

Pruning and Training Peach Trees

Peach trees are pruned to maintain tree size and shape and to help manage light and crop load.



The primary advantages of a V system are that the trees are uniform and easier to prune and thin, the tree form is more conducive to mechanization, and yields are higher for the first 2 or 3 fruiting years because the orchard canopy develops faster than for open center trees.

Growth Habit of Peach Trees

There are several different growth habits for peach trees, ranging from weeping to very upright, but the two that are commercially available are referred to as “Standard” and “Pillar or Upright” type trees and the Standard type is by far the most important.

Standard type

Standard type trees are easily trained to an open center or vase shape with 3 or 4 primary scaffold branches or they can be trained to V-shaped trees with just 2 scaffold branches. Training standard type trees to a central leader form is possible, but is not recommended because trees require considerable pruning and yields tend to be lower than for open center trees. Because standard trees can be maintained at a 7 or 8 ft height with good pruning and most commercial cultivars are the standard form, this discussion on pruning will pertain primarily to standard type trees.

Pillar type

Pillar-shaped trees were developed by the USDA and two cultivars, ‘Crimson Rocket’ and ‘Sweet-N-Up’, have been commercially available for several years. Trees are very upright with narrow crotches. Non-pruned trees have multiple leaders, a canopy diameter of about 6’, and attain a height of about 14’. Research with pillar trees is limited, but trees can be planted at spacings of about 6’ x 12’. It is difficult to maintain an open tree canopy because branches tend to grow upright even after spreading. Multiple leader trees tend to be more productive and require less pruning than trees trained as central leaders. At this time it seems that pruning and tree training should be minimal to avoid excessive tree vigor. Judicious pruning of young trees to prevent excessive shading within the canopy will allow the expression of the natural growth habit and encourage fruiting.

Compact trees have shorter internodes, wider branch angles, and a greater number and longer laterals than standard trees. Examples of compact trees include ‘Com-Pact Redhaven’ and ‘Compact Elberta’. The trees tend to be about 20% smaller than standard trees, but the canopies tend to be dense and light penetration into the canopy may be inadequate for production of high quality fruit.

Types of Pruning Cuts

There are two types of pruning cuts, “heading” and “thinning”.



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Thinning cuts

Thinning refers to removing a limb or shoot at its point of origin along an older branch. Thinning cuts do not induce vegetative growth near the pruning cut and are usually preferred for minimizing tree size and for removing excess shoots. Thinning cuts are also used in older trees as a method of fruiting shoot renewal. When a shoot that fruited the previous season is removed there are buds imbedded in the bark in the collar of the shoot that are released from dormancy and may develop into desirable fruiting shoots for the next year.

Heading cuts

Heading cuts remove the terminal buds that produce plant hormones that normally inhibit shoots from developing from buds below the terminal bud. Heading a one-year-old section of a shoot encourages shoot development from the two or three buds below the cut. Heading older branches encourages shoot development from buds imbedded in the bark within several inches below the cut. Heading cuts are used to shorten and stiffen branches and to induce branching. Heading cuts are usually limited to the year of planting to induce branches from which scaffolds will be selected. "Bench cuts" are a special type of heading cut where terminal section of a branch is removed just above a side branch. Bench cuts are sometimes necessary to redirect upright-growing branches to the outside, but should be avoided if possible because watersprouts will develop on the flat branch section below the bench cut.

Types of Buds and Shoots

Peach trees have only two types of buds - vegetative and fruit. The terminal bud at the end of a shoot is always vegetative and produces a leafy shoot. Axillary buds develop during the summer at the bases of leaves on current season's shoots and can be either leaf (vegetative) or flower buds. Peach flower buds are termed "pure" or "simple" because they contain only flower tissue. A peach flower bud produces a single flower that can set one fruit. Each node (the point on the shoot where a leaf is attached) on a vegetative shoot may have from zero to 3 buds. Nodes at the terminal end of a shoot usually have single buds. The small, pointed buds are vegetative and the larger, rounder, and more hairy buds are flower buds. Many of the nodes on the lower two-thirds of a shoot have 2 or 3 buds arranged side by side. There can be any combination of flower (F) and leaf (L) buds (FL, FF, FLF, FFF), but most often a leaf bud is flanked by flower buds (FLF). The number and distribution of flower buds on a shoot can vary with tree vigor, the cultivar, and the light environment in which the shoot developed. Some cultivars have 25 flower buds per foot of shoot length, whereas other may have only 15 flower buds per foot of shoot length. Short shoots, less than 6" generally have the most fruit buds per inch of growth. Current-season shoots developing on trees with heavy crop loads also have fewer fruit buds on the basal third of the shoot. Shoots developing in low light environments (less than 40% full sun) have fewer flower buds than shoots in high light regions of the canopy. Shoots longer than 2 feet often produce few flower buds at the base and terminal ends of the shoot. Moderately vigorous shoots have a high proportion of nodes with 2 flower buds.

