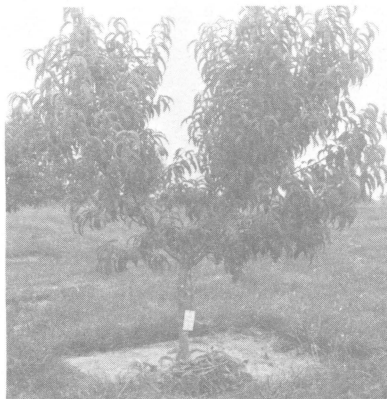


Fig. 19: Pruning during June of the third year. Above, tree before pruning and below, the same tree after short growth was removed from the center.

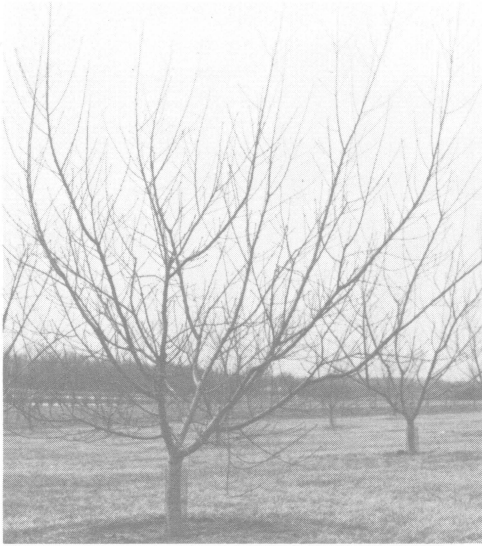


Fig. 20: The same tree as in Figure 19 in its fourth year. Left, before pruning and right, after pruning.



Fig. 21: Shown is the same tree as in Figures 19 and 20 in its fifth year. Left, before pruning and right, after pruning.

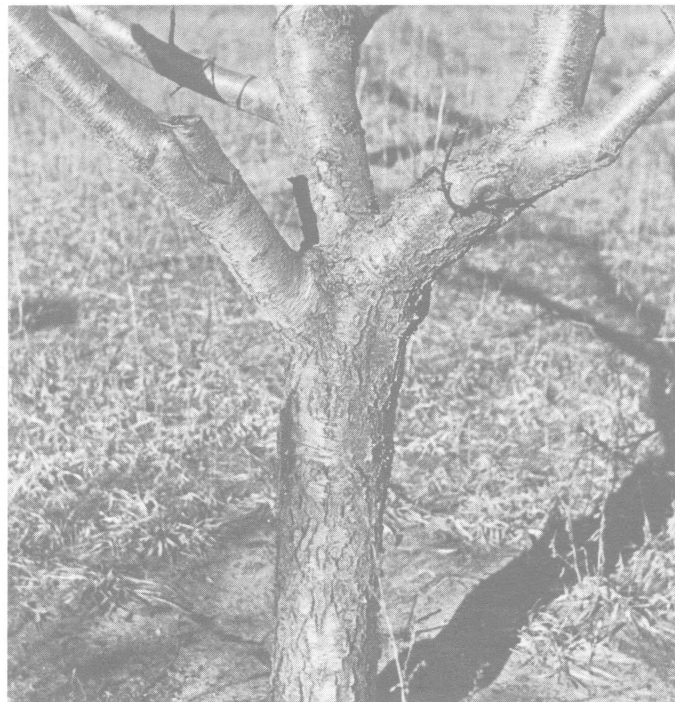


Fig. 22: A satisfactory peach tree can be developed with only two wide angled, primary scaffolds. A five-year-old tree (left) before and (right) after pruning.

Fig. 23: A mature eight-year-old peach tree with good open center framework that is strong and less subject to low temperature injury than one with narrow angles.



Fig. 24: Proper pruning is essential to control of peach canker disease. Cankered branches should be removed, as the one on the left, which has a canker near its base.

thinning out of the remaining laterals. So handled, they may develop into fruiting wood replacing that which was lost or pruned away.

To maintain the trees at the desired height, it is important to head the upward growing branches to strong, outward growing laterals. It is preferable to make the cut at a height one can reach easily with lopping shears or a short pole pruner while standing on the ground. The renewal point is first established by heading back each main branch as soon as it reaches the desired height. This cut is ordinarily made in one-year-old wood. In succeeding years, make renewal cuts in the



Fig. 25: Height of mature peach trees can be controlled by annual heading back of upright growth.

vicinity of the original cut, some years above and some years below it.

