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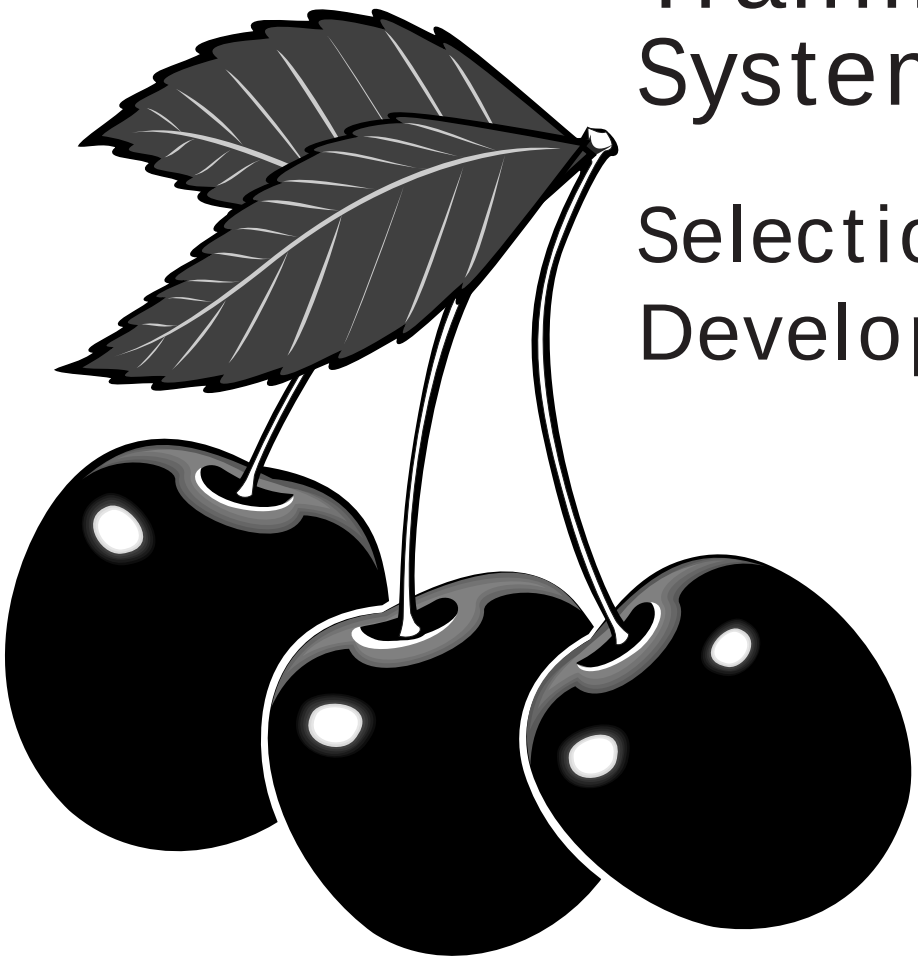
Cherry Training Systems:

Selection and Development



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Contents

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The author wishes to thank the following individuals for their assistance in the preparation of this publication. Without their help, this publication would not have been possible.

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Cherry Training Systems:
Selection and Development

While the objectives of pruning and tree training have changed little over the years, the need for attention to pruning and training has increased dramatically. Pacific Northwest cherry growers now compete in a world market, making fruit size and quality increasingly important. In addition, labor is less available and more expensive than in the past. Trees must be easy to maintain, and fruit must be of high quality and easy to harvest. A good training system provides a structural framework that will accomplish these goals.

Understanding the tree

Cherry trees, particularly variety and rootstock combinations historically grown in the Pacific Northwest, present three significant challenges to an orchard manager:

- **Excessively vigorous growth**—Cherry trees are large and vigorous. Without some type of manipulation, they produce long shoots with few lateral branches. This trait makes maintenance difficult and limits fruit production.
- **Delayed fruiting**—Pruning can help control tree size and produce more branches that are closer together. However, pruning, especially dormant heading cuts, tends to delay fruit production in young trees by directing the tree's energy to vegetative growth. With typical heading cuts and standard rootstocks, cherry trees rarely produce a crop before the fifth or sixth leaf. Moreover, any other factor that increases tree vigor, such as deep, productive soils or over-fertilization, also tends to delay the onset of floral initiation.
- **Narrow crotch angles**—Cherry trees tend to produce branches with narrow crotch angles. These angles often are weak and prone to *bark inclusion,* a condition in which bark is trapped between the trunk and the branch. Splitting can occur at these locations.

With the introduction of dwarfing and precocious (early-bearing) rootstocks (such as Gisela 5, 6, and 12), some of the negative characteristics of cherry trees can be altered. With these rootstocks, it is possible to harvest a crop in the third leaf. Tree size is controlled more easily, and branches naturally form at wider angles. However, without proper management and pruning, these trees may produce smaller fruit.

Whatever the variety and rootstock combination, annual shoot elongation is imperative for maximum fruit quality. The largest and highest quality cherries are produced at the base of the previous season's growth and on 1- to 3-year-old spurs. Therefore, the goal of an orchard manager should be to grow an abundance of new 10- to 12-inch shoots throughout the tree while limiting the number of old spurs.

Training system options

There are many training systems, both supported and freestanding, that are used by cherry growers around the world. This publication describes three commercially successful systems: Steep Leader, Spanish Bush, and Vogel Central Leader. Each has strengths and weaknesses. Choosing the right system depends on a number of factors, including growing conditions, variety, rootstock, labor availability, and management skills.

Consider carefully before selecting a training system. Understanding how various factors interact with one another is an important part of making the right choice.

Figure 1.—Steep leader.

Figure 2.—Spanish bush.

Figure 3.—Vogel central leader.

Steep Leader

The Steep Leader system (Figure 1) is an adaptation of the open vase system commonly used by Pacific Northwest growers. It often is used in low- to moderate-density orchards on full-size rootstock. It is possible to produce moderately large crops of large, good-quality cherries by the seventh or eighth leaf. However, because this system frequently is associated with trees grown on full-size rootstock, production usually does not begin until the fifth or sixth leaf, and trees generally are taller than those trained with the other two systems. This said, however, it is possible to use the Steep Leader system with dwarfing rootstocks, which would significantly increase the precocity of the trees.

Spanish Bush

The Spanish Bush system (Figure 2) produces a true pedestrian orchard of very high density, where the majority of fruit can be harvested from the ground without ladders. This is an advantage where labor availability and cost are of high concern.

It might be possible to use this system with full-size rootstock on poor soils, especially with highly productive varieties (such as Sweetheart). Generally, however, with the good soils commonly found in the Pacific Northwest, a dwarfing rootstock is needed to help control tree growth and vigor.

Without a precocious rootstock, production is delayed due to the extensive number of heading cuts made to establish the system's framework. In addition, due to small tree size, this system should not be selected for frost-prone locations.

Vogel Central Leader

The Vogel Central Leader (Figure 3) is a precocious system of moderately high density that is easy to grow and maintain. High early yields are possible with this system. Tree shape encourages good light penetration throughout the tree. Due to the single leader nature of this system, a dwarfing rootstock is necessary to help maintain reasonable tree height.

Table 1.—Appropriate uses of various training systems.

Growing conditions*	Steep Leader	Spanish Bush	Vogel Central Leader
Good soils	✔	dwarf rootstocks only	dwarf rootstocks only
Poor soils	✔	✔	✔
Frosty sites	✔	—	✔
Rootstocks and varieties*			
Full-size rootstocks	✔	poor soils only	—
Dwarfing rootstocks	✔	✔	✔
Highly productive varieties	✔	✔	✔
Productive varieties/dwarfing rootstocks	✔	✔	—
Characteristics of the training system			
Requires higher management skills	✔	✔	—
Produces high early yields	—	✔	✔
Reduces harvest costs	—	✔	✔

*A "✔" indicates the system is appropriate.

Pruning and training techniques

The developmental process of these training systems uses the following pruning and training techniques.

Heading into 1-year-old wood

This cut stimulates the growth of lateral branches and often is used in the early developmental stages of cherry training systems to force branching. Since heading into young wood invigorates the area around the cut, this type of cut tends to delay fruiting. This cut is used extensively in the Spanish Bush and Steep Leader systems.

Heading into older wood

This cut also encourages lateral branches, but it lacks some of the invigorating effects of cuts made into 1-year-old wood; therefore, it does not delay fruiting to the same degree. However, fruit buds usually are removed with this cut, reducing the crop. Heading cuts into older wood often are used to stiffen branches or remove downward-hanging (pendant) wood. This cut can be used in all three training systems.

Stub or renewal cut

A stub cut is used to renew fruiting wood in order to keep it young and productive. There are two types of stub cuts. In the first type, an existing branch is cut back to a point from 1 inch to several feet of its origin in order to grow a new branch (Figure 4).

This cut is used when there are no lateral branches capable of replacing the current terminal. Existing or adventitious buds grow from the point of the cut, and a new branch is selected. This cut is common in all three systems to maintain fruit quality and size.

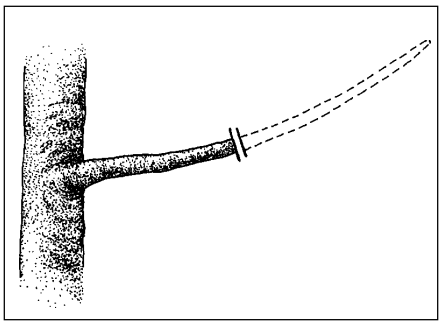


Figure 4.—Stub cut with no lateral branching.

The second type of stub cut is used most commonly in the Vogel Central Leader system, but it also can be used with the Steep Leader system. If a lateral branch begins to grow upright or simply is too mature, it can be cut back so that an existing secondary branch can take over the terminal growth. The primary lateral should be headed to within several buds of the point of origin of the secondary branch (Figure 5).

It is important that the stub consist of live wood and that the secondary branch terminal ***(a)*** be higher than the remaining stub ***(b)***. This prevents vigorous vertical wood from growing out of the stub, and it keeps the secondary branch more horizontal and less vigorous.

Brunner cut

The Brunner cut is a combination of two cuts used to control tree vigor in young trees (Figure 6). A heading cut is made into a strong (temporary) vertical branch ***(a)*** at the same time a weaker (permanent) adjacent branch is headed ***(b)***. The purpose is to divert vigor away from the weaker branch in favor of the strong branch. The strong branch then is removed completely in midseason ***(c)***.

This procedure allows heading cuts to be made into permanent branches without over-invigoration, thereby reducing the potential for delayed fruiting. This cut can be used in the establishment years of the Steep Leader and Spanish Bush systems.

Thinning cut

Thinning cuts remove entire branches at their point of origin and tend to open the tree to better light penetration. Thinning cuts stimulate growth from a more extensive region than heading cuts. They also are less invigorating, so they are less prone to delay fruiting. Thinning cuts are used in all three systems.

Limb manipulation

Most varieties of cherries have a very upright growth habit with narrow branch angles. Therefore, bark inclusion and subsequent weak attachments can become a problem. In addition, this growth habit produces a tree base narrower than the tree top, which causes poor light penetration.

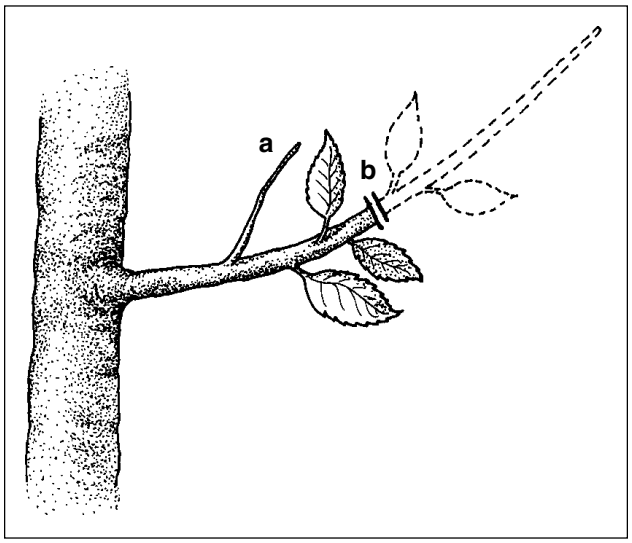


Figure 5.—Stub cut with lateral branching. Note live buds on the stub and the relative height of branch terminals "a" and cut "b."

