Developments in High Density Cherries in the USA

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Cherry growers in the United States have been slow to adopt new high density systems with plantations of over 500 trees per hectare. Until recently they have been satisfied with the quality and returns from lower density plantings of less than 250 trees per hectare. However, in the last few years there is an increasing interest in high density systems, especially in the Pacific Northwest. University rootstock and training system trials are high priority for funding by grower commissions such as the Oregon Sweet Cherry Commission and the Washington Tree Fruit Research Commission. In addition, many growers have put in their own training systems trials while others have utilized new training systems in commercial plantings.

1. Dwarfing rootstocks

In the Mid-Columbia region of Oregon there has been, in recent years, a dramatic shift away from the full size rootstocks to the precocious, dwarfing rootstocks. This is a trend that is probably greater in Oregon than in other parts of the United States. Estimates given by nursery representatives show this trend very clearly (Table 1).

Table 1. Estimated sales of cherry trees on various rootstocks in the Mid-Columbia region of Oregon

Rootstock	Estimated % trees sold 1990	% trees sold 1998	Estimated % trees sold 2001
Mazzard	100	71	40
Gisela 5		19.2	10
Weiroot 158		3.6	
Gisela 7		3.3	
Gisela 6		2.9	50

Data by F. Niederholzer and L. Long

Growers in the Pacific Northwest have been more interested in dwarfing rootstocks than in Michigan or California, the other major U.S. sweet cherry production areas. Except for the few fresh cherry growers, most of the Michigan production is mechanically harvested from trees on full size rootstocks. California growers have found Gisela 6, the most widely planted dwarfing rootstock in California, often lacks the vigor needed for high quality production under their conditions.

Dwarfing rootstocks have been of great interest to the U.S. cherry industry for many years. Universities around the nation have been actively engaged in testing rootstocks such as Gisela 5 since the late 1980's and other rootstocks prior to that time. Large fruit size is a very desirable trait for sweet cherries destined to the fresh market. Early results showed a clear trend towards reduction of fruit size with many of the dwarfing

rootstocks. Even rootstocks such as Gisela 5, 6 and 12, which are now commercially available in the U.S., must be carefully managed to maintain maximum fruit size. Due to the fruit size concern with dwarfing rootstocks, many growers in the Pacific Northwest and California preferred to work with mazzard, recognizing its limitations, rather than risk small fruit. These growers began to look for ways to overcome the weaknesses of full size rootstocks, the most important of which are large tree size and low precocity.

2. High density systems on full size rootstock

Some of the early high density cherry plantings on full size rootstock tried to maintain tree size through limb bending. This was found to be very expensive and of questionable success. In many Pacific Northwest soils, cherries tend to grow so vigorously on mazzard rootstock that even with limb bending trees continued to grow. After only a few years many of these high density orchards became very unproductive due to shading, which caused a significant reduction in the bearing surface.

A more moderate approach is now being taken. New orchards on mazzard rootstock are being planted approximately 4m x 5.5 m. Trees are often summer pruned to increase precocity and reduce vigor. The training system of choice is the Steep Leader system that is described below. Growers believe that they will be able to maintain tree integrity at this spacing even with this rootstock and training system combination.

Although higher density plantings may help to moderately increase early per hectare yields they do not correct the lack of precocity inherent in the mazzard rootstock. Growers are addressing this concern in other ways. It is widely known that pruning a young cherry tree will stimulate new growth and prolong its vegetative state. Conversely, if juvenile cherry trees are minimally pruned they will fruit at a younger age. Since 'Bing' and most other varieties do not readily branch, simply not pruning a tree is not the answer. For years, growers have been looking for ways of obtaining branching without pruning and thereby encourage precocity.

Initially, growers in California and the Pacific Northwest experimented with Promalin to obtain branching without pruning and thereby achieve the goal of earlier production. Table 2 shows the effect of a Promalin treatment on Central Leader 'Lapins' trees on Gisela 11 rootstock (personal communication T. Facteau).

