

CHAPTER 8

Pruning

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CHAPTER 8

Pruning

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To prune or not to prune? This is a question that faces gardeners and landscape enthusiasts often. Most feel they should, but are not sure when, why or how. Pruning is accepted practice for the orchard, fairly frequently carried out in the rose garden, but rather haphazard elsewhere. Most often it is only performed when a shrub or tree begins to encroach on its neighbor, a path, or a building.

Pruning is often looked upon as the answer to make a barren tree fruitful. Carried out correctly, it will -- eventually. However, years of neglect cannot be rectified in one season. The unknowing pruner who cuts because he or she thinks that it should be done but does not know how often ends up with no flowers or fruit at all, due to excessive pruning or carrying out the operation at the wrong time of the year.

This chapter explains the reasons for pruning, the proper techniques and tools to use, and when various types of plants should be pruned.

Reasons for Pruning

The reasons for pruning can be grouped under the four following categories:

- training the plant
- maintaining plant health
- improving the quality of flowers, fruit, foliage, or stems
- restricting growth.

Training the Plant

The first pruning of young trees and shrubs consists of removing broken, crossing, and pest-infested branches.

With **trees**, the rule of pruning away 1/3 of the top growth at transplanting to compensate for root loss is not necessary for properly grown nursery plants. Excessive pruning at transplanting, according to research, reduces growth hormones necessary for root development and delays plant establishment.

As a rule, the central leader of a tree should not be pruned unless a leader is not wanted, as is the case with some naturally low-branched trees or where multiple-stemmed plants are desired.

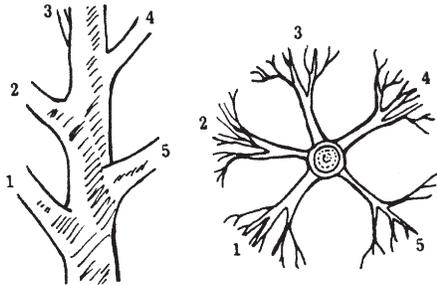
Trees with a central leader such as linden, sweet gum, or pin oak may need little or no pruning except to eliminate multiple leaders or branches competing with the central leader; these should be shortened. Some pruning may be necessary to maintain desired shape and shorten extra-vigorous shoots.

The height of the lowest branch can be from a few inches above the ground (for screening or windbreaks) to 12 feet or more above the ground (as needed near a street or patio). Lower limbs are usually removed over a period of years, beginning in the nursery and continuing for several years after transplanting, until the desired height of trimming is reached.

For greatest strength, branches selected for permanent scaffolds must have wide angle of attachment with the trunk. Branch angles of less than 30 degrees from the main trunk result in a very high percentage of breakage while those between 60 and 70 degrees have a very small breakage rate.

Vertical branch spacing and radial branch distribution are important. If this has not been done in the nursery it can at least be started the following spring after transplanting.

Major scaffold branches of shade trees should be spaced at least 8 inches and preferably 20 inches vertically. Closely spaced scaffolds may restrict growth of the central leader. Scaffolds will be long, weak, and with few lateral branches.



Scaffold branches of trees should have proper vertical and radial spacing on the trunk.

Radial branch distribution should allow 5 to 7 scaffolds to fill the circle of space around a trunk. Radial spacing prevents one limb from overshadowing another, which, in turn, reduces competition for light and nutrients. Remove or prune shoots that are too low, too close, or too vigorous in relation to the leader and scaffold branches.

When deciduous shrubs are planted bare-root, some pruning may be necessary. Light pruning of roots may be needed if any are broken, damaged, or dead.

Shrubs transplanted with a ball of soil or from a container require little, if any, pruning. Occasionally, branches may have been damaged in transit, and these should be removed at the time of planting.

Most evergreen trees and shrubs are sold in a container or B&B (balled and burlapped) and, as with deciduous shrubs, require little pruning of branches.

Maintaining Plant Health

In pruning to maintain plant health, first consider sanitation, which includes the elimination of dead, dying, or diseased wood. Any dying branch or stub can be the entry point or build-up

chamber for insects or pathogens that could spread to other parts of the tree. When removing diseased wood such as a fungal canker or fire blight, it is important that the cut be made in healthy wood, beyond the point of infection, with a sterile blade.

The development of a sound framework through proper thinning will help prevent disease and loss of vigor while maintaining good form.

Evergreen shrubs will benefit from thinning cuts. It will allow penetration of light and air throughout the shrub, increase the total leaf surface, and create an environment less attractive to mites and insects.

Improving the Quality of Flowers, Fruit, Foliage, or Stems

The more flowers and fruit a plant produces, the smaller they become, as can be seen on an unpruned rose bush or fruit tree. Pruning reduces the amount of wood and so diverts energy into the production of larger, though possibly fewer, flowers and/or fruit. Most flowering shrubs will bloom either on 1-year old growth or on new growth. Properly timed pruning will increase the production of wood that will bear flowers.

Some deciduous shrubs have colored barks which are especially delightful in winter. The best color is produced on young stems; the greatest stem length and most intense color results from hard pruning.

Restricting Growth

Over time, trees and shrubs will often grow to sizes that exceed the space allowed for them. Where space is limited, regular pruning becomes necessary to keep plants in bounds. Regular pruning is necessary on formal hedges to maintain a uniform growth rate. To reduce labor, select plants according to size at maturity and avoid planting too close.

Pruning Tools

Pruning shears are good for branches up to ½-inch in diameter. There are two styles of hand shears: scissor action and anvil cut. In the anvil style, a sharpened blade cuts against a broad, flat plate. In the scissor style, a thin, sharp blade slides closely past a thicker (but also sharp) blade. The scissor style usually costs more, but makes cleaner, closer cuts. The anvil type is faster and recommended for thinning evergreens.



Pruning Shears

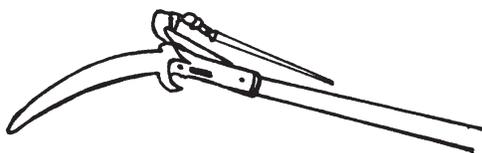


Lopping Shears

Lopping shears have long handles and are operated with both hands. They are recommended primarily for removing stems in deciduous shrubs. Even the cheapest can cut ½-inch diameter material. The better ones can slice through branches of 2 inches or more, depending on plant species.