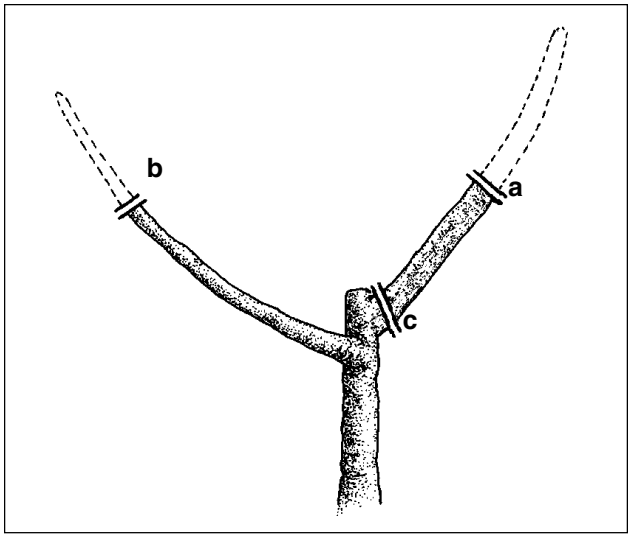


Figure 6.—Brunner cut.

To broaden the base and strengthen limb attachments, you must widen the crotch angles. Besides improving light penetration, spreading helps reduce branch growth and encourages early fruit production (precocity).

To establish wide crotch angles for the Steep Leader or Spanish Bush systems, place a toothpick between the trunk and a young, 3- to 4-inch shoot growing from the trunk. Manipulate branch angles while the tissue still is green but after shoots have grown to 3 or 4 inches in length.

In moist climates where the risk of bacterial canker infection is high, or to establish the proper branch angle for the Vogel Central Leader system, a clothespin can be used as a spreader. Attach the clamp to the trunk just above the developing branch and force the shoot to establish at a 90-degree angle.

There are several ways to spread more mature branches. With the Steep Leader and Vogel Central Leader systems, young branches are spread to a more horizontal angle by tying them to hop clips inserted in the ground. In the Spanish Bush system, two parallel wires usually are strung on opposite sides of the row, and branches are tied to the wires.

Summer pruning

Summer pruning can be used in any of the three systems, but it is a key component of both the Spanish Bush and Vogel systems. Because summer pruning tends to be less invigorating than dormant pruning, it tends to encourage precocity in young trees. However, with some system-variety-rootstock combinations, it can lead to overproduction, so it should be balanced with dormant pruning when necessary. In addition, laterals that form following a summer cut generally have narrower branch angles.

Promalin

Instead of severe heading cuts, which tend to delay fruiting, cherry growers sometimes use Promalin to increase branching. Mix Promalin with latex paint according to label directions and apply to 1-year-old branches at the green tip stage of bud development. For best results, paint the entire region of the branch where laterals are desired, not just the buds. It might be necessary to remove a third of a strongly growing branch to force branching at the base.

Promalin works most consistently in moderate to warm spring temperatures (daytime temperatures above 60°F). Promalin is not a required component of any of these systems, but it can be used in any system to increase branching and precocity.

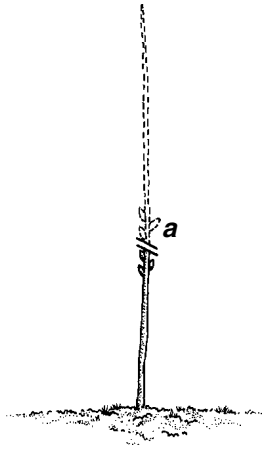
Scoring

Scoring is another method used to encourage branching. Scoring can be used in any system. Notch the branch to the depth of the cambium just above a bud. The cut should extend one-third to one-half the circumference of the branch. To assure adequate response on vigorous trees, you must make a relatively broad cut. A number of tools can be used; for example, you can achieve the desired effect by taping together two hacksaw blades.

Spanish Bush

In the Spanish Bush system, numerous branches help to reduce tree vigor, imparting a small tree structure and encouraging fast and easy tree maintenance and harvest. Since tree size is small, light can penetrate readily through a properly pruned tree, encouraging high fruit quality. In addition, high tree density provides high early yields.

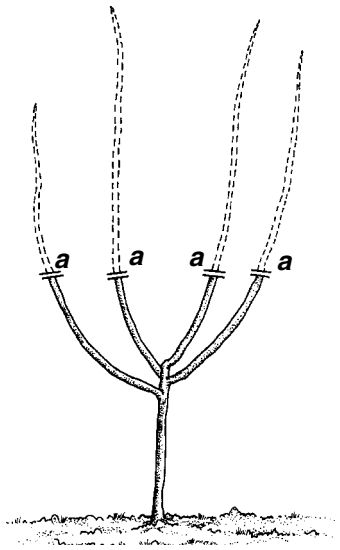
At planting



Head whip.

Plant trees 8 to 10 feet apart in the row with 15 to 18 feet between rows, depending on soil fertility, rootstock, terrain, and equipment size. At bud break, head the whip 12 to 30 inches above the ground, depending on the desired height of primary branches and the presence of buds below the cut ***(a)***. Spread developing shoots to obtain wide crotch angles. Encourage strong tree growth.

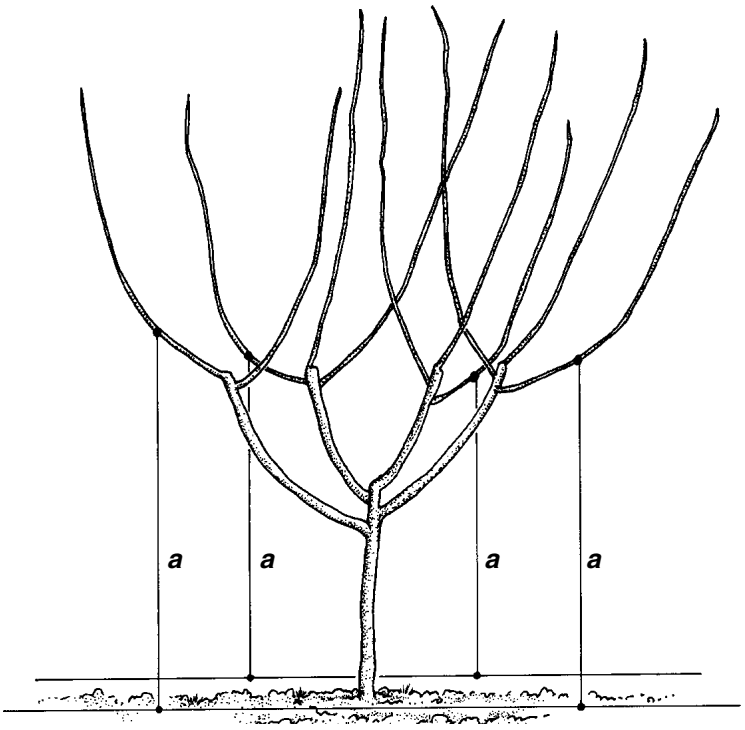
First growing season



Head primary branches.

Allow primary branches to grow 20 to 24 inches in length before making these cuts so the branches will be strong enough to respond with vigorous growth. Cut branches back to a height of 6 inches above the cut made at planting ***(a)***. Cut all branches at the same level. This is the only cut during the first growing season.

Continued—First growing season

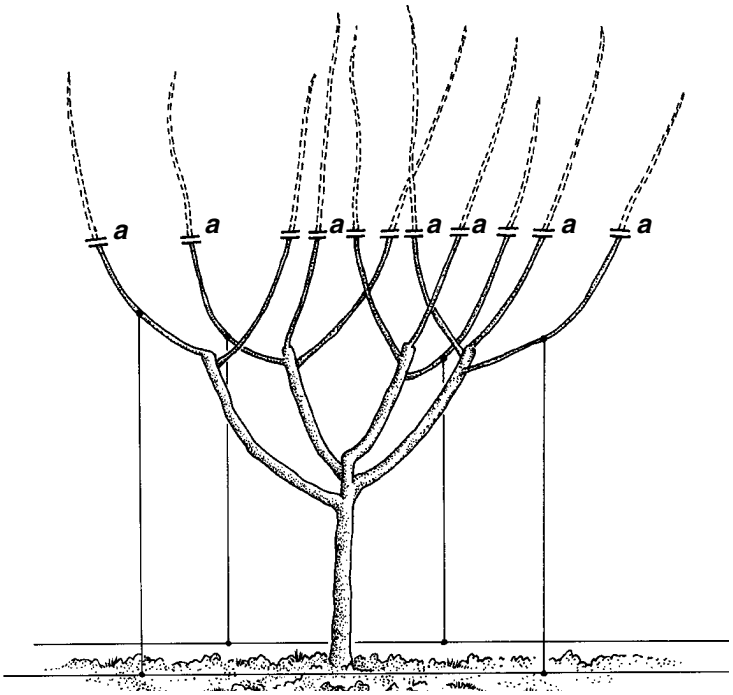


Tie down branches (optional).

By autumn of the first growing season, secondary branches should have grown 20 to 24 inches in length. Run two parallel wires at ground level, one on each side of the tree row, and anchor them to the ground. Tie down secondary branches to the ground wires to open and spread the tree ***(a)***. You can remove the wire system by the end of the second growing season.

Spreading is especially important for upright varieties such as Lapins.

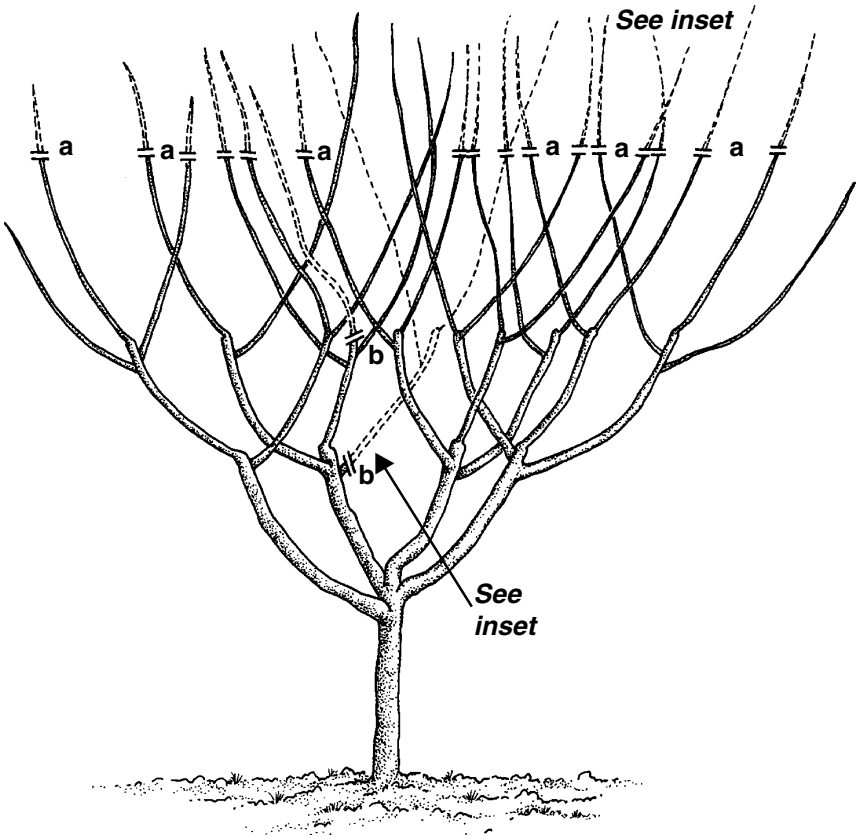
Second spring

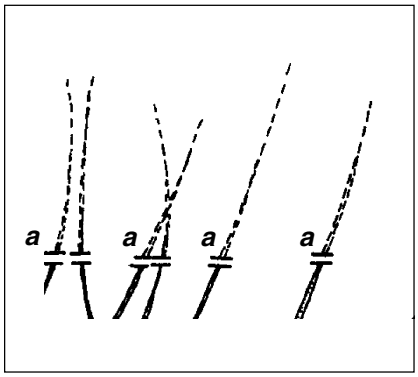


Head secondary branches.

