



# Cherry Rootstocks for the Modern Orchard

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Traditional rootstocks for commercial cherry production include Mazzard and Mahaleb. These rootstocks support a moderate crop load, and with routine care, a proper leaf to fruit ratio is generally easy to maintain. However, none of them confer precocity, and all can be very vigorous, making plantings more difficult to manage and harvest.

Growers today have the advantage of many fully- or semi-dwarfing rootstocks that offer precocity, allow for high-density plantings, and bring a faster return on investment. These precocious rootstocks include the Gisela® series, the Krymsk® series and MaxMa 14®, among others.

Five sour cherry rootstocks from Michigan State University are still under evaluation, but have significant potential to transform cherry growing practices.

All of these precocious rootstocks make high-density plantings possible and enable new systems that are easily trained, easily pruned and more easily harvested. Higher early returns and more sustainable yields through maturity are also possible. In many cases labor demands are reduced and efficiencies are increased.

## **SUMMARY OF ROOTSTOCK ATTRIBUTES**

With the exception of the MSU rootstock

series mentioned above and two new Gisela® rootstocks, all of these rootstocks have been grown commercially for at least a decade. In that time a great deal has been learned about their attributes.

### **GISELA 3**

*Prunus cerasus Schattenmorelle × Prunus canescens*

Gisela 3 is the most dwarfing of the Gisela series. Although it has gained acceptance by growers in northern Europe, it has not been widely planted in the U.S. or most other cherry production areas of the world. Due to its very dwarfing nature it is recommended for planting only in

VOGEL CENTRAL LEADER TREES GROWING ON FIVE ROOTSTOCKS.





DORMANT PRUNING KGB TREES.

deep, fertile soils. Reports from Germany indicate Gisela 3 provides high early yields and when intensively pruned and managed can produce high-quality fruit.

Trees are free of suckers and produce wide branch angles. Trees should be supported. Gisela 3 is recommended for very high-density plantings such as the Super Slender Axe system. Gisela 3 is particularly well adapted to covered orchards.

### **GISELA 5**

*P. cerasus* x *P. canescens*

Gisela 5 has gained wide acceptance in northern Europe and in the northeastern United States where summer temperatures tend to be relatively cool. However, Gisela 5 has failed to gain widespread acceptance in the major cherry production areas on the west coast of the United States, Chile or other hot summer regions. Gisela 5 produces trees about 50% the size of Mazzard. The medium-low vigor of this rootstock coupled with very high fruit production means that trees must be pruned and managed intensively in order to produce high quality fruit. This issue is

accentuated when Gisela 5 is combined with productive cultivars such as Lapins and Sweetheart. When properly pruned and grown on deep, fertile soils, Gisela 5 may be suitable for very high density plantings, especially when combined with an extremely high-density system such as the Super Slender Axe.

### **GISELA 6**

*P. cerasus* x *P. canescens*

Gisela 6 is the most popular rootstock for new plantings in the Pacific Northwest (PNW) of the U.S. Even though it is a relatively vigorous rootstock, it is easy to manage. Typical planting densities are 300 to 500 trees per acre (740-1235 trees per hectare). Although it exhibits medium-high vigor, it is also very precocious, producing harvestable crops by the third leaf with full production possible by the fifth leaf. High production potential continues on Gisela 6 into maturity, so proper pruning is essential to maintain adequate leaf-to-fruit ratio and good fruit size. High fruit quality is possible with cultivars of moderate-to-low productivity such as Bing, Skeena and Regina, but more difficult with very productive cultivars

such as Lapins and Sweetheart.

Gisela 6 is well suited for a wide range of soil types from light to heavy; however, good drainage is essential. Anchorage can be a problem, especially on windy sites, although most growers in the PNW do not provide support.

### **GISELA 12**

*(P. cerasus* x *P. canescens*

Gisela 12 generally produces a tree with slightly more vigor than Gisela 6 when combined with Regina and several other varieties, but it exhibits slightly less vigor with Bing. Gisela 12 is both precocious and productive, producing heavy early crops, with full production possible by the fifth leaf. Good fruit size and quality is possible with proper pruning.

Gisela 12 is adapted to a wide range of soils and is somewhat better anchored than Gisela 6 although there have been some reports of trees leaning in the wind. The tree structure is open and spreading and new branches form readily. Scion compatibility has not been a problem.