Whenever possible, prune from the ground, hence the reason for keeping trees low. New shoots ordinarily develop near the renewal cut. The best of these can be used for fruiting wood the following year and others removed. The center of the tree is kept reasonably open in order to maintain the spreading form.

Avoid climbing in peach trees while pruning, especially with hard soled shoes. The bark is easily scuffed, which results in open wounds where canker infection can take place. If trees are too tall to be pruned from the ground, prune from ladders.

Severe heading back, or "dehorning," may on occasion be acceptable. It fits most logically into the pruning program after trees have been allowed to grow rather tall from lack of pruning in years when frost damage occurred and crops were borne only in the upper parts of the trees. When such trees have a complete crop loss, the severe heading back or dehorning may be the best way to induce new shoot growth lower on the trees, thus increasing bearing surface for the next year. Summer pruning can also be useful (see page 10).

Peach Canker Removal: The peach canker disease presents some special problems in pruning peach and nectarine trees. Complete removal of a canker infected branch is necessary when the canker is near its base. When the canker area is farther out on a branch, the cut should be made six to eight inches below the visible canker edge. In any case, avoid cutting through a canker. If cuts are made through a canker, the disease organism may be transmitted to healthy wood at the next cut by way of the shears, unless the shears are disinfected between cuts. Prunings, with diseased wood should be removed from the orchard and buried. Pruning out of cankered branches should be as complete as possible if this disease is to be kept at a minimum in the orchard. Where canker is a problem, prune as late in the spring as possible. This avoids wounds that are points of easy entry of the pathogen in early spring when the organism is most active.

Red Tart Cherry Trees

Central Leader Training

Cherry growers are setting trees closer together (14 to 18 feet in the row), keeping them small for high yields of hand or mechanical harvest. In this system, young nursery trees normally have all branches removed (whip) and are headed to 24 to 28 inches. This allows proper selection and development off of scaffolds for mechanical harvest. When side branches are 12 inches long, use clothespins to push branches to 45° angles. Branches should be in four directions, spaced 6 to 8 inches apart on the leader trunk. Weaker branches with poor position should be cut out.

In the second year, select another tier of branches on a vigorous leader so that a total of six to eight permanent branches are formed. Spread these branches with clothespins. Spread the lower branches with wooden spreaders.

Summer hedging begins in the third or fourth year. (See cherry under Mechanical Hedging section). Dormant pruning using thinning cuts should be done annually on mature trees.

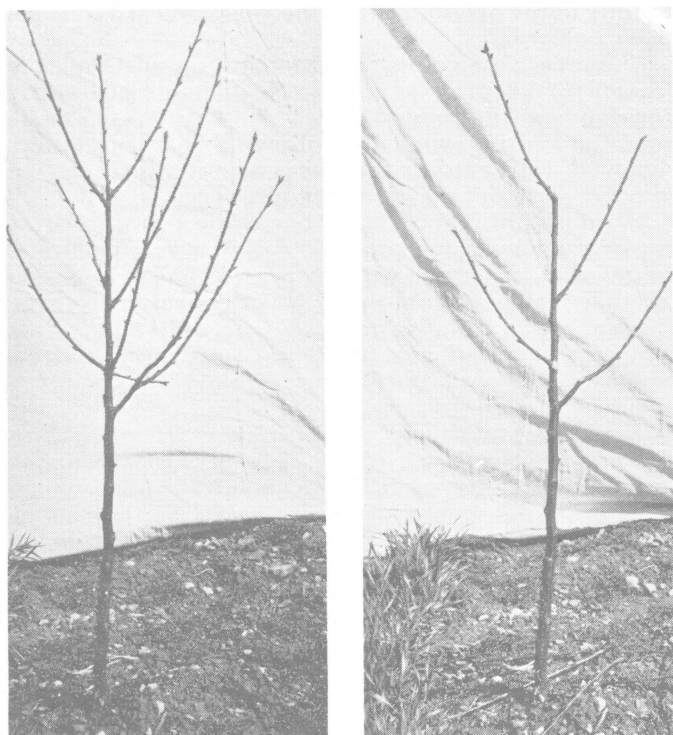


Fig. 26: A one-year-old Montmorency cherry tree at planting. (Left) before pruning and (right) after pruning and selection of four well spaced branches for the primary scaffolds.

Modified Central Leader

Tart cherry trees usually are well branched as they come from the nursery. After planting, select three to four limbs with wide crotch angles spaced at least six to eight inches apart and at intervals so that scaffolds are not directly across from each other (Figure 26). The lowest branch should be 18 to 24 inches above the ground for hand harvest and 26 to 36 inches for mechanical harvest. Allow a central leader to develop over the next two to four years. Select two or three limbs 18 inches above the original four and remove the central leader.



