

# TRAINING AND PRUNING DECIDUOUS FRUIT TREES



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# TRAINING AND PRUNING DECIDUOUS FRUIT TREES

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## TRAINING AND PRUNING DECIDUOUS FRUIT TREES

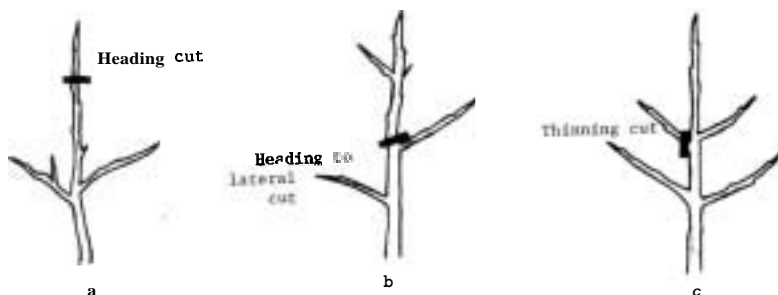
Training and pruning are two most important but often neglected cultural practices. The best training and pruning system depends upon the tree type (species and cultivar). Pruning severity is determined by the rootstock, tree age, tree vigor and management objectives. Proper training from the beginning will help promote a strong, productive tree which requires a minimum of pruning later in life.

This bulletin describes types of pruning cuts, reasons for training and pruning, pruning terminology, pruning and tools, when to prune, general rules of training and pruning, training methods, pruning mature trees and accepted methods of training and pruning for different tree types.

### TYPES OF PRUNING CUTS

There are two basic types of pruning cuts with each serving a specific function:

1. **Heading cut.** In this type of cut the tip of a branch or shoot is cut off, thereby inducing lateral branching and a stiffening of the branch (Figure 1a). When a heading cut is made, it may be necessary to prune back some of the resulting growth. A type of heading cut is a heading to a lateral cut where the shoot is cut off directly above a lateral branch (Figure 1b), thus changing the direction of growth of the branch. Less new growth will result from this type of cut than a heading cut or a thinning cut.
2. **Thinning cut.** This type of cut involves the complete removal of unwanted side branches (Figure 1c). Depending on the crotch angle and branch position, it may be desirable to maintain the branch and head it back some distance from the trunk.



**Figure 1. Basic types of pruning cuts: (a) heading cut; (b) heading to laterals; (c) thinning cuts ( = pruning cut).**

## **REASONS FOR TRAINING AND PRUNING DECIDUOUS FRUIT TREES**

The main objective behind training a young fruit tree is to direct the formation of a strong and balanced tree framework. In contrast, pruning encourages continued tree productivity with the ultimate goals being to maximize yield and fruit quality for the commercial life of the tree. Specific reasons for training and pruning fruit trees are to:

- 1) Maintain a balance between shoots and roots at planting.
- 2) Provide the basic tree form and to aid the development of a strong tree framework by encouraging strong wide crotch angles.
- 3) Stimulate shoot growth near a cut.
- 4) Permit proper levels of light distribution to the tree interior.
- 5) Increase insect and disease control by allowing for better spray penetration.
- 6) Facilitate harvesting.
- 7) Achieve orchard uniformity.
- 8) Produce the proper amount of well distributed fruiting wood.
- 9) Encourage a structurally sound tree by removing branches with weak narrow crotch angles or those with diseased, damaged, or unproductive wood.
- 10) Invigorate and renew the bearing area of older trees.
- 11) Minimize tendencies toward biennial bearing.

## A DESCRIPTION OF TERMS (Figure 2.)

**Central leader:** The central trunk in a central leader pruning system from which the main scaffold limbs emerge.

**Crotch angle:** The angle a scaffold limb makes with the main trunk or a shoot makes with a scaffold limb.

**One-year-old wood:** Term used after leaf fall and during the following growing season to designate shoot or spur growth that developed during the previous growing season.

**Rootstock:** The section of a grafted tree below the graft union.

**Root sucker:** Fast growing vertical shoots emerging from below ground portion of the trunk or roots.

**Scaffold limb:** Major limbs attached to the main trunk.

**Scion:** The section of a grafted tree above the graft union.

**Shoot:** In winter refers to past seasons growth; during the growing season, refers to current seasons growth.

**Spur:** A short shoot that usually terminates in a flower bud.

**Terminal:** The apex of a shoot or limb.

**Two-year-wood:** Wood one year older than one-year-old wood.

**Water sprout:** An unproductive, fast growing, vertical shoot.

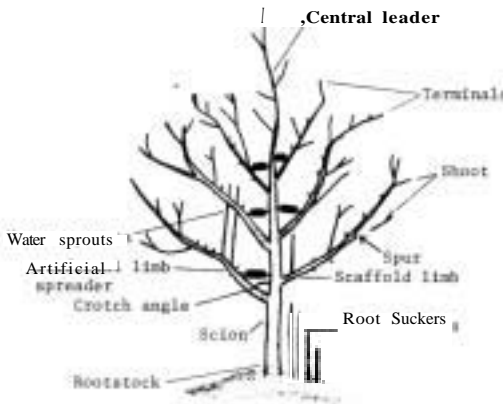


Figure 2. Pruning terminology.

