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Sweet cherry rootstocks

for the Pacific Northwest

Lynn E. Long and Clive Kaiser

All commercial sweet cherry trees are either budded or grafted. The part of the tree above the graft/bud union is known as the *scion* and the part below the graft/bud union is known as the *rootstock*. Sweet cherry scion cultivars have been selected over millennia for many reasons, but over the past century, breeding programs have concentrated mainly on achieving improved characteristics such as yield, taste, fruit size, fruit firmness, fruit color, precocity, and resistance to fruit cracking and disease. In contrast, rootstock cultivars have only recently received attention.

Indeed, it is believed that 'Mazzard' seedlings were first used as sweet cherry rootstocks more than 2,400 years ago by early Greek and Roman horticulturists. The fact that 'Mazzard' continues to be used widely throughout the Pacific Northwest (PNW) is testimony to the success of this seedling variety as a rootstock. Over the past few decades, however, several new rootstocks have gained prominence, offering important attributes lacking in 'Mazzard'. Many of these new semi-dwarfing rootstocks, although reducing tree vigor, may impart some disease resistance, induce precocity, and enable growers to harvest premium-quality fruit from high-density orchards. Furthermore, full production may now be achieved on these semi-dwarfing rootstocks within five or six years, compared to similar trees on 'Mazzard', which may take up to twelve years to reach full production.

This publication presents the current level of understanding of the major cherry rootstocks and links it to their performance in the PNW.

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Sweet cherry trees on dwarf and standard rootstocks.

Graft Compatibility

For millennia, it has been known that 'Mazzard' rootstocks are compatible with all sweet cherry scion cultivars, and even in modern times, no evidence exists to contradict this statement. Since the end of the eighteenth century in France, 'Mahaleb' was also used as a cherry rootstock. This was due in part to the partial dwarfing effect that it imparts on cherry scions when compared to 'Mazzard'. In the mid-nineteenth century 'Mahaleb' became popular in the United States, and by the early 1900s it was the most popular cherry rootstock, due mainly to its ease of propagation from seed and its resistance to some diseases when compared to 'Mazzard'. However, by the mid-1920s 'Mahaleb' was found to be incompatible with several scion cultivars, resulting in premature tree death, and 'Mazzard' again became the rootstock of choice.

Some modern-day rootstocks have been shown to be incompatible with some scion cultivars—for example, 'Weiroot 13' in combination with several scion cultivars, and 'Colt' in combination with either

Lynn E. Long, Extension horticulturist, Wasco County Extension, Oregon State University. Clive Kaiser, Extension horticulturist, Umatilla County Extension, Oregon State University.

'Sam' or 'Van'. At this time there have been no reports of scion incompatibility with any of the commercially available 'Gisela' rootstocks, including '5,' '6' and '12'.

Cold Hardiness

Cold hardiness is a complex physiological attribute, and findings from cherry rootstock research trials around the world are inconsistent. Indeed, one of the main confounding problems is that damage to scion bud wood in fall is due to incomplete acclimatization of the trees. This in turn results in poor winter hardiness as well as damage to the trees in early spring as trees break dormancy too early in the year. That said, multiple studies have shown that many scion cultivars grafted onto 'Mahaleb' rootstocks will acclimatize earlier in fall/winter than on other rootstocks. The parent material of the 'Gisela' rootstocks, *P. cerasus* and *P. canescens*, are both hardier than 'Mazzard' and impart that hardiness to the three 'Gisela' rootstocks currently available in the United States. 'Colt' is perhaps the only rootstock used in the United States that is less hardy than 'Mazzard'.

Flowering and Fruiting Habit

Cherry trees produce only simple buds—that is, only one (solitary) bud per node—and each bud may be either vegetative or floral. Vegetative buds on one-year-old wood may either develop into shoots or remain dormant. In subsequent years, these dormant vegetative buds may become spurs. In other words, spurs are only formed on wood that is two years of age or older. Spurs can remain productive for up to ten years if they enjoy adequate light interception.

