

Pruning Peach Trees

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Annual pruning is one of the most critical management practices for the production of large crops of high quality peaches that are easily harvested. However, pruning is not a substitute for other orchard practices such as fertilization, irrigation, and pest control. Pruning practices vary slightly in different regions of the United States, but have changed little in the east during the past 70 years. Although pruning may vary slightly for different varieties and localities, certain general practices should be followed. The successful pruner must understand the principles of plant growth, the natural growth habit of the tree, and how the tree will respond to certain types of pruning cuts. Yield and fruit quality will be reduced if trees are not properly pruned.

Reasons for Pruning

Annual pruning is required for the following reasons.

- To develop a strong framework capable of carrying large crops.
- To maintain the proper balance between vegetative growth and fruit production to obtain high yields of quality fruit each year.
- To maintain tree height and spread.
- To maintain an open canopy for adequate penetration of light and pesticides.
- To remove broken or diseased limbs.
- To maintain fruiting wood throughout the tree canopy.

When to Prune: There is a great deal of research information and grower experience to indicate that pruning peach trees in the early winter can reduce their cold-hardiness. Peach trees should not be pruned before February, and young trees should be pruned after mature trees.

Summer topping by mowing has been used by some growers to reduce pruning costs and maintain tree size. Experiences with preharvest summer topping indicate that there is little economic advantage compared to dormant pruning. Topping reduces pruning costs by 20 to 30%, but the savings may

be offset by reduced fruit size. Light penetration, flower bud cold-hardiness, shoot growth, and fruit color are not consistently altered by summer topping. If a peach grower wishes to reduce tree height, an inexpensive method may be to mow the tree tops immediately after harvest or during the late winter. Mechanical topping should *always* be followed by detailed pruning to eliminate stubs in the tree tops that produce dense foliage and shade the tree center.

Use "collar cuts": For many years the use of "flush cuts" has been recommended for pruning fruit trees to promote rapid wound closure. Recent research results with peach and other tree species indicate that flush pruning cuts are more susceptible to disease infection than cuts in which a portion of the lateral branch remains. The "collar cut" method results in a pruning cut that leaves a raised collar of tissue at the branch junction. This method promotes rapid wound healing and reduces external dieback and disease infection (Figure 1).

Growth Habit of Peach

The successful pruner must understand how a tree grows and how it will respond to various types of pruning cuts. It is also important to observe the results of pruning.

There are 2 types of buds on a peach tree. 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 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).

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Figure 1. Use "collar cuts" for rapid wound healing rather than "flush cuts".

The number and distribution of flower buds on a shoot can vary with tree vigor, the variety, and the light environment that the shoot developed in. Results from a variety trial in New Jersey indicate that 'Jerseygold' and 'Springgold' had 20 to 23 flower buds per foot of shoot length, whereas 'Harken' and 'Emery' averaged only 15 flower buds per foot of shoot length. Shoots that grow less than 6 inches generally have the most fruit buds per inch of growth. The total number of fruit buds per shoot increases as the shoot's growth increases to about 2 feet.

Moderately vigorous shoots have a high proportion of nodes with 2 flower buds. The leaf buds at most nodes develop into lateral shoots that may be fruitful in subsequent years. A number of axillary buds on vigorous current season's shoots (greater than 2 feet long) grow to produce secondary shoots. Such shoots are not very fruitful because fruit buds do not develop at many nodes on secondary shoots.

The ideal fruiting shoot is 12 to 24 inches long and 3/16 to 1/4 inch thick at its base, and it has no secondary shoots (Figure 2). Proper pruning, fertilization, irrigation, and fruit thinning must be practiced to ensure enough shoot growth each year

to produce adequate fruit buds for the following season.