## REQUIRED PRUNING TOOLS (Figure 3)

Lopping shears with 2-foot handles extend ones reach high up a tree and are capable of cutting branches up to 1 or 1 1/2 inches in diameter.

A pruning saw with coarse teeth and a curved handle is most often used to cut large limbs.

Hand shears are most often used for training one- to three-year-old trees.

A sturdy ladder is essential for pruning larger trees.

Hydraulic or pneumatic pruners or power saws or sickle-bar mowers are sometimes used in the commercial orchard for hedging and topping.



Figure 3. Tools commonly used for tree pruning.

## WHEN TO PRUNE

Pruning is invariably a dwarfing process; however, the time of pruning will influence the amount of dwarfing. Cuts made during the dormant season will have less dwarfing effect than pruning cuts made during active plant growth. Both stored carbohydrates and leaves for photosynthesis are removed when trees are pruned during the growing season.

Generally, it is preferable to prune all fruit trees as late in the dormant season as possible, but before bloom. Pruning too early in the winter increases the possibility of winter injury. If it is impractical because of time or labor considerations to complete pruning in this four to eight week time frame, then start as early as necessary to complete the job before bloom. When several types of fruit trees need to be pruned, prioritize which are to be pruned latest in accordance to their susceptibility to winter injury. For instance, it is better to prune apple or blueberry prior to cold sensitive species like peach and other stone fruit if faced with time or labor constraints. By delaying pruning of peach, apricot, cherries, and plums until March or early April, wood with viable fruit buds can be saved and winter injured wood can be selectively removed.

## MAKING THE CUT

Pruning cuts should be close as possible to the parent branch, leaving little or no stub (Figure 4). Avoid damaging the bark. When sawing off large limbs, first undercut the limb some distance from the trunk, then cut from above a few inches further out (Figure 4). The remaining stub should then be cut off parallel to the trunk.



**Figure 4.** Proper (a) and improper (b) ways to make a large cut. First cut 2/3 through the bottom of the limb (1) about two feet from the trunk. Next completely saw through the limb at (2). Lastly, remove the branch flush with the trunk (3) leaving no stub.

## GENERAL RULES OF TRAINING AND PRUNING

- 1) Head back fruit tree species at planting time just above the desired height of the lower scaffold branches (Typically 2 to 3 feet).
- 2) Young trees should be pruned very lightly since pruning a young non-bearing tree delays production and reduces yields in the early years.
- 3) Tree species exhibit to varying degrees, a phenomenon known as apical dominance. Active shoot tips produce hormones which influences the buds below in terms of growth rate and angle of emergence from the limb (Figure 5). Those buds further from the shoot tip will grow more slowly but will develop desirable, wide crotch angles. A heading cut removes the apical dominance exerted by the shoot tip and consequently lower buds and shoots grow more rapidly.

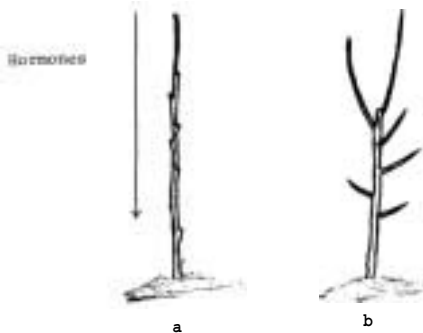


Figure 5. Plant hormones released from the apex (a) suppress the development of lower buds into branches. A heading cut (b) removes the hormonal inhibition, permitting branches to grow from previously inactive buds. The higher, more vigorous terminals now release hormones which cause the branches below to grow slower and possess wider more desirable crotch angles

- 4) Remove all shoots that form a narrow crotch angle (less than 50 degrees) with the trunk of a young tree. These narrow crotch angles may weaken and split from ice formation or the weight of a fruit load. Marginally acceptable crotch angles, approximately between  $45^{\circ}$  and  $55^{\circ}$ , can be widened by artificially spreading young laterals with clothespins (Figure 6), or older laterals with wire spreaders (Figure 7).

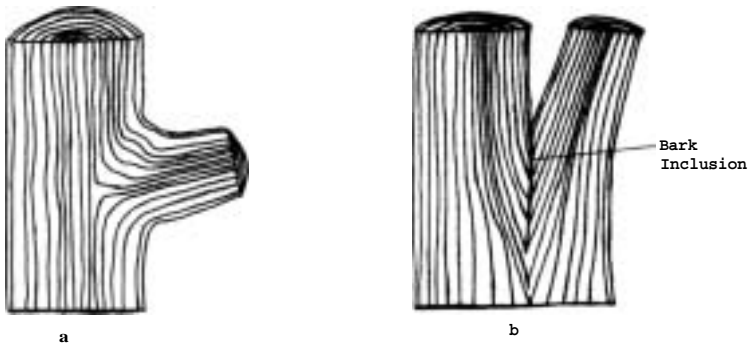


Figure 6. A depiction of a strong wide crotch angle (a), and a weak narrow crotch angle (b). Narrow crotch angles do not have the structural strength of wide crotch angles and are subject to breakage and increased disease incidence due to bark inclusion in the narrow crotch angles.



