

## Sweet Cherry Training Systems

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Historically, cherry growers in Oregon have grown large open vase trees on Mazzard rootstock. While the objectives of pruning and tree training have changed little over the years, the need for increased attention to pruning and training has changed dramatically. Pacific Northwest cherry growers now compete in a world market making fruit size and quality increasingly important attributes. In addition, labor availability is becoming more limiting while costs are increasing. The Pacific Northwest grower must be able to produce trees that are easily maintained and quality fruit that is quickly harvested. A good training system will provide a structural framework that will accomplish these goals.

### Understanding the tree

Cherry trees present three significant challenges to an orchard manager:

- **Excessively vigorous growth**-Cherry trees are large, 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 control a tree's vigor and produce more branches that are closer together. However, pruning, especially dormant heading cuts, tends to delay fruit production 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 factors that increase tree vigor, such as deep, productive soils or over-fertilization also tend 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 inclusions, a condition in which bark is trapped between the trunk and the branch, preventing layers of annual wood from growing together. Splitting can occur at these locations.

With the introduction of dwarfing and precocious rootstocks such as Gisela 5, 6 or 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 more easily controlled and branches naturally form at wider angles. However, without proper management and pruning fruit size may be negatively affected.

No matter the variety and rootstock combination, annual shoot elongation is imperative for maximum fruit quality. The largest and highest quality cherries will be produced at the base of the previous season's growth and on one to three year old spurs. Therefore the goal of any orchard manager should be to grow trees with 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 diverse, commercially successful systems. Each system has inherent 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. There are advantages and disadvantages to each system as shown below in Tables 1 through 3.

- **Steep Leader**

The steep leader system is best suited for low to moderate density orchards on full size rootstock. This system is an adaptation of the open vase system commonly used by Pacific Northwest growers. It is possible to produce moderately large crops by the seventh or eighth leaf generating large, good quality cherries. However, due to rootstock selection, production usually does not begin until the fifth or sixth leaf and trees trained to this system are generally taller than those in the other two systems.

- **Spanish Bush**

The Spanish Bush system 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 may be possible to utilize this system with full size rootstock on poor soils, especially when highly productive varieties such as Sweetheart are selected. Generally, however, with the more vigorous soils commonly found in the Pacific Northwest a dwarfing rootstock is needed to help control tree growth and balance vigor. Without a precocious rootstock production will be delayed due to the extensive number of heading cuts made in establishing 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 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. Third leaf training system trial, Sweetheart cherries

| Training System      | Rootstock | Yield/tree (kg) |
|----------------------|-----------|-----------------|
| Vogel Central Leader | Gisela 6  | 2.5             |
| Open Vase            | Gisela 6  | 1.4             |
| Spanish Bush         | Gisela 6  | 1.0             |
| Spanish Bush         | Mazzard   | 0               |

Table 2. Fourth leaf training system trial, Sweetheart cherries

| Training System    | Rootstock | Yield/tree (kg) | Fruit Weight (g) |
|--------------------|-----------|-----------------|------------------|
| Vogel Cent. Leader | Gisela 6  | 29              | 8.92             |
| Open Vase          | Gisela 6  | 16              | 8.47             |
| Spanish Bush       | Gisela 6  | 18              | 8.41             |
| Spanish Bush       | Mazzard   | 3               | 8.40             |

Table 3. A mark indicates an acceptable combination for or attribute of the training system.

|                                | Steep Leader | Spanish Bush          | Vogel Central Leader  |
|--------------------------------|--------------|-----------------------|-----------------------|
| Good Soils                     | X            | dwarf rootstocks only | dwarf rootstocks only |
| Poor Soils                     | X            | X                     | X                     |
| Frosty Sites                   | X            |                       | X                     |
| Full Size Rootstocks           | X            | poor soils only       |                       |
| Dwarfing Rootstocks            | X            | X                     | X                     |
| Precocious Varieties           | X            | X                     | X                     |
| Prec. Varieties/Dwarfing Root. | X            | X                     |                       |
| Higher Management Skills       |              | X                     | X                     |
| High Early Yields              |              | X                     | X                     |
| Reduced Harvest Costs          |              | X                     |                       |

### Pruning and Training Techniques

The following pruning and training techniques are used in the developmental process of these training systems.