Fig. 27: A mature Montmorency cherry tree before pruning.

If a nursery tree has weak or small branches, remove all branches, treat it as a whip and head the leader to 24 inches. Use clothes pins when shoots are 12 inches long to develop strong branch angles. Select four branches that are 18 to 24 inches above ground, separated by six to eight inches and remove all branches below 18 inches in mid-summer. Allow a central leader to develop as described above.

Because the modified central leader system is usually preferred in training red tart cherry trees, bearing trees are pruned to maintain this shape and for high production of quality fruit (Figure 27). Little pruning is necessary for the first five years.

Characteristically, the red tart cherry tree tends to produce narrow angle crotches. Trees tend to open up with the crop, but the use of spreaders in young trees may be helpful in developing a strong tree framework.

The red tart cherry tree tends to produce a dense top that requires an increasing number of thinning cuts in order to keep the trees open. Unless special attention is given to these trees, the fruiting wood in the lower interior portions will shade out and perhaps die. Because the trees have a spur bearing habit, care must be exercised so as not to remove this portion of the surface when thinning. Such limbs can severely shade the lower portions and may cause limb rub damage to main scaffold members, hence these should be pruned out each year. Occasional cutting back of upright wood to outward laterals is necessary on the main branches.

Mature, red tart cherry trees perform best under light, annual pruning. Remove dead wood and broken branches as they appear, as well as cross growing branches. With properly grown trees, some thinning-out pruning is necessary to aid thorough pest control and to make harvesting easier.

Sweet Cherry Trees

The sweet cherry tree develops into a large tree. The modified central leader system of training, as described for the apple, is most desirable for the sweet cherry tree. Three or four primary scaffold branches with eight inches or more vertical distance between them and with proper spacing around the trunk are



The same tree after pruning to thin out weak wood and open up the tree for good light penetration.

desirable. The sweet cherry tree is occasionally injured by low winter temperatures, and the injury is usually greatest in the areas of narrow crotches. Therefore, special attention must be given to the selection of primary scaffold branches to avoid narrow crotches.

After the primary scaffold branches have been selected, use care in the selection of secondary branches with wide angles. These, likewise are an important part of the tree structure and should not be developed closer than 15 to 18 inches from the trunk. Thinning-out cuts are essential as trees grow older. When the leader reaches the desired height, it should be headed back to an outside branch.

Because of the natural tree size, sweet cherry trees, particularly on Mazzard rootstocks, are difficult to maintain much less than 16 to 18 feet in height. Trees require only light annual pruning. The primary objective here is to remove dead, broken and weak branches, especially those in the center of the tree. As trees grow older, it may be necessary to head back branches when they become too long. Such a procedure should help to develop new fruiting wood near the center of the tree and may also prevent limb breakage.

Plum Trees

A pruned tree is especially important in the spraying operation for the control of brown rot in plum orchards. European plums such as Reine Claude Italian Prune, German Prune, Bradshaw, Imperial Epineuse and Stanley are best pruned and trained to the central leader. Selected scaffold branches on the plum tree may be closer vertically than with apples. However, about six inches of vertical spacing between scaffold branches is desirable.

Lighter pruning may be followed with European and Damson plums than with apples. As trees reach heavy bearing, there is reduced growth of terminals and increased growth of fruiting spurs. At this time, the amount of pruning may be increased. Detailed pruning



Fig. 28: The black knot disease of plum can be partially controlled by pruning out affected branches as shown by dotted lines.

throughout the tree and enough thinning-out cuts to maintain desirable growth over the lower branches is recommended for mature trees.

Cultivars of the Japanese-type plums such as Methley, Formosa and Burbank grow in a more spreading fashion than European plums. The trees also tend to grow thicker. Thus, training young trees and pruning mature trees are similar to those of the peach, except that fewer heading back cuts are generally required than with the peach. Considerable thinning-out of small diameter wood in immature trees is necessary to maintain production of large size plums.

Removal of Black Knot: Pruning is the most important means of controlling Black Knot disease of plum. Branches with these canker-like growths, generally of brown or black color, should be carefully cut from the trees and removed from the orchard. Twigs or branches with the characteristic swelling or knots may be removed any time the infections are first noticed but most certainly cut out during dormant pruning. Cut the branch off six or more inches below the apparent knot to be sure all infected tissue is removed.

