



UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
WASHINGTON, D.C.

**RELEASE OF US SUPERSOUR 1, CITRUS ROOTSTOCK WITH IMPROVED
TOLERANCE TO HUANGLONGBING**

The Agricultural Research Service, U.S. Department of Agriculture hereby releases to nurserymen and growers the US SuperSour 1 citrus rootstock. This rootstock selection originated from a 2003 cross of Hirado Buntan seedling pummelo (*Citrus grandis*) × Cleopatra mandarin (*Citrus reticulata*) made at the USDA A.H. Whitmore Foundation Farm (Groveland, Florida) by Dr. Kim D. Bowman of the U.S. Department of Agriculture, Agriculture Research Service, U.S. Horticultural Research Laboratory (USDA, ARS, USHRL), Ft. Pierce, Florida. Hybrid seed from the cross was planted in 2003 in the greenhouse, evaluated in the greenhouse, and subsequently grown to a large potted tree for propagation by cuttings and grafting. During early evaluation and field testing, the selection that is now known as US SuperSour 1 was identified as BS03-H9-8 and US-1691, with an original source tree identified as FT05-198. Field testing of US SuperSour 1 was planned and conducted by Dr. Kim Bowman, in collaboration with or support from industry partners, including Florida Citrus Research Foundation, Florida Citrus Production Research Advisory Council, and Florida Citrus Research and Development Foundation. Dr. Greg McCollum (USDA, ARS, USHRL) collaborated in the evaluation of fruit quality from field trials. The major positive attributes of this new rootstock are induction of superior fruit productivity, good tree health, and good fruit quality on sweet orange trees infected with *Candidatus Liberibacter asiaticus* (CLas), the causal agent of huanglongbing (HLB), as compared with other rootstocks in common commercial use. US SuperSour 1 rootstock is being released for commercial use in Florida because of the urgent need for new citrus rootstocks that have improved tolerance to huanglongbing (HLB).

Field testing of the US SuperSour 1 rootstock has been primarily in three trials with sweet orange scion, two trials in Lake County with Hamlin scion (planted in 2011 and 2012), and one trial in St. Lucie County with Valencia scion (planted in 2014). All three trials were subject to heavy feeding by natural populations of Asian citrus psyllid (ACP) since planting, and were nearby to large numbers of older citrus trees infected by *Candidatus Liberibacter asiaticus* (CLas) and observed to have symptoms of HLB. Trees in these trials were observed to begin developing widespread symptoms of HLB in the second to third year after planting. In all three trials, the standard rootstocks used for comparison were Swingle, sour orange, Cleopatra, and Ridge. During 2017-18, Swingle and sour orange were the first and fourth most used rootstocks for new propagations in Florida, being used for combined total of 1,101,785 new propagations in the State.

In the oldest trial, with Hamlin scion and planted in 2011, cumulative yield 2015-17 for trees on sour orange and Swingle rootstocks was 24 kg and 30 kg per tree, respectively. In this trial and over the

same time period, trees on US SuperSour 1 had a cumulative yield of 33 kg fruit per tree, which was a 38 percent higher yield than trees on sour orange, and a 10 percent higher yield than trees on Swingle. In this trial, trees on the other commercial rootstocks, Cleopatra and Ridge, both yielded 29 percent less than trees on sour orange. In the second trial with Hamlin scion and planted in 2012, similar relative differences were observed for cumulative yields for 2016-17, with trees on US SuperSour 1 and Swingle rootstocks exceeding the yield of trees on sour orange by 36 percent and 8 percent, respectively, while yield of trees on Cleopatra and Ridge was less than trees on sour orange. In the Valencia trial in St. Lucie County, a similar result was obtained in comparison of cumulative fruit yield for 2017-18, with trees on US SuperSour 1 and Swingle rootstocks yielding 32 percent and 23 percent more fruit than trees on sour orange, respectively, and trees on both Cleopatra and Ridge rootstocks yielding less fruit than trees on sour orange.

Fruit quality was examined in detail for the 2016 harvest of Hamlin in Lake County (2011 planting) and 2018 harvest of Valencia in St. Lucie County (2014 planting). At harvest time (December 15) individual fruit weight of Hamlin on US SuperSour 1 rootstock was 141 g, and about 22 percent heavier than Hamlin fruit on sour orange rootstock, and similar to individual fruit weight on Swingle rootstock. In other aspects of fruit quality, including percent juice, juice color, total soluble solids, percent acid, and brix/acid ratio, Hamlin fruit quality on US SuperSour 1 rootstock was similar to or superior to fruit on sour orange and Swingle rootstocks. At harvest time for the Valencia trial (March 15), individual fruit weight for trees on US SuperSour 1 rootstock was 253 g, and about 38 percent or 12 percent heavier than fruit on Swingle and sour orange, respectively. In other aspects of fruit quality, including percent juice, juice color, total soluble solids, percent acid, and brix/acid ratio, Valencia fruit quality on US SuperSour 1 rootstock was similar to or superior to fruit on sour orange and Swingle rootstocks.

