Sweet Cherry Training Systems

Lynn Long

Extension Agent, Wasco County, Oregon State University, The Dalles, Oregon

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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 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 control a tree's vigor 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, preventing layers of annual wood from growing together. 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 article 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 (Table 1). Understanding how various factors interact with one another is an important part of making the right choice. Following a description of pruning and training techniques, a training protocol for each system is outlined.

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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.

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.

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.

It is important that the stub consist of live wood and that the secondary branch terminal be higher than the remaining stub. 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. A heading cut is made into a strong (temporary) vertical branch at the same time a weaker (permanent) adjacent branch is headed. 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.

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 allows for poor light penetration.

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 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 often 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

TABLE 1

Appropriate uses of various training systems.

	Steep Leader	Spanish Bush	Vogel Central Leader
Growing conditions*			
Good soils	☆	dwarf rootstocks only	dwarf rootstocks only
Poor soils	☆	☆	☆
Frosty sites	☆	—	☆
Rootstocks and varieties*			
Full-size rootstocks	☆	poor soils only	—
Dwarfing rootstocks	☆	☆	☆
Precocious varieties	☆	☆	☆
Precocious 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.

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. Score 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

The Spanish Bush system (Fig. 1) 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.

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.

First Growing Season

- Head primary branches.
- Tie down branches (optional).

Second Spring

- Head secondary branches.
- Head tertiary branches.
- Thin for good light penetration.

After Harvest or Dormant, at Maturity

- Renew fruiting wood.
- Thin for light penetration.
- Fruiting wood to increase fruit size.
- Top and hedge the tree annually in the fall.

STEEP LEADER

The Steep Leader system (Fig. 2) is an adaptation of the open vase system commonly used by Pacific Northwest growers. It is best suited for 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 usually is used 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.

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.

First Dormant Season

- Select leaders.

Second Dormant Season or Spring Second Leaf

- Choose secondary branches that will continue terminal growth.
- Establish a permanent bottom whorl.
- Leave temporary secondary branches to divert vigor.

Dormant or Spring Pruning to Maturity

- Thin to weak wood.

Dormant or Summer Pruning at Maturity

- Remove overly vigorous branches.
- Renew wood.
- Maintain light paths.
- Remove pendant wood.
- Maintain proper tree height.
- Reduce leader tips to one shoot.
- Tip lower branches.
- Maintain a pyramid shape to the tree.

FIGURE 1

Spanish bush training system.

FIGURE 2

Steep leader training system.

FIGURE 3

Vogel central leader training system.

VOGEL CENTRAL LEADER

The Vogel Central Leader (Fig. 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.

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.

First Spring

- Remove buds at bud swell.
- Establish branch angle.

Spring Pruning, Until Maturity

- Continue training branches.
- Thin emerging shoots.

Spring or Summer, Years 2 and 3

- Maintain a dominant terminal on all lateral branches.
- Stub back or remove thick branches.
- Maintain light penetration and encourage fruiting wood.

Spring or Summer, at Maturity

- Repeat the procedures listed under Spring or Summer, Years 2 and 3, above.

Postharvest, at Maturity

- Maintain tree height.

A more complete description of tree training for the three systems can be found in "Cherry Training Systems: Selection and Development," a Pacific Northwest Extension Publication PNW543 published in March 2001. It is available for $3.00 from Publication Orders, Extension and Station Communications, Oregon State University, 422 Kerr Administration, Corvallis, OR 97331-2119 (fax: 541-737-0817).

CONVERSION FACTORS ENGLISH VS. METRIC

To convert Column 1 into Column 2, multiply by:	Column 1	Column 2	To convert Column 2 into Column 1 multiply by:
	Length		
.621	kilometer, km	mile	1.609
1.094	meter, m	yard	.914
3.281	meter, m	foot, ft	.3048
39.4	meter, m	inch	.0254
.03281	centimeter, cm	foot, ft	30.47
.394	centimeter, cm	inch	2.54
.0394	millimeters, mm	inches	25.40
metric:	1 km = 1000 m; 1 meter = 100 cm; 1 meter = 1000 mm		
English:	1 mile = 5280 ft; 1 mile = 1760 yards; 1 yard = 3 ft; 1 ft = 12 inches		
	Area		
247.1	kilometers^2, km^2	acre	.004047
2.471	hectare, ha	acre	.4047
.4047	trees/hectare	trees/acre	2.471
metric:	1 ha = 10,000 m^2 = .01 km^2		
English:	1 acre = 43,560 ft^2		
	Volume		
1.057	liter	quart (US)	.946
English:	1 US gallon = 4 quarts		
	Mass—Weight		
1.102	ton (metric), MT	ton (English)	.9072
2.205	kilogram (kg)	pound, lb	.454
52.5	ton (metric) of apples	apple packed box, *carton	.01905
metric:	1 metric ton = 1000 kg		
English:	1 ton = 2000 lb; 1 packed box or carton* of apples = 42 lb		
	Yield or Rate		
0.446	ton (metric)/hectare, MT/ha	ton (English)/acre	2.242
.892	kilogram/hectare, kg/ha	pound/acre	1.121
.991	ton (metric) of apples/hectare, MT/ha	bins* of apples/acre	1.009
.4047	trees/hectare	trees/acre	2.471
0.107	liter/hectare	gallon (US)/acre	9.354
metric:	1 metric ton = 1000 kg; 1 hectare = 10,000 m^2		
English:	1 ton = 2000 lb; apple bin* = 900 lb; 1 acre = 43,560 ft^2		
	Temperature		
1.8 C + 32	Celsius, C	Fahrenheit, F	.555 (F-32)

**Commercial cartons (packed boxes) of fruit and field/storage bins of fruit do not have universal weights. The weight of fruit in a packed box or carton varies around the world and with the type of fruit, but is here taken for apples as 42 lbs (19.05 kg); the weight of fruit in a bin also varies but is here taken for apples as 900 lbs (408.2 kg).*