Floral buds may contain up to five flowers per bud, and they develop either from an axillary (lateral) bud on one-year-old shoots or an axillary bud of a spur. Where axillary buds on one-year-old wood become floral, flowers will either abort or produce terminal fruit. In either case, this will result in blind wood in subsequent years. Where numerous axillary buds on a one-year-old shoot become floral, this will result in the entire shoot having blind wood that supports neither leaves nor fruit. Some cultivars such as 'Tieton', 'Lapins' and 'Sweetheart' have a greater propensity for the production of entire shoots of blind wood than do other cultivars.

Many of the new semi-dwarfing rootstocks change the fruiting habit of the tree, resulting in increased flower density and greater numbers of spurs on the trunk and in the center of the tree. Unfortunately, however, semi-dwarfing rootstocks are prone to setting solitary (axillary) flower buds on one-year-old wood, which results in blind wood.

Frost and Bloom

Although trees on productive rootstocks are at least as sensitive to frost as those on standard rootstocks, the former will often produce more fruit after a severe frost due to initially higher flower counts. Furthermore, in situations where no frost protection is in place, flowers closest to ground level are affected worse than those furthest from the ground. Consequently, where spring frosts occur during flowering, and artificial heating of the orchards does not take place, fruit set on semi-dwarfing rootstocks will be more severely affected than on non-dwarfing rootstocks, simply because the non-dwarfing trees are taller and the flowers are further from the ground. Given the fact that cherries are such a high-value crop, it is advisable to install propane heaters and fans to protect the flowers during spring frosts.

Growth Habit and Size

Many of the new rootstocks are also size-controlling. However, the degree to which a tree is dwarfed depends not only on the rootstock but also on scion cultivar selection, soils, pruning severity and training system choice.

When coupled with 'Bing', 'Gisela 12' is more dwarfing than 'Gisela 6'. However, a 'Regina'/'Gisela 12' combination produces a tree that is approximately 10 percent larger than 'Regina'/'Gisela 6'. Other varieties appear to exhibit similar influences, but observations are inconclusive at this time.

The site or location can also play a role in the relative size of the tree. For example, in the eastern United States, 'Gisela 6' produces a tree that is only 60 percent the size of a standard tree, whereas in the PNW it produces a more vigorous tree growing to 90 percent of full size. Soil type and growing conditions probably play a role in this discrepancy. Likewise, 'Maxma 14' grows more vigorously in the rich soils of the PNW than in the calcareous soils of southern France. Similarly, 'Colt', released in Europe as a semi-dwarfing rootstock, was found to produce a full-size tree on irrigated sites in the PNW.

'Gisela 5' is the most dwarfing commercially grown rootstock in the PNW, reducing the tree to approxi-

mately 50 percent that of standard size. Indeed, research undertaken by the sweet cherry research lab at Washington State University found that 'Gisela 5' and 'Gisela 6' had, respectively, 45 percent and 20 percent lower-trunk cross-sectional areas after seven seasons when compared to 'Mazzard'.

Knowing that a rootstock will decrease tree size to 50 or 90 percent of the size of a standard tree can be helpful; however, it doesn't tell the whole story. For example, with proper pruning and training system influence, a tree on 'Gisela 6' can easily be maintained at a height of only 8 feet. When severely pruned, many of the productive rootstocks such as the 'Gisela' and 'Krymsk' series respond with moderate, controlled growth, whereas a tree on 'Mazzard' will become invigorated through the growth of water-sprouts. This moderate response, in conjunction with a naturally wider branch angle, makes trees on many of these productive rootstocks much easier to manage.

Anchorage

Although typically grown without support, trees on 'Gisela 6' and sometimes 'Gisela 5' will often tilt away from the prevailing winds. This is especially true for the more top-heavy central leader trees. Support, through stakes or a trellis system, may be beneficial with these two rootstocks. Anchorage seems to be adequate for all other rootstocks.