- **Heading into one year old wood**

This cut stimulates the growth of lateral branches and is often 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 lacks some of the invigorating attributes of cuts made into one year old wood and therefore does not delay fruiting to the same degree. Heading cuts into older wood are often used to stiffen branches or remove pendant wood. In addition, fruit buds are usually removed with this cut, reducing the crop. 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 one inch to several feet of its origin in order to grow a new branch. 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. (Fig. 1). This cut is common in all three systems to maintain fruit quality and size. The second type of stub cut is most commonly used in the Vogel Central Leader system but can also be used with the steep leader system. If a lateral branch begins to grow upright or is simply 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. It is important that

the stub consist of live wood and that the secondary branch terminal (a) be higher than the remaining stub (b). (Fig. 2). This will prevent vigorous vertical wood from growing out of the stub and keep the secondary branch more horizontal and less vigorous.

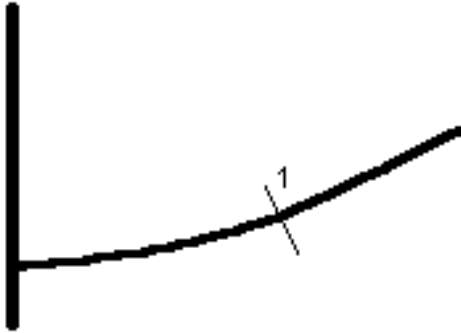


Fig. 1  
Stub cut with no lateral branching present

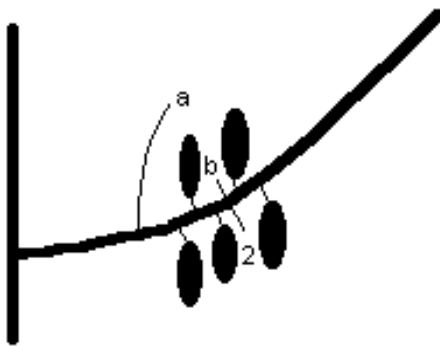


Fig. 2  
Stub cut with lateral branching. Note live buds present on stub and relative height of terminals a and b.

- **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 are also less invigorating therefore 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. Included bark and subsequent weak attachments can therefore become a problem. In addition, a narrow tree base makes for poor light penetration since the base may be narrower than the tree top. To broaden the base, wide crotch angles can be established on young shoots growing from the trunk by placing a toothpick between the trunk and a three to four inch shoot. It is wise to use this technique to establish wide branch angles for the Steep Leader and Spanish Bush systems. This technique, however, should be avoided in moist climates where the risk of bacterial canker infection is high. In these regions a clothespin can be used as a spreader by

attaching the clamp to the trunk, forcing the shoot to establish at a 90° angle. This method is used to establish the proper branch angle for the Vogel Central Leader system. Branch angles should be manipulated while the tissue is still green but after shoots have grown to three or four inches in length.

There are several ways of effectively spreading more mature branches. With the Steep Leader and Vogel Central Leader systems young branches are tied to hop clips inserted in the ground and spread to a more horizontal angle. The Spanish Bush system generally utilizes two parallel wires strung on opposite sides of the row with branches tied to the wires. Besides improving light penetration, spreading will help to reduce branch growth and increase precocity.

- **Summer Pruning**

Summer pruning can be used in any of the three systems but is a key component of both the Spanish Bush and Vogel systems. Since 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 may lead to over-production and should be balanced with dormant pruning when necessary. In addition, laterals that form following a summer cut generally have narrower, less attractive branch angles.

- **Promalin**

Instead of severe heading cuts, which tend to delay fruiting, cherry growers often use Promalin to increase branching. Promalin is mixed with a latex paint according to label directions and applied to one-year-old branches at the green tip stage of bud development. For best results the entire region of the branch where laterals are desired should be painted, not just the buds. On strongly growing branches it may be necessary to remove a third of the branch to force branching at the base. Promalin works most consistently under moderate to warm spring temperatures. Promalin is not a required component of any of these systems but may be used in any system to increase branching and precocity.