Pole pruners have a cutter with a hook above and a cutting blade beneath. The cutter is on a pole and is operated by pulling downward on a rope. The poles can either be in sections that fit together or telescoping and can be made of several materials. Wooden poles are heavy. Aluminum poles are light but can conduct electricity if they touch an overhead wire. Fiberglass or some type of plastic compound is probably the best choice. Poles can be fitted with saws, but are often cumbersome.

Use of pole pruners can be dangerous, as material cut overhead can fall on the operator (unless it hangs up in other branches); exercise caution and wear head and eye protection.



Combination pole saw pruner

Hedge shears have long, flat blades and relatively short handles, one for each hand. Power hedge shears are also available. All hedge shears have a negative impact on plant health and appearance when in an informal planting.



Hedge shears

There are many makes and models of pruning saws. Fineness of cutting edge is measured in points (teeth per inch). An 8-point saw, such as an apple saw, is most desirable for delicate, close work. Average saws are about 6 points, while 4½-point saws are for fairly heavy limbs.

A fixed-blade saw with a leather scabbard is safer and easier to use. Folding saws either require a screwdriver (for a slotted-head holding screw) or will have a protruding wing nut, which can scar the trunk when a limb is cut. If the saw suddenly folds while in use, the operator's fingers can be injured.

Blades can be either straight or curved. Many prefer a curved blade that cuts on the draw stroke. A double-edged saw has fine teeth on one side, coarse on the other; these can be difficult to use in densely branched plants.

Bow saws are good only where no obstruction exists for a foot or more above the area to be cut.



Pruning saw

Bow saw

Chain saws come in a variety of sizes, both gas and electric. However, in general, chainsaws are not appropriate for pruning live plant material. They are better suited to tree removal and cutting firewood.

Care of Tools

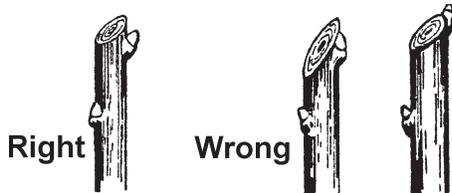
Clean and oil tools regularly. Wipe an oily cloth on blades and other surfaces after each use. Keep cutting edges sharp. Several passes with a good oil stone will usually suffice. Wooden handles should be painted, varnished, or regularly treated with linseed oil. Use tools properly. Don't twist or strain pruners or loppers. Keep the branch to be cut as deeply in the jaws and near the pivot as possible. Don't cut wire with pruning tools.

Pruning Techniques

Twigs and Small Branches

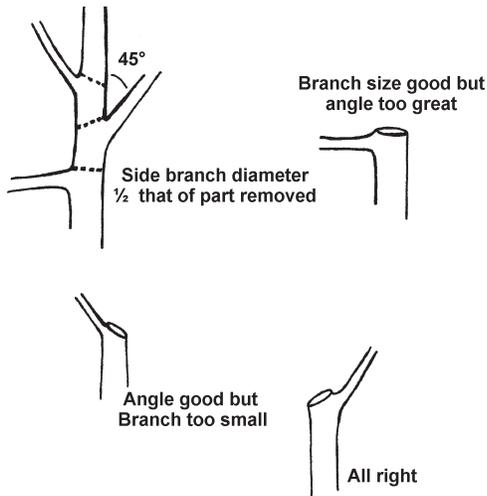
When pruning twigs and small branches, always cut back to a vigorous bud or an intersecting branch. When cutting back to a bud, choose a bud that is pointing in the direction you wish the new growth to take. Be sure not to leave a stub over the bud or cut too close to the bud.

Proper pruning angle



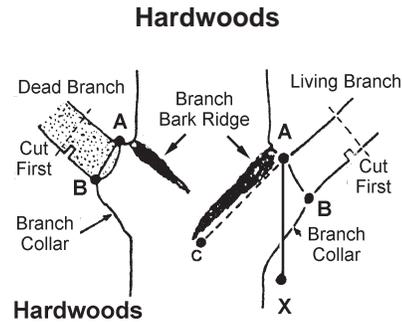
When cutting back to an intersecting (lateral) branch, choose a branch that forms an angle of no more than 45 degrees with the branch to be removed. Also, the branch that you cut back to should have a diameter at least half that of the branch to be removed.

Make slanting cuts when removing limbs that grow upward; this prevents water from collecting in the cut and expedites healing.

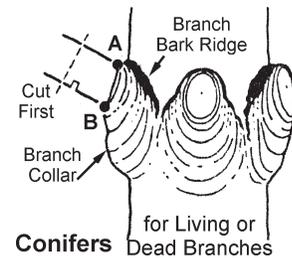


Thick, Heavy Branches

Large branches should be removed flush with the collar at the base of the branch, not flush with the trunk.



Conifers



The collar is an area of tissue that contains a chemically protective zone. In the natural decay of a dead branch, when the decay advancing downward meets the internal protected zone, an area of very strong wood meets an area of very weak wood. The branch then falls away at this point, leaving a small zone of decayed wood within the collar. The decay is stopped in the collar. This is the natural shedding process when all goes according to nature's plan. When the collar is removed, the protective zone is removed, causing a serious trunk wound. Wood-decay fungi can then easily infect the trunk. Even if the pruned branch is living, removal of the collar at the base still causes injury to the tree.

For over half a century, the recommendations for pruning have been to flush-cut and paint. These recommendations have no basis in scientific fact. The flush-cut increases the tree injury, which the paint hides. The paint is primarily cosmetic, a psychological treatment for the person doing the pruning, to show that he or she has done something to "help" the tree. In fact, paints or wound dressings may trap moisture and increase disease problems.

When cutting branches over 1½ inches in diameter, use a 3-part cut. This is accomplished by first sawing the bottom of the branch, 6 to 12 inches out

from the trunk and about 1/3 of the way through the branch. Next, make a second cut from the top, about 3 inches further out from the undercut, until the branch falls away. The resulting stub can then be cut back to the collar of the branch without danger of tearing the bark from the trunk. If there is danger of the branch damaging other limbs below or objects on the ground, it must be properly roped and supported, then carefully lowered to the ground after the second cut.

Root Pruning

A tree growing in the woods or landscape for several years may develop long roots, running 15 to 25 feet or more away from the plant. These, along with many-branched side roots, physically support the tree. The area in a 3-foot radius of the trunk of the tree contains very few of the small feeding roots essential to gathering nourishment for the tree.