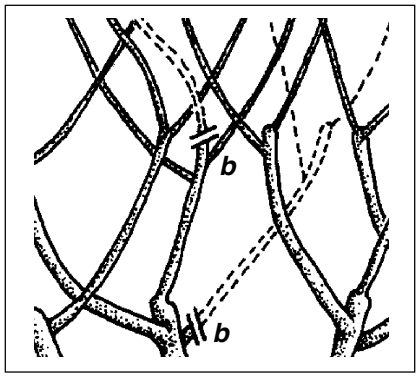
If secondary branches have reached 20–24 inches in length, head them back to 10 inches during bloom of the second growing season ***(a)***. Otherwise, wait until they grow to 20–24 inches long. Again, make all cuts at the same level.

Continued—Second spring





a.—Head tertiary branches.



b.—Thin for light penetration.

Head tertiary branches.

By late spring, tertiary branches should have grown to nearly 24 inches in length. Except for center and horizontal branches, cut back the new growth to 10 inches above the previous cut ***(a)***. Make all cuts at the same level. Leave horizontal branches unheaded so they can produce fruit. Also leave center branches intact to force a more spreading growth habit. (They will be thinned out after fruiting begins.)

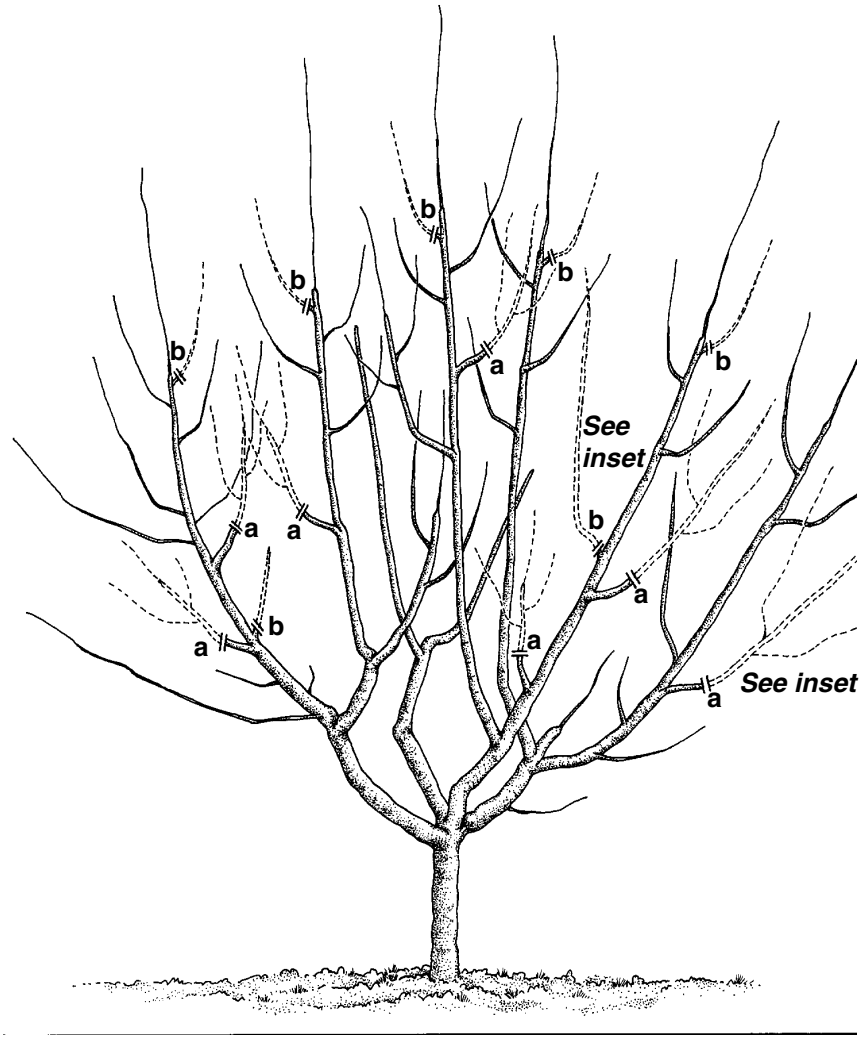
These are the last training cuts made in the formation of the tree. Pruning of the tertiary branches is particularly important for upright, poorly branching varieties such as Bing and Lapins and for strong rootstocks such as Mazzard and Mahaleb. For naturally branching varieties such as Sweetheart or weaker rootstocks such as Gisela 5, this final heading cut might not be necessary.

Thin for good light penetration.

At the same time, you might need to thin some branches in order to allow better light penetration. Thin out vigorous, upright branches while leaving weaker, horizontal branches to fruit ***(b)***. From now on, thin branches at every pruning.

At the same time, discourage strong tree growth. Reduce fertilizer applications until the tree begins to fruit so that new shoot growth is less than 2 feet long.

After harvest or dormant, at maturity



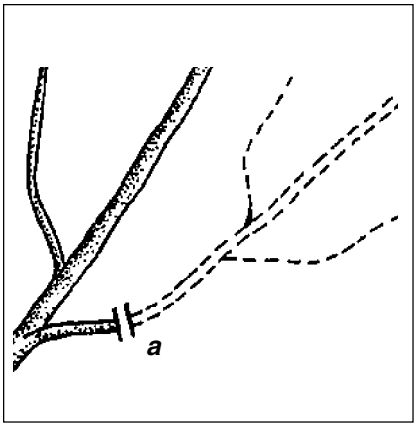
Renew fruiting wood.

At maturity, secondary or tertiary branches become permanent scaffold branches. Fruit develops on weak, renewable branches growing from the permanent scaffolds. To maintain fruit size, fruiting wood must be renewed regularly. Stub back about a quarter of the fruiting branches each year so that in 4 years all fruiting wood is renewed ***(a)***.

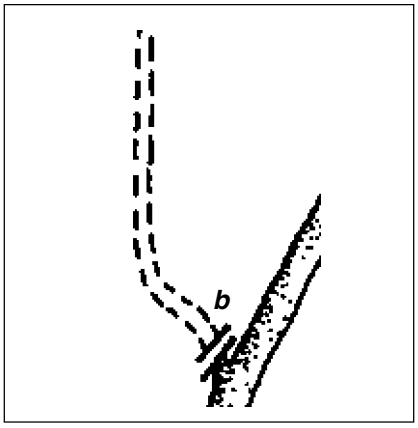
This pruning normally is done after harvest as a summer cut. However, when using a dwarfing rootstock, or when tree vigor is low, you might elect to prune during the dormant season to encourage growth, vigor, and fruit size.

Thin for light penetration.

Thin out branches in the inner canopy that are interfering with light penetration. Thin out vigorous, upright branches while leaving weaker, horizontal branches to fruit ***(b)***.

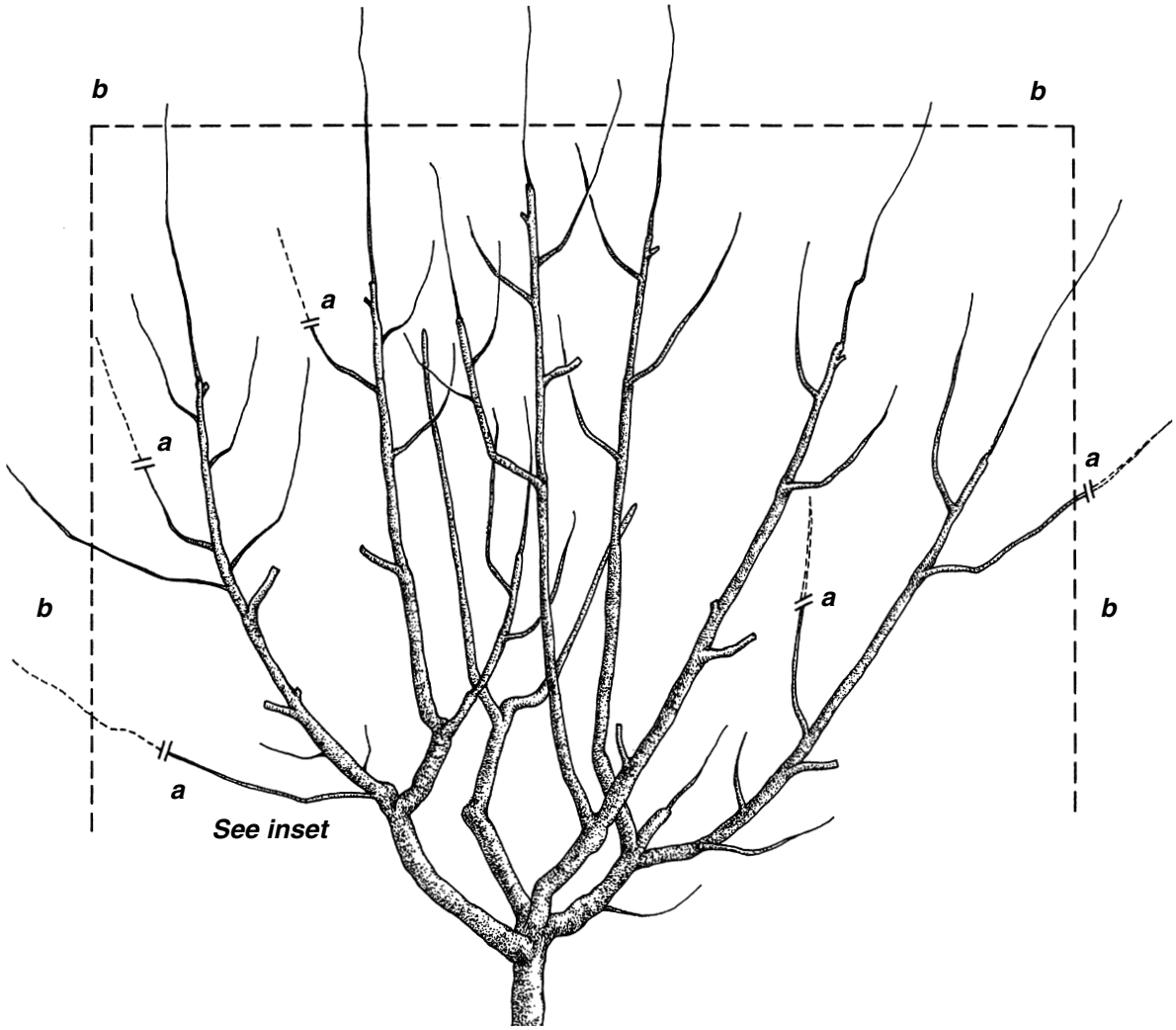


a.—Renew fruiting branches.



b.—Thin for light penetration.

Continued—After harvest or dormant, at maturity

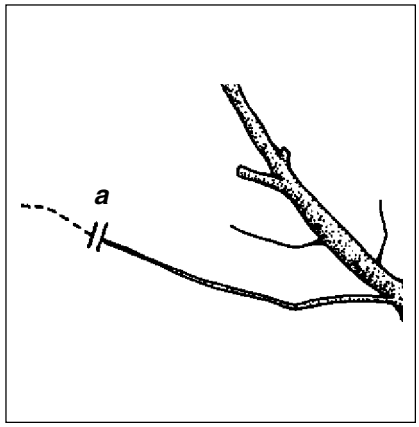


Head fruiting wood to increase fruit size.

To reduce fruit load and increase fruit size, head back long fruiting wood after harvest or during the dormant season ***(a)***.

Top and hedge the tree annually in the autumn.

At maturity, top trees at 8 feet and hedge them annually ***(b)***.

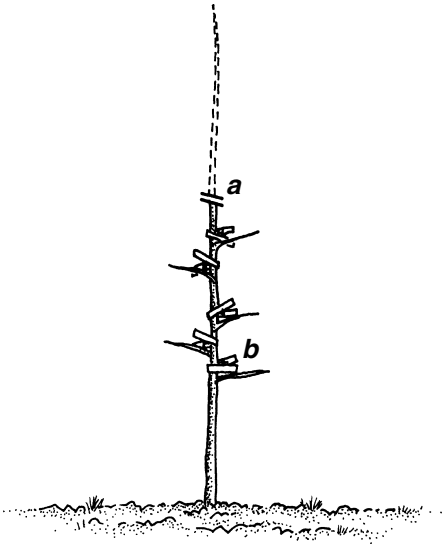


a.—Head fruiting wood.