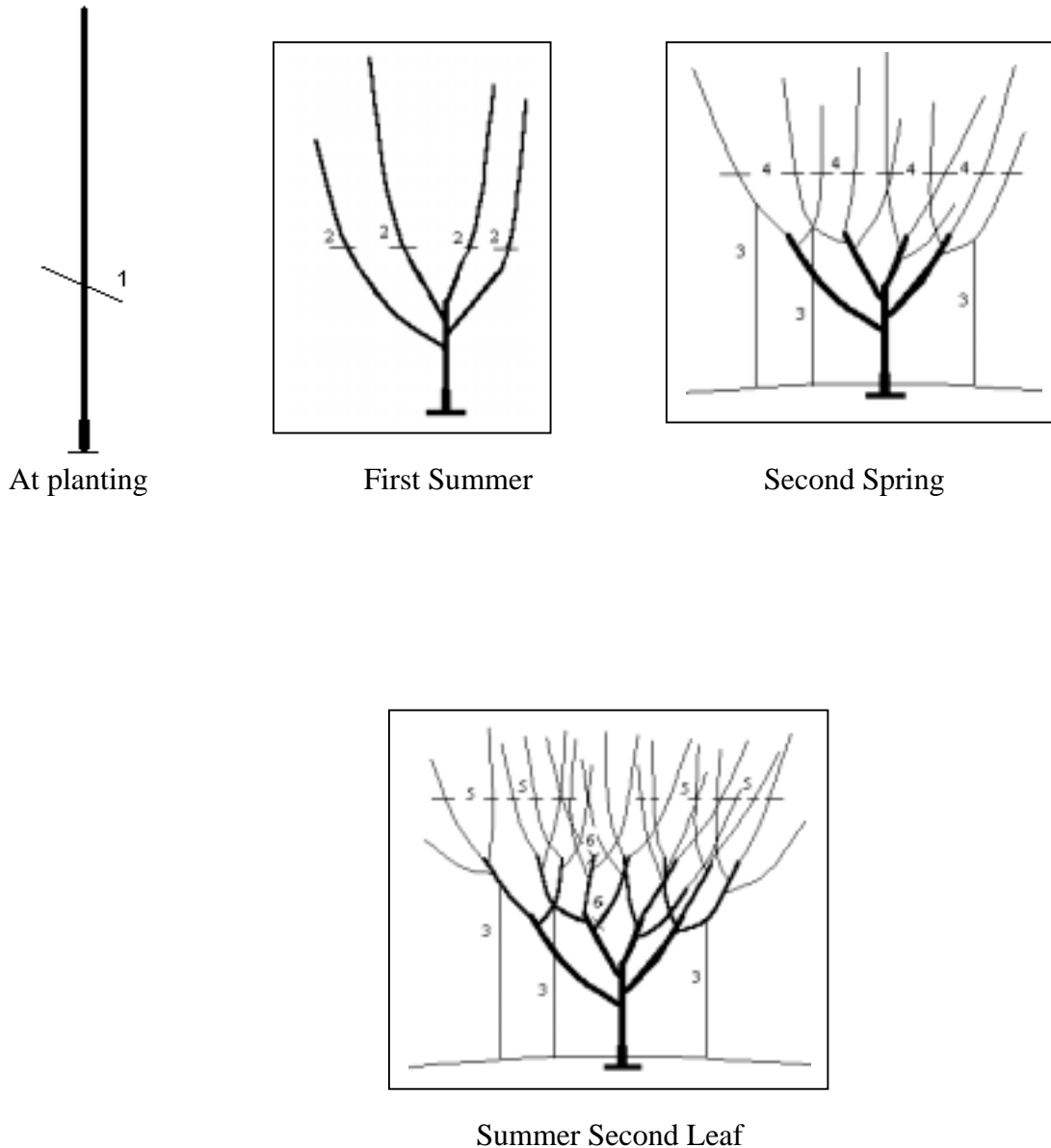
- **Scoring**

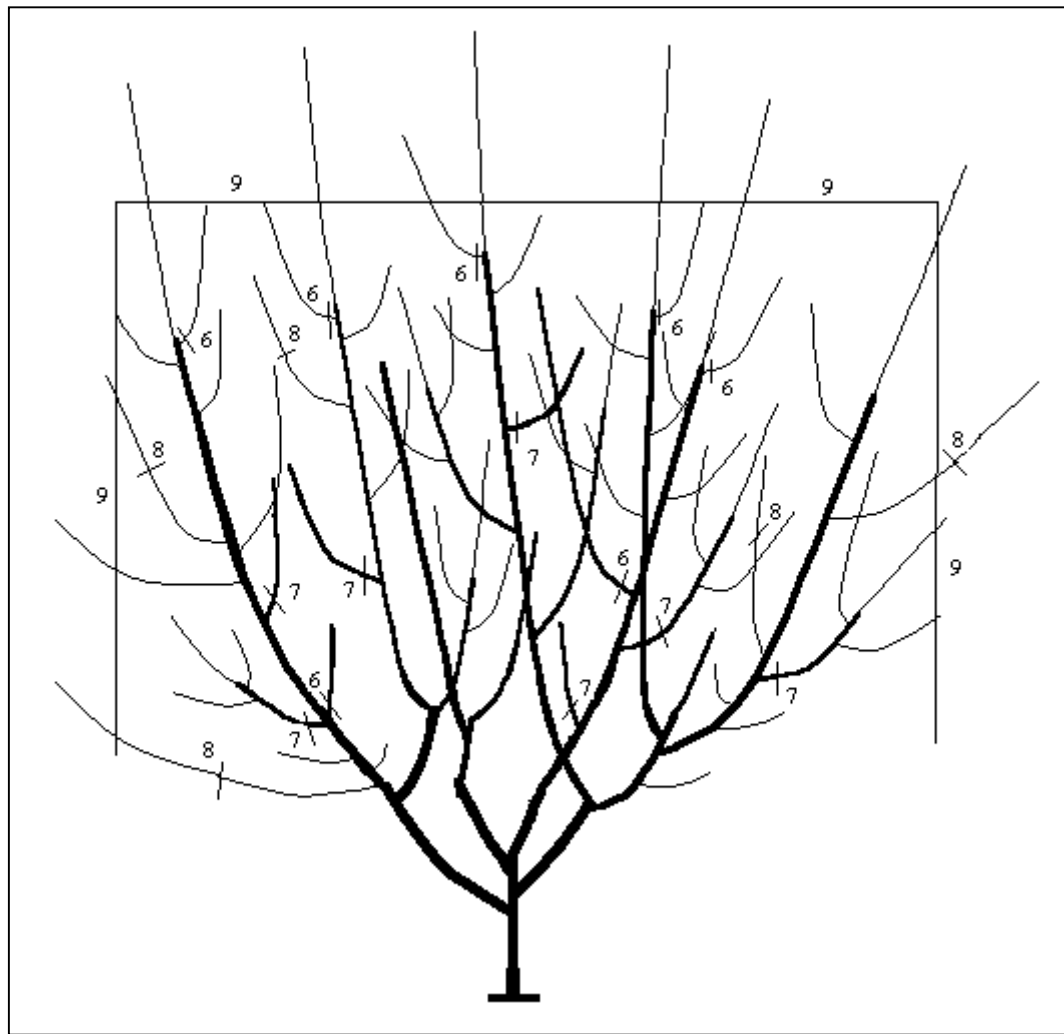
Scoring is another method used by cherry growers to encourage branching. A score, to the depth of the cambium is made just above a bud. The cut should extend 1/3 to 1/2 the circumference of the branch. There are a number of tools that can be used to accomplish this cut, but to assure adequate response on vigorous trees a relatively broad cut needs to be made. The desired effect can be achieved by taping together two hacksaw blades. An orchard manager may choose to use scoring as an option in any system.

## SPANISH BUSH

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

### Methodology





Maturity  
Annual Fall Pruning

1) **Head whip at planting**

Trees should be planted eight to ten feet apart in the row and 15 to 18 feet between rows depending on soil vigor, rootstock, incline and equipment size. At bud break, head whip 12 to 30 inches above the ground depending upon desired height of primary branches and presence of buds below the cut. Spread developing shoots to obtain wide crotch angles. Encourage strong tree growth.

2) **Head primary branches during first growing season**

Allow primary branches to grow 20 to 24 inches in length. Cut branches back to a height of six inches above the first cut. A vigorous response is desired from the cut so wait until proper branch size before making the cut. Branches should all be cut at the same level. This is the only cut during the first growing season.

- 3) **Tie down branches (optional)**  
Anchor two parallel wires at ground level running on either side of the tree row. Ground wires should be installed the first dormant season after planting. Secondary branches should be well developed by the autumn of the first leaf. Tie down secondary branches to open and spread the tree. Spreading is especially important for upright varieties such as Lapins. The wire system can be removed by the end of the growing season.
- 4) **Head secondary branches in second leaf**  
By autumn of the first leaf secondary branches should have grown 20 to 24 inches in length. Wait until bloom of the second leaf to head these branches back to 10 inches. If growth is not sufficient at this time, then wait until adequate branch size. Again, all cuts should be made at the same level.
- 5) **Head tertiary branches in second leaf**  
By late spring of the second leaf tertiary branches should have grown to nearly 24 inches in length. Center and horizontal branches excepting, cut back the new growth to 10 inches above the previous cut. All cuts should be made at the same level. Horizontal branches are left unheaded in order to fruit. Center branches are left intact to force a more spreading growth habit and will be thinned out after fruiting begins. These are the last training cuts made in the formation of the tree. This final heading cut is particularly important for upright, poorly branching varieties such as Bing and Lapins and 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 may not be necessary.
- 6) **Thin for good light penetration**  
By late spring of the second leaf some branches may need to be thinned in order to allow for better light penetration. Choose vigorous upright branches to thin out while leaving weaker, horizontal branches to fruit. From this point on thinning branches is an ongoing process that needs to be performed at every pruning.  
**At the same time**  
Discourage strong tree growth. Until tree begins to fruit fertilizer applications should be reduced so that new shoot growth is less than two feet long.