Vegetative buds at most nodes have the potential to develop into lateral shoots that may be fruitful in subsequent years. Axillary buds develop along the growing shoot and normally remain dormant until the following spring. However, some axillary buds on vigorous current season's shoots (greater than 2 feet long) remain dormant for only a few days and grow to produce secondary shoots or "syllaptic shoots". Syllaptic shoots are not very fruitful because few nodes have fruit buds. The ideal fruiting shoot is 12 to 24 inches long and 3/16 to 1/4 inch thick at its base, with no syllaptic shoots. Proper pruning, fertilization, irrigation, and fruit thinning must be practiced to ensure adequate annual shoot growth to produce appropriate numbers of fruit buds for the following season. Remove short shoots (less than 6" long) because they tend to produce small fruit due to inadequate leaf area in the vicinity of the fruit.

The Role of Light

Leaves intercept light and in the biochemical reaction called photosynthesis, light energy is used to produce carbohydrates. These carbohydrates are used for growth of all parts of the tree (leaves, shoots, trunks, roots and fruit). Light penetrates only about 3 or 4 ft into the tree canopy. The fruiting zone of an open center tree can be thought of as a doughnut supported by scaffold branches. The ring-shaped fruiting zone is about 4 ft wide and 4 ft deep. If light becomes limiting, the fruiting zone will move higher above the ground with little fruiting in the lower portion of the tree. The critical light levels differ for different types of growth and at different times of the season. Flower bud development requires about 20% full sun, especially during June and July. Low light levels later in the season have little effect on flower bud production or fruit set the following year. Production of large, highly colored fruit with high sugar levels requires 25% full sun during the final 6 weeks before harvest. By pruning to minimize shade, peach trees can be held to 8 ft in height with fruit developing throughout most of the canopy. Shoots developing in very shaded regions of the canopy tend to die during the growing season. Dead shoots in the tree interior are indicative of a canopy that is too dense, and shoots creating the shade should be removed.

Pruning

Time of Pruning

Peach trees can be pruned in the summer or during the dormant season, but the objectives of pruning vary with time of pruning. Summer pruning is performed in July, when sylleptic shoots are visible, to select scaffold branches on young trees and to redirect the growth of young scaffold branches. For fruiting age trees removing upright and vigorous shoots in June and July will reduce shading to maintain fruiting wood in the canopy interior. Light during June and July, but not later in the season, is critical for flower bud development. Summer pruning to reduce shade two to four weeks before harvest will moderately increase fruit red color, but fruit size and sugar levels will be unaffected. Dormant pruning is used to remove upright and vigorous shoots that shade the tree interior, to limit the size of the tree and to remove excess fruiting shoots. Dormant pruning alone will not reduce shading enough to maintain fruiting wood in the lower regions of the canopy. Trees that are summer pruned each year often require little dormant pruning. Pruning temporarily reduces a tree's tolerance to low temperatures. Therefore, avoid pruning before late February and before predicted low temperatures.