Apricot Trees

Apricot trees are best trained to the open center system as described for peach trees, but the modified central leader system can also be satisfactory.

With young as well as mature trees, long, slender branches require some heading back to laterals that are growing in an outward direction. Trees should be kept open with considerable thinning-out pruning in order to induce annual formation of fruit-bearing wood. In the case of the apricot, fruits are borne on short spurs that are rather short lived. A primary objective is to remove those branches loaded with spurs that are six years old or older. Annual heading-back and thinning-out will help assure formation of young, productive spur growth.

Apricot trees that are neglected and produce short annual terminal growth often fall into a biennial bearing habit, producing a heavy crop of small fruits one year and a light or no crop the next. To overcome this, pruning and fertilizer programs should be coordinated so as to result in 16 to 24 inches of terminal growth annually.

Apricots bloom very early; consequently, all or most of the flowers or young fruits are frequently killed by frost. Delaying pruning until after bloom may be advisable with apricots.

Pruning Neglected Trees

On occasion it becomes necessary to prune fruit trees that have been neglected for a period of years. The situation is often confusing to the pruner when he approaches a tree that has overgrown its desired bounds, is too tall, overly dense and unproductive in a large portion of its interior. The primary pruning objectives with such trees are to reduce tree height and to thin out branches. This will permit good light penetration throughout the tree and assure better spray coverage as well as fruit production.

A suggested procedure for pruning a neglected tree is as follows:

1. Lower the height of the tree where necessary. Up to four or five feet of growth can be removed in one year. If it is necessary to remove more top growth, spread the pruning over two or three years, removing three to five

feet of the older wood each year. Most of the water sprout growth in the tree top, resulting from the previous year's pruning, will be removed with the older growth taken out. The final cut in the top should be just above an outside lateral branch. Subsequent pruning in the tree top will consist largely of annual water sprout removal.

2. Remove undersized, large (over 2 inches diameter) branches from the interior of the tree, if necessary. Usually, it is best to remove all branches at once rather than distributing the cuts over a period of years as in tip removal. However, if more than four large branches must be removed, remove half one year and half the next.

3. Prune off low hanging branches and dead, diseased or broken branches wherever they exist in the tree.

4. Head back lateral branches that are too long, bringing the tree to a desired breadth. Prune upper branches to shorter lengths than those lower on the tree.

5. Thin out branches in all parts of the tree. Remove underhanging branches, strong upright growing shoots and water sprouts as well as other weak growth. Thin the outer areas of the tree first and the interior last. This procedure permits the pruner better vision so he can leave some bearing wood near the center of the tree and avoid leaving all the bearing surface in the tree's periphery. The amount of thinning-out pruning will be determined by the original density of the tree. It needs to be sufficient to permit some light penetration to the center of the tree when in leaf. Light is necessary to the regeneration of fruiting wood in any part of the tree.

6. Complete rejuvenation of a neglected tree may take one, two or three years of rather severe pruning, as indicated in the previous paragraphs. For apple and pear trees, it is usually best to distribute the pruning over two or three years, especially when large cuts are needed. Peach, plum and cherry trees can often be completely pruned back and thinned-out in one year.

7. Follow annual, moderate pruning once the tree has been rejuvenated.

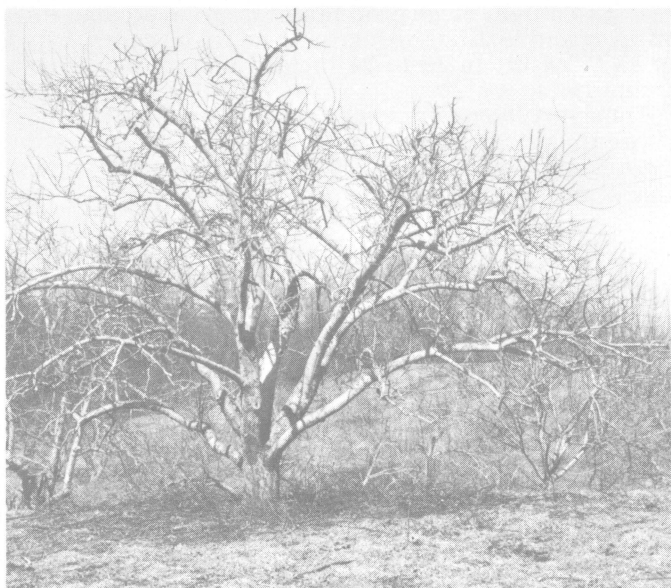


Fig. 29: Pruning a neglected apple tree can aid in bringing it back into useful production. The tree above was partially pruned, as shown in photo below, in one season. Heavy pruning should be carried out over 2 to 3 seasons.