### **Pruning at Maturity (after harvest or dormant)**

- 7) **Renew fruiting wood**  
At maturity secondary or tertiary branches become permanent scaffold branches. Fruit is grown off weak, renewable branches growing from the permanent scaffolds. To maintain fruit size, fruiting wood needs to be regularly renewed. Stub back a percentage of the fruiting branches each year so that in four years all fruiting wood is renewed. Normally this is done after harvest as a summer cut. However, depending on rootstock and tree vigor orchard managers may elect to prune during the dormant season to encourage growth, vigor and fruit size.

**At the same time**

Thin out branches in the inner canopy that are shading and interfering with light penetration (See 6 above).

8) **Head fruiting wood to encourage fruit size**

To reduce fruit load and encourage fruit size long fruiting wood should be headed after harvest or during the dormant season.

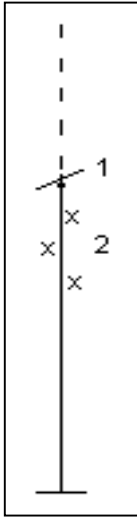
9) **Topping and hedging performed annually in the autumn**

At maturity trees are topped at eight feet and hedged annually.

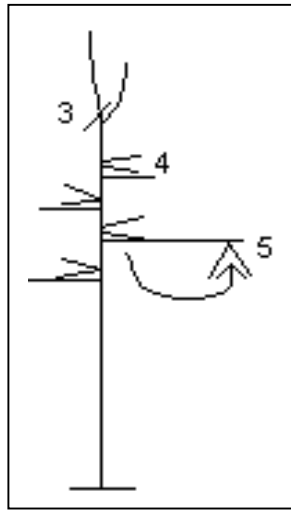
## Vogel Central Leader

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

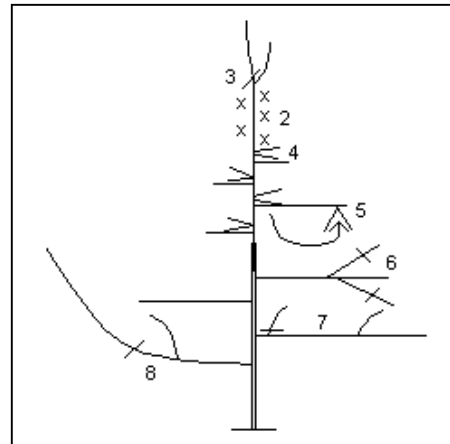
### Methodology



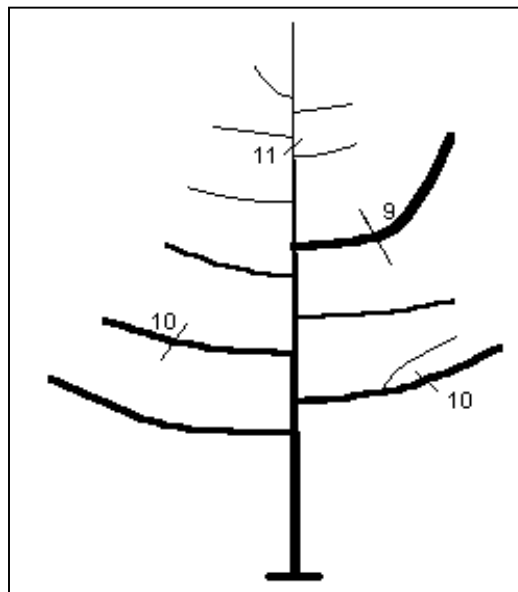
At Planting



Early Spring



Second Year to Maturity



## At Maturity

### 10) **Head whip at planting**

Trees should be planted 8 to 12 feet apart in the row and 15 to 18 feet between rows depending on soil vigor, rootstock, terrain and tractor size. At planting, head whip 30 to 36 inches above the ground based on desired height of primary fruiting branches.