Figure 7. Clothespins can be used to increase the crotch angle of tender, newly formed laterals as early as possible (before 8 inches in length).

- 5) The growth of limbs or buds adjacent to a pruning cut is strongly encouraged, thereby allowing one to direct future growth by careful selection of optimum cutting sites.
- 6) Pruning cuts during the early growing season will have more of a dwarfing effect than cuts made after most growth ceases later in the summer or during the dormant season.
- 7) Maximum productivity of a bearing tree is achieved by maintaining the top of the tree narrower than the bottom in order to permit efficient light utilization.
- 8) Bearing trees should be more severely pruned if they appear to lack vigor as indicated by insufficient growth of terminal shoots.
- 9) Avoid leaving stubs when removing limbs.
- 10) Moderate pruning every year is superior to severe pruning at greater time intervals.
- 11) Prune as late in the winter or spring as possible but before full bloom.
- 12) When reducing the height of oversized trees, always head the main limb to a lateral even if it requires removing several extra feet of main limb.
- 13) Neglected trees should be correctively pruned gradually over several years so that excessive growth of suckers and water sprouts may be minimized.

## **TRAINING METHODS**

Fruit trees are trained to one of four basic methods: A modified central leader, a central leader, a multiple leader, or an open center. Since a modified central leader is the most widely accepted system, it will be discussed first.

## TRAINING TO A MODIFIED CENTRAL LEADER

The most often used training system is the modified central leader. The objective of a modified leader system is to develop a tree with typically four to nine scaffold limbs attached to a strong central trunk (Figures 8-12). We start with a central leader system, however, the end result is a multiple leadered tree. The temporary central leader produces hormones which stimulates the production of scaffold limbs with strong wide crotch angles. The central leader will be headed to a lateral between 7 and 10 feet in height so that it no longer grows straight up but instead somewhat to one side. The top center will be thinned out to allow better light penetration. Tree height will be kept lower than central leader trained tree to facilitate spraying and harvesting. Scaffold limbs should be evenly spaced around the tree, starting about 2 feet above the ground with approximately 8 to 12 inches vertical distance between them.

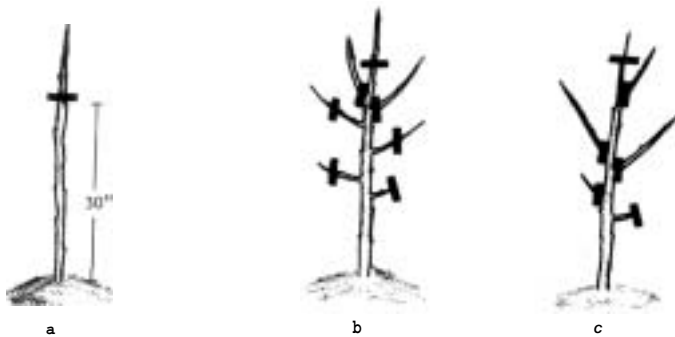
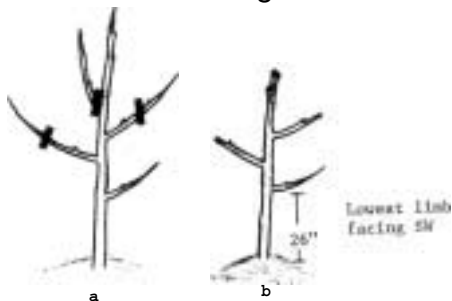


Figure 8. Training a tree to a modified central leader at planting time: (a) single whip tree headed back to 30 inches: (b,c) branched tree with showing branches with undesirable crotch angles thinned out and branches with desirable crotch angles partially retained. Branched trees are also headed back at about 30 inches (■ = pruning cut).

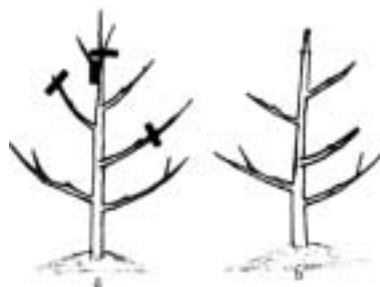
## FIRST YEAR TRAINING - AT PLANTING TIME

Young trees received from nurseries are generally single whip one-year-old trees (Figure 8). If the plant is a single whip, it should be headed back to a height between 24 and 40 inches (Figure 9). The larger or more vigorous whips should be headed back toward the higher end of this range. In general, low heading induces fewer but longer shoots than high heading. If the young tree is branched when received from the nursery, the center leader should be headed back and branches with narrow crotch angles removed. Three options exist for laterals with wide crotch angles: (1) Newly formed shoots or laterals with wide crotch angles may be completely removed if improperly positioned. (2) Laterals may be pruned back to  $1/3$  or  $1/2$  its length, thereby diminishing competition with the central leader for dominance. (3) Very short, favorably positioned laterals located some distance from the apex of the central leader may be entirely saved except for the terminal which should be removed. Clothespins may be used to increase the crotch angles of very young lateral branches (Figure 7). The lowest branch should be facing the southwest (Figure 9) in order to reduce sunscald damage to the trunk. White paint or some kind of tree wrap will also help prevent sunscald damage to the trunk. The lowest scaffold limb should be approximately 24 to 30 inches above the ground for apple and 20 to 26 inches above the ground for most other fruit trees. It is generally not a good practice to allow fruit to set on any fruit tree during the first 2 years because it will delay the establishment of the tree framework.