Pruning to Manage Crop Load

Fruit size is negatively related to the number of fruit on a tree. Crop load is typically adjusted within 45 days after bloom by removing excess fruit and leaving fruit about 6 inches apart on a shoot. The hand-removal of fruits requires much labor and is expensive because it can require up to 130 man-hours per acre. Retaining fewer fruiting shoots during pruning and leaving fruit 4 inches apart on the shoot can reduce thinning time and improve fruit size. The distance between fruit on a shoot or the number of fruit per tree is not very important, but the number of fruit per acre is critical for fruit size. Therefore, if trees are pruned lightly to retain many fruiting shoots, fruit should probably be thinned to at least 8 inches between fruit. Also consider the genetic component of the cultivar for fruit size. In general, early-season cultivars produce smaller fruit than late-season cultivars. Therefore, early-season cultivars should have lower crop loads and this can partially be achieved by retaining fewer fruiting shoots per acre. The optimum numbers of fruit per acre depend on the cultivar and availability of irrigation. For small-size cultivars a provisional number of fruit per acre is about 45,000, which would require 11,250 shoots if the fruit are thinned to 4 fruit per shoot. For medium-size cultivars a reasonable target crop load is 70,000 fruits on 17,500 shoots per acre and for large-fruited cultivars 100,000 fruit on 25,000 shoots per acre is suggested. To calculate the desired number of shoots per tree, simply divide the desired number of shoots by the number of trees per acre. For example, for large-fruited cultivars with a tree density of 150 trees per acre, retain 167 shoots per tree and retain 4 fruit per shoot to produce 100,200 fruit per acre.

Open-Center

The most common training system for peach during the past 100 years is the open-center because relatively small trees with good light distribution throughout the tree can be maintained fairly easily. Young peach trees must be pruned carefully to develop and maintain fruiting wood near the tree center. It is fairly easy to maintain fruiting wood at the tree interior with a combination of summer and dormant pruning, but once lost, it is very difficult to develop new fruiting wood at the tree interior.

Pruning may vary slightly depending on the specific objectives and capabilities of individual peach producers, but the following guidelines can be followed to develop low, spreading, open-center trees.

Pruning at Planting

Peach trees are pruned at planting to balance the tree top with the small root system and to induce branching on the trunk. Fall-planted trees should be pruned the following spring before bud break. The height of the scaffold limbs above the ground depends on the height of the initial heading cut. Most growers desire scaffold limbs originating 20 to 24 inches above the ground to facilitate herbicide application, grass mowing, and other orchard practices. Small trees, particularly those from southern nurseries that are “June-budded,” usually have no side branches and should be headed at 24 to 30 inches above ground. Trees that are budded in June are small because they grow for only three months after budding. August-budded trees are larger because they grow for about five months during the season following budding. The scaffold branches will develop within 4 to 6 inches below the heading cut, so if one desires branches higher on the trunk, then a higher heading cut can be used. Larger trees usually arrive from the nursery as branched whips. Since most of the side branches are weak, they should be pruned to 2 or 3 buds. Shoots often develop from these stubs and may be suitable for major scaffold limbs. Strong branches with wide crotch angles should be pruned to 6 or 7 buds and can be retained for scaffold branches. The height at which branched trees can be headed depends on the size of the tree and positions of good side branches. Trees 3 to 6 feet tall can be headed at 24 to 30 inches above ground. It is usually preferable to head larger trees at 3 to 4 feet because low side branches on the trunks are damaged or removed for shipping. An alternative method of heading large trees with few desirable branches involves heading trees at 10 inches above the ground. This will allow the tree to grow a new central leader from which scaffold branches can be selected during the first winter. About 10% of large trees (trees with trunks more than 3/4 inch in diameter) may not survive the severe heading, but little tree mortality has been observed with moderate size trees.

The First Summer

Trees should be pruned at least once and possibly two times during the summer before growth ceases. Summer pruning reduces the amount of dormant pruning required the first winter and will direct growth into the desirable scaffold branches. In late-May and again in July, remove low shoots on the trunk to a height of 20 inches. Remove all shoots forming angles less than 45 degrees with the trunk. Remove vertical shoots that are unacceptable as scaffold branches. Encourage a spreading growth habit by pinching upright-growing shoots back to an outward-growing bud or sylleptic (secondary) shoot. Pinching used in this way is actually a type of bench cut. Pinching should be done in late June and/or July while shoots are actively growing. Another approach to pruning first-year trees involves retaining the top few shoots with poor crotches and to head them in half in late June. Growth of the headed shoots is suppressed while encouraging growth of the lower shoots that have wide crotches. The small “bush” in the tree center is removed during the winter to leave the lower wide-croched branches.

The First Winter

At the end of the first season, some trees will have many desirable limbs, but others will have limbs on only one side or may have vertical growth habits and upright leaders. The first winter is the most important time to select branches that will develop into a strong framework capable of carrying heavy crops in the future.