Table 2. Effect of Promalin on Central Leader 'Lapins' trees on Gisela 11 rootstock planted in 1996.

	Kg/tree		
	1998	1999	2000
Central leader, Vogel	0.16	14.51	20.1
Central leader, Promalin	0.61	23.0	20.3
LSD, 5%	0.22	2.8	NS

In this experiment, Promalin increased precocity for the first two years of production. By year 3, or the 5th leaf, there were no differences between treatments. Although, effective

at increasing early yields when it induced branching, growers in the Pacific Northwest soon discovered that Promalin did not work consistently enough to rely on year after year and therefore began looking for other techniques to promote branching without pruning. For this reason bud scoring has recently gained popularity. Growers have found this method to be useful and more reliably successful. Table 3 (personal communication T. Facteau) gives the results of a trial designed to investigate the differences between tools used for scoring and scoring dates. The double blade tool had two parallel blades that removed a section of bark 5 mm wide. The grape tool was a blade used for scoring grapes that removed a section of bark 6 mm wide and the saw blade was from a Leatherman tool.

Table 3. Effect of scoring tool and date on branch formation of 'Bing'/mazzard trees

Scoring tool	Scoring date	# of limbs scored	Scored buds/limb	Scored buds forming branches(%)
Double blade		20	14.9	59.2
Grape tool		20	13.4	57.7
Saw		19	14.2	67.9
	3/9 (dormant)	14	12.9	63.6 a
	3/21 (green tip)	15	13.3	75.6 a
	4/7	15	14.7	73.2 a
	4/17 (leaves present)	15	15.7	28.9 b

Means followed by the same letter are not statistically different
Data by T. Facteau

Scoring notches need to be made immediately above a bud and penetrate to the cambium. Several tools can be used to make this cut and a wide range of treatment dates around bud break will give successful results. The 21 March treatment corresponds to bud break. Branching decreased significantly by the time the trees began to leaf out on 17 April. The main concern with scoring is the increased potential for bacterial canker (*Pseudomonas*) infection. It is suggested that scoring cuts be treated with a copper spray immediately after treatment. Wood up to four years old has been scored successfully. With this treatment it is possible to completely establish the structure of a tree with no heading cuts.

3. Training systems

In the Pacific Northwest most new orchards on mazzard rootstock are being trained to the Steep Leader system but growers planting trees on dwarfing rootstock are often selecting either the Spanish Bush or the Vogel Central Leader systems. There has also been interest in Spanish Bush and Central Leader training systems in other parts of the country, but the Pacific Northwest seems to be leading the nation in this area also.

To determine whether a given rootstock performs more satisfactorily under a certain training system, trials were started in 1997 and 1998 by Oregon State University looking at the interaction of rootstocks and training systems. Tables 4 and 5 show estimated yields and fruit size

Table 4. Estimated yields and fruit weight on 5th leaf 'Bing' trees comparing rootstock and training systems

	Central Leader		**Steep Leader**		**Spanish Bush**	
Rootstock	**T/hectare**	**Fruit wt g**	**T/hectare**	**Fruit wt g**	**T/hectare**	**Fruit wt g**
Maxma 14	11.9	8.2	4.3	9.3	13.2	8.8
Edabriz	10.3	6.7	7.6	8.6	10.5	7.0
Pontaleb	6.7	9.8	2.2	9.9	9.0	9.3
Mazzard	1.3	9.3	0	9.5	0.4	8.3
Average	**7.6**	**8.5**	**3.5**	**9.3**	**8.3**	**8.4**

Table 5. Estimated yields and fruit weight on 4th leaf 'Bing' trees comparing rootstock and training systems