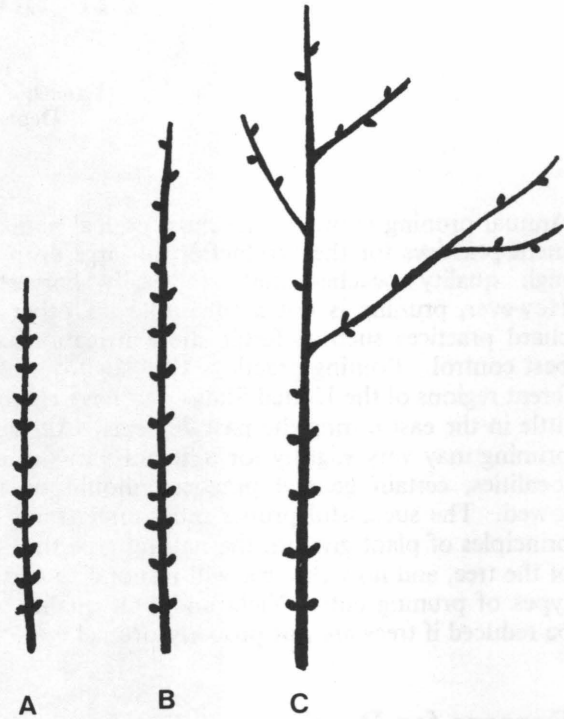


Figure 2. Short shoots less than 8 inches long have a high density of fruit buds, but produce small fruits (A). Shoots 12 to 24 inches long (B) are most productive. Long shoots that are branched (C) produce fewer flower buds.

The critical light level needed for flower bud development has not yet been identified for peach. However, shoots developing in 20% full sun at the tree interior may produce only half as many flowers per foot of shoot as shoots at the tree periphery that receive more than 70% full sun. Shoots developing in shaded regions of the tree also tend to die during the season and sometimes during the winter. When the center of a peach tree is opened by pruning, to admit more sunlight, the outer shell of foliage 3 to 4 feet deep around the tree receives more than 30% full sun (Figure 3). Annual pruning improves light distribution throughout the tree, which is necessary for the development of flower buds and fruit.

Pruning to Obtain the Open-center Tree

Peaches are typically pruned to an open-center, or vase, shape. This shape allows relatively good light penetration throughout the tree. The resulting low, spreading form also facilitates thinning, pruning, and harvest from the ground. Young peach trees must be pruned carefully to develop and maintain fruiting wood near the tree center. The fruiting surface of poorly pruned trees will move further from the tree

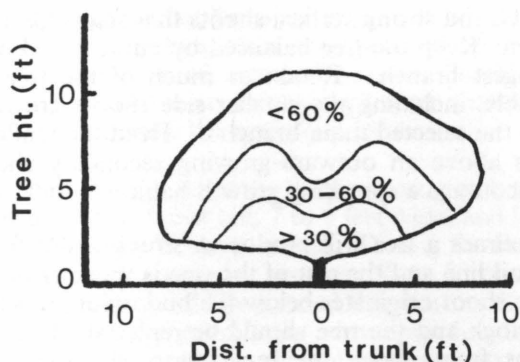


Figure 3. Light distribution in an open-center peach tree showing 3 zones of light (% full sun).

center each year, which results in reduced yields and increased production costs. Although pruning may vary depending on the specific objectives of individual peach producers, the following guidelines can be followed to develop the low, spreading, open-center tree form.

Pruning at Planting: Peach trees are pruned at planting to balance the tree top with the reduced root system and also to induce branching of the trunk. Fall-planted trees should be pruned the following spring. The height of the scaffold limbs above the ground can be varied by the height of the heading cut. It is preferable to have scaffold limbs 20 to 24 inches above the ground to facilitate herbicide application 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. August-budded trees are larger because they grow for about 5 months during the season following budding. The scaffold branches will develop within 4 to 6 inches below the cut. 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 are headed depends on the size of the tree and positions of good side branches. Trees 3 to 5 feet tall can be headed at 24 to 30 inches above ground. Larger trees must usually be headed at 3 to 4 feet because low side branches on the trunks are damaged or removed for shipping.

An alternative method of heading unbranched large trees 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. Preliminary research results indicate that about 10% of large trees (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: Pruning the first-year tree during its first summer can be an effective method of developing the tree frame. Trees should be pruned at least once and possibly 2 or 3 times during the summer before growth ceases. Summer pruning will reduce the amount of dormant pruning required the first winter and will direct growth into the desirable scaffold branches. During May and again in July, shoots on the trunk should be removed to a height of 20 inches. All shoots that form narrow angles of less than 45 degrees with the trunk should be removed. Vertical shoots that are unacceptable as scaffold branches should be removed. A spreading growth habit can be encouraged by pinching upright-growing shoots back to an outward growing bud or secondary shoot. Pinching should be done in June and/or July while shoots are actively growing.

There is a new method of pruning first-year trees that seems very promising. Do not remove the top few shoots with poor crotches. Instead, head the top several shoots by half in early June. Growth of the headed shoots is suppressed and growth of the lower shoots that have wide crotches is encouraged. The small "bush" in the tree center is removed during the winter.