If trees were pruned during their first summer, very little pruning will be needed during their first winter. The pruned trees should begin to resemble an open-vase. Remove branches on the trunk within 20 inches from the ground and branches that form angles of less than 45 degrees with the trunk. Branches with narrow crotches are weak and may split from the trunk because bark extends into the crotch. Narrow crotches are also susceptible to winter injury, cytospora canker, and borers. Some trees produce only 2 limbs that resemble a Y. If the 2 limbs form a strong wide crotch (U-shaped) they can both be retained, otherwise remove 1 of the limbs and new limbs should develop along the trunk in subset years.

Each peach tree is fairly unique, so there are at least two basic methods of developing an open-center tree that has a strong framework, and they seem to be equally effective. The most common method involves selecting 3 primary branches with wide crotch angles that are spaced evenly around the trunk. Some trees will not have 3 acceptable limbs at the end of the first season, but excellent trees can be developed with only 2 main branches. Sometimes, 4 to 6 desirable limbs will grow at one point on the trunk. Remove all but 3 of these branches because there will eventually be 3 dominant limbs and the others will be squeezed out. The other method of developing an open center form is to head the tree at 3 to 4 feet at planting; this is often preferable with the larger nursery trees. Select 3 to 5 limbs that are distributed evenly on the trunk and spaced 4 to 6 inches apart vertically. After the first year's growth, peach trees with 3 main branches at 24 to 30 inches above ground look quite different from those that have 4 or 5 main limbs extending to 4 feet. However, as these trees grow for several years and are trained to the open-center, they will appear much more uniform. Northern peach growers often prefer trees with 5 to 8 branches in case one or more branches are injured by low winter temperatures.

Avoid horizontal limbs on young trees because they will bend downward with the weight of a crop and will eventually need to be removed to allow equipment to move under the tree. Watersprouts (upright shoots developing along the upper side of a branch) will also arise along the top of a horizontal limb. An angle of 40 to 50 degrees from the vertical is most desirable. Remove root suckers, downward growing shoots, and strong vertical shoots that shade the tree center. Keep the tree balanced by shortening the strongest branches. Encourage early fruiting by retaining as much of the tree as possible, including the smaller side shoots growing from the selected main branches. Head the scaffold limbs above an outward-growing secondary shoot to encourage a spreading growth habit. Sometimes a tree will produce a strong shoot from the soil line and the rest of the tree is weak or dead. If the

shoot originates below the bud union, it is the rootstock and the tree should be replaced. If it develops from above the bud union, it should be pruned to a strong shoot. Secondary limbs with wide crotches developing at the appropriate height on these shoots can later be selected as scaffold limbs.

Second Summer

Pruning trees during the second summer helps improve light penetration into the tree center and develop fruiting wood for the third season. Shoots developing on the trunk below the scaffold branches should be removed in June. Remove vigorous upright shoots developing near the tree center. By late June, when sylleptic (secondary) shoots develop on growing shoots, the upright portion of the terminal shoot can be pinched just above an outward growing sylleptic shoot. This will encourage the spreading growth of the tree and direct growth into the desired secondary shoot. Summer pruning should be completed by mid-July.

Second Winter

Peach trees that have grown well for two years may be 5 to 7 feet tall, 6 to 8 feet wide, and have trunks 3 to 6 inches in diameter. Such trees will also have numerous flower buds, and, if pruned moderately, may produce 20 to 40 pounds of fruit during the third summer. Excessive pruning will reduce yield the third summer. Trees should have 2 or more well-spaced scaffold branches with wide crotch angles. If this is not the case, try to select appropriate scaffold branches and remove all others. Remove all large watersprouts originating near the tree center. Scaffolds with less than 30 inches of new growth and have several side branches should be pruned to leave 2 or 3 well-spaced side branches. Remove shoots developing on the lower sides of scaffold limbs because fruit on these shoots will pull the scaffolds down interfering with herbicide application. Retain most of the other one-year shoots throughout the tree. Sometimes 2 shoots of equal size will develop near the end of a scaffold branch and will form a V-crotch. One shoot should be removed to prevent weak crotches. The terminal ends of scaffold branches often grow upright. In the event that the tip of a scaffold is oriented vertically, it may be redirected outward by pruning to an outward growing secondary shoot. This type of bench cut is preferably performed during the summer but can be performed during the winter.