Power Pruning

Commercial orchardists have adapted various types of power-operated equipment to make the pruning operation easier, quicker, and more efficient. Most power pruners work on the principle of compressed air activating a piston that operates the shear head. Power saws operate on the same principle. Some power pruners operate from the tractor hydraulic system instead of using compressed air.

Small, powered chain saws are also used in orchard pruning. These saws are especially useful in orchards when rather large cuts must be made.

Along with the use of power pruners has come the use of various types of platforms and mobile towers from which the pruning is done and that move the workmen through the orchard. Such equipment is commercially available, although some growers have built their own. Development and use of such equipment have increased the efficiency of power pruners, hastened the pruning work in large orchards and made the entire job easier.



Fig. 30: Small power saws hasten removal of large limbs.



Fig. 31: Hydraulically controlled towers and pruning equipment increase worker efficiency. This equipment operates from the tractor hydraulic system.

The use of pruning platforms and hydraulic towers makes possible the pruning of a tree from the outside toward the center. In this way, the outer and higher branches can be thinned easily and effectively. As a result, more light may penetrate the interior of a tree, inducing more productive wood in this area. The net result is greater exposure to light of the entire leaf and fruiting areas of a tree, which increases production of well-colored, high quality fruit per tree. Use power pruners with cautions as over pruning and improper cuts can be so easily made.

Pruning Equipment

For the small orchardist and the home fruit grower, hand tools provide the best and most economical pruning equipment. Hand shears, lopping shears, pole pruners and pruning saws of various sizes and styles are available. Each tool will perform well if properly used and the cutting edges are kept sharp.

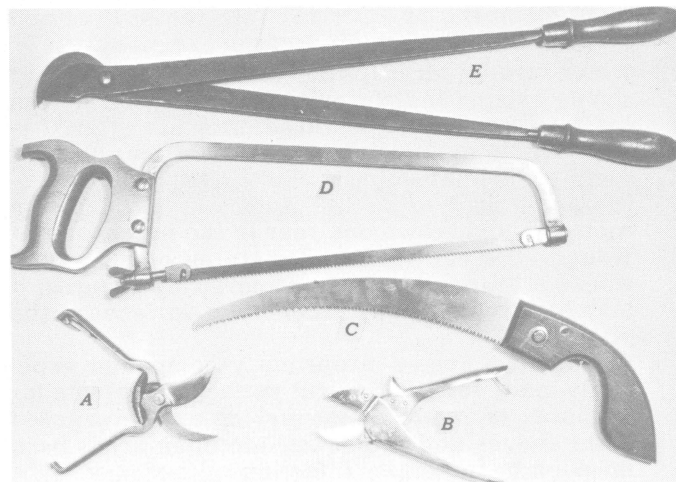


Fig. 32: A hydraulically driven sickle blade mower can be mounted on a forklift and used to top hedge peach trees during summer.



Fig. 33: Peach tree size can be maintained in high density plantings with a sickle blade mower mounted on a forklift.

Fig. 34: Small cuts are made with hand shears. The type hand shears at left (A) make snug cuts for all tight pruning. The "roll cut" type (B) handles small twigs very easily and is useful for detail pruning.

Curved saw, C, which cuts on a draw or pull stroke, works fast on larger limbs but does not make as clean cuts as D. The curved saw speeds up peach pruning. The swivel-blade orchard pruning saw, D, makes a clean, close cut in narrow crotches and at difficult angles.

The steel-handled lopping shears, E, are indispensable in peach pruning and are useful for mature apple trees where many limbs over an inch in diameter must be cut. Care in placing the blade of lopping shears against the supporting limb will make a snug cut.

PRUNING TERMS

(Terms are defined primarily as they are used in the text of this bulletin.)