The First Winter: At the end of the first season, some trees will have many desirable limbs, and others will have limbs on only one side or may have vertical growth habits and upright leaders. The first winter is the most critical 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 trees should begin to resemble an open-vase. Remove branches on the trunk below the 20-inch height. Remove branches that form angles of less than 45 degrees with the trunk. A narrow-crotch branch is weak because bark extends into the crotch, and the branch may split from the trunk. A narrow crotch branch is also susceptible to winter injury, cytospora canker, and borers. Unless they form a strong, wide crotch, remove 1 of any 2 limbs of equal size that tend to divide the tree and form a Y (Figure 4).

Since all peach trees do not grow alike, there are at least 2 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 side branches that have wide-angled crotches and that are spaced evenly around



Figure 4. A "V" crotch is weak and susceptible to splitting, winter injury, and canker. One branch should have been removed during the first winter to avoid the weak crotch.

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. It is best to remove all but 3 of these branches because there will eventually be 3 dominant limbs and the others will be squeezed out.

Another 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.

Avoid horizontal limbs on young trees because they will grow downward with the weight of a crop and will eventually need to be removed to allow equipment to move under the tree. Watersprouts 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 cutting back the strongest branch. Retain 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 be selected as scaffold limbs.

The Second Summer: Although it is not necessary, it is highly desirable to prune trees once or twice during the second summer. 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 secondary shoots develop on terminal shoots, the upright portion of the terminal shoot can be pinched just above an outward growing secondary shoot. This will encourage the spreading growth of the tree and direct growth into the desired secondary shoot.

The Second Winter: Peach trees that have grown well for 2 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.

Each tree should have 2 or more well-spaced, wide-angled scaffold branches. If this is not the case, try to select appropriate scaffold branches and remove all others. Remove all large watersprouts that tend to grow through the tree center. Scaffolds that have made less than 30 inches of growth and have several side branches should be pruned to leave 2 or 3 well-spaced side branches. Shoots developing on the lower sides of scaffold limbs should be removed. If these shoots fruit, the extra weight will pull the scaffolds down so that they interfere with herbicide application. Retain most of the other 1-year growth throughout the tree.

Sometimes 2 shoots of equal size will develop near the end of a scaffold branch and will form a V-crotch. Such crotches are weak, and one shoot should be eliminated. The terminal ends of scaffold branches often grow upright. In the event that a scaffold develops a vertical orientation near its tip, it may be turned out 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.

The Third Summer: 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.

The Third Winter: 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

The objective of pruning peach trees for the first 3 years is primarily to grow a tree that has 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 3 growing seasons, a well-trained peach tree should have 3 to 5 wide-angled scaffold branches 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 sizes. A spreading growth habit will be encouraged by the weight of fruit on the limbs and heavy pruning should not be necessary (Figure 5).

Summer pruning should be continued to eliminate vertical watersprouts and to tip upright scaffold limbs to outward growing secondary shoots (Figures 6 and 7).

Remove large, branched upright watersprouts. These shoots may be 4 to 7 feet long; they are not very fruitful, and they shade the tree center. Do not head these shoots to a side shoot with flower buds because several vigorous shoots will emerge and continue to create a vigor problem. Completely remove vigorous upright shoots that have secondary branches. Retain nonbranched shoots that have flower buds. 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 are those with 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. Where there is an excess of branches, remove some to permit light to reach the tree center. However, maintain a supply of shoots that have strong flower buds. A properly trained peach tree will produce 50 to 70 pounds of fruit during the fourth and fifth seasons (Figure 8).



Figure 5. A three-year-old peach tree before (a) and after (b) dormant pruning. Note the removal of upright vigorous shoots and the retention of the best fruiting shoots.



Figure 6. A two-year-old peach tree in late June showing upright shoot growth that is shading the tree center.



Figure 7. The same tree after summer pruning. The upright shoots in the tree center were removed and vigorous shoots were pinched back to outward-growing secondary shoots.