Planting Depth

Although scion rooting has been noted in limited cases, it does not seem to be as serious or as prevalent in cherries as in apples where the benefits of the rootstock are lost. Nevertheless, except for trees grown on 'Mazzard' rootstock, it is wise to plant the graft union several inches above the soil level in order to prevent scion rooting.

Root Suckers

Most commercial cherry rootstocks used in the PNW express limited to no root suckering. Occasionally, depending on the conditions, 'Mazzard' can show low levels of suckering. This has also been observed with 'Krymsk 5' and several of the 'Weiroot' clones such as 'Weiroot 158'. To date, however, this has not been a problem with other cherry rootstocks.

Yield and Fruit Quality

One of the main advantages of the semi-dwarfing rootstocks is precocity when compared to traditional rootstocks. Indeed, research results from the sweet cherry research laboratory at Washington State University, comparing 'Bing' on 'Mazzard', 'Gisela 5' or 'Gisela 6', found that after seven seasons, 'Bing' grafted on 'Gisela 6' were the most productive, yielding between 13 and 31 percent more than those on 'Gisela 5', and 212 to 657 percent more than those on 'Mazzard', depending on the year. Both 'Gisela' rootstocks improved precocity compared to 'Mazzard', bearing fruit in year 3 in the orchard.

Bacterial Canker

Bacterial canker, caused by *Pseudomonas syringae*, is a pathogen of sweet cherries found in all cherry production areas around the world. Infection rates of 50 to 80 percent have been reported in some of the wetter regions of the PNW, such as the Willamette and Hood river valleys in Oregon. Even in the drier regions of Central Washington and Oregon, infection and mortality rates can approach 10 percent or more in some years.

The *P. avium* clone F 12/1 has shown tolerance to this pathogen. Therefore it is used in the Willamette Valley as a high-budded stock in order to slow down or stop a branch infection before it infects the trunk and threatens the entire tree. In this situation, the stock is grown out to the point of branching and scion wood is budded onto the branches of the rootstock.

Reports from the literature (Spotts et al., 2010) as well as limited grower experience would indicate that 'Colt' rootstock shows greater tolerance to the disease than 'Mazzard', while 'Krymsk 5' shows greater to similar tolerance to the disease than 'Mazzard'. Additionally, trees grown on 'Gisela 6' were less tolerant than 'Mazzard'.

Virus Susceptibility

Prune dwarf virus (PDV) and prunus necrotic ringspot virus (PNRSV) are commonly found in mature orchards throughout the PNW. Most strains of these two viruses show few if any symptoms when trees on 'Mazzard', 'Mahaleb' or 'Colt' rootstocks are infected. However, some of the newer rootstocks, such as 'Gisela 7' and 'Weiroot 158', show varying degrees of sensitivity to one or both of these viruses

when inoculated in a controlled trial (Lang et al., 1998). In this same trial, 'Gisela 5', '6' and '12' were shown to have varying levels of tolerance to these two viruses, with only a slight reduction in vigor when infected.

Two Russian rootstocks, VSL 2 ('Krymsk 5') and LC 52 ('Krymsk 6'), were found to be hypersensitive to these viruses (personal communication). Much debate has taken place over the past few years concerning the importance of these findings. Since hypersensitive trees die quickly when infected, some scientists believe that hypersensitivity may ultimately be beneficial to an orchard block since infected trees die before the virus can be transmitted to surrounding trees. In addition, a limited number of the hypersensitive 'Gisela 7' trees were planted by PNW growers in the mid-1990s without reports of widespread mortality. However, it would be wise not to plant trees on hypersensitive rootstocks in an interplant situation among mature trees or close to blocks of older trees that may be infected with one or both of these viruses.