THE VARIETY, ROOTSTOCK AND TRAINING SYSTEM TRIAL BEING PRUNED.

### **GISELA 13**

*Schattenmorelle x P. canescens*

According to information provided by Gisela, Inc., Gisela 13 is similar to or slightly more vigorous than Gisela 6 with about the same yield capacity, although both of these traits varied with the evaluation site. These trees were reported to be well anchored with few root suckers.

### **GISELA 17**

*P. canescens x P. avium*

According to Gisela, Inc. (giselacherry.com), Gisela 17 produces a tree somewhat larger than Gisela 6 or Gisela 13 with a yield potential similar to or somewhat less than Gisela 6. They further reported that Gisela 17 shows somewhat reduced potential to over-crop compared to Gisela 5 or Gisela 6, suggesting this rootstock would do well with the more productive self-fertile cultivars. Gisela 17 is reported to be less demanding as to soil and climatic conditions than Gisela 5 and has performed well in replant sites in Germany.

### **KRYMSK 5**

*P. fruticosa x P. lannesiana*

Krymsk 5 has been used in commercial production in Oregon for more than 10 years. Tree size is similar to Gisela 12 but it is neither as precocious nor as productive. Commercial production of Lapins and Skeena on Krymsk 5 through the twelfth

leaf in Oregon indicates premium quality fruit can be consistently produced on this rootstock when properly managed.

Krymsk 5 is adapted to a wide range of soil types, with reports it will grow well in heavier soils than Mazzard. Accounts from Russia, where this rootstock originates, indicate it is well adapted to cold climates. In addition, it has performed well in the hot climate production regions of the western U.S. Trees are well anchored and do not need support. Low-to-moderate levels of crown suckers have been noted. Trees grafted onto Krymsk 5 rootstock are hypersensitive to prune dwarf virus (PDV) and Prunus necrotic ringspot virus (PNRSV).

### **KRYMSK 6**

*P. cerasus x (P. cerasus x P. maackii)*

Krymsk 6 produces a tree that is only 75 to 80% the size of trees on Krymsk 5 or Gisela 12, so higher density plantings are possible with this rootstock. In one commercial orchard in Oregon, Lapins and Skeena fruit size and quality on this rootstock has been excellent through the twelfth leaf.

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, with low-to-moderate root

suckering. Tree form is good, with wide crotch angles. Like Krymsk 5, Krymsk 6 is hyper sensitive to PDV and PNRSV.

### **MAXMA 14**

*P. mahaleb x P. avium*

Although MaxMa 14 has gained broad acceptance in southern France for its good performance in calcareous soils, it has obtained only moderate acceptance in other production areas globally. A perception by growers in Chile that it provides some resistance to bacterial canker has encouraged growers there to plant MaxMa 14. Some growers in the PNW like its semi-vigorous growth habit and moderate precocity.

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

### **MSU ROOTSTOCK SERIES**

Five sour cherry rootstocks are currently being evaluated in Michigan and the PNW for their ability to serve as sweet cherry rootstocks. The five rootstocks, Cass, Clair, Clinton, Crawford and Lake, have each shown some very interesting characteristics. In all cases these rootstocks are at least as dwarfing as Gisela 5, while Clare produces an even smaller tree. In addition, all rootstocks trend towards more flowers per leader cross-sectional area than Gisela

5 or Gisela 6. However, after two years of trials at Prosser, Washington, fruit size on all rootstocks was similar to Gisela 5 and Gisela 6 (Personal communication, Dr. Amy Iezzoni, Department of Horticulture, Michigan State University).

However, similar fruit size was only obtained in 2012 because pea-sized fruit were thinned by 50%. In 2013 fruit were thinned to achieve standard crop loads for each selection. In many parts of the world, high labor costs would constrain growers from using hand labor to thin flowers or fruitlets. The use of pruning and chemicals could reduce the demand for hand thinning and allow growers to obtain consistently high yields and reduce annual yield fluctuations.

In addition, Lake, Cass and Clare significantly advance fruit ripening by up to one week. For some markets, this may be a considerable advantage, providing growers with higher returns and greater revenue.

**VARIETY, ROOTSTOCK, TRAINING SYSTEM TRIAL**

In order to grow consistently high-quality fruit, these precocious rootstocks must be well matched with the proper scion. A trial was established in The Dalles, Oregon in 2006 with the goal of determining which rootstock, variety and training system combinations produced the best yields of high-quality fruit.