These roots are usually located quite some distance from the trunk, branching off the long main roots. As a consequence, if the tree were to be dug and moved, a major part of the necessary feeding roots would be cut off in the balling operation; the tree might easily die when transplanted. This is the reason nurserymen root-prune nursery plants, to force them to grow a large number of small feeding roots near the base of the plant which are moved in the balling operation and ensure growth after transplanting.

To make it possible to safely dig small trees or shrubs in the woods, such trees should be root-pruned a year or so before they are moved. In the spring, sever half the roots by forcing a sharp spade into the soil around the plant alternately leaving a shovel width of untouched soil between cuts. The circle of cuts should be slightly smaller than the size of the ball that will eventually be dug. In the fall, sever the other half of the roots, thus cutting all the roots that are at a depth of a foot or less. The tree can then be moved the following spring.

Recent research indicates that most of the new roots grow from the cut end. Therefore, a root ball 4 to 6 inches larger than the root-pruned area must be dug to get the newly developed roots.

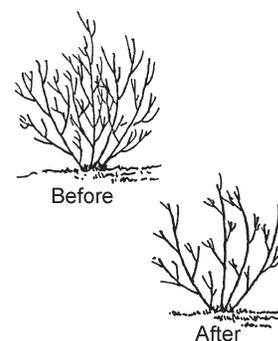
Root pruning is also used to force a vigorously growing fruit tree, wisteria vine, or dogwood into bloom. Using a spade to cut the roots early in the spring, as explained above, is all that is sometimes necessary to force a tree, shrub, or vine into bloom the following year.

Pruning Shrubs

Deciduous Shrubs

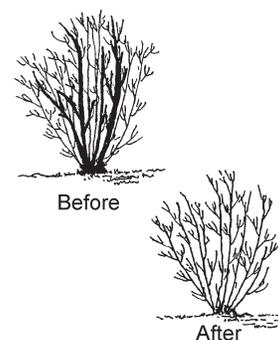
The pruning recommended for most deciduous shrubs consists of thinning out, gradual renewal, and rejuvenation pruning.

In **thinning out**, the first cuts are made close to the ground with a saw or loppers to remove the oldest, largest stems. This is followed by removal of vigorous branches where they join weaker side shoots. This allows light into the shrub center and promotes a “fountain” shape. Considerable growth can be cut out without changing the plant’s natural appearance or habit of growth. Plants can be maintained at a given height and width for years by thinning out. This method of pruning is best done with pruning shears, loppers, or a saw (not hedge shears). The ultimate goal is to develop a shrub containing 7 to 12 stems, all of different ages. Each year, one or two stems are eliminated and replaced by others.



Thinning

In **gradual renewal** pruning, a few of the oldest and tallest branches are removed at or slightly above ground level on an annual basis. Some thinning may be necessary to shorten long branches or maintain a symmetrical shape.



Gradual Renewal

To **rejuvenate** an old, overgrown shrub, 1/3 of the oldest, tallest branches can be removed at or slightly above ground level before new growth starts.

When the shrub to be pruned is grown for its flowers, the pruning must be timed to minimize disruption of the blooming. Spring flowering shrubs bloom on last season's growth and should be pruned soon after they bloom. This allows for vigorous growth during the summer, to provide flower buds for the following year.

Some examples of shrubs that bloom on last season's growth:

<i>Cercis chinensis</i>	Chinese Redbud
<i>Chaenomeles japonica</i>	Japanese Quince
<i>Deutzia</i> species	Spring-flowering deutzias
<i>Forsythia</i> species	Forsythias
<i>Kerria japonica</i>	Kerria
<i>Lonicera</i> species	Honeysuckle
<i>Magnolia stellata</i>	Star Magnolia
<i>Pieris</i> species	Japanese Pieris
<i>Rhododendron</i> species	Azaleas
<i>Rosa</i> species	Rambling rose species
<i>Spiraea</i> species	Early white spirea species
<i>Syringa</i> species	Lilac species
<i>Viburnum</i> species	Viburnum
<i>Weigela florida</i>	Old-fashioned weigela

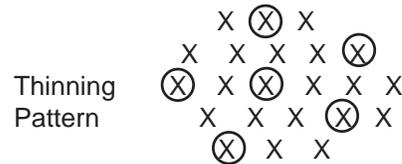
Some shrubs that bloom after June usually do so from buds which are formed the same spring. Such shrubs should be pruned in late winter to promote vigorous growth in the spring.

Some examples of shrubs that bloom on current season's growth:

<i>Abelia x grandiflora</i>	Butterfly bush
<i>Buddleia davidii</i> or <i>globosa</i>	Japanese beauty bush
<i>Clethra alnifolia</i>	Summersweet
<i>Hibiscus syriacus</i>	Shrub althea
<i>Hydrangea arborescens</i>	Hills of Snow
<i>Hydrangea paniculata</i>	PeeGee Hydrangea
<i>Hypericum</i> species	Saint Johnswort
<i>Rosa</i> species	Bush Rose
<i>Spirea bumalda</i>	Anthony Waterer Spirea
<i>Symphoricarpos</i>	Coralberry

Evergreen Shrubs

For most evergreen shrubs, thinning is the most desirable procedure. First, establish the desired perimeter on the top and sides of the plant. Shoots that have grown past this point are removed where they join another branch inside the interior of the shrub. Shoots that extend to the perimeter are allowed to remain. Approximately one out of every three or four shoots is removed.



Most of the pruning should be done as soon as the ground thaws in the spring. Pruning during late fall and winter often results in sun scald. Touch-up pruning, on a small scale, can be done throughout the summer months.

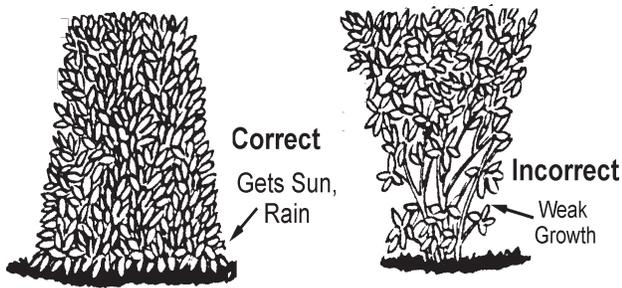
Pruning Hedges

Hedges consist of plants set in a row so as to merge into a solid, linear mass. They have served gardeners for centuries as screens, fences, walls, and edgings.