The only pruning that should be required during the first growing season is to remove all shoots arising below the first main scaffold limb. They can be pulled off or rubbed off in the summer when still green.



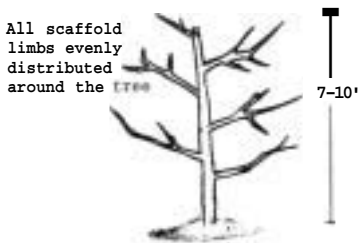
**Figure 9.** Before (a) and after (b) First dormant pruning (= pruning cut).



**Figure 10.** Before (a) and after (b) second dormant pruning (= pruning cut).

## SECOND YEAR TRAINING - ONE YEAR AFTER PLANTING

Pruning during the first dormant season is similar to the previous dormant season in that a leader is selected and headed back approximately 12 inches above the point where new laterals are desired (i.e. about 20 inches above the highest permanent lateral) (Figure 10). Lateral branches to become scaffold limbs should be selected and headed back to  $1/2$  to  $1/3$  their length. This will initiate new shoots to form on the laterals and will also insure that the central leader remains dominant. Remove improperly positioned laterals and all those with narrow crotch angles. Scaffold branches once established will be stronger and bear fruit earlier if they are spread toward a horizontal position with wire spreaders. Vigorous upright growth from the scaffolds and root suckers should be removed. Pruning during the second growing season entails removing all shoots in competition with the new leader just below where the heading cut was made. Also as was the case the previous season, do not allow shoots to form below the lowest scaffold limb.



**Figure 11. A tree properly trained to a modified central leader after the third dormant season.**



**Figure 12. A bearing tree with a proper tree framework.**

### **THIRD YEAR TRAINING – TWO YEARS AFTER PLANTING**

The tree should possess several good scaffold limbs. However, if additional scaffold limbs are required, head back the main central leader 12 inches above their optimum location (Figure 11). If four to seven good scaffold limbs already exist, then simply remove shoots in competition with the main central leader. Scaffold limbs should be headed back if: 1) More secondary laterals are desirable on them, 2) there is a risk that a scaffold limb may overtake the central leader as the main leader, 3) the tree is out of balance because of preferential growth of one scaffold limb over the others. Upper scaffold limbs should be shorter than the lower scaffold limbs to prevent shading of the former. Retain several secondary laterals that have formed on scaffold limbs pruned the previous season, but save none that are closer than twelve inches to the central leader.

The same criteria exists for pruning during the third growing season as the second growing season.

### **FOURTH YEAR AND FUTURE PRUNINGS – THREE YEARS AFTER PLANTING**

Four to seven strong scaffold limbs should be present and therefore the basic framework established by this time (Figure 11), but if not, head the central leader 12 inches above where new scaffolds are required. Scaffold limbs should be handled in the same manner as described after third year pruning. Maintain the central leader until seven to ten years after planting, at which time it should be headed to a lateral (Figure 12).

The major objective after the basic framework has been established is to encourage the production of good fruiting wood. This consists of heading back vigorous shoots, selective thinning of small branches near the center of the tree, crossed branches and water sprouts. Large pruning cuts should be unnecessary because the framework has been developed by this time. Avoid heavy pruning since it will delay bearing. Pruning in future years will entail thinning cuts and heading to lateral cuts on weak or unproductive limbs in an effort to improve vigor and increase the amount of good fruiting wood. Diseased or severely damaged limbs should always be removed.

## TRAINING TO A CENTRAL LEADER

This training system encourages the development of a tall tree compared to other pruning methods. The conical-shaped tree utilizes light efficiently but makes harvesting all trees except those on dwarfing rootstocks difficult (Figure 13). This training system is also hard to establish on windy sites. The poor anchorage afforded by some dwarfing rootstocks and/or high winds often makes artificial support desirable. Although the central leader training system has been used frequently in the past, it is now only recommended for some apple cultivars on a dwarfing rootstock in a high density situation (i.e. 10 and 15 feet within and between row spacing, respectively). In the Pacific Northwest, trees trained to a central leader have incurred heavy damage due to the rapid spread of fireblight down the leader to the trunk with gravity. Avoid using this system with varieties or in areas where fireblight may be a serious problem.

The initial training in a central leader system is similar to a modified central leader. The major difference is that the main central leader remains dominant for the life of the tree and is not removed after seven to ten years as in the modified central leader system. However, do not allow the central leader to overgrow and shade the lower scaffold limbs.



**Figure 13. A bearing tree properly trained to a central leader training system.**

## TRAINING TO MULTIPLE LEADERS

A multiple leader trained tree will be wider but shorter than one pruned to a central leader (Figure 14). Light penetration is not maximized if overall tree shape tends away from a conical-shape toward a flat top. Limb spreading with wire spreaders is imperative to suppress the upright growth of scaffold limbs.