### 11) **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. This procedure is intended to reduce leader competition and provide for wider branch angles.

### 12) **Establish branch angle (Spring)**

Attach clothespin at 90° angle to the trunk when new lateral shoots grow to three or four inches in length. Clothespins should be moved to shoot tip after two to three weeks helping to keep shoot flat. For adequate weight, large plastic rather than wooden clothespins should be used. Moderate growth will help to maintain horizontal branch angle. For this reason fertilizers should generally be avoided until cropping begins.

### 13) **At the same time**

If both top buds grew select the weaker shoot to form the new leader and remove the second.

### 14) **Year two and three (Spring)**

Head leader only if growth of leader was greater than 32 inches. Leader should be treated as in establishment year. Remove buds and clothespin emerging shoots. Thin emerging shoots, if necessary, to provide for good light distribution throughout tree. Branches should be encouraged to grow throughout the entire length of the trunk in a spiral rather than allowing distinct whorls to develop. As branches mature, a greater distance between the branches needs to be maintained in order to provide for adequate light penetration.

### 15) **Maintenance pruning (spring or summer)**

Maintain a dominant terminal on all lateral branches by pinching side shoots.

At the same time

16) Vertical shoots growing from primary laterals should be pinched back or removed completely only if they are growing within a few inches of the trunk. All other shoots growing off the primary lateral should be left and allowed to develop as potential renewal branches.

17) Primary laterals that are growing vigorously upright should be stubbed back to a lateral, being sure to leave a live stub.

18) Branches thicker than one half of trunk diameter should be stubbed back or removed to allow good light distribution throughout tree.

19) In order to continually promote young fruiting wood and encourage large fruit size several laterals should be stubbed back each spring. Remove pendant wood first and older wood after it has been allowed to fruit for three or four years. There should be a good balance between established fruiting wood and renewal shoots. When stubbing branches, be sure to maintain the typical “Christmas tree” shape by stubbing lower branches further from the trunk compared to upper branches.

**At Maturity (spring or summer)**

Procedures 5 through 9 should be repeated each year to maintain good light distribution and maximum fruit size throughout tree. In a large, mature tree, there may be as many as 15 to 20 renewal cuts made per year, but each tree needs to be read as an individual. More cuts are needed to invigorate weaker trees or to reduce overcropping.

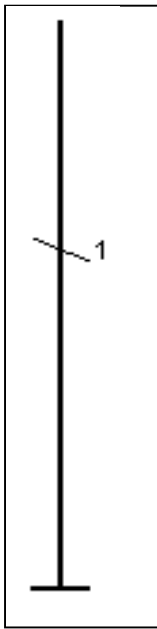
**20) Maintaining Tree Height (post-harvest)**

No attempt should be made at controlling tree height until tree growth begins to slow. Tree height can be maintained by cutting tree top back to a flat, weak lateral. Depending on tree vigor as much as four feet can be removed.

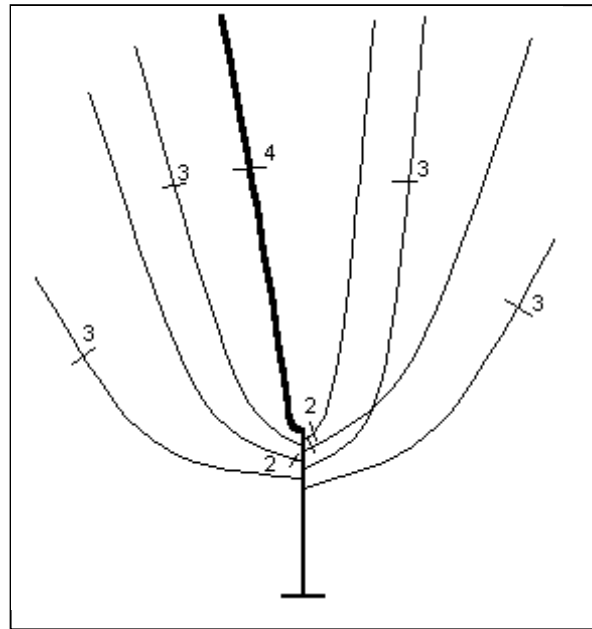
## Steep Leader

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.