Choosing the Right Rootstock

Several factors must be taken into account when selecting rootstocks for a new orchard (Table 1). Soil fertility, scion cultivar choice and desired training system are some of the more important aspects. In most cases you will want to avoid the most dwarfing rootstocks, such as 'Gisela 5' and 'Krymsk 6', where soils are shallow or low in fertility. Other productive rootstocks such as 'Gisela 6', 'Krymsk 5' or even 'Maxma 14' may perform more satisfactorily on these sites, but higher planting densities should be considered where soils are poorest. In addition, it is best to avoid planting 'Mahaleb' rootstocks in heavy soils. 'Mahaleb' will do poorly under these conditions, and will potentially die out, whereas 'Krymsk 5' and '6', although not adapted to wet soils, will survive in heavier soil conditions than 'Mahaleb' or even 'Mazzard'.

Full-size rootstocks such as 'Mazzard', 'Mahaleb' and 'Colt' are best suited to standard-density orchards of 120 to 160 trees per acre. However, when trained as a Spanish bush or modified Spanish bush (KGB), all three of these rootstocks may be grown at densities of between 300 and 340 trees per acre. Commercial plantings at these higher densities, in the PNW as well as in Australia and Spain, have proven successful using these training systems. Due to the increased vigor of these rootstocks, a spindle or central leader system is usually not recommended since these trees tend to grow very tall. Furthermore, scion cultivars of low productivity, such as 'Regina' and 'Tieton', have not produced satisfactory yields on these rootstocks.

Most modern-day rootstocks such as 'Gisela 6', 'Gisela 12', 'Krymsk 5' and 'Krymsk 6' are semi-dwarfing, resulting in trees ranging in size between 'Gisela 5' and the grouping of 'Mazzard', 'Mahaleb' and 'Colt'. Soil depths of 3 feet to greater than 5 feet are normally recommended for semi-dwarfing rootstocks. On shallower soils it is necessary to increase the tree density. All of the semi-dwarfing rootstocks are well suited to the modern training systems grown in the PNW. Although 'Maxma 14' is precocious, it produces a full-size tree and is therefore not recommended for some of the higher-density systems such as the UFO (upright fruiting offshoots) system or single leader trees such as the Vogel central leader.

The moderately vigorous rootstocks are also more widely adapted to and grow well with most variety combinations. It is true that the most productive varieties such as 'Sweetheart' and 'Lapins' can be a challenge with any size-controlling rootstock, but even with these combinations, growers have been successful at consistently growing high-quality fruit. The key is to pay close attention to pruning principles (see PNW 592) and to perform required procedures in a timely fashion. While productive varieties can be challenging, these moderate size-controlling rootstocks are just right for varieties of lower productivity such as 'Regina' and 'Tieton', and perform well with moderately productive varieties such as 'Bing', 'Skeena' and 'Benton'.

'Colt' (*P. avium* x *P. pseudocerasus*)

'Colt' was released by the research station in East Malling, England, in the 1970s as a semi-dwarfing rootstock. However, in the irrigated orchards of the PNW it produces a vigorous tree that is similar in size to 'Mazzard' with similarly low precocity. In addition, 'Colt' is sensitive to droughty soils and to cold winter temperatures.

'Colt' has been widely planted in California due to its resistance to cherry stem pitting, a debilitating virus disease readily found in that state. It has also shown resistance to *Phytophthora* root rot, bacterial canker and gopher damage, but is susceptible

to crown gall. In the PNW, 'Colt' performs well in replant situations where cherries follow cherries on non-fumigated sites (Long, 1995).

'Gisela 5' (*P. cerasus* x *P. canescens*)

Although it is the most popular rootstock in Germany and other parts of Europe, 'Gisela 5' has failed to gain widespread acceptance in the PNW. It is the most dwarfing rootstock currently available commercially in the United States. In the PNW, 'Gisela 5' is known to reduce vigor by up to 50 percent or more compared to 'Mazzard' seedlings. The medium-low vigor of this rootstock coupled with very high fruit production has caused fruit size and quality issues. This problem is accentuated when 'Gisela 5' is combined with productive cultivars such as 'Lapins' and 'Sweetheart'. When properly pruned and grown on deep, fertile soils, it may be suitable for very high-density plantings of 400 to 800 trees/acre and is probably best suited to spindle systems such as the Vogel central leader, or to the UFO system developed at Washington State University.

