

2019–2020 Florida Citrus Production Guide: Rootstock and Scion Selection¹

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When preparing for new planting or 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 and 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 type, soil pH, pest and disease pressure, desired tree spacing and size control, and other characteristics. Several new rootstock selections were recently released; therefore, 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, a program managed by NVDMC (New Varieties Development & Management Corporation) that makes advanced UF/IFAS citrus selections available to growers and nurseries for trial and potential early commercialization. New information is anticipated to 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/fast-track/> for the newest information on rootstocks and scions released under the Fast Track 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 citrus 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 among the rootstocks that perform 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.

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Rootstock Effects on Pests and Diseases

Many of the newer rootstock cultivars are of partially trifoliate origin, thereby 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, the damage from *Phytophthora* is exacerbated in roots already compromised by HLB. Although thus far no rootstock has shown to induce the desired levels of tolerance to HLB, trees grown on some 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. While 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.

In 2015, five rootstocks with improved tolerance to HLB were released by the USDA: US-1279, US-1281, US-1282, US-1283, and US-1284. All five are hybrids of mandarin and trifoliate orange, produce medium-sized trees, and appear adapted to Florida's flatwood soils. In 2018, the USDA release three new SuperSour rootstocks, US SuperSour 1 (SS1), US SuperSour 2 (SS2), and US SuperSour 3 (SS3). SS1 performs well with sweet orange on the ridge and East coast flatwoods, whereas SS2 and SS3 perform well on the ridge and the East coast flatwoods, respectively. All three SuperSour rootstocks induced higher yield than standard sour orange in the presence of HLB under the tested conditions.

Tree Spacing and Size

Trees should be spaced based on the expected size of the tree and life span 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 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 is Flying Dragon, allowing for an in-row spacing of only 5–7 feet as well as closer between-row spacing, if feasible. Yield efficiency and 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 the 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 new information on compatibility and other factors is expected to be available soon.

One trend 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 two 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 late-maturing varieties with high pound solids and yields. An interesting variety obtained by irradiation and released by the 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 ‘Midknight’ and ‘Delta.’ These are South African selections that reach commercial maturity several weeks before traditional Valencia oranges grown in Florida. Mid-knight 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, no information is 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 ‘LB8-9’ (SugarBelle®) 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. Bingo, an easy-peeling seedless mandarin with a deep orange color, is another HLB-tolerant variety suitable for the fresh-fruit market. It matures early in the season and provides all attributes to compete with Cuties and Halos from California. Several UF/IFAS-USDA collaborative experiments are underway to identify rootstock most suitable to combine with both SugarBelle® and Bingo. One of the newest varieties in the UF/IFAS arsenal of fresh-fruit varieties is Marathon mandarin, which is seedless and easy to peel. Marathon obtained its name from its exceptional ability to hold long on the tree.

Other commercial varieties managed by the NVDMC with interest for the fresh market include Roe Tangerine and Aroema Tangerine, which are low seeded and easy peeling. Roe resembles a traditional Florida tangerine, which matures around Thanksgiving, and has good tree retention (it holds through January) but requires clipping. Aroema can be harvested through November; it has a delicate peel that requires careful handling to preserve external quality. The USDA variety ‘US Sun Dragon’ was recently released by the USDA. It is orange-like, HLB tolerant, and may have potential for the juice market.