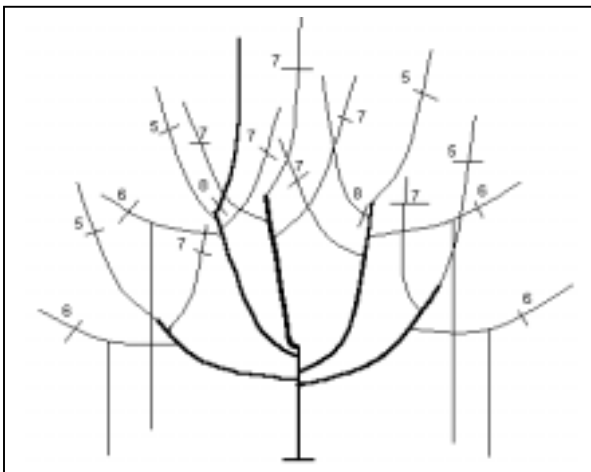
### Methodology



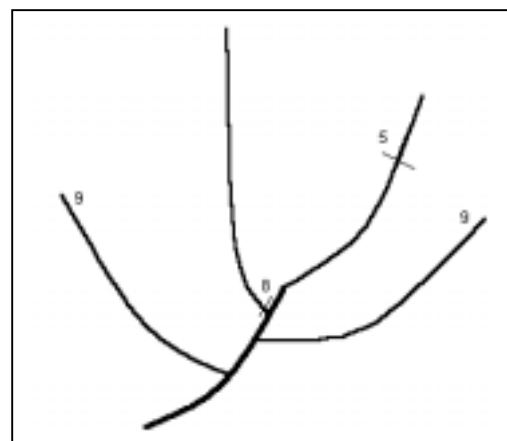
At Planting



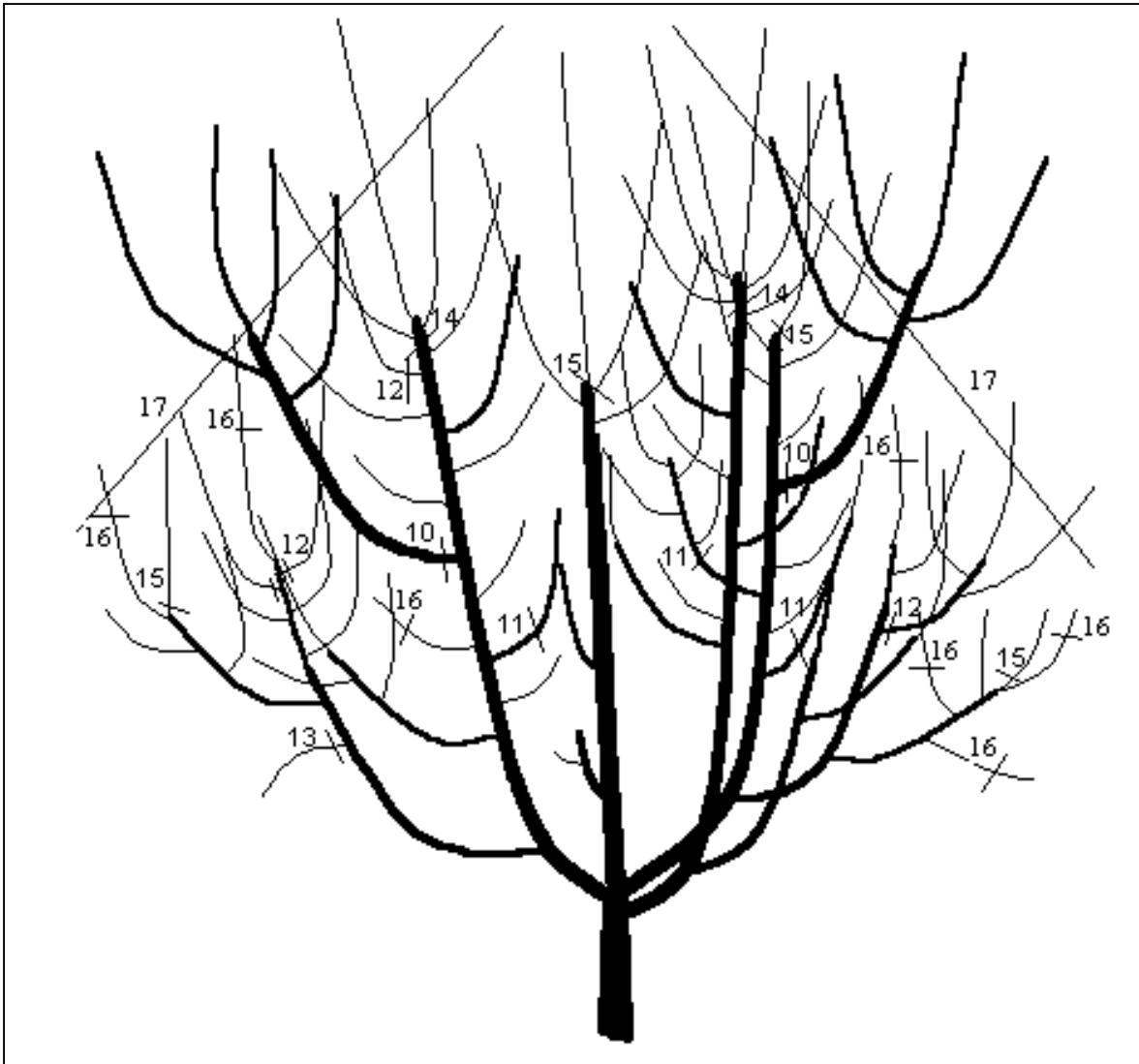
First Dormant



Second Dormant or Spring Second Leaf Maturity



Dormant or Spring Pruning to



Dormant or Summer Pruning at Maturity

1) **Head whip at planting**

Trees should be planted 16 to 20 feet apart in the row and 18 to 24 feet between rows depending on soil vigor, terrain, equipment size, and manager's skill level. At planting head whip 30 to 36 inches above the ground based on desired height of primary scaffold branches. Use toothpicks or clothespins to establish wide branch angles.

2) **Select leaders, first dormant**

Three permanent leaders should generally be selected if in row spacing is less than 20 feet, otherwise, select four well distributed leaders. Allow leaders to grow close to vertical.

**3) Head leaders to establish permanent bottom whorl**

Head leaders two to three feet from trunk to encourage branching. Two branches will be selected from the regrowth. The first to continue terminal growth elongation and the second for the establishment of a permanent bottom whorl.

**4) Maintain vigor control through branch selection**

A strong branch may be left as a temporary branch to divert vigor from the permanent scaffold branches.

**5) Choose secondary branches that will continue terminal growth**

One branch should be selected per leader to serve as an extension of the permanent scaffold branch. Head this branch approximately two feet from its point of origin.

**6) Establish permanent bottom whorl**

One outside secondary branch per scaffold should be selected and tied to horizontal in order to establish a permanent bottom whorl. Head these branches two to three feet from their base.

**7) Leave temporary secondary branches to divert vigor**

It may be necessary to leave several temporary branches until fruiting in order to control overall tree vigor. These branches should also be headed at about two feet