More than any other commercial rootstock, 'Gisela 5' tends to advance both flowering and fruit ripening by two to four days, a potential advantage for early-ripening cultivars where an early harvest window provides higher returns. This may, however, be disadvantageous in a frost-susceptible site or when the harvest of a late-ripening cherry is advanced.

'Gisela 5' produces trees that are open and spreading with wide branch angles, but branching may be sparse. Anchorage is usually adequate, but some growers have taken the precaution to support the tree. Some suckering may occur, depending on growing conditions, but this is usually not a problem. Trees on 'Gisela 5' rootstock have shown good winter hardiness, and scion compatibility has not been an issue.

'Gisela 5' does not perform well in heavy soils and needs good drainage. Trees show sensitivity to replant stress so should only be planted on virgin sites or where the soil has been properly treated with fumigants prior to planting.

'Gisela 6' (*P. cerasus* x *P. canescens*)

'Gisela 6' is the most popular rootstock for new plantings in Oregon. Even though it is a relatively vigorous rootstock, it is easy to manage. Recommended planting densities are 300 to 500 trees per acre. Although it

Table 1. Planting parameters for various commercially available cherry rootstocks

Variety	Best suited for...					
	super high density	moderately high density*	low density*	shallow or poor soils	low-productive varieties	highly productive varieties
'Colt'	No	No	Yes	Yes	No	Yes
'Gisela 5'	Yes	No	No	No	Yes	No
'Gisela 6'	No	Yes	No	At higher densities	Yes	Needs proper management
'Gisela 12'	No	Yes	No	At higher densities	Yes	Needs proper management
'Krymsk 5'	No	Yes	No	At higher densities	Yes	Needs proper management
'Krymsk 6'	Needs proper management	Yes	No	At higher densities	Yes	Needs proper management
'Mahaleb'	No	No	Yes	Avoid heavy soils	No	Yes
'Maxma 14'	No	Yes	No	At higher densities	Yes	Needs proper management
'Mazzard'	No	No	Yes	Yes	No	Yes

*See text

exhibits medium-high vigor, it is also very precocious, producing harvestable crops by the third leaf with full production possible by the fifth leaf. Due to these high production levels, trees on 'Gisela 6' need to be properly pruned from an early age in order to maintain fruit size and quality. Premium fruit quality is possible with cultivars of moderate to low productivity, such as 'Bing', 'Skeena' and 'Regina', but more difficult with very productive cultivars. As with all size-controlling rootstocks, it is imperative to maintain adequate levels of vigor in order to produce high-quality fruit. The production of new shoots is much easier to achieve with 'Gisela 6' compared to 'Gisela 5' and is one of the reasons for the popularity of this rootstock.

'Gisela 6' tends to advance flowering and fruit ripening only slightly compared to 'Mazzard'. Trees are open and spreading with good branching. Anchorage can be a problem, especially on windy sites, although most growers in the PNW do not provide support.

'Gisela 6' is well suited for a wide range of soil types from light to heavy; however, good drainage is essential. Trees grown on this rootstock have not been prone to suckering and scion compatibility has been good.

'Gisela 12' (*P. cerasus* x *P. canescens*)

Tree vigor and size on 'Gisela 12' is variable depending upon cultivar combination. Several years of testing in The Dalles, Oregon, and in Prosser, Washington, indicated that when combined with 'Bing', 'Gisela 12' produced a tree intermediate in size to 'Gisela 5' and '6'. However, grower experience with 'Regina' indicates that 'Gisela 12' produces a tree approximately 10 percent larger than 'Gisela 6'. For this reason some growers prefer a 'Regina'/'Gisela 12' combination as they find it easier to maintain shoot growth and ultimately fruit size.

