Update on New Citrus Rootstocks

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Rootstocks are important in determining the adaptation of citrus trees to soil type, susceptibility to soil pests and pathogens, and they influence many other characters including tree size, yield and fruit quality. New citrus rootstocks originate as imports from other states and countries and from the breeding program at the University of California, Riverside. This breeding program is partially supported by the Citrus Research Board. Most rootstocks are evaluated in trials in California before release here, but some imports may have little or no testing in California.

A good summary of the characteristics of older rootstocks and information about how to choose a rootstock is University of California, DANR Publication 21477, California Citrus Rootstocks. It is available for $10.00 by telephoning 1-800-994-8849. A brief summary of rootstocks that are not described fully in this publication is given below.

African shaddock x Rubidoux trifoliate - developed in the USDA citrus breeding program at Indio and subsequently tested by UCR scientists, this rootstock tends to produce large vigorous trees and has excellent resistance to Phytophthora root rot and citrus nematode. It has appeared tolerant to tristeza in California, but susceptible in one test in Florida. Tests for tristeza tolerance are being repeated. Not tolerant to calcareous soils. w/ Ewr. ?

Benton citrange - a Ruby orange x trifoliate hybrid selected in Australia where it is used as a rootstock for lemons. It is the only trifoliate hybrid that is known to be compatible with Eureka lemon. Good Phytophthora resistance, but susceptible to the Troyer/Carrizo biotype of citrus nematode. Adaptation to calcareous soils is poor. Some results from Florida show good performance with oranges, but it is not recommended for oranges in Australia because of variable performance.

C32 citrange - produces very large, vigorous trees with high yields. Fruit quality similar to that with Troyer. Similar to Troyer in tolerance to Phytophthora and citrus nematodes. Difficult to propagate due to low fruit production and low seed number. Fairly broadly adapted, but poor on calcareous soils.

C35 citrange - produces a semidwarf tree with high yield for tree size. Fruit quality is similar to that with Troyer. Excellent resistance to Phytophthora and citrus nematode. Very susceptible to iron chlorosis on calcareous soils. Incompatible with Eureka lemon.

Gou-tou sour orange - this may be a sour orange hybrid. It is being used as a rootstock in Florida. It has good tristeza tolerance. It is susceptible to *Phytophthora citrophthora*, but has good tolerance to *P. parasitica.* Fruit quality is poor, similar that with rough lemon, and it is difficult to propagate. Yields not always good.

Rangpur x Troyer - a USDA hybrid released in Florida. Trees bear well when young and are semidwarf in size. With Lane Late navel, yield at Lindcove after 2 years has been good and fruit quality similar to Troyer. In Florida, it was considered very promising based on young trials, but later results have been disappointing. Susceptible to Phytopthora. No known Advant. over C35

Rich 16-6 trifoliate - a trifoliate orange selection that appears to be more compatible with nucellar navels than Pomeroy or Rubidoux. Otherwise, similar to other trifoliates.

Sun Chu Sha mandarin - a rootstock released in Florida following good performance in trials affected by citrus blight, tristeza, and *Phytophthora parasitica,* however, some greenhouse tests indicate it is fairly susceptible to Phytophthora. It had satisfactory performance on calcareous soils in Texas with grapefruit, mandarin hybrids, and sweet orange, but yield of mandarin hybrids was lower than that of trees on sour. There is very little data on performance in California. In a lemon trial in Ventura, 5 year old Eureka and Lisbon trees were smaller than those on other rootstocks. With Lane Late navel at Lindcove, fruit had low granulation, high juice content, high solids and high acid. 8-month-old trees at Lindcove had little freeze damage, but similar trees at few miles away showed much more damage and were rated as similar to rough lemon. Overall, Sun Chu Sha probably does not confer much cold hardiness. Yield after 2 years of production was low at Lindcove and medium at Redbanks. Tree size is similar to that of Troyer. It could be considered for calcareous soils where it may perform better than Cleo.

Volkameriana - generally similar to rough lemon, but often has slightly better fruit quality and somewhat better Phytophthora tolerance. Seedlings are quite variable so it is difficult to propagate uniform trees.

1449 citremon - this is a lemon x trifoliate orange hybrid that has been available for many years. It has been used as a rootstock for Lisbon lemons, but has not become popular. Susceptible to citrus nematode.

1452 citrumelo - a grapefruit x trifoliate orange hybrid that has been available for many years. It performs well in some locations, but recent reports from other countries suggest that it is susceptible to some strains of tristeza.

Compatibility problems. For Eureka lemons, Macrophylla has long been the rootstock of choice in California. Its main disadvantage is that trees are often short-lived. Most trifoliate hybrids are not compatible with Eureka lemons and trees die when 5-15 years old. Benton citrange is the only trifoliate hybrid for which there is good evidence of compatibility with Eurekas. C35 appears incompatible. C32 has not yet shown problems, but trees are only 7 years old. African shaddock x Rubidoux trifoliate has not been tested with Eurekas. Yuma Ponderosa, Rangpur, rough lemon, or Volkameriana can be used if the soil is well drained and Phytophthora and citrus nematode can be controlled.

Mandarins are also incompatible with some trifoliate hybrid rootstocks, although problems generally do not occur for 10-15 years. Relatively few of the many trifoliate hybrid rootstocks now available have been tested with mandarins, so performance is not well understood. Cleo is generally a good rootstock for mandarins, though it does not bear well when young and can give small fruit size. One option would be to interplant trees on Cleo and a trifoliate hybrid at high density. This should give better early yields, and still allow a productive grove if trees on the trifoliate hybrid eventually decline.

Calcareous soils. Choice of rootsocks is limited on calcareous soils because trifoliate and most trifoliate hybrids show severe iron chlorosis. It is difficult to predict the severity of this problem from a soil analysis because many factors interact to determine response of rootstocks. None of the commonly available trifoliate hybrids is better than Troyer and Carrizo in this respect, so if these rootstocks have problems, so will other trifoliate hybrids including Swingle and C35. Rootstocks with the best tolerance include Rangpur, Cleo, and Sun Chu Sha, but these have other limitations as discussed above.