**8) Thin to weak wood**

Select smaller and weaker wood as permanent branches. Thin out very strong wood.

**9) Leave branches unpruned to encourage fruiting**

As tree matures, temporary branches should be left unheaded in order to encourage early fruit production. These branches should be removed once tree begins to fruit and growth slows.

**10) Remove over-vigorous branches**

Any branches with a basal diameter greater than two-thirds the diameter of the parent branch should be removed. The largest wood should be at the bottom of the tree. The idea of large, smaller, smallest should be kept in mind as you work up the tree.

**11) Renew wood**

Each leader should be treated as an individual spindle tree with young wood growing off each leader. Since the best quality cherries are grown on young wood, this wood should be favored by stubbing back a percentage of the older branches each year. This secondary wood should be no older than three years old.

**12) Maintain light paths by thinning shoots**

Remove older wood that is shading lower branches and thin out a percentage of the young shoots in order to maintain quality production throughout the tree.

**13) Remove pendant wood**

Pendant wood will tend to overset and/or produce small cherries.

**14) Maintain proper tree height**

As the tree reaches maximum height prune the top back to weak laterals.

**15) Reduce leader tips to one shoot**

Single out tips at the end of main leaders. Also, where adjacent branches are the same size, remove one. This will help to reduce shading.

**16) Tip lower branches**

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

**17) Maintain pyramid shape**

To encourage good light distribution and high quality fruit throughout the tree, a pyramidal shape should be the goal of mature tree pruning. Keep in mind the idea that branch sizes from tree bottom to tree top should follow the pattern of „large, smaller, smallest“.

**For more information**

A complete training system manual covering these three training systems is down loadable from the web at <http://eesc.orst.edu/agcomwebfile/edmat/PNW543.pdf>.