

Citrus Rootstock Breeding and Evaluation

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The objective of the citrus rootstock breeding project is to provide the California citrus industry with a wider diversity of rootstocks that improve productivity and profitability. The current range of rootstocks does not provide good choices 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 is a very long-term project that 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.

Progress on the specific objectives of the 2006-2007 proposal is summarized below. Budget cuts reduced accomplishments in some areas.

Evaluation of 18 existing rootstock trials: Tree size and heath measurements were collected from the Fukumoto navel orange trial at Lindcove, a Moro trial at Woodlake, a compatibility trial at Irvine, and Washington navel trials at UCR and Woodlake. Representative trees and bud unions were photographed for each rootstock in each trial (Fig. 1). Yield records were collected from two of the four trials originally planned. Two trials were not harvested due to freeze damage and staff availability. Packout data was collected for the two Lindcove trials. Trees in a new tristeza tolerance trial of 50 rootstocks were tested for CTV infection, and negative trees (about 13%) were reinoculated. Detailed tables (see Table of Woodlake Moro trial for example) that summarize data on several trials are available on the project web site (<http://plantbiology.ucr.edu/people/?Roose>) (the ? is part of the address).

New trials for lemons and mandarin in the Coachella Valley: We had planned to initiate new rootstock trials for the Coachella Valley, but experienced repeated problems in propagating trees due to inadequate facilities and labor. The rootstock seedlings were eventually discarded.

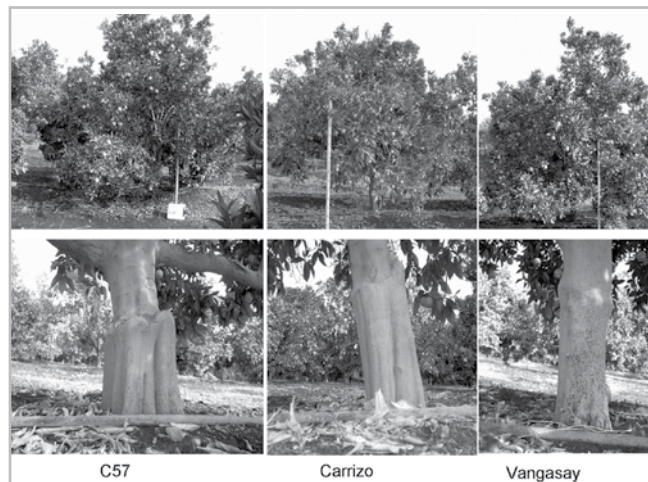


Figure 1. Trees and budunions for three different rootstocks in the Woodlake Moro blood orange rootstock trial. Trees on C57 and Vangasay grew well while those on Carrizo were much smaller in size.

New trials for mandarins: Seedlings of 23 rootstocks are being grown to initiate a new set of trials for Tango and other mandarins, mainly in the San Joaquin Valley. Seedlings were initially grown at Lindcove and later transferred to TreeSource Nursery who will grow the trees at no cost to the project. The rootstocks were budded in summer and should be planted in 2008.

Iron chlorosis tolerance screening: Seeds were collected from 69 standard rootstocks and promising hybrids and grown in a greenhouse at UCR. Seedling populations of 36 varieties that had adequate uniformity were selected for screening, transplanted into soil mix supplemented with 5% and 15% calcium carbonate, and monitored for growth and chlorosis after 3 months. The 5% stress level gave good discrimination among varieties, but the 15% level stopped growth of many selections.

Phytophthora root rot resistance: Seedlings of 36 selected hybrids were inoculated with *Phytophthora parasitica* (supplied by Greg Douhan's lab) in late July 2007, planted in sand beds, and harvested in fall 2007. Tolerance ratings will be based on comparison of photographs of the root system of each seedling before and after growth in the *Phytophthora* test soil. Scoring of roots systems is still in progress, but it is clear that the stress level was high.

Repropagation of selected genotypes: These selections must be repropagated because the land will be used for expansion at UCR. All selected genotypes were repropagated, and the land occupied by the original trees was released which will reduce project expenses.