The first objective of this work was to assess the influence of three training systems on fruit yield and quality of Bing, Regina and Sweetheart trees. Training systems included 1) a multi-leader bush (Kym Green Bush (KGB)), 2) a spindle system (Vogel Central Leader (VCL)) and 3) a tri-axe system (Steep Leader (SL)). The second objective was to determine the influence on yield and fruit quality of up to five different rootstocks on Bing, Regina and Sweetheart trees. The final objective was to evaluate the influence of the interaction of these cultivars, rootstocks and training systems on yield and fruit quality.

Regina scion-wood was budded onto Mazzard, MaxMa 14, Gisela 6, Krymsk 5 and Krymsk 6 and planted in a commercial orchard in 2006 in The Dalles, Oregon, USA. Bing was budded onto rootstocks Mazzard, MaxMa 14 and Gisela 6. Sweetheart was budded onto rootstocks Mazzard, MaxMa 14, Gisela 6 and Krymsk 5. Each variety-rootstock combination was

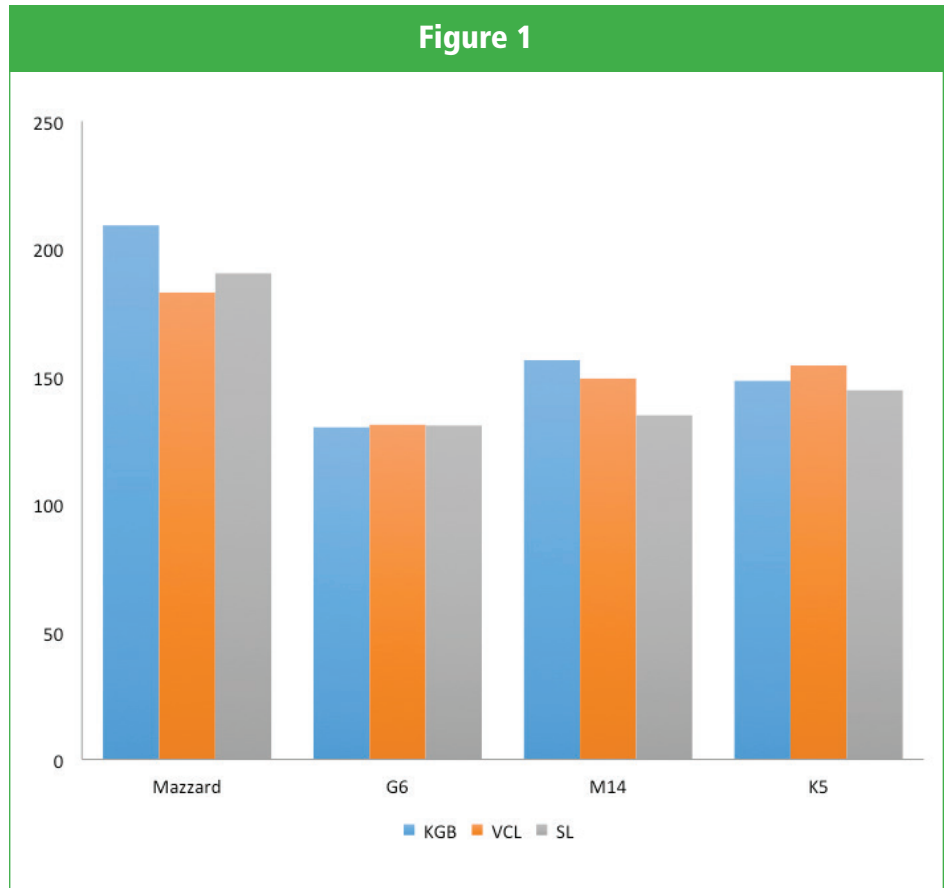


FIGURE 1 – RELATIVE TREE SIZE OF SWEETHEART GROWN ON FOUR ROOTSTOCKS AND TRAINED TO THREE SYSTEMS AS EXPRESSED BY TRUNK CROSS SECTIONAL AREA (CM<sup>2</sup>).