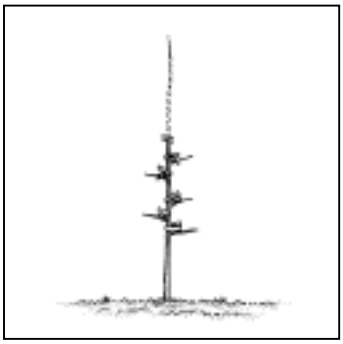
	Central Leader		**Steep Leader**		**Spanish Bush**	
Rootstock	**T/hectare**	**Fruit wt g**	**T/hectare**	**Fruit wt g**	**T/hectare**	**Fruit wt g**
W 72	7.4	8.6	6.0	9.1	2.9	9.1
W 158	3.6	9.3	1.6	9.8	3.1	9.4
Mazzard	0.0	9.7	0.0	10.4	0.4	8.3
Average	**3.7**	**9.2**	**2.5**	**9.8**	**2.2**	**8.9**

In the fourth leaf, trees trained to the Central Leader system attained high yields on both Weiroot 72 and 158. However, the Spanish Bush training system showed the highest yields with listed rootstocks by the 5th leaf except on mazzard. The Steep Leader training system produced very large fruit with all listed rootstocks in both the 4th and 5th leaf. With Weiroot 72, the Steep Leader and Spanish Bush performed equally as well.

Although growers are experimenting with Spanish Bush and Central Leader systems and a few commercial plantings have been made in recent years, it is the Steep Leader system that has gained popularity in the Pacific Northwest over the last dozen years (Long, L.E., 2001). The Steep Leader is an adaptation of the open vase system used by growers throughout the U.S. for many years. It is best suited for low to moderate density orchards

on full-size rootstock although it has been successfully adapted to dwarfing rootstocks as well. On full size rootstocks it is possible to produce moderately large crops of large, good-quality cherries by the seventh or eighth leaf, but with full size rootstocks production usually does not begin until the fifth or sixth leaf. 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.

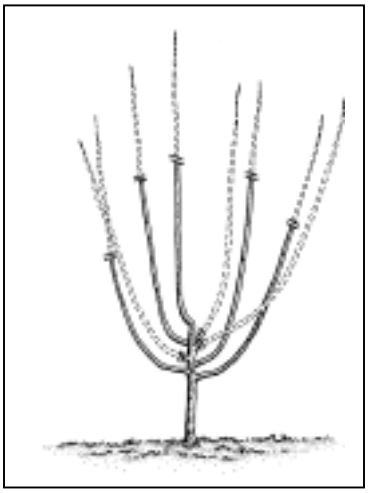
At planting



Head Whip

Trees should be planted 5 to 6 meters apart in the row and 5.5 to 7 meters between rows if on a full size rootstock. Tree spacing also depends on soil vigor, terrain, equipment size, and manager‘s skill level. At planting head whip 80 to 100 cm above the ground. Use toothpicks or clothespins to establish wide branch angles.

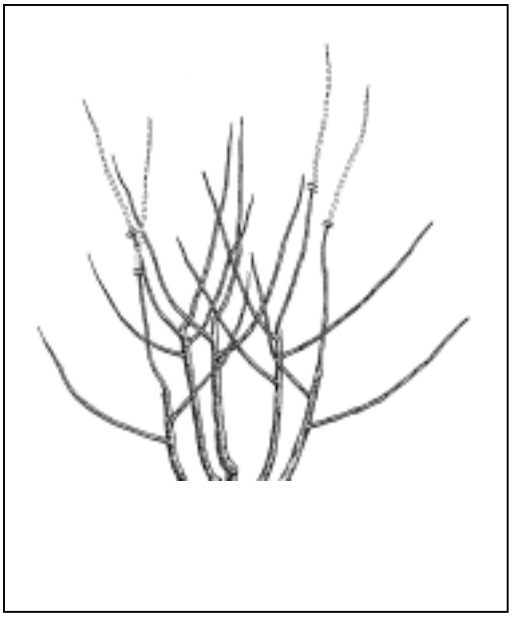
First dormant season



Select leaders

Select three permanent leaders if in-row spacing is less than 6 meters. Otherwise, select four well distributed leaders. 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.

Head leaders 60 to 80 cm from the trunk to encourage branching and establish a permanent bottom whorl.



Second dormant season or spring second leaf