'Gisela 12' is both precocious and productive, producing early heavy crops, with full production possible by the fifth leaf. Good fruit size and quality are possible with proper pruning.

'Gisela 12' is adapted to a wide range of soils, resists suckering and is well anchored. The tree structure is open and spreading and new branches form readily. Scion compatibility has not been a problem.

'Krymsk 5' (*P. fruticosa* x *P. lannesiana*)

This precocious, semi-dwarfing rootstock originated in the Black Sea region of Russia. Grower experience in the PNW suggests that 'Krymsk 5' is comparable in size to 'Gisela 6' with slightly less precocity and yield. Production of 'Lapins' on 'Krymsk 5' through the eighth leaf in Oregon indicates that premium-quality fruit can be produced consistently on this rootstock when properly managed.

'Krymsk 5' is adapted to a wide range of soil types, with reports that it will grow well in heavier soils than 'Mazzard'. Accounts out of Russia indicate that the rootstock is well adapted to cold climates. In addition,

Table 2. Attributes of various commercially available cherry rootstocks

Variety	Tree size*	Precocity	Advance bloom/ harvest	Compatibility	Root suckers	Anchorage
'Colt'	100	No	No	Good	No	Good
'Gisela 5'	50–60	Yes	2–4 days	Good	No	Fair to good
'Gisela 6'	85–90	Yes	0–1 day	Good	No	Fair
'Gisela 12'	80–100	Yes	No	Good	No	Good
'Krymsk 5'	85–90	Yes	No	Limited data	Moderate	Good
'Krymsk 6'	65–70	Yes	No	Limited data	Moderate	Good
'Mahaleb'	90	Slight	No	Fair to good	No	Good
'Maxma 14'	100	Yes	No	Good	No	Good
'Mazzard'	100	No	No	Good	Low	Good

*Percent of full size

early indications suggest that trees on this rootstock might also perform well in hotter climates, as leaves remain turgid in extreme heat and don't show the characteristic cupping of 'Gisela' trees in hot conditions. Trees are well anchored and do not need support. Low to moderate levels of root suckers can be found growing from the crown, but usually not in the tree row. The tree form is excellent, with wide branch angles.

'Krymsk 6' (*P. cerasus* x (*P. cerasus* x *P. maackii*))
'Krymsk 6' produces a tree that is only 75 to 80 percent the size of 'Krymsk 5' or 'Gisela 12'. In one commercial orchard in Oregon, 'Lapins' fruit size and quality through the eighth leaf on this rootstock has been excellent.

Like 'Krymsk 5', 'Krymsk 6' rootstocks seem to be adapted to both cold and hot climates as well as heavier soils. Trees are well anchored, but there is low to moderate root suckering. Tree form is good, with wide crotch angles. Like 'Krymsk 5', 'Krymsk 6' is sensitive to PDV and PNRSV.

'Mahaleb' (*P. mahaleb*)
'Mahaleb' is slightly more precocious and slightly less vigorous than 'Mazzard' and it is one of the most drought-tolerant cherry rootstocks, having deep-set roots. 'Mahaleb' is, however, extremely sensitive to water-logged soils as well as soils that may be anaerobic for a short time during the winter months. 'Mahaleb' is best suited to deep, well-drained loams and sands as well as the calcareous soils typical of Spain and southern Italy. There, and in similar locales around the world, 'Mahaleb' is the preferred rootstock. In the PNW, 'Mahaleb' rootstocks are generally used only in light, sandy-loam soils and readily die out in ravines and other low-lying areas where water collects.

Incompatibility of some sweet cherry cultivars can be a problem with 'Mahaleb', as this condition has been detected up to six years after planting. 'Chelan' and 'Tieton' have expressed incompatibility symptoms when grown on 'Mahaleb'. In addition, 'Mahaleb' is attractive to gophers. Consequently, control measures must be pursued with diligence.