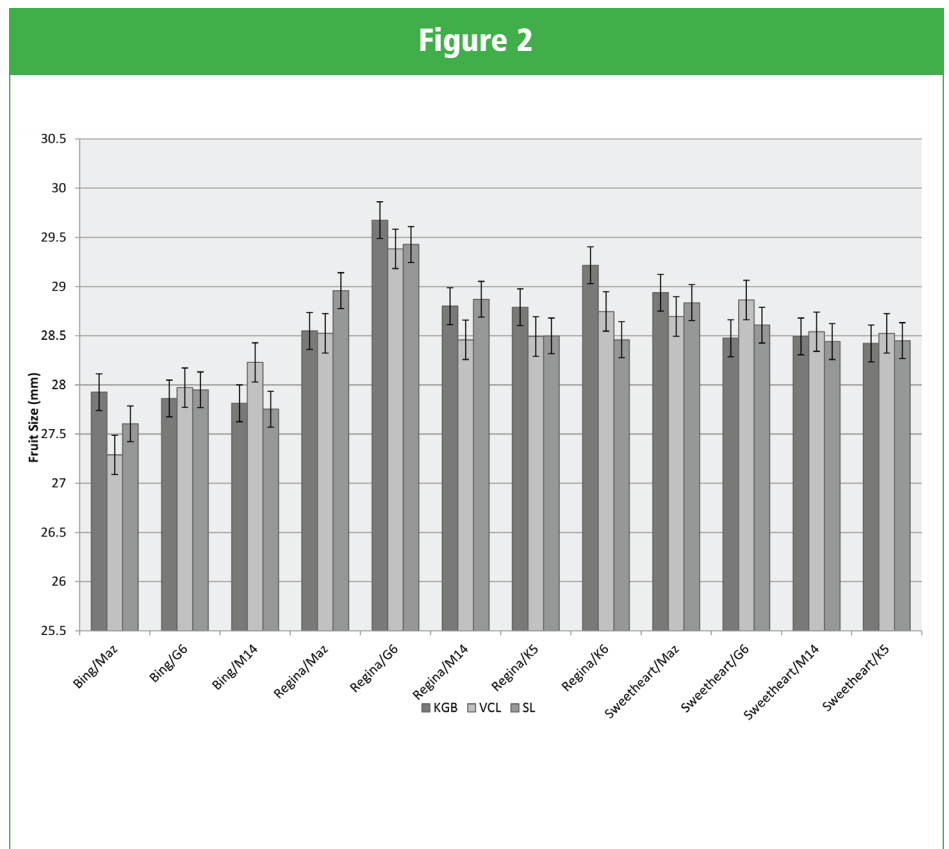
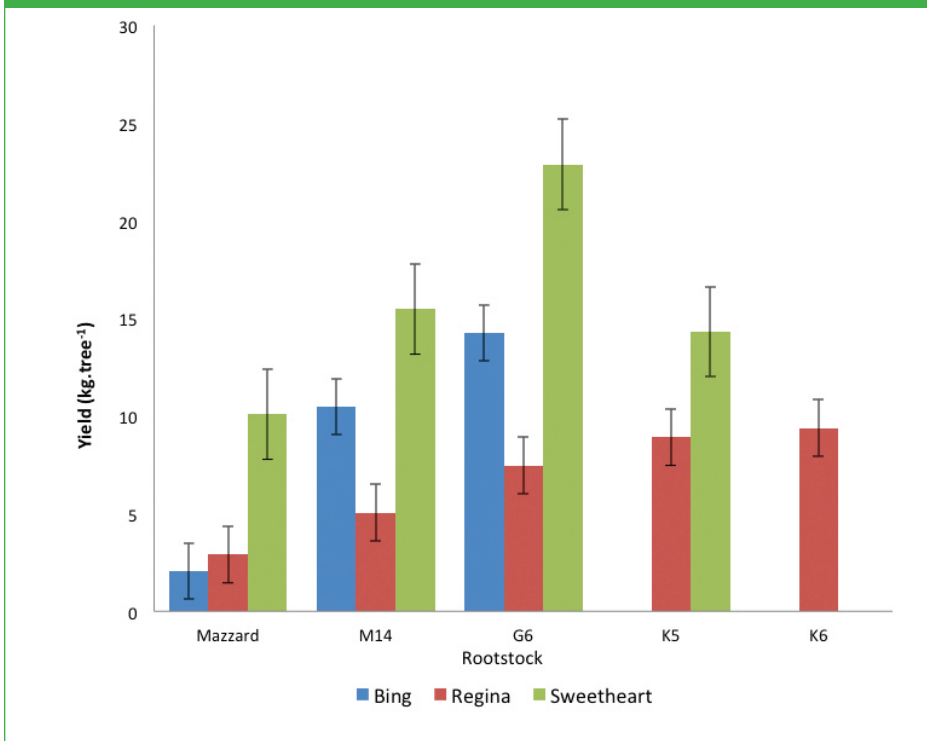


FIGURE 2 – FRUIT SIZE ON ALL TRAINING SYSTEMS, BING, REGINA, AND SWEETHEART 4TH THROUGH 7TH LEAF.

