

Citrus Rootstock Breeding and Evaluation

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Citrus rootstocks are the foundation of any citrus grove, and choosing a rootstock is typically a decision that affects performance and profitability for the life of the grove. The objective of this project is to provide the California citrus industry with a wider diversity of rootstocks and with information that allows the optimal rootstock to be chosen for a given site. The current range of rootstocks does not include good options for specific conditions, such as calcareous soil types, long-term compatibility with mandarins and lemons, strong resistance to all citrus nematode biotypes, and tolerance or resistance to new threats such as *Diaprepes* root weevil.

Development of new rootstocks involves production of hundreds of potential new varieties by hybridization, screening these for essential or important traits including seed production, trueness-to-type, *Phytophthora* root rot tolerance, citrus nematode resistance, tristeza virus tolerance, tolerance to calcareous soils, etc. Candidate rootstocks then enter field trials to evaluate their effects on yield, tree size, fruit quality, compatibility with important scion varieties, and other traits. All of this requires many years of effort. Progress on the specific objectives of the 2007-2008 proposal is summarized below.



Porterville location of new rootstock trial for Tango mandarin planted in June 2008.

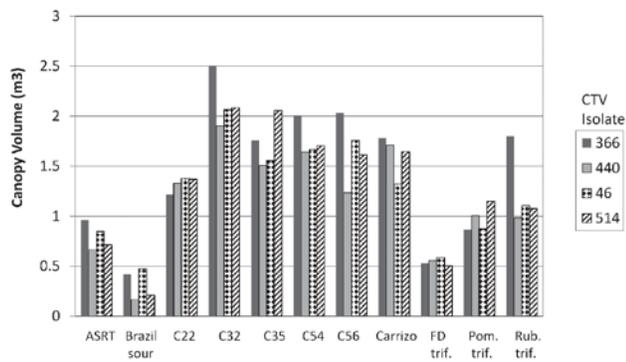


Figure 1.

Evaluation of 18 existing rootstock trials: Tree size and health measurements and photographs were collected from four trials in Ventura Co. Yield records were collected from trials at UCR and Lindcove as originally planned. Packout data were collected for Atwood navel and Lane Late navel trials at Lindcove. A fruit quality study was completed for trees on the 29 rootstocks in the Lane Late navel trial at Lindcove.

A 2005 trial to evaluate compatibility and performance of Fukomoto from 9 bud sources on Carrizo, C35, and Volk was evaluated in October 2007. Most trees were in good health, and there were no significant effects of rootstock or bud source on tree health ratings. Rootstock suckers were highest for trees on Volk, and lowest for those on Carrizo. However, the number of scion sprouts at the budunion, a symptom of compatibility problems, was significantly higher for trees on C35 and Carrizo (4.5-4.8) compared with those on Volk (2.6). This trial was evaluated again in December 2008 and analysis of these results should be more informative about this possible compatibility issue.

A 2006 tristeza tolerance trial at South Coast Research and Extension Center (Irvine) includes 784 trees, with 50 rootstocks each having 16 trees. Four trees of each rootstock were inoculated with each of four CTV isolates, and 95% test positive. Although it is not possible to maintain virus-free control trees at this location, trees testing negative for CTV were larger than those testing positive. By November 2008, 4 of the 16 trees on sour had died, and none had health ratings above 3.0 on a 0-5 scale. In contrast, for Carrizo, a CTV-tolerant rootstock, no trees had died and all had health ratings above 3.5. It is too early to determine if rootstock tolerance varies with CTV isolate, but ASRT appears stunted by CTV as reported previously by Florida scientists (Figure 1).

In the 2001 Elderwood Heights trial for oranges on calcareous soil, the largest trees were on C54, Schaub rough lemon, and African shaddock x Rubidoux trifoliolate, with small trees on Rich and 4008 trifoliolate, a Sour + Carrizo somatic hybrid from the University of Florida, and some other experimental hybrids. Tree size was not well correlated with iron chlorosis rating, as some trees with substantial chlorosis were relatively large. The lowest chlorosis ratings were for trees on C22, a Sour x Cleo hybrid, a Rangpur x Shekwasha hybrid, and a Nova+HB pummelo somatic hybrid from the University of Florida. Detailed tables that summarize data on several trials are available on the project web site (<http://www.plantbiology.ucr.edu/people/?Roose>).

New trials for mandarins: Seedlings of 23 rootstocks were initially grown at Lindcove and later transferred to TreeSource Nursery who grew the trees at no cost to the project. Seedlings were budded with Tango mandarin, and one trial of 11 replications was planted in June 2008 with cooperator Harrison Smith on a Porterville Adobe soil (Figure 2). Additional trees will be planted in spring 2009 on different soil types near Bakersfield (Johnston Farms) and Orosi (Arlen Miller).

Iron chlorosis tolerance screening: A 2007 experiment testing 36 varieties was continued until October 2008 and identified two new hybrids with tolerance approaching that of sour orange. For a new 2008 experiment, seeds were collected from 14 standard rootstocks and 199 new hybrids and grown in a greenhouse at UCR. Seedling populations of 51 varieties that had adequate uniformity were selected for screening, transplanted into soil mix supplemented with 0, 5% and 15% calcium carbonate, and monitored for growth and chlorosis after 3 months. Nearly all rootstocks performed similarly at 5 and 15% calcium carbonate, and one very promising new hybrid was identified. Several others had good tolerance.

Phytophthora root rot resistance: Seedlings of 61 selected hybrids and standard rootstocks were tested for resistance to *Phytophthora parasitica* (supplied by Greg Douhan's lab) in 2008. The most tolerant rootstocks (those growing the most roots after inoculation) included ASRT, Swingle, C35, Pomeroy trifoliolate and many experimental hybrids (mostly pummelo x Swingle and pummelo x Flying Dragon). Sweet orange, Carrizo, and (surprisingly) sour orange and Flying Dragon were among the most susceptible rootstocks in this test. A second trial evaluating a mostly different set of 35 rootstocks for *P. citrophthora* during winter 2008 identified a few tolerant rootstocks, including Pomeroy trifoliolate, C35, and some experimental hybrids, but most standard rootstocks (including sour orange) and hybrids were quite susceptible.

New releases: We summarized data on three new rootstock hybrids of Sunki mandarin x Swingle trifoliolate parentage, tested as C22, C54, and C57, and tentatively named Bitters, Carpenter, and Furr respectively. Release of these rootstocks should occur in June 2009 when CCPP will have greenhouse budwood sources that have completed a full VI test.

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