Steep Leader

A moderate-density orchard is possible on standard rootstock with the Steep Leader system. Each nearly vertical leader is treated as a separate spindle producing young wood and high-quality fruit.

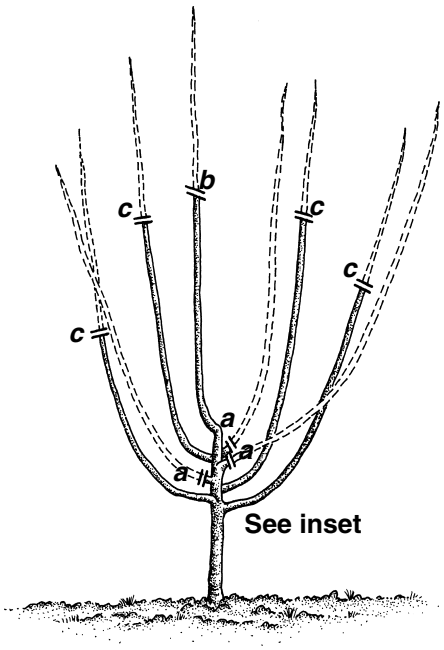
At planting



Head whip.

Plant trees 16 to 20 feet apart in the row with 18 to 24 feet between rows, depending on soil fertility, terrain, equipment size, and the manager's skill level. At planting, head the whip 30 to 36 inches above the ground, based on the desired height of primary scaffold branches ***(a)***. Use toothpicks or clothespins to establish wide branch angles ***(b)***.

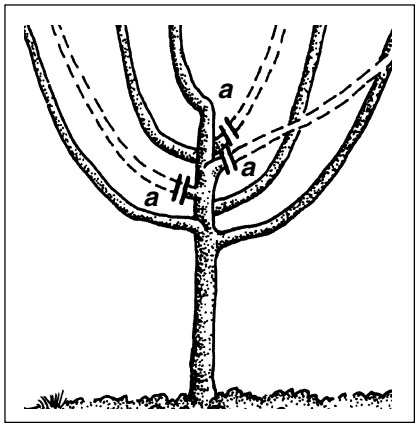
First dormant season



Select leaders.

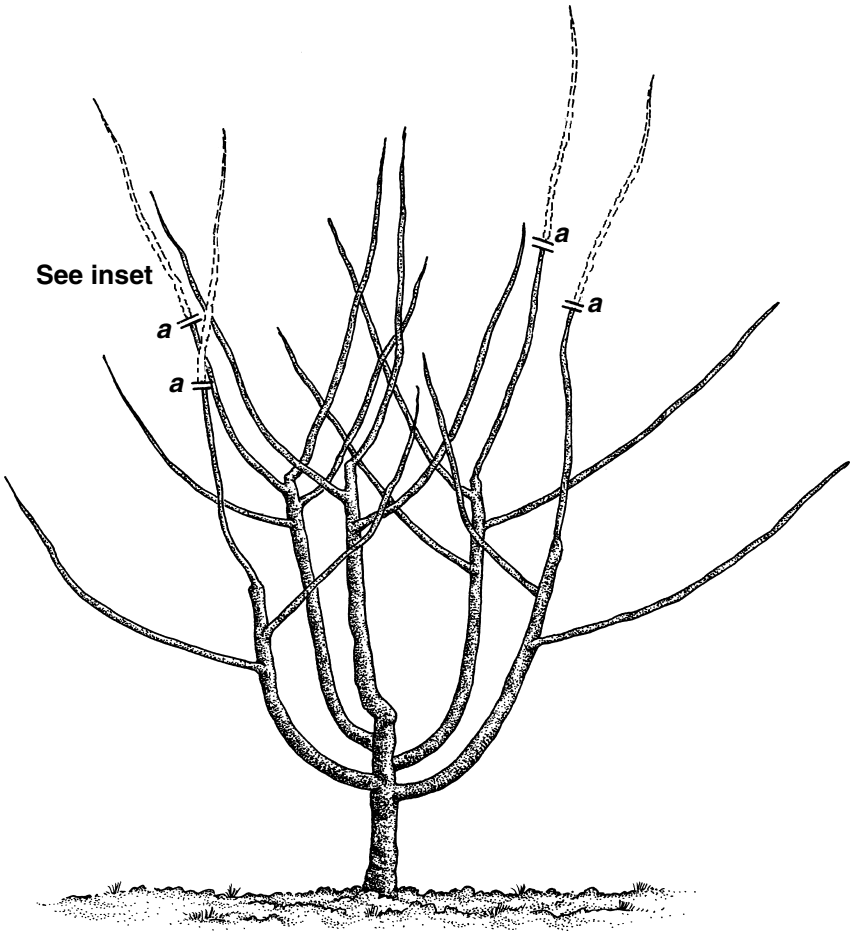
Select three permanent leaders if in-row spacing is less than 20 feet. Otherwise, select four well distributed leaders ***(a)***. Establish a wide base, but allow leaders to grow nearly vertical. You might wish to leave one or two other leaders as temporary branches, including vigorously growing branches that would tend to invigorate the tree if removed ***(b)***.

Head leaders 2 to 3 feet from the trunk to encourage branching and establish a permanent bottom whorl ***(b and c)***.



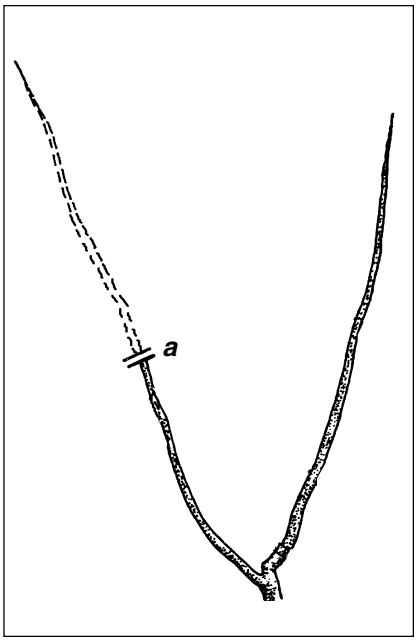
a.—Select leaders.

Second dormant season or spring second leaf



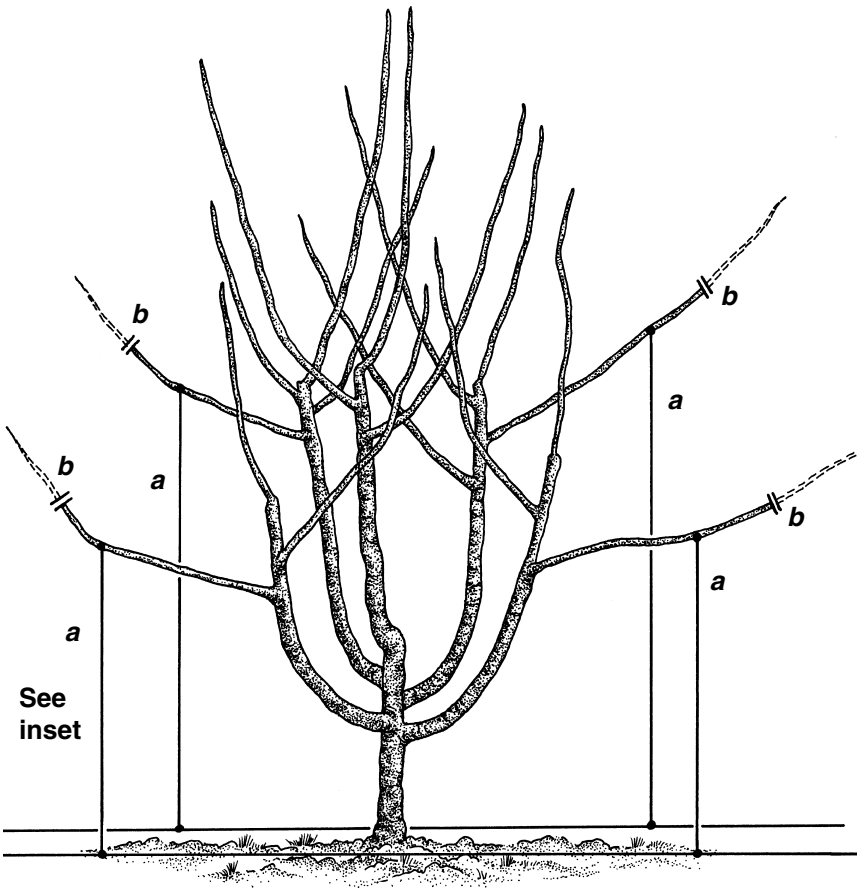
Choose secondary branches that will continue terminal growth.

Select one branch per leader to serve as an extension of the permanent scaffold branch. Head this branch approximately 2 feet from its point of origin ***(a)***.



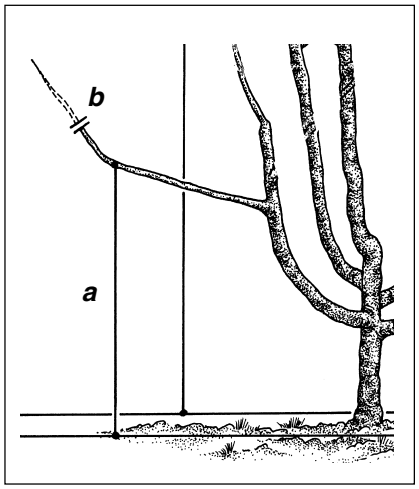
a.—Head secondary branches.

Continued—Second dormant season or spring second leaf



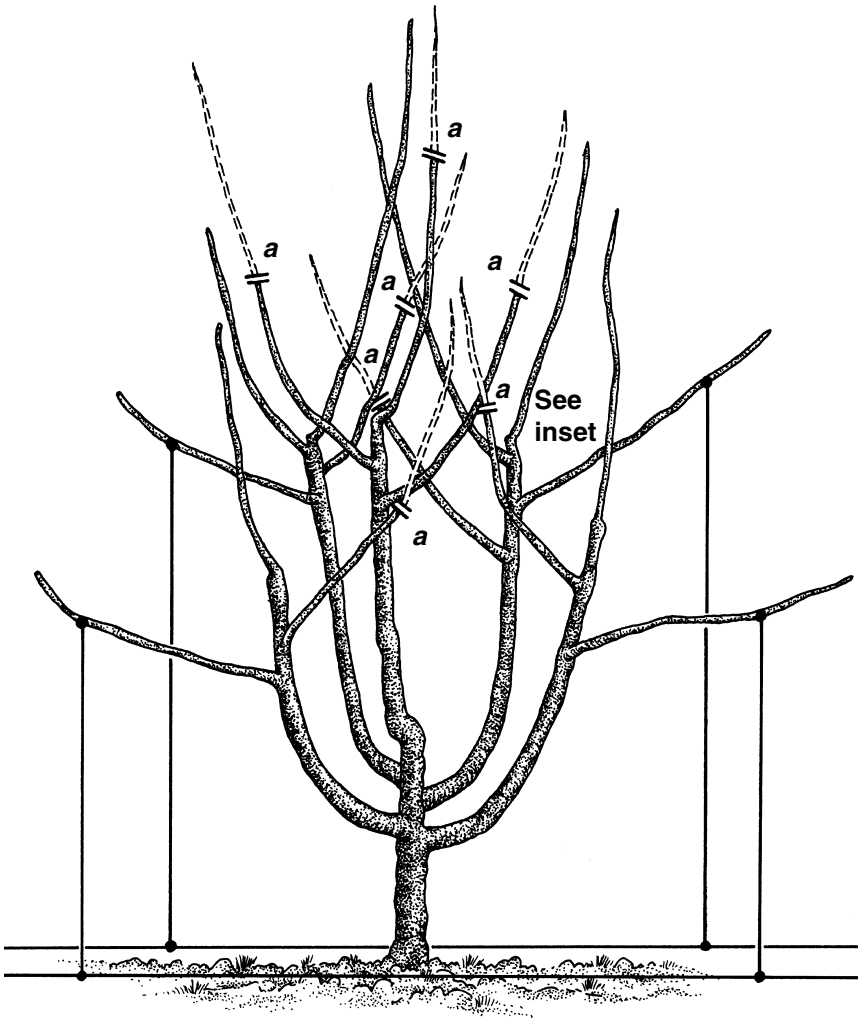
Establish a permanent bottom whorl.