**Figure 3**



**FIGURE 3 – AVERAGE PER TREE FOURTH THROUGH SIXTH LEAF YIELD OF THREE VARIETIES COMBINED WITH FOUR ROOTSTOCKS.**

trained to each of three systems: the KGB, VCL and SL.

**TREE SIZE**

When combined with Sweetheart, Mazzard produced the largest trees with all training systems (Fig. 1). Krymsk 5, MaxMa 14 and Gisela 6 produced trees that were relatively similar in size with Gisela 6 trending slightly smaller than other rootstocks.

**YIELD AND FRUIT SIZE: SELECT A ROOTSTOCK TO MATCH THE VARIETY AND TRAINING SYSTEM**

**Regina.** With a variety of lower productivity, such as Regina, it is important to choose rootstocks and training systems to maximize productivity. Our trials showed that Regina grafted to any of the rootstocks produced fruit of the highest quality (Fig. 2).

The five rootstocks evaluated in this trial with Regina produced the largest fruit on the following systems (Fig. 2):

- Mazzard SL
- Gisela 6 KGB
- MaxMa 14 KGB, SL
- Krymsk 5 KGB
- Krymsk 6 KGB

The greatest yields were from Regina on Krymsk 6, Krymsk 5 and Gisela 6. Com-

pared to Mazzard the following rootstocks, through the sixth leaf, produced as follows (Fig. 3):

- 3.2 times greater yield on Krymsk 6;
- 3.1 times greater yield on Krymsk 5;
- 2.6 times greater yield on Gisela 6; and
- 1.7 times greater yield on MaxMa 14.

**Bing** is a variety of moderate productivity with yields intermediate between the low-yielding Regina and the high-yielding Sweetheart. Highest yields were obtained on Gisela 6 rootstock (Fig. 3).

The three rootstocks evaluated in this trial with Bing produced the largest fruit on the following systems (Fig. 2):

- Mazzard KGB
- Gisela 6 KGB, VCL, SL
- MaxMa 14 VCL

Overall Gisela 6 was the best rootstock selection to provide a good balance of yield and fruit size. Compared to Mazzard the following rootstocks, through the sixth leaf, produced as follows:

- 6.9 times greater yield on Gisela 6;
- 5.1 times greater yield on MaxMa 14.

**Sweetheart** is a highly productive variety, and proper pruning is critical on any rootstock to obtain a balanced leaf-to-fruit

ratio and high-quality fruit. On Gisela 6 rootstock, Sweetheart bore fruits of excellent size (Fig. 2).

The four rootstocks evaluated in this trial with Sweetheart produced the largest fruit on the following systems (Fig. 2):

- Mazzard KGB, VCL, SL
- Gisela 6 VCL, SL
- MaxMa 14 KGB, VCL, SL
- Krymsk 5 KGB, VCL, SL

Overall Gisela 6 was the best rootstock selection to provide a balance of yield and fruit size. Compared to Mazzard the following rootstocks, through the sixth leaf, produced as follows:

- 2.3 times greater yield on Gisela 6;
- 1.5 times greater yield on MaxMa 14;
- 1.4 times greater yield on Krymsk 5.

Although Gisela 6 produced greater quantities of high-quality fruit compared to the other rootstocks, Sweetheart on Gisela 6 is a challenging combination for many growers. The production of consistently high-quality fruit is made difficult by the productive nature of both the scion and rootstock. Both MaxMa 14 and Krymsk 5 provide greater precocity than Mazzard while more easily maintaining the proper leaf-to-fruit ratio than Gisela 6.

**SUMMARY**

With productive rootstocks, the importance of proper training and pruning cannot be overemphasized. If mismanaged, trees can quickly become imbalanced, producing small, poor quality fruit. However, when properly managed, all of these precocious rootstocks can provide early high yields of premium quality fruit. This research helps to identify the best combinations of variety and training system for a number of important, precocious rootstocks.

**ACKNOWLEDGEMENTS**

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**ADDITIONAL RESOURCES:**

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