'Maxma 14' (*P. mahaleb* x *P. avium*)
'Maxma 14' originated in Oregon from an open-pollinated 'Mahaleb' tree. However, it has been most widely accepted in France due to its precocity, semi-dwarfing nature and resistance to iron-induced chlorosis caused by calcareous soils.

Often a change in growing location modifies rootstock characteristics. In a trial conducted in Oregon on loamy soils, 'Maxma 14' rootstock produced a tree larger than 'Mazzard' through the fifth leaf when combined with 'Bing'. For this reason it is not recommended for super-high-density plantings in the PNW. Fruit size was statistically similar, although trending smaller, but production in the fifth leaf was significantly greater with an average of 46 pounds per tree compared to only 2.8 pounds per tree for 'Mazzard'. Due to high yields, trees must be properly pruned each year.

'Maxma 14' shows good scion compatibility and a broad adaptation to soil types and environmental conditions. Very little suckering has been noted.

'Mazzard' (*Prunus avium*)
Growers in the PNW have a long tradition of planting 'Mazzard' rootstock. It is well adapted to PNW soils, it is winter hardy, and due to the fact that it is the same species as sweet cherry, there have been no cases of incompatibility. In addition, due to high vigor and moderate productivity, premium fruit quality can be obtained with only moderate inputs in pruning and management.

Unfortunately, it lacks precocity, often not coming into production until the fifth or sixth leaf or into full production until the twelfth leaf. Vigorous growth makes it difficult to control in high-density plantings, and the large tree size reduces picker efficiency and increases the hazards associated with harvest.

'Mazzard' does well in a wide range of soils from sandy-loam to clay-loam. However, as with other cherry rootstocks, it does not perform well in poorly drained or wet soils. Root suckers are usually not a problem except in limited situations.

F 12/1 (*P. avium*)
F 12/1 is a vegetatively propagated selection of 'Mazzard' used in many locations around the world instead of the seedling-propagated 'Mazzard'. Western Oregon growers prefer F 12/1 to 'Mazzard' due to its resistance to bacterial canker. The F 12/1 rootstock forms the trunk from the branch union down and the scion is budded onto each lateral branch. The bacteria-resistant rootstock slows the progression of

canker infection that develops on the branches and hinders the infection from proceeding to the trunk.

Many nurseries, however, prefer not to grow this selection due to sensitivity to crown gall caused by *Agrobacterium tumefaciens*. F 12/1 is more vigorous than 'Mazzard' seedling in many locations where it is grown.

Summary

Unfortunately, no one rootstock can satisfy all the requirements for consistently producing copious amounts of large, firm fruit of premium quality. Growers are strongly advised to consider carefully the effects of each specific rootstock/scion combination as a function of environmental and cultural practices when replanting an orchard (Tables 1 and 2). Selecting the proper rootstock depends not only on the management skills of the grower but also on the scion cultivar, training system and site selected for the orchard. Furthermore, it is often possible for semi-dwarfing cherry rootstocks to be highly productive. However, when these rootstocks are combined with productive scion cultivars, it can lead to an over-cropping situation. In addition, productive scion/rootstock combinations are only recommended for fertile soils. For more information about the attributes of specific cultivars, please see PNW 604, "Sweet Cherry Cultivars for the Fresh Market."

Semi-dwarfing rootstocks do, however, have major economic advantages. A recent study conducted among several Oregon growers (Seavert and Long, 2007) found that growers could recover their entire cost of establishment in eight years with a high-density orchard on productive rootstocks, compared to fifteen years for a standard-density orchard on 'Mazzard' rootstock.

The development of these new semi-dwarfing, precocious rootstocks has been almost as significant to the sweet cherry industry as to the apple industry several decades ago. When compared to 'Mazzard', 'Colt' and even 'Mahaleb', size-controlling rootstocks have allowed sweet cherry growers an opportunity to plant high-density, pedestrian orchards that afford high early yields, easier management and a safer and more productive working environment.

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