The tree should be trained as in a central leader or modified central leader system in that it is headed back and the wider angled better positioned laterals are retained as scaffold limbs and the others are removed. However, no leader is allowed to become dominant as the main leader. From four to as many as eight scaffold limbs may be present with this system. Due to the absence of a central leader, spreaders must connect limb to limb in order to widen the crotch angles. Head the scaffolds in the dormant season to stimulate branching. Do not allow equal sized shoots to compete for dominance at the end of a scaffold limb. Use your discretion to determine if the shoot to the inside or outside should be retained. Confine tree spread to a reasonable size for between row cultural practices and to prevent limb breakage from a heavy fruit load. A conical tree shape should be maintained.

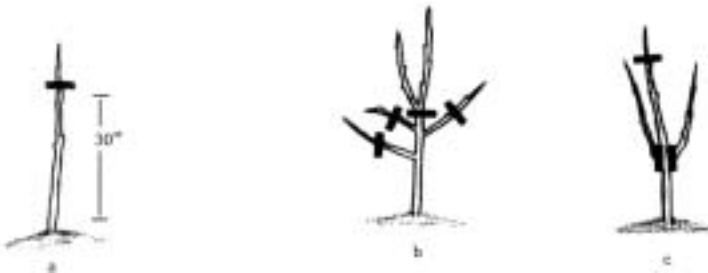


**Figure 14. A bearing tree trained to a multiple leader training system.**

## TRAINING TO AN OPEN CENTER

The open center pruning system is mainly used for peaches and nectarines. Trees pruned to this system possess scaffold limbs connected in a relatively short space on the trunk and lack a central leader (Figures 15-17). Since peach or nectarine fruit is borne on one-year-wood, older or less vigorous trees require heavy pruning to produce sufficient fruiting wood. Nearly all of the fruiting wood of an unpruned tree will be around the tree extremities.

An open center trained tree usually consists of three main scaffold limbs, the lowest one being about 20 inches above the ground. It is extremely important that the scaffold limbs possess wide angles (Figure 15). Do not allow any scaffold to face directly into the prevailing wind during the growing season in order to avoid branch growth into the open center. Generally tree height should be no greater than 10 feet.



**Figure 15. Single whip (a) or branched peach tree (b,c) as received from the nursery with appropriate training cuts. ( = pruning cut).**

## **FIRST YEAR TRAINING – AT PLANTING TIME**

Peaches are generally received from the nursery as whips, but will sometimes have several branches which have already formed (Figure 15 a-c). If branches are suitably placed, they may be headed back to several buds and allowed to develop into scaffold branches (Figure 15 b), but if branches possess narrow crotch angles, they should be cut off flush with the trunk (Figure 15 c). At planting time the tree should be headed at a height of 30 inches to induce branching at a height of about 18 to 20 inches.

During the first growing season, a slight amount of training may be required. All branches arising below the desired main scaffold branches should be removed as should any suckers growing from the rootstock. Branches arising from the uppermost buds on the trunk will generally have narrow crotch angles and will have to be pruned off, while branches forming 10 inches or more below will generally have the best crotch angles and form the best scaffold branches. Remember, we want three or sometimes four main scaffold branches which are nearly horizontal; however, none should face southwest. Scaffold limbs should be fairly close together vertically, yet far enough apart so they do not grow together and become structurally weak.

## **SECOND YEAR TRAINING – ONE YEAR AFTER PLANTING**

Pruning during the first dormant season consists of removing unwanted scaffold branches which have developed during the previous summer and removing all branches arising above the permanent scaffold branches (Figure 16). Branches within 12 inches of the trunk on the main scaffold branches should be cut out so that they do not shade the center of the tree. Try to maintain balanced growth of the main scaffold branches so that no one branch dominates over the others. Heading back to lateral will frequently solve this problem.

During the second growing season, removal of suckers and some light pruning may be necessary to avoid dominance of a scaffold branch. Branches that will shade the center and those that rub against each other should be removed, but try to avoid unnecessary pruning cuts because they will delay bearing. Only corrective pruning should be required at this time.



**Figure 16. Before (a) and after (b) first dormant pruning of peach.**  
 (■ = pruning cut).



**Figure 17. Before (a) and after (b) second dormant pruning of peach.** (■ = pruning cut).

## **THIRD YEAR AND FUTURE PRUNING**

Pruning during the third dormant seasons mainly consists of thinning cuts (Figure 7). If desired, a small amount of fruiting wood located in the tree interior may be saved for one year but be sure and remove it during the following year. After trees have reached an appropriate height, the higher limbs are headed to laterals. A renewal point should be established on each main scaffold by reaching up to a height of 7 to 9 feet and making a cut with a lopping shears above an outward growing lateral. This will induce formation of one-year-old fruiting wood and will help maintain a low tree height. Each year you will come back to this renewal point and select more fruit wood. Pruning of mature trees will involve removal of some wood older than one year and also removal of diseased and damaged wood (Figure 7). Peach trees respond well to pruning because pruning encourages the formation of one-year wood on which the fruit is borne. Pruning will accomplish thinning of fruit buds and help to distribute the crop evenly throughout the tree, and as a result, larger and better quality fruit will be produced. Pruning should be done every year to maintain production of vigorous fruiting wood and good quality fruit.