Table 1. Woodlake rootstock trial for Moro blood orange, planted 1997 on a somewhat calcareous site (cooperator: T. Baker). 2006 tree size, health and crop ratings. Budunion rating on scale of 1-7 (1=severe benching, 5=smooth, 6 = scion overgrowth, and 7 = bulge. Chlorosis rating 0-5, 5 = all leaves chlorotic.

Stock	2006 Survival (of 12)	2006 Canopy Volume (cf)	2006 Union Rating (0-7)	2006 Health Rating (0-5)	2006 Sucker Count (5 if >5)	2006 Chlorosis Rating (0-5)	2006 Crop Rating (0-5)
Vangasay lemon	12	717	6.42	3.58	2.83	0.88	2.97
Volkameriana	12	714	7.00	3.42	1.08	0.75	3.22
C57 Sunki x trif.	12	708	3.29	3.50	1.08	1.04	3.13
C32 citrange	12	702	4.13	3.58	0.00	0.79	2.51
*Siam. pumm. x trif.	5	645	3.70	3.90	0.40	0.80	2.98
Trifeola	12	639	3.42	3.17	0.42	1.42	2.55
X639	12	637	3.71	3.79	0.42	0.88	2.76
C146 Sunki x trif.	12	629	2.88	3.33	1.50	1.21	3.09
1452 citrumelo Afr.shad. x	10	622	3.80	3.35	1.60	1.05	3.07
Rub. trif. Siam.pumm. x G.	12	604	3.38	3.08	0.42	1.29	2.93
trif.-FLA C54 Sunki x trif.	11	598	2.68	2.82	3.18	1.23	2.65
*Macrophylla	12	595	3.71	3.21	0.33	1.25	2.51
Sun Chu Sha mand.	6	583	4.75	3.83	0.17	0.75	3.75
C22 Sunki x trif.	11	566	5.86	3.55	1.36	1.05	2.42
FD x Nakon pumm6 - FLA	12	557	3.92	3.25	0.42	1.00	2.80
Sunki x Marks trif. FLA	12	555	2.54	3.21	2.83	0.63	2.88
*Taiwanica x trif 26,5	12	553	3.83	3.21	1.08	0.83	2.51
C35 citrange	5	543	3.00	3.60	0.60	1.00	2.88
Benton citrange	10	525	3.50	3.05	0.90	0.90	2.84
Sunki x Ben. trif.-FLA	12	503	3.92	3.21	0.17	1.13	2.68
Sunki x Pal. sour 19,8	12	498	3.54	3.00	0.17	1.08	2.13
Shekwasha x trifoliolate	12	460	6.17	3.21	0.25	0.92	2.22
Carrizo	10	458	4.25	3.25	0.90	0.65	2.76
Rich 16-6 trif.	12	445	3.79	2.08	0.75	0.88	1.97
Rubidoux trif.	11	435	3.05	2.82	0.00	1.73	2.05
Cleo x Rub. trif.-FLA	11	428	2.77	3.14	0.36	1.68	2.24
*FD x Nakon pumm4- FLA	12	414	4.42	2.83	0.00	1.21	2.30
4008 trifoliolate	4	405	2.50	2.63	1.00	1.38	2.43
Sunki x FD trif. 6A-38,5	12	403	2.71	3.54	0.42	1.38	1.97
Swingle	12	393	3.79	2.96	0.75	1.17	2.05
Schaub rough lem.	10	385	2.30	2.75	2.70	1.40	2.49
Sunki x Jacobsen trif.	11	335	6.45	2.55	4.64	0.82	1.74
Taiwanica x trif 26,2	12	264	3.63	2.33	1.42	0.75	1.76
	8	223	3.63	1.81	0.25	0.25	1.43

* Guard rows only - < 12 trees originally planted. All trees on Wilking x trifoliolate died.

New releases: We continued to summarize data on three hybrids scheduled for release soon. These are C22, C54, and C57, hybrids of Sunki mandarin x Swingle trifoliolate parentage. Plant characteristics were tabulated, SSR markers that distinguish them from each other and other common rootstocks were identified, and performance in different trials was summarized. Brief descriptions were provided to citrus nurseries, and budwood was made available under test agreements so that nurseries could begin propagating seedsource trees. Formal release of these hybrids is expected soon.

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