Select one outside secondary branch per scaffold, and tie it to horizontal in order to establish a permanent bottom whorl ***(a)***. Head these branches 2 to 3 feet from their base ***(b)***.



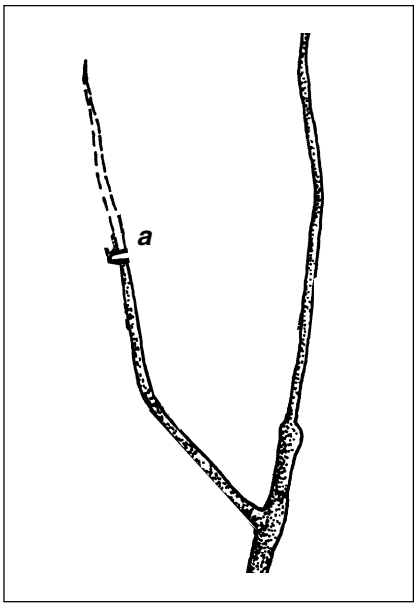
a & b.—Establish a permanent bottom whorl.

Continued—Second dormant season or spring second leaf



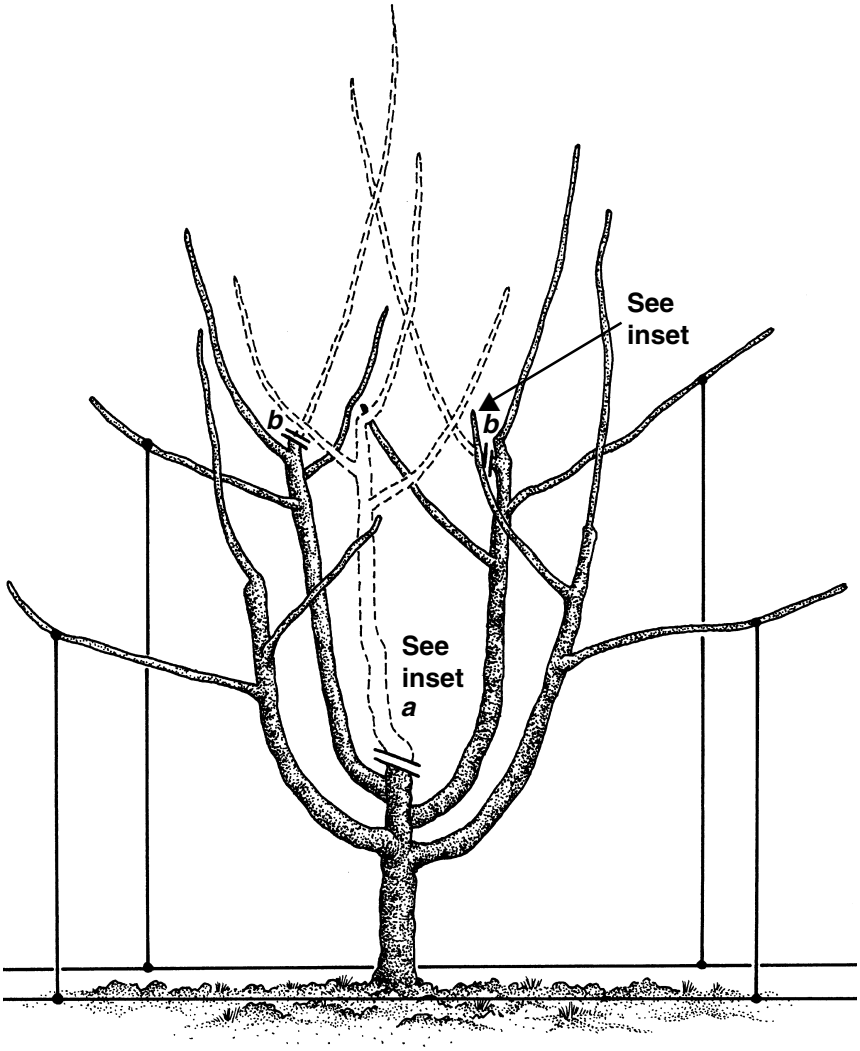
Leave temporary secondary branches to divert vigor.

It might be necessary to leave several temporary branches until fruiting begins in order to control overall tree vigor. Head these branches at about 2 feet ***(a)***.



a.—Head temporary secondary branches.

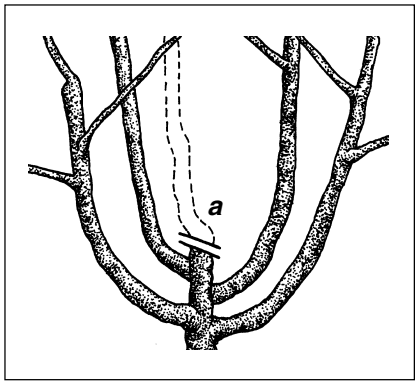
Dormant or spring pruning to maturity



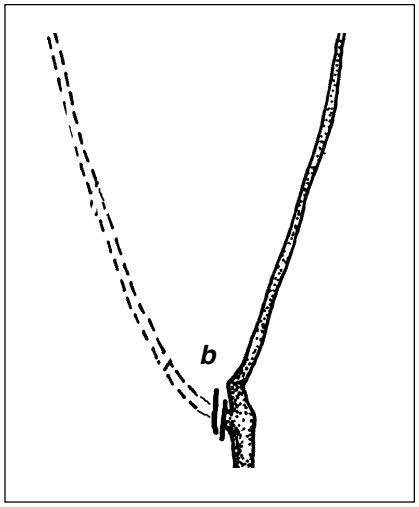
Thin to weak wood.

Select smaller and weaker wood as permanent branches. Thin out very strong wood ***(a)***.

As the tree matures, leave temporary branches unheaded in order to encourage early fruit production. Remove these branches once the tree begins to fruit, and growth slows ***(b)***.

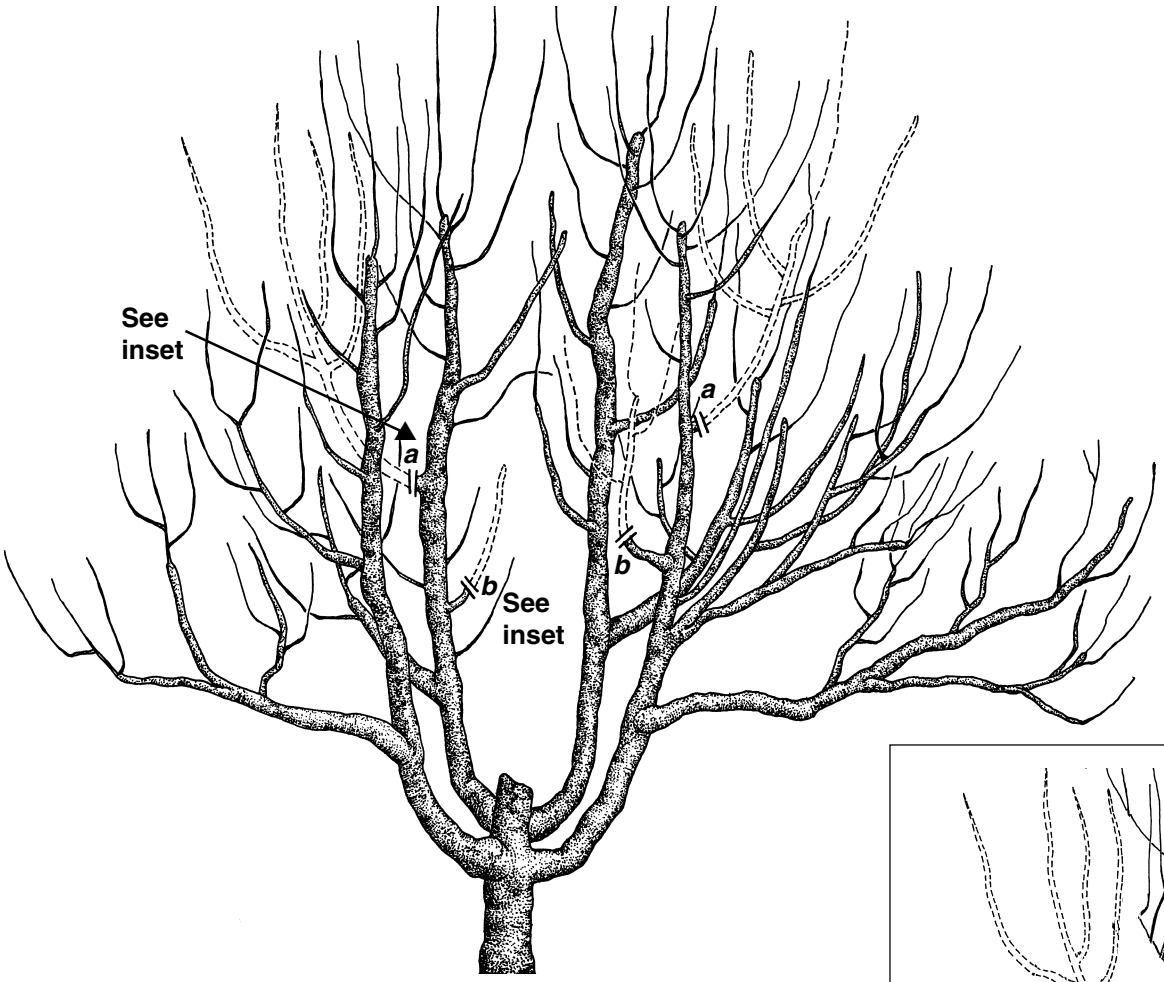


a.—Thin out very strong wood.



b.—Remove temporary branches.

Dormant or summer pruning at maturity

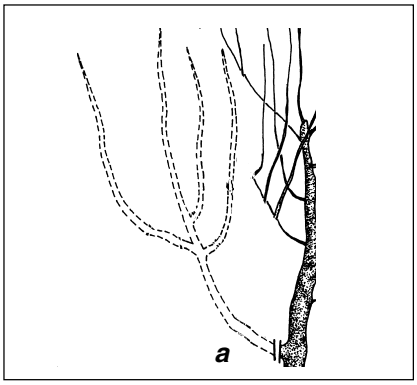


Remove overly vigorous branches.

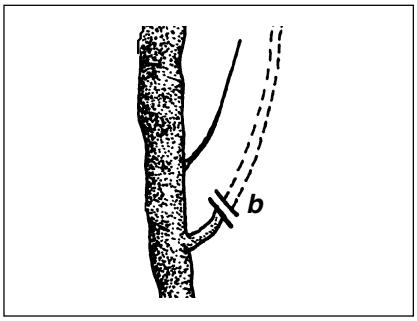
Remove any branches with a basal diameter greater than two-thirds the diameter of the parent branch ***(a)***. The biggest wood should be at the bottom of the tree. Keep in mind the idea of "big, smaller, smallest" as you work up the tree.

Renew wood.

Each leader should be treated as an individual spindle tree growing its own young wood. Since the best quality cherries are grown on young wood, favor it by stubbing back one or two older branches each year ***(b)***. This secondary wood should be no more than 3 years old.