## **PRUNING MATURE TREES**

The two main objectives in pruning mature trees are to maintain appropriate height and spread and to renew good fruiting wood. If the tree has been pruned every year, shoot growth and fruiting wood should be fairly well distributed throughout the tree. Continue to prevent unbalanced or dense growth by selective thinning.

A poorly trained tree often possesses upper limbs that shade the lower along with an excessive amount of suckers or water sprouts (Figures 18, 19). First, correct this inefficient tree shape by pruning the top heavier than the bottom in an effort to gradually obtain a conical-shaped tree. A good place to cut an umbrella shaped limb is just before it begins to droop downward. Always head to an upward growing lateral whenever possible. Heading cuts should be used to stiffen flimsy shoots which may break with the weight of a fruit load.

Excessive suckering (Figure 18) may be due to several reasons: (1) loss of apical dominance on large limbs, (2) excessive pruning and/or high rootstock vigor, (3) removal of large limb(s) upsetting the root/shoot ratio. Methods must be employed which minimize sucker growth. First, prune limbs to an upward rather than to a downward shoot. If the limb is already too high, it should be cut to a manageable height. The apical dominance offered by the upward growing shoot will suppress sucker growth. Secondly, when pruning a badly neglected tree, prune it gradually over a 2 to 4 year period rather than all at once. If trees have shown a tendency to sucker, you may eventually decrease vigor by reducing fertilization rates.

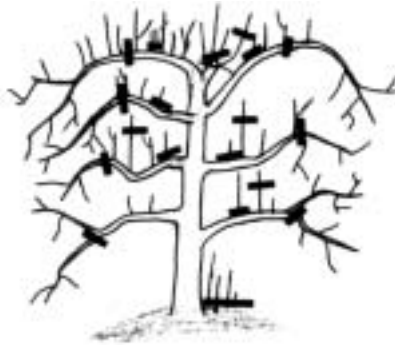


Figure 18. A neglected apple tree in need of corrective pruning. Upper limbs tend to shade the lower limbs. Suckers and water sprouts are abundant. Scaffold limbs should be headed back over a 2 or 3 year period. Upper limbs should be correctively pruned before lower limbs. Whenever possible, head to an upward growing lateral. Remove some water sprouts completely and some partially. (■ = pruning cut).

Mechanical hedging is often used to supplement pruning in order to save on labor costs. It should not be used as an alternative to pruning. The interior of the tree should be pruned as well. Cuts made by hedging or topping equipment are sometimes ragged, leaving torn bark thereby increasing future disease and insect problems. As in the case of corrective pruning a neglected tree, topping or hedging should not be too drastic, ideally no more than one to two feet a season or else severe suckering will result.

We just discussed how to avoid a sucker problem, but if it already exists, there are ways to gradually correct it over a period of 3 to 5 years. Remove most of the vigorous suckers but retain one or two and head them back preferably to a lateral (Figure 20). Also keep several weak suckers with wide crotch angles but do not head them. The vertical headed sucker(s) will inhibit the growth of other shoots below and encourage the weaker shoots to become fruiting wood. The one or two strong suckers should be headed to a lateral the next year so that apical dominance is maintained. The weak or unheaded suckers may be headed to an upward lateral if they become too long or droop excessively with a fruit load. These weak suckers may form spurs and become fairly productive fruit producers with time.



**Figure 19.** A standard-size apple tree that was topped off at 15 feet one year. Three or four years later a severe sucker problem persists; however, this can be corrected gradually.

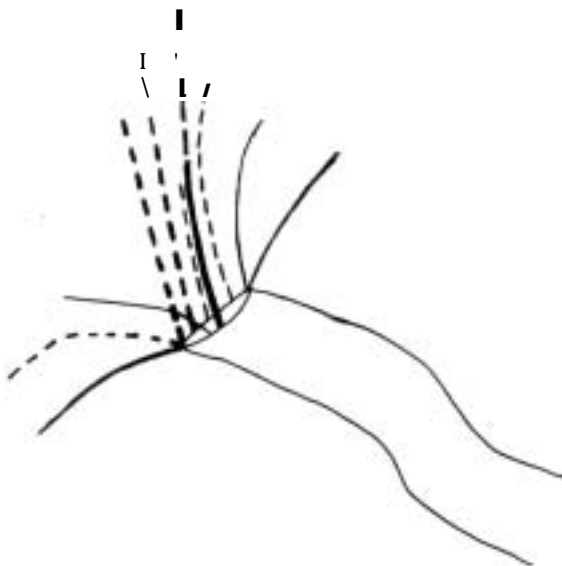


Figure 20. A large cut on a scaffold branch often results in an excessive amount of suckers the next growing season. Remove all except one or two vigorous suckers which are to be headed back. Several non-vigorous suckers should be retained since they will eventually become fruit producers. (Retain = — ; Remove = - - - .)