- 1 Bearing tree—a fruit tree that has reached the age of capably producing fruit annually.
- 2 Branch—a shoot that has developed to maturity and has passed through one or more dormant seasons.
- 3 Bud—the initial of an unclogged branch or tip of a shoot. A bud may develop into leaves or a vegetable shoot, or into flowers and their subtending parts. It may be terminal as at the end of a branch or shoot, or lateral as in the axil of a leaf.
- 4 Bud Union—the point of attachment between the scion cultivar and the stock of rootstock upon which it is budded or grafted.
- 5 Crotch, crotch angle—the angle between two contiguent shoots or branches near the point of their union.
- 6 Cultivar—a term that is now used in place of the older term, variety, when designating a specific horticultural variation in a plant species.
- 7 Disbudding—the removal of dormant buds, a practice sometimes followed on newly planted or young trees in the selection of buds for development into scaffold branches.
- 8 Dwarf tree — generally, a cultivar that has been propagated on a size controlling rootstock, as M 27 and M 9 and produces a small sized apple tree.
- 9 Espalier—a wall or framework upon which a tree or other plant may be trained; or, the shape to which a plant is trained to be more or less picturesque as well as productive.
- 10 Feather maiden tree — a one-year branched tree in the nursery.
- 11 Fruiting wood—branches of a tree or other plant carrying flower buds and the potential for bearing fruit.
- 12 Growth regulator—a chemical substance that may inhibit or accelerate vegetative growth or may affect the initiation of floral or vegetative buds or in some way may alter the normal growth habit of the plant. The substance may occur naturally in plants or it may be formulated and applied to plants for the purpose of producing desired effects upon growth habits.
- 13 Heading back—usually refers to cutting away a portion of the terminal growth of a branch; it may be an upright branch or one growing laterally.
- 14 Hedging—a term applied to pruning by mechanical devices that cut away, in bulk fashion, portions of the tops and sides of trees.
- 15 Malling rootstocks—one of many groups of rootstocks classified at the East Malling Research Station in England. They represent various degrees of size control of the trees of cultivars propagated on them.
- 16 Old Wood—in pruning, this refers to branches that have been productive or bearing for a number of years, generally for more than five or six.
- 17 One-year wood—wood or branches that were produced by the previous season's growth.
- 18 Pome fruit—fruits are classified into specific types according to structure; the pome fruits are all similar in structure, although appearances may be quite different, and are represented by the apple, pear and quince.
- 19 Rootstock—the root system and portion of attached stem upon which another plant part is propagated (budded or grafted)
- 20 Scaffold branch—one of the branches comprising the basic framework of a tree or other plant; primary scaffolds are those arising directly from the main trunk of the tree.
- 21 Semi-dwarf tree—a cultivar that has been propagated upon a specific size-controlling rootstock that produces a mature tree somewhat smaller than a standard tree and somewhat larger than a dwarf tree; rootstocks most often used for this purpose are M 26 and M7.
- 22 Semi standard — a cultivar that has been propagated upon a specific size controlling rootstock that produces a tree larger than semi dwarf but smaller than standard. Rootstocks such as MM 106, M 2 and MM 111 are often used.
- 23 Shoot—vegetative growth produced from a dormant bud that possesses leaves, generally, the growth developing during a current season.
- 24 Spreader—a short piece of wood or metal used to insert between a lateral branch and the main trunk of a young tree for purposes of producing a more horizontal growth habit of the branches wider crotch angles.
- 25 Spur—short, thick growth upon which flowers and fruits are born, typically on most apple, apricot, cherry and pear trees.
- 26 Spur type tree—refers to mutations of apple cultivars that produce fruiting spurs earlier than conventional ones of the same cultivar generally one that has a smaller tree size.
- 27 Standard tree—commonly refers to a tree that has been propagated by grafting or budding a cultivar on a seedling rootstock.
- 28 Stone fruit—a specific type of fruit classified according to structure; refers primarily to peaches, plums, apricots, cherries and similar fruits with a stone layer surrounding the seed.
- 29 Sucker—refers to shoots arising from the rootstock below the bud or graft union.
- 30 Thin wood—refers to branches of rather small diameter in relation to overall length; these usually develop in the more shaded portions of a tree and from the lower sides of larger branches and are generally unfruitful or produce small, poorly colored fruits.
- 31 Thinning Out—refers to the removal of branches in a portion of the tree or throughout the tree or other plant for purposes of permitting greater light and spray penetratio into all areas of the plant.
- 32 Water sprout—term applied to vigorous, succulent shoots arising indiscriminately and generally on the larger branches of a tree; they are often produced in large numbers just below a pruning cut.
- 33 Whip—a single, unbranched shoot that has developed from budding or grafting a cultivar on a rootstock and grown one year in the nursery row.
- 34 Wound—the cut surface remaining on the plant where a branch has been removed by pruning; it may also refer to any other open surface on the plant.
- 35 Wound dressing—a proprietary compound especially made for treating cut surfaces on plants for purposes of reducing the drying of the exposed plant tissues and protecting the open areas from invasion by infections infectious organisms.

Think Metric

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)				
° F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	° C