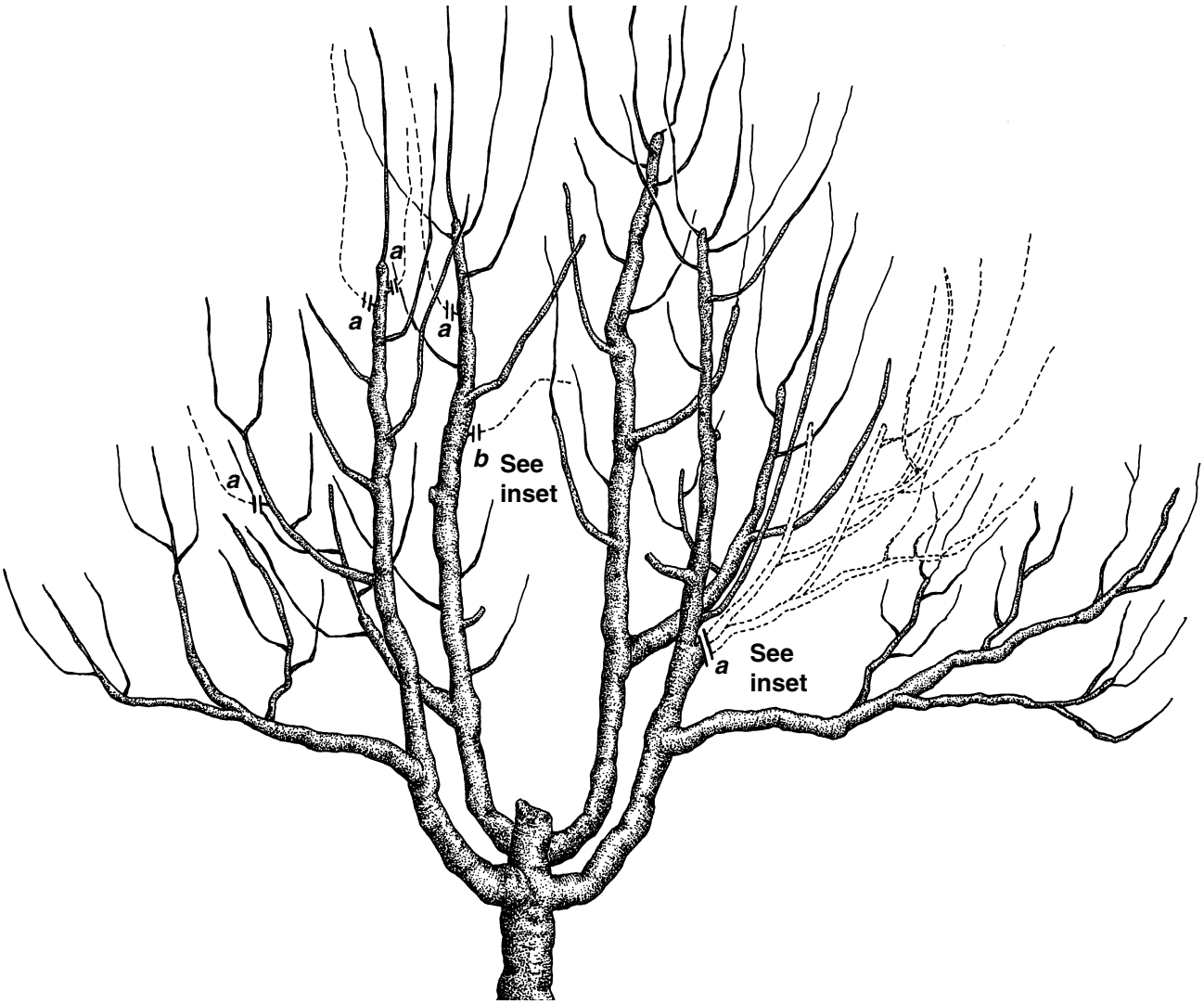


a.—Remove vigorous branches.



b.—Renew wood.

Continued—Dormant or summer pruning at maturity

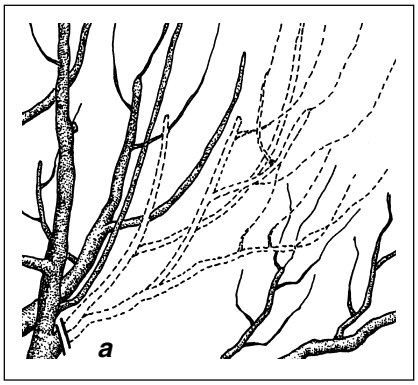


Maintain light paths.

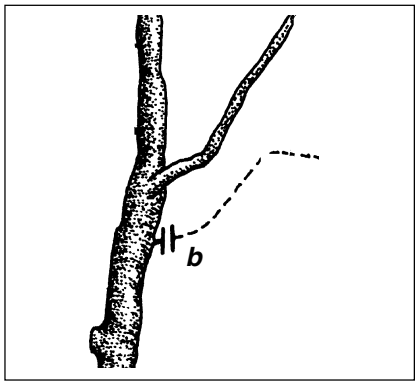
Remove wood that is shading lower branches in order to maintain quality production throughout the tree ***(a)***.

Remove pendant wood.

Pendant wood tends to overset and produce small cherries ***(b)*** and should be removed.

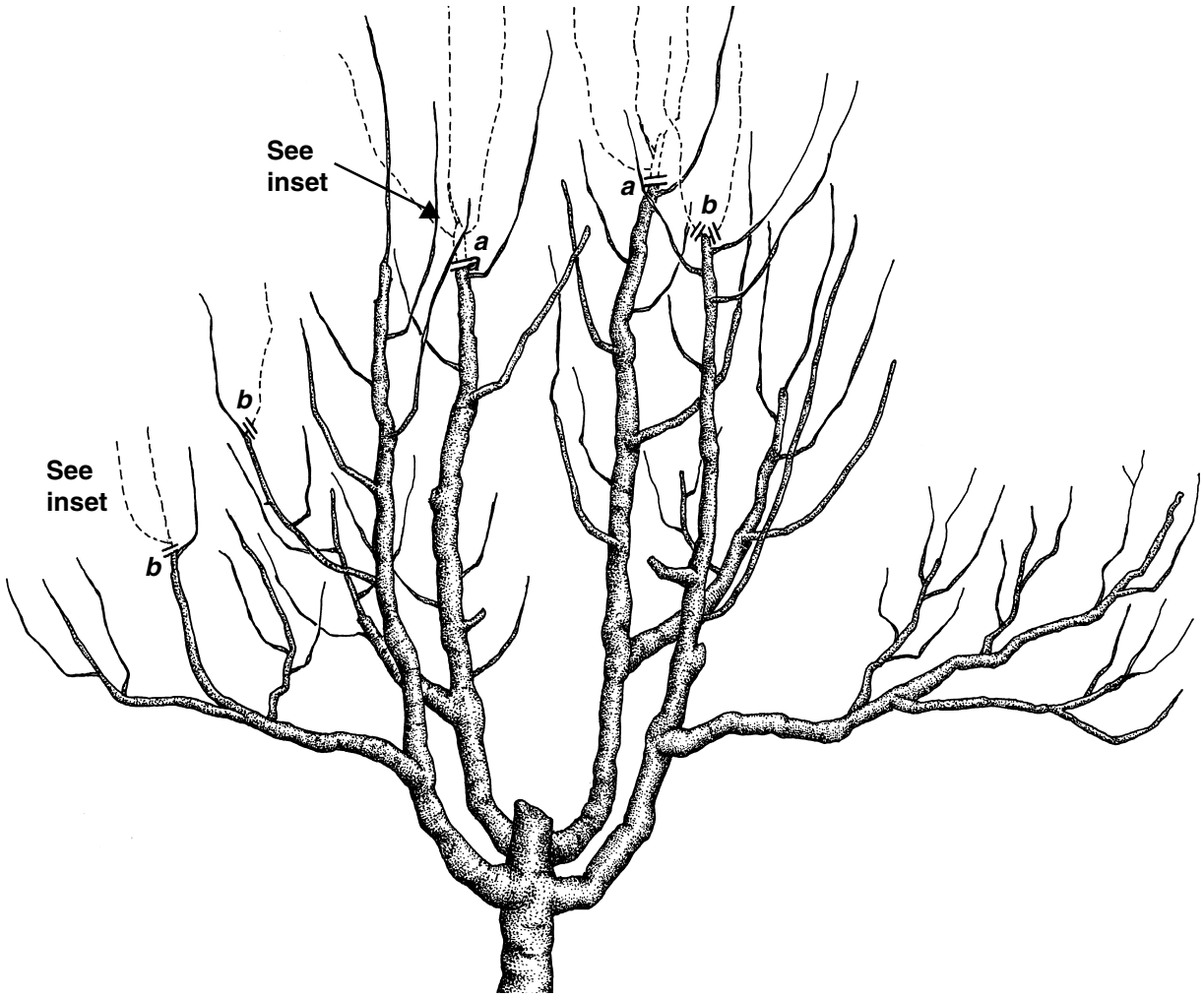


a.—Maintain light paths.



b.—Remove pendant wood.

Continued—Dormant or summer pruning at maturity

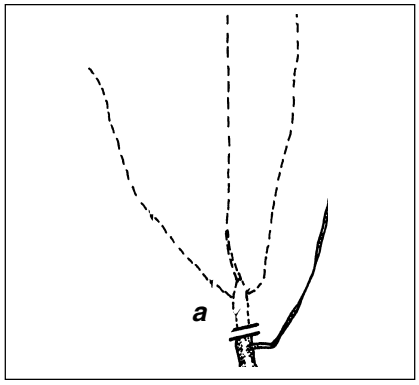


Maintain proper tree height.

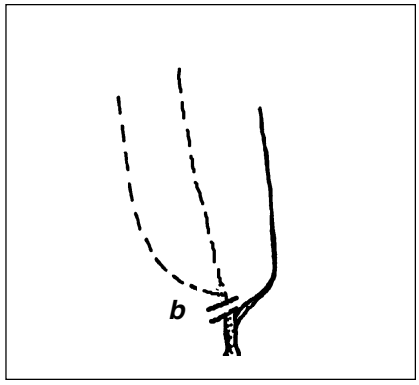
As the tree reaches maximum height, prune the top back to weak laterals ***(a)***.

Reduce leader tips to one shoot.

Single out tips at the end of main leaders ***(b)***. Also, where adjacent branches are the same size, remove one. This helps to reduce shading.

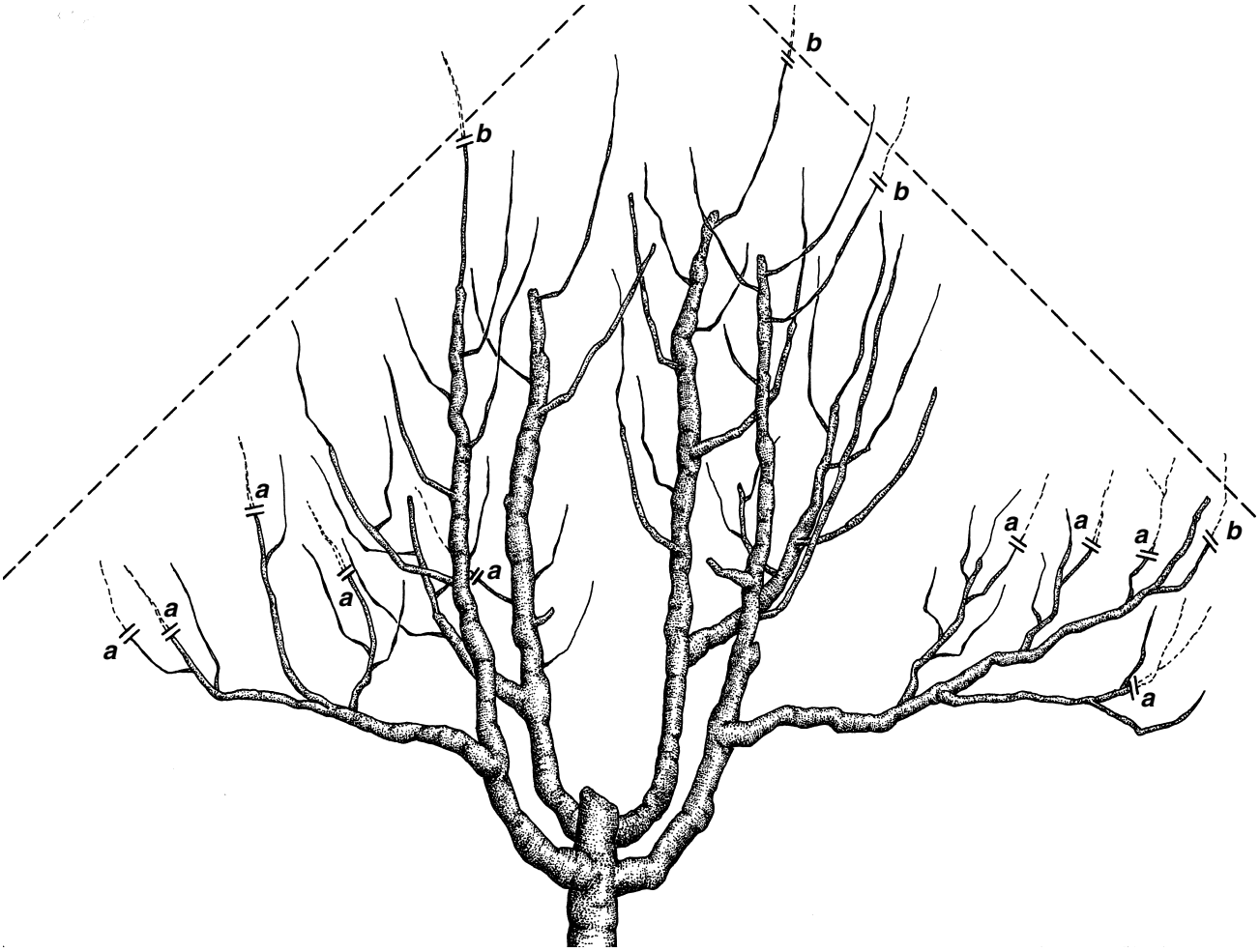


a.—Maintain tree height.



b.—Reduce leader tips to one shoot.