A well-shaped hedge is no accident. It must be trained from the beginning. The establishment of a deciduous hedge begins with the selection of nursery stock. Choose young trees or shrubs 1 to 2 feet high, preferably multiple-stemmed. When planting, cut the plants back to 6 or 8 inches. This will induce low branching. Late in the first season or before bud-break in the next, prune off half of the new growth. In the following year, again trim off half the new growth to encourage branching.

In the third year, start shaping. Hedges are often shaped with flat tops and vertical sides. This unnatural shaping is seldom successful. The best shape, as far as the plant is concerned, is a natural form -- rounded or slightly pointed top with sides slanting to a wide base. After plants have been pruned initially to induce low branching, the low branching will be maintained by trimming the top narrower than the bottom, so that sunlight can reach all of the leaves on the plant.

Hedge Pruning



The same principles used with the thinning process involving shrubs also applies to hedge pruning. Die back will result if new growth is continually sheared off. Shearing stimulates bud break on the shrub surface which eventually severely shades the center of the plant. Thinning the plant will promote small diameter branches that resist winter breakage. It also allows snow to filter down into the plant rather than sitting on the top.

What can be done with a large, overgrown, bare-bottomed, and mis-shaped hedge? If it is deciduous, the answer is fairly simple. In the spring, before leaves appear, prune to one foot below the desired height. Then thin carefully for the next few years to give it the shape and fullness desired. If hedge plants have declined too much or they are located in the shade, remove them and replant.

Rejuvenating evergreen hedges is more difficult. As a rule, evergreens cannot stand the severe pruning described above. Arborvitae and yew are exceptions; other evergreen hedges may have to be replaced.

Hand pruners are useful for removing small diameter branches. Larger branches can be removed with loppers and/or a pruning saw.

Pruning Roses

All roses need some type of pruning. If roses are not pruned for a number of years, plants deteriorate in appearance, often develop more than the usual disease and insect problems, and the flowers become smaller and smaller.

Hybrid Tea, Grandiflora, and Floribunda roses require annual pruning in the spring, after winter protection has been removed. As a guideline, follow the old saying that roses are pruned when the forsythia blooms. If rosebushes are pruned too early, injury from repeated frost may make a second pruning necessary.

The only tools necessary are sharp hand pruners and gloves. If the rose collection is large, a small saw and loppers will also help. Loppers are used to cut out large dead canes.

Remove branches that are dead, damaged, diseased, thin, weak, growing inward, and branches that cross or interfere with other branches. Proper pruning encourages new growth from the base making the plant healthy and attractive and resulting in large blossoms. Cut at least 1 inch below damaged areas. Remove all weak shoots. If two branches rub or are close enough that they will do so soon, remove one. On old, heavy bushes, cut out one or two of the oldest canes each year.

Cut back the remaining canes. The height to which a rose should be cut will vary depending upon the normal habit of the particular cultivar. The average pruning height for Floribundas and Hybrid Teas is between 12 and 18 inches, but taller growing Hybrids and most Grandifloras may be left at 2 feet.

Make cuts at 45-degree angles above a strong outer bud. Aim the cut upward from the inner side of the bush to push growth outward and promote healthy shoots and quality flowers.

Other types of roses have special pruning needs:

A **rose standard**, or tree rose, is a Hybrid Tea, Grandiflora, or Floribunda budded at the top of a tall trunk. Prune tree roses as you do Hybrid Teas, cutting the branches to within 6 to 10 inches of the base of the crown in order to encourage rounded, compact, vigorous new growth.

Miniature roses are 6 to 12 inches high, with tiny blooms and foliage. Miniature roses do not need special pruning. Just cut out dead growth and remove the hips.

Old-fashioned **Rambler roses** have clusters of flowers, each usually less than 2 inches across. They often produce canes 10 to 15 feet long in one season. Ramblers produce best on year-old wood, so that this year's choice blooms come on last year's growth. Prune immediately after flowering. Remove some of the large, old canes. Tie new canes to a support for the next year.

Large-flowering **climbing roses** have flowers more than 2 inches across, borne on wood that is 2 or more years old. Canes are larger and sturdier than those of Ramblers. Many flower just once in June,

but some, called ever-blooming climbers, flower more or less continuously. This group should be pruned in autumn, any time before cold weather sets in. First cut out dead and diseased canes. After this, remove 1 or 2 of the oldest canes each season to make room for new canes. The laterals, or side shoots, are shortened 3 to 6 inches after flowering. If the plant is strong, keep 5 to 8 main canes, which should be tied to the trellis, fence, wall, or other support. If it is not strong, leave fewer canes.

Pruning Shade Trees

Young shade trees may require pruning to develop a good framework. If the tree is recently planted, wait until the following spring to prune; this will benefit root development. Multiple leaders and crowded branches should be removed before bud break. Avoid mid-summer, late fall, or early winter pruning. A few tree species will bleed when pruned but this is not harmful.

Storm damage can be remedied at any time of the year. Dead branches are removed at the collar; painting wounds is not recommended.

Pruning Vines and Ground Covers

The pruning of ornamental vines is similar to the pruning of ornamental shrubs. Flowering vines are pruned according to flower production; those that flower on new wood are pruned before new growth begins, those that flower on last season's growth are pruned immediately after flowering.

Vines that are grown for foliage are pruned to control growth and direction. Timing is less critical than for flowering vines.

Ground cover plants require very little pruning. Dead or damaged stems should be removed whenever observed. Some trailing ground covers, such as English ivy, may need pruning to prevent encroachment on lawn areas or other plants.

Training and Pruning Apple Trees

Nonbearing Apple Trees

Proper training and pruning are essential for development of structurally strong, productive apple trees that will bear high quality fruits continuously and annually. Since pruning reduces potential fruit production, the ideal management system is one that requires a minimal amount of pruning to achieve the goals of exceptional fruit quality and sturdy tree structure. The use of dwarf trees is highly recommended. Not only will dwarf trees bear fruit at a much younger age than full-sized trees on seedling rootstock, these trees will also require much less pruning effort.

