

Citrus Production Guide: Rootstock and Scion Selection¹

Ute Albrecht, Fernando Alferez, and Mongi Zekri²

When preparing for replanting, an important factor to consider is the choice of rootstock. Choosing the right rootstock and scion combination can result in higher economic returns without any additional cost. Rootstocks affect scion vigor, yield, fruit size, juice quality, and pest tolerance. However, tree growth, yield, and fruit quality interact strongly with climate, soil type, tree spacing, and other factors, often producing contradictory reports on rootstock performance in different areas.

Rootstock selection should be based on soil adaptability, soil pH, pest and disease pressure, desired tree spacing and size control, and other characteristics. Several new rootstock selections were recently released, but not much information exists on their long-term performance under different environmental conditions and different commercial management. Many of these new rootstocks are currently being evaluated under the Fast Track program and it is anticipated that new information will be available in the near future. Also important is the choice of scion to be used in combination with the selected rootstock. Several novel scion varieties have been released by the breeding programs at the USDA and the University of Florida. These novel varieties are expected to have better field performance (disease tolerance) and better fruit quality, making some of them suitable for the fresh fruit market. Check <http://nvdmc.org/fasttrack.html> for the newest information on rootstocks and scions released under this program.

Soil Characteristics

Choosing the right rootstock for your soil type is critical. Rootstocks performing satisfactorily on the well-drained sandy soils of the central Florida ridge may not be suitable for the wet “flatwoods” soils of the southwest and eastern Florida production areas. Equally important is the ability to better tolerate conditions of high pH and salinity. Unfortunately, few rootstocks have shown to be as adaptable to suboptimal soil conditions as sour orange. Although Cleopatra is able to tolerate conditions of higher salinity and alkalinity better than most rootstocks, it is not well suited for poorly drained soils. Also suitable for high pH or calcareous soils is Volkamer lemon. Rootstocks such as C-35, Carrizo, and Swingle are amongst the rootstocks performing most poorly in the presence of high pH and salinity. Thus far, little is known regarding the impact of soil type on the performance of the newer rootstock cultivars.

Rootstock Effects on Pests and Diseases

A lot of the newer rootstock cultivars are of partially trifoliolate origin, therefore inheriting some degree of tolerance to Phytophthora. In respect to the Phytophthora/Diaprepes root weevil complex, US-802, US-897, US-942, and UFR-1 are more tolerant in comparison with other rootstocks. Unfortunately, damage from Phytophthora is exacerbated in roots already compromised by HLB. Although thus far

1. This document is HS1308, one of a series of the Horticultural Sciences Department, UF/IFAS Extension. Original publication date September 2017. Visit the EDIS website at <http://edis.ifas.ufl.edu>.

2. Ute Albrecht, assistant professor; Fernando Alferez, assistant professor, Horticultural Sciences Department, UF/IFAS Southwest Florida Research and Education Center, Immokalee; and Mongi Zekri, Extension agent IV, UF/IFAS Extension Hendry County; UF/IFAS Extension, Gainesville, FL 32611.

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution authorized to provide research, educational information and other services only to individuals and institutions that function with non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. For more information on obtaining other UF/IFAS Extension publications, contact your county's UF/IFAS Extension office.

U.S. Department of Agriculture, UF/IFAS Extension Service, University of Florida, IFAS, Florida A & M University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Nick T. Place, dean for UF/IFAS Extension.

no rootstock has shown to induce desired levels of tolerance to HLB, trees grown on some of the newer rootstock cultivars produce good yields under high HLB pressure and exhibit lower than average rates of fruit drop. These rootstocks include US-942, US-802, US-1516, and UFR-4. Whereas most of the newer available rootstocks are tolerant to citrus tristeza virus, little is known regarding tolerance to blight, except for US-896, US-812 and US-942, which are considered tolerant to this disease.