Third Year

Trees develop best when low branches and watersprouts are removed in June. Upright portions of terminal shoots should be pinched just above an outward growing secondary shoot to encourage the spreading form. After the third season, peach trees are usually 6 to 9 feet tall, 7 to 9 feet wide, and have trunks 4 to 7 inches in diameter. During the fourth summer, peach trees may produce 50 to 80 pounds of fruit. Trees should be pruned the same as during the second winter to maintain a low spreading form. It is most important to remove watersprouts, low branches, and excess fruiting shoots.

Pruning Young Fruiting Trees

During the first 3 years, the primary objective of pruning peach trees is grow a tree with a strong structure capable of supporting heavy future crops. As the trees fill their allotted spaces during years 4, 5, and 6, the orchardist must encourage a transition from vegetative growth to fruit production. After three growing seasons, a well-trained peach tree should have 3 to 5 scaffold branches with wide angles, evenly distributed around the tree. Young fruiting trees usually grow fairly vigorously and moderate corrective pruning is needed to keep their centers open and maintain the desired tree size. The weight of fruit on the limbs encourages a spreading growth habit and heavy pruning should not be necessary. Continue annual summer pruning to eliminate vertical watersprouts and to tip upright scaffold limbs to outward growing secondary shoots. Remove large, vigorous upright shoots and water sprouts with sylleptic shoots. These shoots may be 4 to 7 feet long; they are not very fruitful, and they shade the tree center. Rather than shortening these vigorous shoots to retain side shoots with flower buds, completely remove them because several vigorous shoots will emerge and continue to create a vigor problem. Retain non-branched shoots that have flower buds, even if they are oriented vertically. The weight of fruit will pull these shoots down and suppress their vigor. Do not remove all fruiting shoots in the center of the tree. The most productive open-center trees have fruiting wood throughout the tree canopy. It is fairly easy to maintain fruiting wood inside the tree; but, once it is lost, it is difficult to re-establish. Remove some excess of branches to permit light to reach the tree center. However, maintain a supply of shoots that have strong flower buds. Depending on the cultivar and tree spacing, a properly trained peach tree will produce 50 to 80 pounds of fruit during the fourth and fifth seasons.

Pruning Middle-Aged Trees

Peach trees have a shell of fruit-bearing wood about 4 feet in depth. This shell may be 4 to 8 feet above ground on low trees or 8 to 12 feet on taller upright trees. Total yield is usually greater for the taller trees, but the increased cost of pruning, thinning, harvesting, and spraying tall trees usually offsets the higher yields. Trees that are 7 to 9 feet tall have been very profitable in the East. Careful, annual selective pruning is required to maintain low, spreading trees that have much of their growth on a low, horizontal plane. Every season, some of the smaller twigs die, especially in shaded parts of the tree. Some of the older branches also become weak and die from other causes such as canker and borers. Remove the larger dead and badly cankered branches. It is not economical to remove all small, dead twigs, but some should be removed because they may rub and puncture fruit, and the bases of such shoots are entry sites for canker.

By the sixth year, the canopy should be fully developed for maximum yields. The objectives of pruning peach trees during years 6 through 10 are to maintain tree heights of 7 to 9 feet above ground and to maintain productive fruiting wood throughout the tree. The low spreading tree form can be maintained with proper pruning and fertilization. Remove all

vigorous watersprouts that grow vertically; do not cut them to side shoots. Retain 12- to 18-inch fruiting shoots regardless of their orientation. Remember that flowers and fruit are borne on wood produced the previous year. If left unchecked, fruiting wood tends to grow farther out on the ends of branches each year. Prune each year to keep the tree within bounds and to prevent the branches from breaking. Stimulate growth of one-year fruiting wood in the tree center by thinning-out and heading-back inside branches. As trees come into bearing, weight of fruit bends some branches toward the ground, and these limbs may not return to an orientation above the horizontal after harvest. Some limbs, especially on the lower portions of the tree, should be removed by thinning to a shoot that is oriented above the horizontal. Some years, peach trees produce more fruiting wood than other years. Because pruning is used to manage crop load, more shoots should be removed when ample fruit buds exist, especially for varieties with small fruit. Thin-out fruiting shoots to a spacing of about 4 to 6 inches apart along the limbs to stimulate better growth of remaining shoots, to prevent excess fruiting and fruit thinning, and improve fruit size. Also remove the 3- to 6-inch-long fruiting shoots that are mixed with the more desirable 12- to 18-inch shoots. The shorter shoots produce small fruit. A thorough pruning job requires time and labor (10 to 15 minutes per tree), but it also saves time and labor during thinning and harvest.