The Planting Year

Ordering quality nursery stock will reduce the time and effort needed for tree training. Heavily branched (or feathered) one-year old nursery trees will naturally fruit more heavily earlier in the life of the orchard. These trees will rarely need pruning at planting except to eliminate oversized branches - branches with a diameter exceeding $\frac{1}{2}$ to $\frac{1}{3}$ the diameter of the trunk or leader. Whenever a branch does need to be pruned, whether on these newly planted trees or later when these trees mature, it is important that the entire branch is cut out. If instead, you prune offending branches by simply cutting off a portion of the end, you will not solve the structural problem the branch is causing. Rather, the branch will regrow in a vigorous and upright manner, creating unwanted shading of other wood, delaying fruiting.

Branches are most productive at an angle some 60 to 75° from the vertical leader or trunk - not quite, but nearly flat. The branches on well feathered nursery trees will naturally develop wide, strong crotches. The few that are too upright growing can easily be tied down or spread to a wider angle.

The use of a tree training stake is the key first step to properly training young apple and pear trees. Dwarf trees frequently require some sort of support in part because they bear fruit so young in life. Staked trees are easy to train - simply tie the leader or trunk to the stake. Lateral limbs that need spreading can be pulled down into position with

soft twine or string tied to the stake. And staked trees will bear fruit earlier and be more productive than trees that are not staked. Electrical conduit pipe (3/4 to 1 inch in diameter) and pressure treated wood (2 inches in diameter) are ideal tree stakes. Use stakes 8 to 10 feet long, setting them up to 3 feet into the soil to insure good anchorage.

While well branched trees are the ideal, you often will have to settle for trees that have only a few or perhaps no branches. Again, newly planted trees should be tied to a tree training stake. If the few branches they do have are uniformly distributed around the tree, then no pruning is required. If the tree is one-sided, or becomes one-sided after an oversized branch or two is removed, then perhaps the best course of action is to remove them all and start over. This will often be the case when a tree comes with only one or two branches. For trees that have been pruned back to a single trunk or leader (whip), cut the leader off at a height of 36 inches above the ground to encourage the development of wide-angled branches.

The Year After Planting

Beginning in the second year, pruning in the late winter or very early spring should be an annual management practice. If the trees grew exceptionally well the previous summer, or came from the nursery with many laterals, some thinning of laterals may be necessary. More than 5 to 7 laterals at this stage may cause crowding. Crowding means shade, and shaded wood will produce few flower buds and fruit.

How do you select branches to remove? First, remove any branches that are oversized just as we did at planting. Oversized branches will create internal shade problems, limiting fruit production in the future. Once again, any branch over 1/2 the diameter of the trunk where it joins the trunk is a candidate for removal. Be sure to follow the complete removal rule. Completely remove the offending branch - removing a portion of it will not solve the problems it will soon create. You should also remove any excessively low branches. Branches less than 20 to 22 inches above the ground will be difficult to mow under and will likely produce inferior quality fruit as they sag under crop loads.

Some limb spreading may be necessary in this second spring. Limbs can be positioned at the desired angle by simply tying them down using the

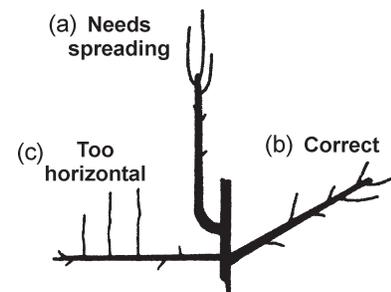
tree stake as an anchor. Check the leader to be sure it is properly tied to the stake. Once again, no tipping of branches is recommended. There is no easier way to delay and reduce fruiting than by tipping or heading back branches. Remember, deer are tip pruners and trees that deer prune bear few if any fruits!

Year Three and Beyond

The basic pruning rules we have practiced in the first two years of the tree's life do not change as the tree ages although the size of some of our pruning cuts might. We continue to train the leader to the stake and eliminate any oversized branches that develop. Some branches that didn't seem too vigorous in years 1 and 2 may become problems, growing at a much faster rate than other parts of the tree. These excessively large branches will need to be removed, again by cutting them out completely. And some shade problems may develop as growing branches crowd each other. Again, completely eliminate a branch or two to eliminate shading rather than cutting back all branches.

Additional limb spreading may be needed for certain upright-growing branches, especially with cultivars like Delicious and Macoun which have a natural upright growth tendency.

Balance is the key. Branches should be relatively uniform in size and evenly distributed around the trunk. The top of the tree should be narrow compared to the lower portion, as shading of the lower branches will reduce fruit production. The trunk or leader should be straight, again to reduce shading on the lower branches. And branches should be positioned at an appropriate angle to intercept the most sunlight possible. The key tools for achieving these goals are a tree training stake, whole limb pruning, and limb spreading.

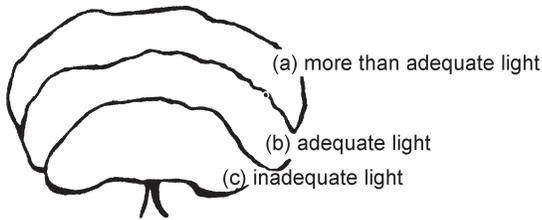


Bearing Apple Trees

When pruning is underway, older, bearing trees should be pruned first. Young, nonbearing apple trees and stone fruits should not be pruned until after March 1 to minimize chances of winter injury.

The balance between vegetative and fruiting growth is influenced by the crop load, fertilization, and pruning. Fruiting may be poor because vigor is too high or too low. Excessive vigor can be the result of inadequate fertilization, no pruning, excessive cropping, or shading of fruiting wood. Good fruiting wood requires moderate vigor and exposure to good light levels.

Light is the source of energy that produces the crop. Bearing wood that is shaded is low in vigor and produces small, poorly colored fruits. Good light exposure is necessary for the development of flower buds as well as optimum size, color, and sugar content of the fruit. Studies have shown that a typical tree canopy is composed of different layers or zones in respect to light exposure. As shown below, an outside zone of leaves and fruit receives a high proportion of direct light and light levels above those required for good growth and fruiting; a second zone receives adequate light exposure; and a third, inner zone receives inadequate light exposure and is unproductive.