Tree Spacing and Size

Trees should be spaced based on the expected size of the tree and lifespan of the grove. A more densely planted grove may provide earlier economic returns despite an initially higher investment. US-897, C-22, and UFR-6 rootstocks produce relatively small size trees, which should be spaced at 6-8 feet within the row and 15 feet between rows. The only rootstock producing an even smaller tree size is Flying Dragon, allowing for an in-row spacing of only 5-7 feet as well as closer between-row spacing, if feasible. Quality of fruit on these small tree-size inducing rootstocks is usually high compared with some of the more vigorous rootstocks. Most of the other available rootstocks will induce trees of average size with a recommended spacing of 8-12 feet that produce fruit of intermediate to high quality. If the desired grove architecture is for a larger in-row spacing of trees (12-15 feet), rootstocks such as US-802, Volkamer lemon, and Cleopatra mandarin are an appropriate choice. The high vigor of these rootstocks may be advantageous in that they allow a tree to better cope with the damaging effects of HLB compared with less vigorous trees. Although yield will be high on these rootstocks, fruit quality will generally be lower, which may be disadvantageous when used in combination with some of the scion varieties that have poor quality juice.

Rootstock/Scion Combination

Choice of rootstock will also depend on the scion variety selected for the new planting. An excellent example is sour orange which is susceptible to tristeza virus only when used in combination with sweet orange. Therefore, sour orange is now predominantly used for production of grapefruit and lemon cultivars. Most of the more recently released rootstocks have been evaluated in combination with only few selected scion varieties. Field trials involving different scion/rootstock combinations that include new releases are under evaluation and it is expected that new information on compatibility and other factors will be available in the near future.

One trend that is increasingly followed by the industry and researchers is to develop high-quality sweet orange varieties that reach commercial maturity in early and mid-season with reduced production costs. Higher fruit quality and maturation standards achieved earlier would also reduce the need for juice blending with late varieties. Also, developing varieties with an early maturation window and improved internal fruit quality would allow replacement of Hamlin, which is particularly sensitive to citrus canker. Interesting varieties have been developed through irradiation and other techniques at the University of Florida by the Citrus Cultivar Improvement Team. These are the early Valencia somaclone Valquarius SF14W-62, which reaches commercial maturity about 2 months earlier than standard Valencia selections, and B9-65, which has superior quality in terms of pound solids and fruit size. Yield, juice quality, and maturity dates (February/March) for Vernia, a mid-season sweet orange somaclone, are also quite desirable when compared with standard Valencia. An interesting feature is that Vernia has the highest color score of any orange at time of harvest. Other Valencia somaclones like N7-3 and T2-21 mature in the same time window or a little later than standard Valencia selections, but have superior fruit quality and may also be considered for the fresh market. Other interesting varieties are the OLL series which are also early varieties with high pound solids and yields. An interesting variety obtained by irradiation and released by USDA is 'US Early Pride', a very low seeded mutant of Fallglo mandarin hybrid that matures early (early October) in the season.

In general, to hit the juice market earlier, there is a need for advancing the harvesting window for Valencia selections. Although not new, there are interesting choices such as the introduced 'Midnight' and 'Delta'. These are South African selections that reach commercial maturity several weeks before traditional Valencia oranges grown in Florida. Midnight trees are less vigorous than other Valencia selections and grow well on Carrizo and Swingle rootstocks. Delta trees are more vigorous, and since fruit has lower Brix than other Valencia selections, rootstocks recommended for this scion are Swingle and Carrizo. So far, there is no information available about the performance of these two varieties on newly released rootstocks from UF or the USDA.

New scion releases with potential for the fresh fruit industry include Sugar Belle® 'LB8-9' as the most promising variety. These trees are vigorous and relatively tolerant to HLB and Alternaria. Mature trees can reach 20 feet in height depending on the rootstock. This makes regular pruning, hedging, and topping imperative to maximize

light exposure and achieve good yield. Fruit matures from late November to early January and may be seedy depending on crosspollination incidence. Fruit is easy peeling and retention is good and well past normal market maturity. In general, Sugar Belle® performs well on any common rootstock, although interaction with Cleopatra may result in high acidity of fruit.

For more detailed information on citrus rootstocks, please refer to the 'Rootstocks for Florida Citrus', SP 42, by Castle, Tucker, Krezdorn, and Youtsey and the Florida Citrus Rootstock Selection Guide, HS 1260, which was developed in a collaborative effort of citrus researchers from UF/IFAS and USDA. The interactive guide assisting in the selection of rootstocks best suited for the individual needs of a citrus operation can be found at <http://flrootstockselectionguide.org/>.