Pruning Older Trees

Peach trees in the mid-Atlantic region often remain profitable until they are 15 to 20 years old. As peach trees age, they become less vigorous. Good fruiting wood becomes scarcer and is often located at the ends of long, leggy limbs. A major objective of pruning older trees is to encourage the production of good fruiting shoots. Old trees can be invigorated by cutting back into wood that is 3 or more years old. Cut to good outward-growing side limbs. New shoots will develop from dormant buds under the bark near the pruning cuts. Pruning to invigorate old trees reduces the following season's crop because much bearing surface is removed, but it is the only way to renew a tree. Increasing the nitrogen fertilizer by 10 to 20% may also help encourage new growth. Heavy pruning encourages growth of new wood during the two seasons following treatment. Such severe pruning to renew old trees is profitable only in blocks where most of the trees are still present and are in reasonably good vigor. Where more than 20% of the trees are missing or are weak, renewal pruning may not be profitable and it may be time to remove the old trees and replant the entire block.

Perpendicular-V

During the past 20 years a number of mid-Atlantic peach growers have transitioned to the "Perpendicular V" or "Kearney Agricultural Center Perpendicular V" (KAC-V) orchard system for peaches and nectarines. Trees are planted at spacings of about 5 or 6 x 18 feet and trained to 2 scaffold branches oriented perpendicular to the row to form V-shaped trees. The primary advantages of this system are that the trees are uniform and easier to prune and thin, the tree form is more conducive to mechanization, and yields are higher for the first 2 or 3 fruiting years because the orchard canopy develops faster than for open center trees. The primary disadvantage is that orchard establishment costs are higher due to increased tree densities and the trees are taller, so if mechanization is not available increased costs associated with ladder work may offset the benefits.

First Year

At planting head the trees 18 to 24 inches above ground. Large trees with branches can be pruned to retain one wide-crotch branch growing into the row middles on each side of the tree. When shoots are 14 to 22 inches long (probably in mid-July), select two branches growing perpendicular to the row towards the row middles and competing branches should be headed to half their original length. Avoid selecting branches that are too horizontal (more than 45 degrees from vertical) or too vertical (less than 20 degrees from vertical) with narrow crotches. The ideal branch angle for primary scaffolds is 25 to 40 degrees from vertical. During the winter, remove low branches and all branches competing with the 2 primary scaffold branches. Remove vigorous upright shoots from each scaffold. Avoid heading the scaffold branches unless it is necessary to redirect the growth of an improperly oriented shoot. If a tree grew poorly the first summer, then select 2 primary scaffold limbs growing perpendicular to the row and cut them back to a length of about 8 to 16 inches. This type of severe pruning usually stimulates regrowth the following summer with many strong shoots from which to select scaffold branches. Summer pruning these trees the second summer when shoots are 18 to 22 inches long is important to select the proper scaffolds and to eliminate shading in the lower canopy.

Second year

The second summer the trees should be pruned in July to maintain the dominance of the selected scaffold branches. Minimize shading by removing watersprouts and vigorous upright shoots that shade the tree interior. Pruning the second winter is similar to the first year. Remove vigorous upright shoots a thin out fruiting shoots (shoots with fruit buds) to regulate crop load. Avoid heading the scaffold unless shoots need to be redirected. Avoid severe heading cuts that may create flat branches (bench cuts) where watersprouts tend to arise. The tree should consist of two scaffold branches with moderately vigorous (12 to 28 inch-long) shoots spaced 6 to 10 inches along the length of the scaffold. These shoots will produce a moderate crop the third year.

Third and Fourth Years

Trees are now transitioning to the fruiting stage and pruning is similar to the previous year. The primary concern is preventing shading between and within trees by eliminating large and vigorous shoots. Summer prune in June or July to remove upright and vigorous shoots that shade the lower parts of the tree. Keep the center of the tree open to allow light penetration to the lower fruitwood. While dormant pruning remove large competing branches and strong side-shoots. As trees approach their permanent height (usually about 10 to 12 feet), cut scaffolds back to an upright fruiting shoots.