# TRAINING AND PRUNING OF APPLE

## **Dwarf and Semi-dwarf Apple**

Apple cultivars grown on dwarfing or semi-dwarfing rootstocks with less than 12 and 18 feet within and between row spacings, respectively, are best trained to a central leader system. Trees grown in this intensive manner may require stakes or a wire trellis for support. To help maintain an upright central leader, remove flower blossoms from the leader to prevent bending from a fruit load. Confine tree height to between 8 and 11 feet. Scaffold limbs may be pruned as needed to control tree width, to induce branching and to stiffen the limb.

Cultivars grown on a semi-dwarfing rootstock such as MM 106 or MM 111, which will achieve 65-85% of standard tree size, are not usually staked and are grown at wider spacings. The training and pruning system recommended for most apple cultivars on semi-dwarfing rootstocks in non-intensive plantings is the modified central leader.

## **Spur-type Apple**

Spur-type apple trees such as 'Starkrimson', 'Goldspur', 'Grandspur', 'Lawspur', 'Romespur', and 'Starkspur' cultivars are generally trained to a central leader or a modified central leader system. Spur-type trees should possess a greater number of scaffold limbs (6 to 10) than non-spur trees and tend to be about 70% the size of a non-spur tree. They are known as spur-type trees because they produce many small spurs instead of shoots. These long-lived spurs produce most of the fruit and as a consequence, the fruiting area remains close to the trunk. Also since these spurs are long-lived, there is not as much need to prune in order to stimulate new fruiting wood.

Clothespins (Figure 7) during the first year and wire spreaders or notched boards (Figure 8) during the subsequent years should be used to widen the crotch angles of scaffold limbs since there is a tendency for these spur-type apples to produce upright growth with narrow crotch angles. Spreading helps to initiate early fruit bud formation and earlier bearing. If lower scaffold limbs become low in vigor or if there is a need to renew fruiting wood, one may head back scaffold limbs in an effort to increase productivity.

## **Standard Non-spur Delicious Apple**

Generally a modified central leader or a multiple leader is recommended over a central leader training system. These full size trees produce many branches with relatively wide crotch angles. Fruit is borne on shoots and spurs and the fruiting zone tends to move toward the outside of the tree. Spurs of non-

spur 'Delicious' are productive for only a relatively short time compared to spur-type trees. Therefore limbs with older spur systems should be pruned regularly. Some pruning of the tree interior will help encourage productive fruiting wood to form in this area. Yearly pruning is essential to confine tree size since mature apple trees are often 45 feet in height and spread.

### **Tip Bearing Apples**

Cultivars such as 'Granny Smith' and 'Rome Beauty' have a strong upward growth habit and as a result produce limbs with narrow crotch angles. Fruit laden scaffold limbs sometimes require some kind of support. Due to their inherent growth characteristics, a central leader training method is best. More fruit is borne on one-year-wood compared to other apple cultivars. The fruiting zone tends to move toward the periphery of the tree. Therefore, pruning should encourage the development of young one- to three-year-old wood by numerous small to medium thinning cuts toward the outside of the tree. One must prune to limit tree spread before it interferes with cultural operations.

## **TRAINING AND PRUNING APRICOT**

Apricots are not adapted to Missouri conditions due to their tendency to bloom before danger of frost is past. Nevertheless, numerous homeowners purchase these trees every year and inquire as to the best pruning method. Although apricots are sometimes pruned to an open vase system, a modified central leader system is most often recommended.

Apricots typically have more branches than most fruit trees when received from the nursery. A heading height of 30 inches is usually satisfactory. Prune favorably positioned limbs to three to six buds and remove the other limbs flush with the trunk. The apricot produces most of its fruit laterally on short-lived spurs. Since relatively little fruit is produced on shoots, cut back long shoots one year after planting to induce branching and spur formation. If necessary, select additional scaffold limbs in subsequent years to obtain a full complement of four to six scaffold limbs. Bearing trees must be prevented from growing too high by heading limbs to an upward growing lateral. Shoots, especially in the upper part of the tree must be frequently thinned out to allow adequate light penetration to lower fruiting spurs.

## **TRAINING AND PRUNING PEAR**

Pear trees have a tendency to grow upright and form narrow crotch angles. A modified central leader or a central leader method with four to seven scaffold limbs is most often used. A modified central leader has the advantage over a central leader pruned tree in that after the first 8 to 10 years, the former lacks a central leader, thereby making it more difficult for fireblight to spread downward to the trunk and completely kill the tree. Limbs with narrow crotch angles are often unavoidable, and although not desirable, it is not as critical with pears as with apples or stone fruit which are prone to trunk splitting. Encourage tree spread by pruning to outside laterals whenever possible.

Most of the pear fruit is produced terminally on long-lived spurs, and approximately 10% of the spurs may be renewed each year on a bearing tree. Weak wood and suckers should be removed. Limbs should be thinned out to allow for light penetration to developing and existing spurs. When the desired height is reached, the top should be headed to upward growing laterals as with apples.