Pruning Middle-aged Trees

By the sixth year, peach trees have usually filled their allotted spaces and have attained adequate sizes for maximum fruit production. 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 each tree. The low, spreading tree form can be maintained with proper pruning and fertilization. All vigorous watersprouts that grow vertically must be removed; do not cut them to side shoots. Retain shoots that grow horizontally and 12- to 18-inch fruiting shoots regardless of their orientation. Remember that flowers and fruit are borne on wood produced the previous year. Fruit 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 1-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 can be partially a thinning process, more wood 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 around the limbs. This stimulates better growth of remaining



Figure 8. A well-trained five-year-old peach tree before (a) and after (b) dormant pruning. Note the 3 wide-angled scaffold branches and the low spreading, open-center appearance. Vigorous upright shoots and low branches have been removed. Upright branches have been thinned to outward-growing shoots and only good fruiting shoots have been retained.

shoots, helps control production of excess fruit and the amount of fruit thinning, and improves 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.

If trees produce many 3- to 5-foot watersprouts, the watersprouts should be totally removed and the rest of the pruning should be more moderate to avoid excess vigor. Nitrogen fertilization should also be reduced to control tree vigor.

A peach tree has a shell of fruit-bearing wood about 4 to 5 feet in depth. This shell may be 4 to 8 feet above ground on low trees or 7 to 11 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 will offset the increased production. Trees that are 7 to 9 feet tall have been very profitable in the East. Careful, selective pruning is required annually 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 can cause limb rubs, fruit punctures, and because the bases of such shoots are entry sites for canker.

Pruning Older Trees

Peach trees in Virginia usually remain profitable until they are 15 to 20 years of age. As peach trees age, they become less vigorous. Good fruiting wood becomes more scarce and is often at the ends of long, leggy limbs. The 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. Pruning to invigorate old trees will reduce the following season's crop because much bearing surface is lost, but it is the only way to renew the tree. Increasing the nitrogen fertilizer by 10 to 20% may also help encourage new growth.

Trees that are moderately to heavily pruned make excellent growth of new wood during the 2 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. It is best to remove the old trees and replant the entire block.

Prevent Canker

Virginia peach orchards, unlike those in states to the north, have not been extensively infected with cytospora canker. This disease invades tree tissues through wounds, and it can be a major contributor to the decline of peach orchards. Although canker has not been a serious problem in Virginia, winter injury resulting from unusually cold temperatures may predispose trees to infection. Several precau-

tionary measures can be taken while pruning to minimize canker infection.

- Remove limbs that form narrow-angled crotches with the trunk.
- Remove dead twigs on scaffold limbs.
- Use "collar cuts" rather than "flush cuts".
- Do not prune in rainy or misty weather.

Pruning Winter-injured Trees

Winter temperatures of -10 to -15°F will usually kill some or all flower buds; temperatures below -15°F may injure or kill shoots and limbs. The severity of winter injury should be considered before pruning peach trees. When at least 20% of the flower buds remain alive, trees should be pruned normally because only about 10% of a full bloom is necessary to set a commercial crop. When less than 20% of the flower buds are alive, pruning should be moderate to retain most of the fruiting shoots. Pruning should be limited to removal of vigorous upright watersprouts that increase tree height and shade the tree center.

Occasionally, a very cold winter will cause wood injury, also called "blackheart", where the center portion of a limb is killed and discolored (Figure 9). In such cases, peach producers usually overestimate the severity of injury. Winter-injured trees usually survive. Although yield is reduced for at least one season, properly pruned winter-injured trees can be productive for many years. It is advisable to delay pruning until the extent of injury is determined; then prune cautiously.

Severe dehorning consisting of heading back into wood that is 3 years old or older, may fatally weaken a tree or delay its return to good cropping for several years. Moderate dehorning has some value but should not be made into wood over 4 years of age. Light pruning soon after growth starts, in combination with nitrogen fertilizer, is most satisfactory. Injured trees are unable to utilize starch reserves in their wood and are deficient in carbohydrates until new leaves become functional. Severe pruning removes leaf buds and reduces carbohydrate production. However, if trees are not pruned, the low carbohydrate reserve is diluted to many growing points and shoot growth is weak. Therefore, winter-injured trees should receive moderate pruning. Pruning should consist primarily of removal of water sprouts.



Figure 9. Winter-injured peach tree showing "blackheart" and bark splitting. Such trees usually survive and grow reasonably well if pruned moderately and fertilized.

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Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, and September 30, 1977, in cooperation with the U.S. Department of Agriculture. Mitchell R. Geasler, Director, Virginia Cooperative Extension Service, and Vice Provost for Extension, Virginia Polytechnic Institute and State University, Blacksburg, Virginia; Clinton V. Turner, Administrator, 1890 Extension Program, Virginia State University, Petersburg, Virginia.