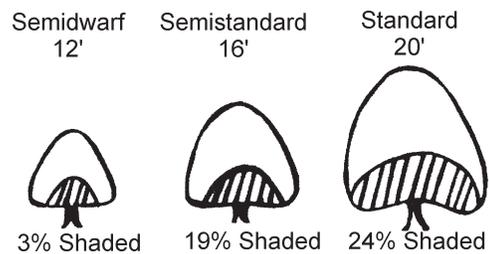


The relative proportion of these zones in a tree is influenced by tree size and shape. As tree size increases, the percentage of the tree that is shaded and unproductive (third zone) increases. Trees that have wide tops and narrow bottoms also have a high percentage of shaded areas in the tree canopy. Trees should be cone-shaped, or larger at the bottom than the top, to maximize adequate light exposure.

Good light exposure in the tree canopy can also be maintained by a good pruning program. Ideally, pruning should remove unproductive wood and develop a uniform distribution of vigor and light exposure throughout the tree. Proper pruning can also help to maintain desired tree size and shape.



Pruning should be done on a regular basis and consist of moderate cuts made throughout the tree to distribute vigor and provide good light penetration. Heading cuts should only be used where branching is desired or in areas where vigor is low. Drooping or low-hanging branches should be removed or pruned to a lateral that is positioned above horizontal. Remove crossing, dead, or damaged limbs. Watersprouts should be removed unless one is needed for the development of new bearing surface. Watersprouts can be easily removed by hand as they develop in the summer.



Without regular annual pruning, trees often become overly thick, and irregular bearing may occur. Spray penetration is reduced, and problems such as scale may develop in the dense areas of the tree. With this type of tree, make many thinning cuts throughout the tree with emphasis on the upper, outer portions of the tree. This will open up areas into the tree canopy as well as re-establish good tree shape.

Avoid bench cuts to outward-growing limbs unless necessary. Such cuts result in weak limbs and an umbrella shape that creates a sucker problem. Remove no more than 2 large limbs per year. If large amounts of pruning are required, it should be spread over a 2 to 3 year period. In addition, such pruning should be preceded and followed for 1 to 2 years by a reduction or elimination of nitrogen application, depending on soil type, variety, and grower experience.

The excess vigor that can result from severe pruning can decrease fruit quality. The effect is much the same as from excessive nitrogen application, and may include excessively large, poorly colored, soft apples which will not store well. Vegetative growth competes with fruit for calcium; thus, under conditions of excessive vigor, calcium related disorders such as bitterpit may develop.

Pruning Other Fruit Trees

The general purpose of pruning fruit trees is to regulate growth, increase yields, improve fruit size and quality, and reduce production costs. Pruning is necessary to shape trees for convenience of culture and repair of damage.

Most pruning is done during the dormant season, preferably just before active growth begins in the spring. At this time, pruning wounds heal quickly, flower buds can be easily recognized, and injury from low winter temperature is avoided. Summer pruning (from late July through mid August) may be done to help train trees to the desired form and maintain small tree size. Summer pruning should consist of making thinning cuts of branches of $\frac{1}{2}$ inch diameter or smaller. Do not prune larger branches at this time. It should be remembered that all pruning has a dwarfing effect. For maximum yield of high quality fruit, prune only as necessary to establish a tree with a strong framework capable of supporting heavy crops annually without damage and to maintain a tree sufficiently open to allow penetration of sunlight, air, and spray material for good fruit development and pest control.

Pear, cherry, and apricot trees are trained to the leader system recommended for the apple. Special attention should be given to the selection of scaffold limbs for sweet cherry because it is subject to winter injury and splitting at the point where the limbs join the main stem of the tree. It is essential that the crotch angles be as wide as possible to ensure a strong framework, and the rule about removing oversized branches is always obeyed.

The plum may also be pruned in a manner similar to the apple. European and prune types generally develop into well-shaped trees, even if little pruning is done. Thinning out excessive growth constitutes the bulk of pruning after heading back to 30 to 36 inches at the time of planting. Varieties of the Japanese type are usually a little more vigorous, and may need some heading back as well as thinning of excessive growth after they come into bearing.

Peach trees are usually trained to the open-center system. Newly planted trees should be headed to about 30 inches in height, just above a lateral branch or bud. If the tree is branched when it comes from the nursery, select 3 or 4 laterals, well-spaced up and around the trunk, for the permanent scaffold limbs. The lowest limb should be about 15 inches and the highest about 30 inches from the ground. Cut these back to two buds each, and remove all other laterals.

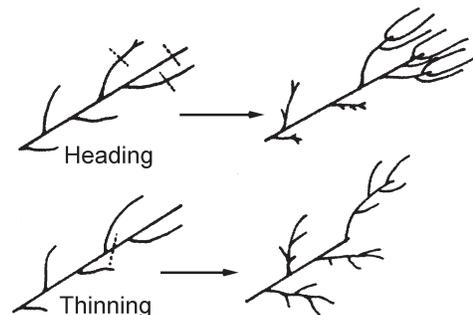
If no desirable laterals are available, head the tree to the desired height and cut out all side branches to one bud. A number of shoots will develop during the season, from which you can select scaffold limbs. Selection can be made during the summer or delayed until just before growth begins the second season.

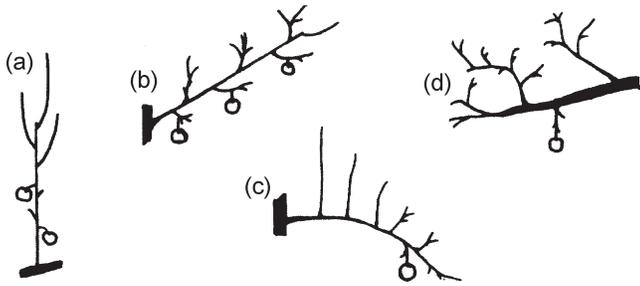
Once the scaffold system of the young peach tree is established, prune as little as possible until the tree begins to bear. Remove all strong, upright shoots growing in the center of the tree, and lightly head back terminal growth on the scaffold limbs to outward-growing laterals. This aids in the development of an open-center tree.

As fruit is borne on wood of the previous year's growth, it is necessary that the peach be pruned annually to stimulate new growth and maintain production near the main body of the tree. Pruning of the mature peach tree consists mainly of moderate thinning and heading back to outward-growing laterals to keep the tree low and spreading. A height of 8 or 9 feet is usually preferred.