Continued—Dormant or summer pruning at maturity

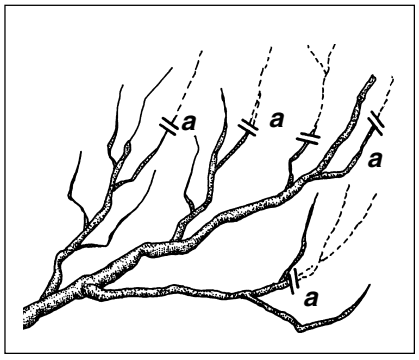


Tip lower branches.

Tipping the lower branches reinvigorates this region of the tree where vigor is hardest to maintain, and helps to ensure large cherries. Tip only what you can reach from the ground with loppers ***(a)***. The top rarely needs to be invigorated, and tipping in the top causes shading.

Maintain a pyramid shape to the tree.

To encourage good light distribution and high-quality fruit throughout the tree, a pyramid shape should be the goal of mature tree pruning ***(b)*****.** Keep in mind that branch sizes from bottom to top should follow the pattern of "big, smaller, smallest."

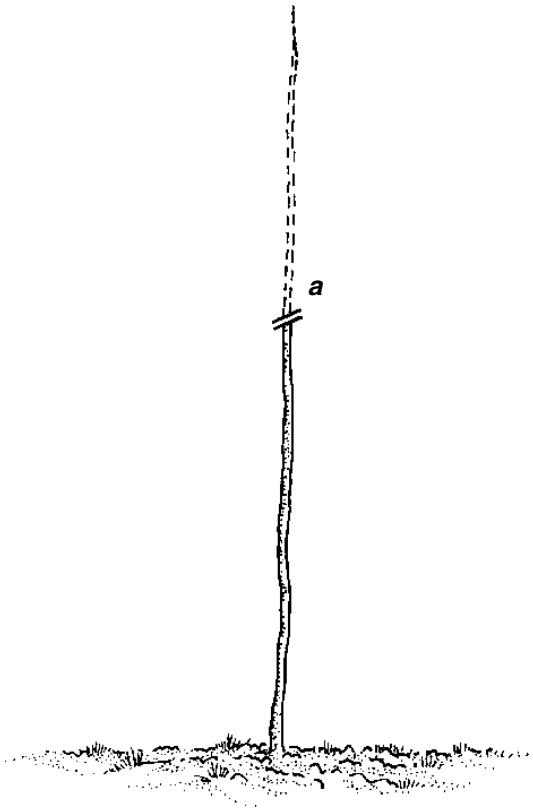


a.—Tip lower branches.

Vogel Central Leader

By taking advantage of the inherent central leader nature of a young cherry tree, the Vogel Central Leader system requires little establishment pruning. This factor, coupled with modest growth characteristics and an intermediate planting density, helps to provide for high early yields.

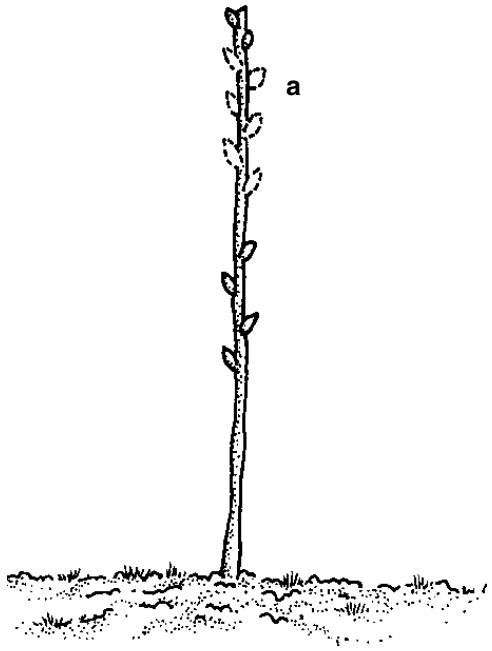
At planting



Head whip.

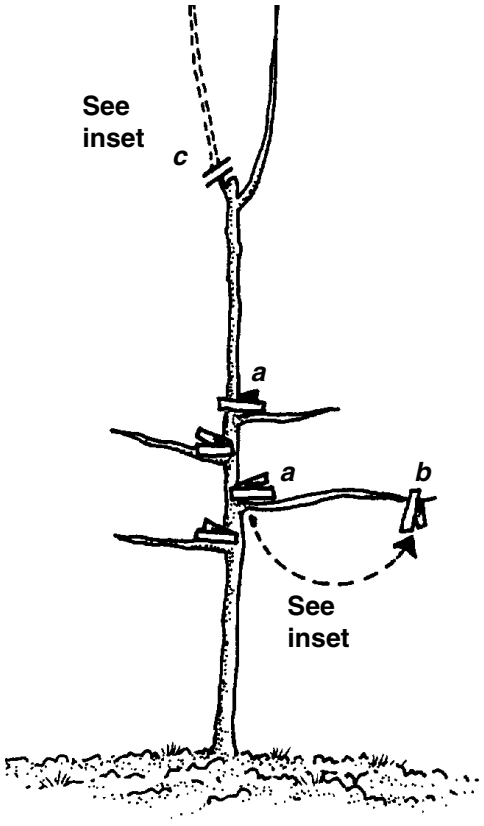
Plant trees 8 to 12 feet apart in the row with 15 to 18 feet between rows, depending on soil fertility, rootstock, terrain, and tractor size. At planting, head the whip 30 to 36 inches above the ground, based on the desired height of the primary fruiting branches ***(a)***.

First spring



Remove buds at bud swell.

As buds swell in early spring, allow the top two buds to remain, while removing the next five to six buds ***(a)***. This procedure is intended to reduce leader competition and provide for wider branch angles.

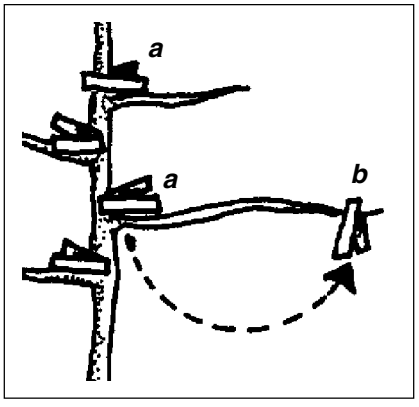


Establish branch angle.

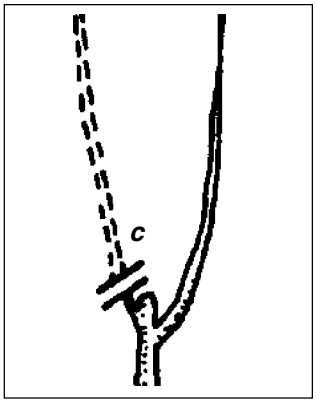
When the remaining lateral shoots have grown to 3 or 4 inches in length, attach a clothespin at a 90-degree angle to the trunk just above these shoots ***(a)***. Move the clothespins to the shoot tip after 2 to 3 weeks to help keep the shoot flat ***(b)***. For adequate weight, use large plastic clothespins rather than wooden pins.

Moderate growth helps to maintain a horizontal branch angle. For this reason, generally avoid fertilizers until cropping begins.

At the same time, if both top buds grew, select the weaker shoot to form the new leader and remove the other ***(c)***.

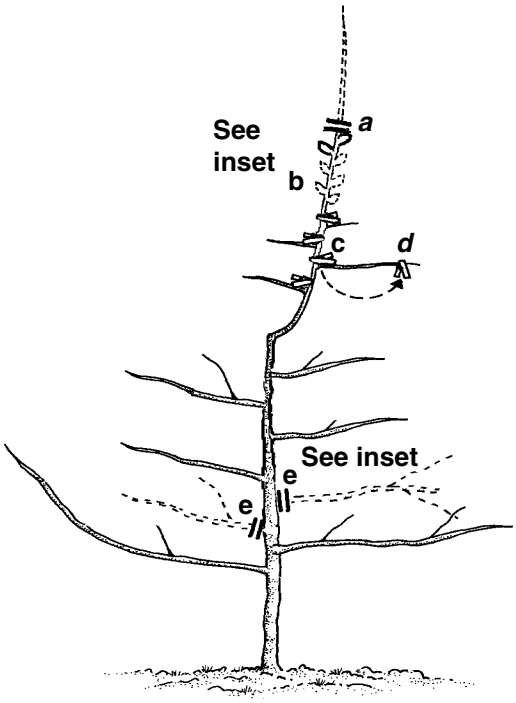


a & b.—Spread shoots



c.—Remove the stronger shoot.

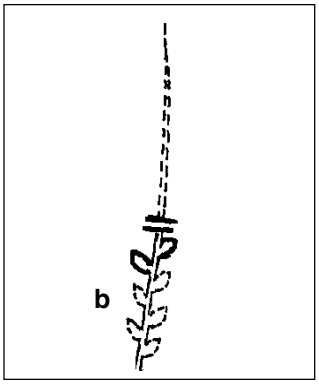
Spring pruning, until maturity



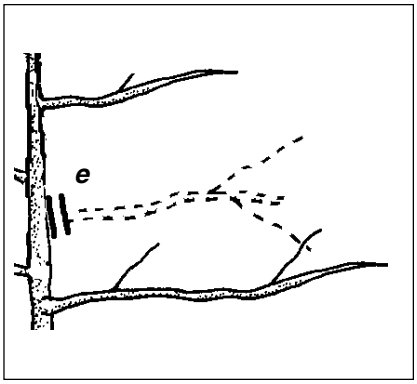
Continue training branches.

Head the leader only if its growth during the previous year was greater than 32 inches ***(a)***. Treat the leader as in the establishment year. Keep the top two buds and remove the next five to six buds ***(b)***. Apply clothespins to emerging shoots ***(c and d)***.

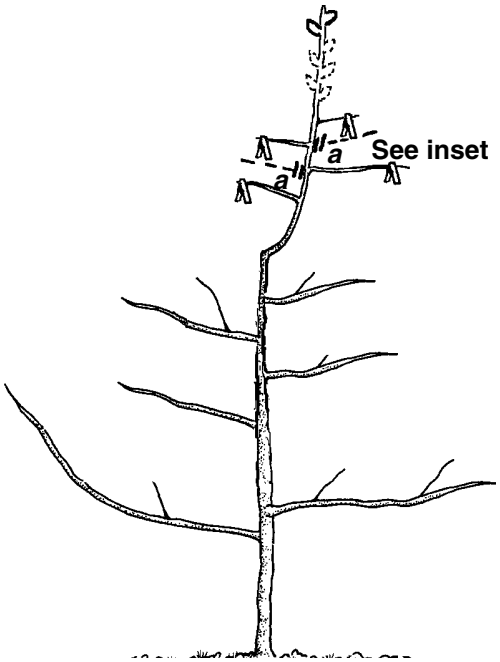
Encourage branches to grow throughout the entire length of the trunk in a spiral rather than allowing distinct whorls to develop. As branches mature, maintain a greater distance between the branches by thinning out those that are closely spaced in order to provide for adequate light penetration ***(e)***.



b.—Remove buds.