Mature Trees

As trees fill their space and transition to the fruiting stage, only slight summer pruning should be needed in July to remove vigorous upright shoots that shade the lower parts of the tree. Remove these shoots totally, do not head them because they will remain vigorous and shade out the tree center. Dormant pruning is relatively simple because trees are fairly uniform. Remove branches that are older than one year. When dormant pruning is completed, each scaffold branch should give rise to only one-year old fruiting shoots (sometimes called “hangers”). A system of renewal pruning can be established by completely removing previous season’s fruiting shoots. New fruiting shoots for the following year will develop from buds imbedded around the base of the shoot that was removed. The ideal fruiting shoots to retain are 10 to 18 inches long with a basal diameter of 3/16 to 5/16 inches. One of the major problems with parallel-V trees is a tendency to leave 2-year old branches or too many one-year-old shoots on the scaffold limbs which leads to limb crowded and shading. When dormant pruning is completed, one should be able to walk between trees within a row without touching branches.

Quad-V

The Quad-V orchard system is somewhat of a compromise between open-center and Parallel-V. Trees are typically planted at spacings of about 6 or 7 x 18 feet. The mature tree will have 4 fairly upright scaffold branches spaced at approximately 90 degrees from each other around the trunk and look similar to two V-shaped trees inserted at right angles to each other and pruning of the Quad-V is similar to the Parallel-V. Results from trials in Pennsylvania indicate that the Quad-V may be more profitable than open-center or Parallel-V systems.

First Year

At planting head the trees 18 to 24 inches above ground. Large trees with branches can be pruned to retain one to four wide-crotch branches oriented around the tree. Two or more branches on one side of the tree are undesirable and all but one should be removed. When shoots are 14 to 22 inches long (mid-July), select up to four branches growing arising as close to 90 degrees from each other around the trunk as possible and head competing branches to half their original length. Avoid selecting branches that are too horizontal (more than 40 degrees from vertical) or too vertical (less than 20 degrees from vertical) with narrow crotches. The ideal branch angle for primary scaffolds is 25 to 35 degrees from vertical. During the winter, remove low branches and all branches competing with the four scaffold branches. Remove vigorous upright shoots from each scaffold. Avoid heading the scaffold branches unless it is necessary to redirect the growth of an improperly oriented shoot. If a tree grew poorly the first summer, then select up to four scaffold limbs and cut them back to a length of about 8 to 16 inches.

Second year

During the second summer the trees should be pruned in July to maintain the dominance of the scaffold branches. Minimize shading by removing watersprouts and vigorous upright shoots that shade the tree interior. Pruning the second winter is similar to the first year. Remove vigorous upright shoots a thin out fruiting shoots (shoots with fruit buds) to regulate crop load. Avoid heading the scaffolds unless shoots need to be redirected. Avoid severe heading cuts that may create flat branches (bench cuts) where watersprouts tend to arise. At the end of the second year, a well-grown tree should consist of four scaffold branches with moderately vigorous (12 to 28 inch-long) shoots spaced 8 to 12 inches along the length of the scaffold. These shoots will produce a moderate crop the third year.

Third and Fourth Years

As trees fill their space the primary concern is preventing shading between and within trees by eliminating large and vigorous shoots. In June or July remove vigorous shoots that shade the lower parts of the tree. Keep the center of the tree open so light can penetrate to the lower fruitwood. While dormant pruning, remove large competing branches and strong side-shoots. As trees approach their permanent height (usually about 9 to 11 feet tall), cut scaffolds back to an upright fruiting shoot.

Mature Trees

As trees fill their space and enter the fruiting stage, trees need only slight summer pruning in July to remove vigorous upright shoots that shade the lower parts of the tree. Remove these shoots totally, do not head them because they will remain vigorous and shade out the tree center. Dormant pruning consists of removing branches that are older than one year. When dormant pruning is completed, each scaffold branch should give rise to only one-year old fruiting shoots (“hangers”). Shoot renewal is encouraged by completely removing previous season’s fruiting shoots. New fruiting shoots for the following year will develop from buds imbedded around the base of the shoot that was removed. The ideal fruiting shoots to retain are 10 to 18 inches long with a basal diameter of 3/16 to 5/16 inches.

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