When pruning fruit trees for best production, remember these basic concepts:

- (1) Pruning results in strong growth close to the pruning cut. Pruning reduces the number of shoots so remaining shoots are stimulated. However, total shoot growth and size of the limb is reduced.
- (2) Two types of pruning cuts are heading back (tipping) and thinning out (bulk). Heading is cutting off part of a shoot or branch to stimulate branching and stiffen the limb. Thinning cuts remove the entire shoot or branch at its junction with a lateral, scaffold, or trunk. Thinning cuts are less invigorating, improve light penetration, and can redirect the limb.





(3) Limb position affects vigor and fruitfulness.

Vertical or upright branches, typical in the tops of trees, produce the longest shoots near the end of the limb and tend to be excessively vigorous and not very fruitful. Fruit are often of poor quality and subject to limb rub. Limbs growing slightly above horizontal are more apt to develop a uniform distribution of vigor and fruitfulness. Light distribution tends to be even, and because fruit hang along the branch, they are less prone to limb rub. Limbs growing below horizontal tend to develop suckers along the upper surface. Excess sucker growth will result in shading. Hangers, or limbs developing on the underside of branches or scaffolds, are heavily shaded and low in vigor. Fruit developing on such wood is of poor size and color.

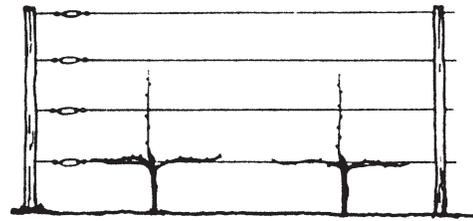
(4) Pruning alters the balance between the tree top and root system. Thus, a pruning program should be developed along with a good fertilization program. Severe pruning and/or excess fertilization can increase excessively the vigor of the tree and decrease fruiting.

Special Training System

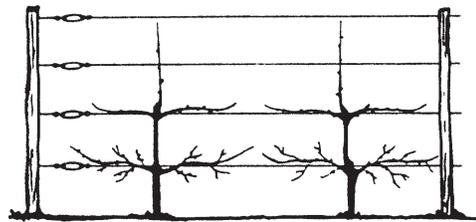
The foregoing suggestions for pruning fruit trees are concerned with training for maximum production of high quality fruit. In addition, many home gardeners prune for decorative purposes.

Numerous training systems, based on the art of *espalier*, which originated in France and Italy about 400 years ago, have been devised. Some are quite elaborate, requiring considerable time and patience as well as detailed knowledge of the plant's growth characteristics. The easiest espalier system is the horizontal cordon. Apples, pears, and plums adapt well to this system. The trees are usually supported by a wall, fence, or wire trellis. Training to the four-tier cordon or four-wire trellis is relatively easy.

An espalier system can serve to separate yard areas and to provide an effective way of producing a large volume of high quality fruit in a limited area. Trees trained in this fashion should be grafted on dwarfing rootstock. Otherwise, they tend to grow too large and are difficult to hold within bounds.



First Winter



Second Winter

A simple, four-wire trellis may be constructed by setting 8-foot posts 2 feet in the ground, spacing them 12 feet apart, and running wires through the posts at heights of 18, 36, 54, and 72 inches. Plant two unbranched whips of the desired variety 6 feet apart between each two posts.

Before growth begins in the spring, cut off the whip just above the first bud, below the point where the whip crosses the lowest wire. Usually three or more shoots will develop near the point of the cut. Retain the uppermost shoot and develop it as the central leader. The other two can be developed into main scaffold branches to be trained along the lower wire, one on each side of the central stem. Remove all other growth. The two shoots selected for scaffold limbs should be loosely tied to the wire as soon as they are 10 to 12 inches long. Twine, plastic chainlink ties, or other suitable material may be used. Tie the shoots so that they are nearly horizontal. This reduces vegetative vigor and induces flower bud formation. If the end of the shoot is tied below the horizontal, however, new growth at the end will stop, and vigorous shoots will develop along the upper side. At the end of the first season, the lateral branches on the lower wire should be established and the central leader should have grown above the second wire.

During the dormant pruning at the end of the first winter, cut the central leader off at a bud just below the second wire. Repeat the process of the previous spring by developing two scaffold branches to tie to the second wire and allow the central leader to grow above the third wire.

This process is repeated during the next two seasons, at which time a total of eight scaffolds, four on each side of the tree, should be firmly established. The leaders should be bent to form one of the scaffolds, rather than being cut off at the top wire.

By the end of the fourth season, the trees should be in heavy production. All pruning is then done during the spring and summer months. After new growth in the spring is about 2 inches long, cut it off, and also removing about $\frac{1}{4}$ of the previous season's growth. Terminals of the scaffold are left untouched.

About the first of August, or as soon as new growth reaches 10 to 12 inches in length, cut it back to two or three buds. Repeat about a month later, if necessary. This encourages fruit bud formation and prevents vigorous growth from getting out of bounds.

Training and Pruning Small Fruit

Grapes.

For grapes to be most productive, they must be trained to a definite system and pruned rather severely. There are several training systems used. The two most common are the vertical trellis and the overhead arbor. Both of these are satisfactory in the home planting if kept well-pruned.

Of the many variations of the vertical trellis, the single-trunk, four-arm, Kniffin system is the most popular. Posts are set 15 to 20 feet apart and extend 5 feet above the ground. Two wires are stretched between the posts, the lower being about $2\frac{1}{2}$ feet above the ground and the upper, at the top of the posts. The vine is set between the posts and trained to a single trunk with four semipermanent arms, each cut back to 6 to 10 inches in length. One arm is trained in each direction on each wire.

During annual winter pruning, one cane is saved from those that grew from near the base of each arm the previous summer. This cane is cut back to about ten buds. The fruit in the coming season is borne on shoots developing from those buds. Select another cane from each arm, preferably one that grew near the trunk, and cut it back to a short stub having two buds. This is a renewal spur. It should grow vigorously in the spring and will be the likely source of the new fruiting cane selected the following winter. All other growth on the vine should be removed. This leaves four fruiting canes, one on each arm, with eight to ten buds each, and four renewal spurs, one on each arm, cut back to two buds each.

The same training and pruning techniques may be effectively used in training grapes to the arbor system. The only difference is that the wires supporting the arms are placed overhead and parallel with each other instead of in a horizontal position. Overhead wires are usually placed 6 to 7 feet above the ground.