## **TRAINING AND PRUNING PEACH AND NECTARINE**

Peaches and nectarines differ in that fruit of the former have fuzzy skin. The tree itself and the fruiting habits are indistinguishable. The open-centered training system is most often used. The number of main scaffold limbs varies from two to five, with three being most common. It is imperative that strong wide angles scaffold limbs be selected. Remember that pruning during the early years should be light.

Bearing peach and nectarine trees respond better to pruning than any fruit tree since the crop is almost entirely borne on one-year-old shoots. Yearly pruning stimulates new growth for the following year's crop. Pruning severity should be largely determined by the estimated crop load in the spring. For instance, if a bumper crop is expected, heavier pruning will facilitate the time consuming operation of fruit thinning in the spring. Conversely, if trees incur heavy winter damage, it may be wise to delay pruning so that a partial crop may be achieved. If there exists no chance for a crop, then cut out damaged or diseased wood and prune moderately so that vegetative growth is not excessive.

When terminal growth is less than one foot a year or when trees approach an optimum height, head scaffold limbs to a two- or three-year-old lateral. Excessive cuts in one-year-old wood near the top of the tree results in a dense growth of new wood which may shade lower portions of the tree. Good air circulation throughout the tree will minimize brown rot.

## **TRAINING AND PRUNING PLUM (EUROPEAN AND JAPANESE)**

European and Japanese plums are different species, each with its own distinctive fruiting habits.

European plums such as 'Bluefre', 'Earliblue', 'Green Gage', 'Italian Prune', 'Stanley', etc., are best pruned to a modified central leader with four to eight scaffold limbs. The fruit is mostly borne laterally on long-lived spurs which may reach one or two feet in length. European plum trees require less pruning compared to Japanese plums. Besides the initial training, the only pruning necessary is the removal of diseased or damaged limbs. As the tree becomes old, some thinning out and heading back may be advisable to: 1) increase vigor, 2) increase light penetration, 3) increase fruit size, and 4) facilitate spraying and harvesting.

Japanese plums such as 'Burbank', 'Red Ace', and 'Santa Rosa', and Japanese hybrid plums are most often pruned to an open center. However, they may be pruned to a modified central leader like European plums. Scaffold limbs usually number from three to five for an open center system. Most of the fruit is borne on long-lived spurs (5 to 8 years) but the spurs are much shorter in length than those of European plums. Japanese plums are pruned much heavier than European plums. In addition, limbs tend to be more brittle. There is greater need to limit tree width to prevent tree spread from interfering with cultural practices.

## **TRAINING AND PRUNING SOUR CHERRY**

Recently sour cherries have been most often pruned to a modified central leader instead of an open center system due to weak crotches of the latter. A properly trained tree will contain four to six wide angled scaffold limbs arranged along a three foot vertical span of trunk with the lowest about 20 inches above the ground. Do not allow limbs with narrow crotch angles since the wood of cherry tends to be weak and brittle.

The fruit is borne on two- to five-year-old spurs and on the terminals of one-year-old shoots. Generally, little pruning is required after the initial framework has been established. The tree should be thinned out as needed for proper light penetration and spray coverage. The major portion of the crop tends to be near the outside of the tree.

## **TRAINING AND PRUNING SWEET CHERRY**

Sweet cherries are most often pruned to a modified central leader. Sweet cherries require less pruning than nearly any other fruit tree for several reasons: 1) Fruit is borne on short spurs with an economic lifetime of 10 years and not on shoots stimulated by pruning. 2) The small fruit size requires that many fruiting points be established. Since the spurs have a productive lifetime of 10 years, approximately 10% of the fruit bearing area should be renewed each year. The geometry of a properly trained sweet and sour cherry tree is similar. Vigorous shoots of non-bearing cherry trees may require heading back to induce branching. Due to the upright growth habit of sweet cherry, maintain as much spread as possible by retaining outward growing laterals.

Head back scaffold limbs when they attain 15 feet so that a 20 feet maximum tree height is not exceeded. Remove diseased or damaged wood as soon as possible. Gumming or dead areas may be the result of bacterial canker, and if severe enough, the entire limb should be removed. If an area of the tree is particularly thick, it should be thinned to allow for adequate light penetration and spray coverage.

## **TRAINING AND PRUNING ENGLISH WALNUT AND PECAN**

The English or Persian walnut trees are usually trained to a modified central leader. An ideally trained tree will contain five or six main scaffold limbs spirally arranged around an 8 foot vertical span of trunk. Since the lowest scaffold limb should be about 4 feet above the ground, nursery trees are headed about 5 or 6 feet above the ground. Remove approximately half of the top growth at planting time to start out with a proper root to shoot ratio. After the scaffold limbs are established, very little pruning is required. Some thinning out may be beneficial on heavy bearing cultivars.

Pecan trees may be trained to a modified central leader with five to ten wide angles scaffold limbs, but often grow satisfactorily without much training or pruning because of their tendency to grow naturally into an upright tree with strong scaffold limbs. It may be advisable to protect the trunk against sunscald damage as in the case of walnut.

Very little pruning is necessary for mature pecan and walnut trees except to remove diseased or damaged limbs and perhaps topping to limit tree height.



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