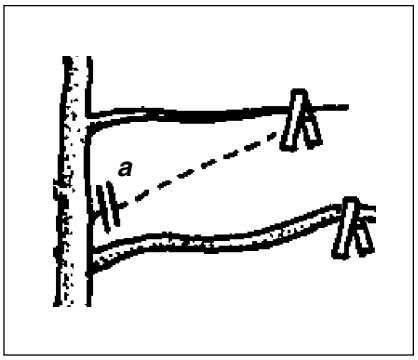


e.—Thin branches.



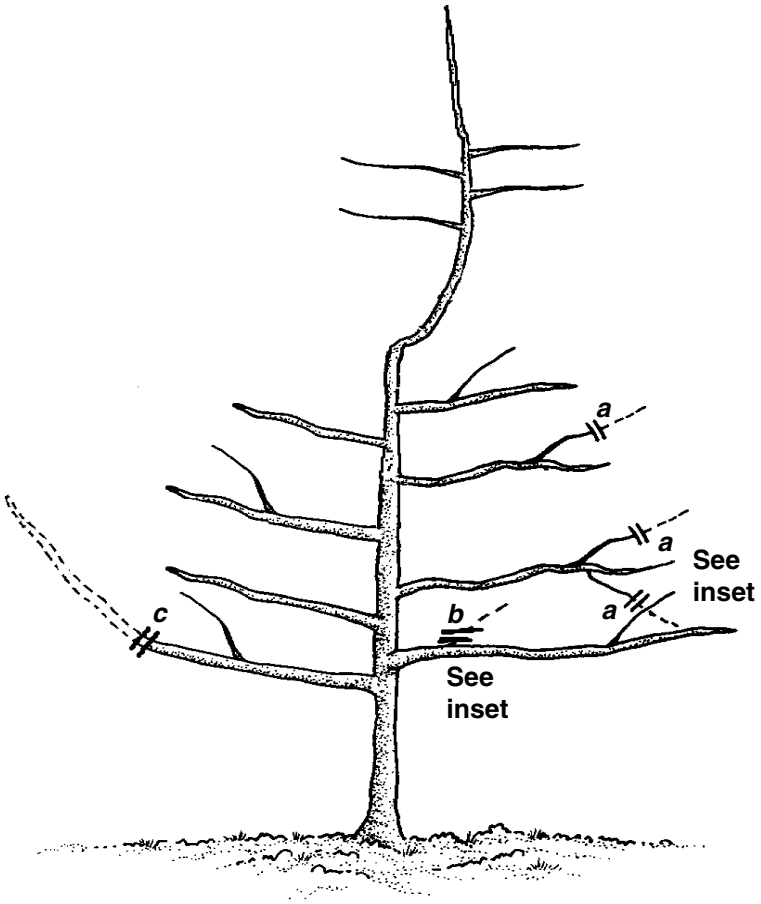
Thin emerging shoots.

Thin emerging shoots, if necessary, to provide for good light distribution throughout the tree ***(a)***.



a.—Thin emerging shoots for light penetration.

Spring or summer, years 2 and 3

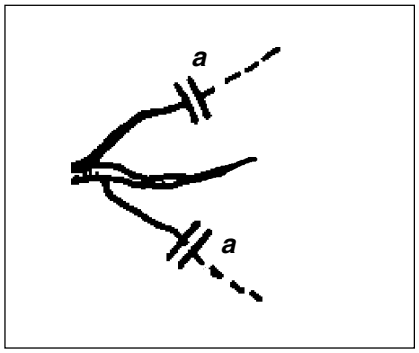


Maintain a dominant terminal on all lateral branches.

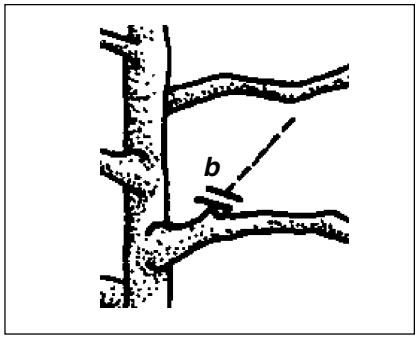
Pinch side shoots on laterals ***(a)***.

Pinch back or remove vertical shoots growing from primary laterals only if they are growing within a few inches of the trunk ***(b)***. Leave all other shoots growing off the primary lateral, and allow them to develop as potential renewal branches.

Stub back primary laterals that are growing vigorously upright, being sure to leave a live stub ***(c)***.

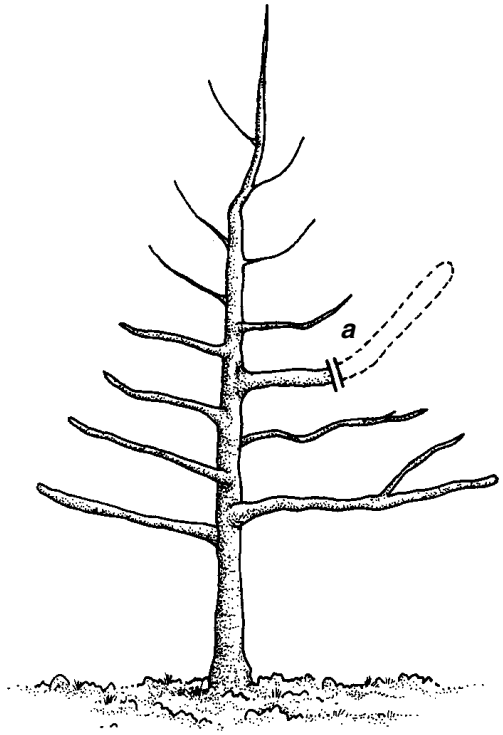


a.—Pinch side shoots.



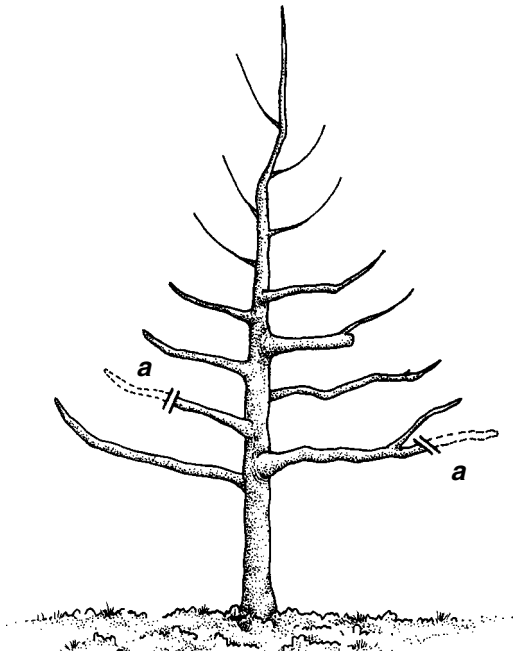
b.—Pinch back or remove vertical shoots near trunk.

Continued—Spring or summer, years 2 and 3



Stub back or remove thick branches.

Stub back or remove branches thicker than one-half the trunk diameter to allow good light distribution throughout tree ***(a)***.



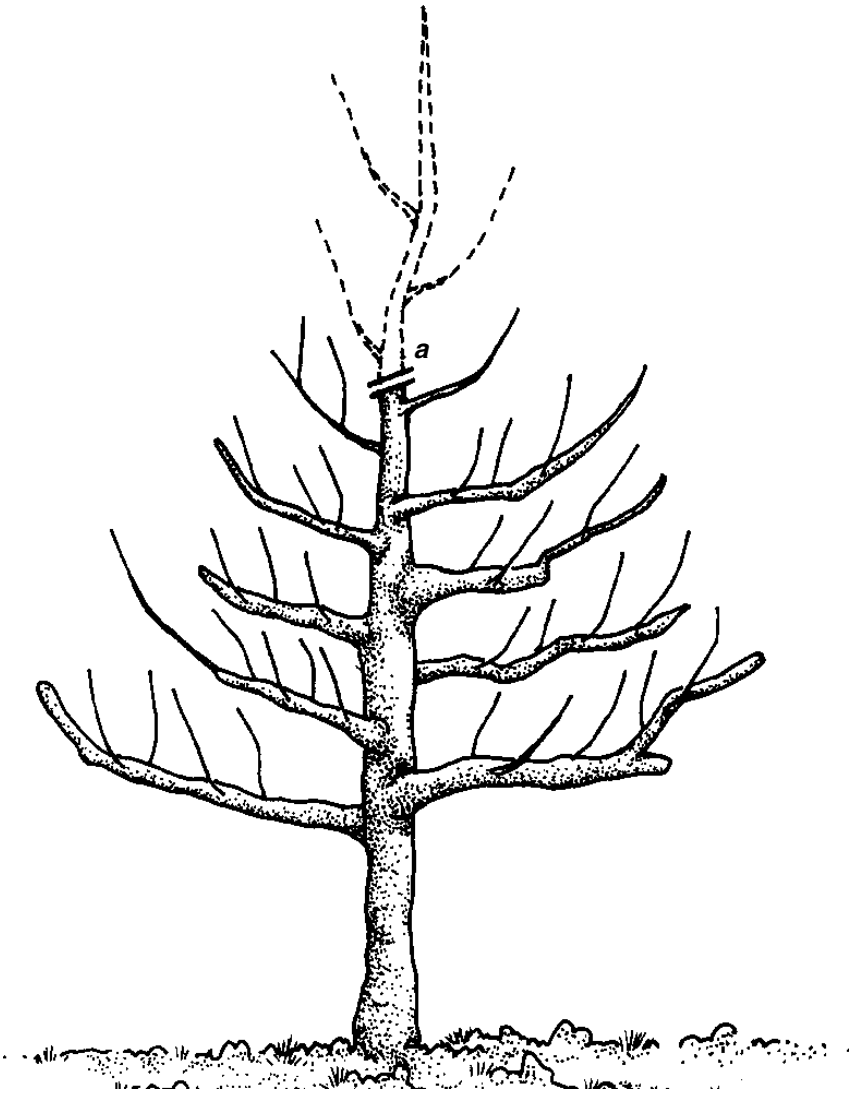
Maintain light penetration and encourage fruiting wood.

In order to promote young fruiting wood and encourage large fruit size, stub back several laterals each spring ***(a)***. Remove pendant wood first, and then older wood that has been allowed to fruit for 3 or 4 years. There should be a good balance between established fruiting wood and renewal shoots. To maintain the typical "Christmas tree" shape, be sure to stub lower branches farther from the trunk than upper branches.

Spring or summer, at maturity

Repeat the procedures shown on pages 23 and 24 each year to maintain good light distribution and maximum fruit size throughout tree. In a large, mature tree, there may be as many as 10 to 15 renewal cuts made per year, but each tree needs to be evaluated individually. More cuts are needed to invigorate weaker trees or to reduce overcropping.

Postharvest, at maturity



Maintain tree height.

Make no attempt to control tree height until tree growth begins to slow. You can maintain tree height by cutting the tree top back to a flat, weak lateral ***(a)***. Depending on tree vigor, you can remove as much as 4 feet of height.

For more information

Cold Resistance of Stone Fruit Flower Buds, PNW 221

Irrigating Deciduous Fruit and Nut Trees in Oregon, EC 1424

Leaf Analysis of Nutrient Disorders in Tree Fruits and Small Fruits, FS 118

Managing Orchard Floor Vegetation in the Pacific Northwest, PNW 313

Nutrient Disorders in Tree Fruits, PNW 121

Orchard Spraying in the Pacific Northwest, PNW 174

Sweet Cherry Varieties in Oregon, FS 57

Training and Pruning Sweet Cherry Trees for Mechanical Harvesting, FS 202

Using Horticultural Spray Oils to Control Orchard Pests, PNW 328

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