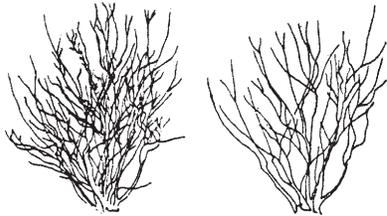
If an arm dies, or for any reason needs to be replaced, choose the largest cane that has grown from the trunk near the base of the dead arm and train it to the trellis wire. To renew the trunk, train a strong shoot from the base of the old trunk to the trellis as though it were the cane of a new vine. Establish the arms in the same manner as for a new vine, and cut off the old trunk.

Pruning may be done anytime after the vines become dormant. In areas where there is danger of winter injury, pruning may be delayed until early spring. Vines pruned very late may bleed excessively, but there is no evidence that this is permanently injurious.

Blueberries.

Until the end of the third growing season, pruning consists mainly of removing low spreading canes and dead and broken branches. As the bushes come into bearing, regular annual pruning will be necessary. This should be done between January and March. Select six to eight of the most vigorous, upright-growing canes for fruiting wood and remove all others.

After about 5 or 6 years, a cane begins to lose vigor and fruit production is reduced. At the dormant pruning, remove the older canes of declining vigor and replace with strong, vigorous new shoots that grew from the base of the bush the previous season. Keep the number of fruiting canes to six or eight, and remove the rest. Head back excessive terminal growth to a convenient berry-picking height.



Pruning blueberries, before and after

Brambles

Most brambles benefit from some form of support. They may be grown on a trellis, trained along a fence, or tied to stakes.

A simple trellis, the T-trellis, is used in many home gardens. Two wires are set about 4 feet above ground and spaced 2 feet apart by a lateral cross arm attached to posts set 15 to 20 feet apart in the row. Fruiting canes are tied to these wires in the spring.

If individual plant stakes are used for support, they are driven into the ground about 1 foot from each plant and allowed to extend 4 or 5 feet above the ground. Canes are tied to the stake at a point about midway between the ground and the tips of the canes, and again near the ends of the canes.

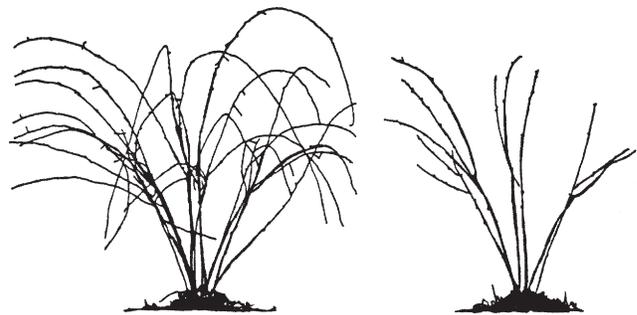
Canes of bramble fruits are biennial in nature; the crowns are perennial. New shoots grow from buds at the crown each year. Late in the summer, the new canes develop fruit buds. Early in the second season, fruit-bearing shoots grow from these buds. After fruiting, the old canes die.

These fruiting canes may be removed any time after harvest. They should be cut off close to the base of the plant, removed from the planting, and destroyed. Some growers, as a sanitation practice, do this immediately after harvest. Most, however, wait until the dormant pruning.

The dormant pruning is usually delayed until danger of severe cold is past and accomplished before the buds begin to swell. It consists of the removal of all dead, weak, and severely damaged canes, and the selection and pruning of the fruiting canes for the coming season. Where possible, fruiting canes $\frac{1}{2}$ -inch or more in diameter are selected. Only three to four canes should be left per foot of row.

Black raspberries should be topped in the summer when the young shoots are about 24 inches high; purple raspberries, when about 30 inches high. Summer-topping consists of removing the top 3 to 4 inches of the new shoots by snapping them off with the fingers or cutting them with shears or a knife. Where trained to supports, let them grow 6 to 8 inches taller before topping.

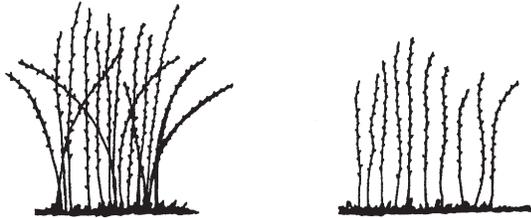
At the dormant pruning, thin each plant until only four or five of the best canes remain. Cut the lateral branches of the black raspberry to 9 to 12 inches long; those of the purple raspberry to 12 to 15 inches long.



Pruning black raspberries, Before and after

Red raspberries should not be summer-topped. At the dormant pruning, where the hill system of culture is used, thin until only seven or eight of the best canes remain per hill.

If the plants are grown in hedgerows, keep the width of the rows to 18 inches or less, and remove all plants outside the row areas. Thin the canes within the hedgerows to 6 to 8 inches apart, saving the best canes.



Pruning red raspberries, before and after

Where the canes are supported either by a trellis or stakes, cut the canes back to a convenient height for berry-picking, usually 4 or 5 feet. Grown as upright, self-supporting plants, whether in hills or in hedgerows, the canes should be cut back to about 3 feet in height. Any lateral branches should be cut to about 10 inches in length.

For everbearing red raspberries, most growers prune everbearing cultivars to produce a single fall crop on the tips of new canes only. In this system, all canes are pruned to ground level in early spring each year.

New shoots of erect blackberries should be summer-topped when they are 30 to 36 inches high. To prevent the planting from becoming too thick and reducing yields, it may be necessary to remove excess sucker plants as they appear. This can be done either with a hoe or by hand. In the hedgerow type of culture, leave only three or four shoots per running foot of row. Grown in hills, four to five new shoots may be allowed to develop in each hill.

At the dormant pruning, where supports are used, head the canes to 4 to 5 feet in height. Canes grown without support should be headed to 3 feet. Cut lateral branches back to 15 or 18 inches long.

Trailing blackberries require little pruning. All dead and weak canes should be removed after harvest or at the dormant pruning. They should be thinned to seven or eight of the best canes per hill, cut to about 5 feet in length, and tied to either a stake or trellis.

Summary

Pruning is the removal of parts of a woody plant for a specific purpose. These purposes include: training the plant; maintaining plant health; improving the quality of flowers, fruit, foliage, or stems; and restricting growth.