In other measurements of trees in the three trials, including assessments of tree size, tree health, and tree survival, trees on US SuperSour 1 rootstock were similar to or superior to trees on Swingle, Sour orange, Cleopatra, and Ridge rootstocks. For canopy health scored in the Valencia trial in January 2018, trees on US SuperSour 1 rootstock had an average value of 3.4 (on a 0-5 scale, where 5 is best), while trees on sour orange, Cleopatra, Swingle, and Ridge had average values of 3.2, 3.2, 3.1, and 2.0, respectively.

Performance information from all three field trials with US SuperSour 1 rootstock is encouraging at this time, indicating yield, fruit quality, and tree health on this rootstock that is equal to or better than on the commercial rootstocks Swingle, sour orange, Cleopatra, and Ridge, when trees are heavily affected by huanglongbing (HLB). However, it should be noted that the duration of all three trials was less than the expected life of a commercial field planting, and changes in relative performance among the rootstocks might be observed in the coming years. In addition, even when a superior rootstock is used, fruit yield and quality is often significantly reduced in trees affected by HLB, as compared with unaffected trees. Growers should take care to make good decisions about where and when planting citrus trees is a good investment. Choice of a good rootstock can help improve the performance of citrus trees, but does not ensure profitability. It is suggested that use of US SuperSour 1 rootstock, like the use of all new rootstocks for which limited information is available, should be initially focused on additional grower trials, and small scale field plantings.

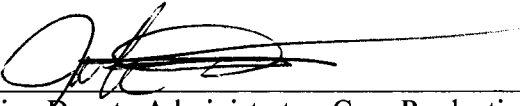
For field testing in the three trials described above, US SuperSour 1 rootstock was propagated by cuttings from a greenhouse source tree using previously described methods, as was also the case for trees on the rootstocks sour orange, Swingle, Cleopatra, and Ridge. In a comparison of cutting propagation of US SuperSour 1, sour orange, Swingle, and Cleopatra, the proportion of single node

cuttings that rooted and grew to make healthy nursery liners was 39 percent, 34 percent, 88 percent, and 21 percent, respectively. Source plant material for US SuperSour 1 was previously provided to the Florida Bureau of Citrus Budwood Registration clean budwood program (3027 Lake Alfred Road - Highway 17, Winter Haven, Florida 33881) and will be distributed, following USDA release, according to Florida Department of Agriculture and Consumer Services (FDACS) regulations. Seed has never been observed on the clone US SuperSour 1, so for propagating trees on this rootstock to be planted into the field, cuttings or micropropagation from the tested FDACS sources are the recommended methods of propagation, at this time. It is possible that seed of this rootstock may eventually be available, but suitability of this clone for uniform apomictic seed propagation has not been evaluated.

Small quantities of plant tissue for research, as well as additional information on US SuperSour 1 rootstock may be obtained from Kim D. Bowman, U.S. Department of Agriculture, Agriculture Research Service, U.S. Horticultural Research Laboratory (USDA, ARS, USHRL), 2001 South Rock Road, Ft. Pierce, Florida 34945 (kim.bowman@ars.usda.gov). Genetic material of this release will be deposited in the National Plant Germplasm System where it will be available for research purposes, including development and commercialization of new cultivars. Appropriate recognition should be made if this germplasm contributes to the development of a new breeding line or cultivar.

ARS GIVES NO WARRANTIES OR GUARANTEES, EXPRESSED OR IMPLIED, FOR THE MATERIAL, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Signature:



Acting Deputy Administrator, Crop Production and Protection
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11/2/2018
Date

Three SuperSour Rootstocks Released by USDA in 2018

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US SuperSour 1 (SS1)

- Selection from a cross of pummelo × Cleopatra mandarin.
- Superior performance with sweet orange on the ridge and East coast flatwoods.
- Induction of superior scion yield and good scion fruit quality in presence of HLB.
- Released by USDA on 2 November 2018. Clean plant material available; no restrictions.

US SuperSour 2 (SS2)

- Selection from a cross of trifoliolate × (Sour orange × ichangensis).
- Superior performance with sweet orange on the ridge.
- Induction of superior scion yield and good scion fruit quality in presence of HLB.
- Released by USDA on 2 November 2018. Clean plant material available; no restrictions.

Table 1. Yield of Hamlin on **SS1** and **SS2** in a RCB trial in Lake County. Trees planted in 2011.

Rootstock	Fruit yield per tree (as percent of yield on Sour orange)			
	2015	2016	2017	Cumulative
SuperSour 2	67	292	166	192
SuperSour 1	44	192	200	138
Swingle	44	183	233	125
Sour orange	100	100	100	100
Ridge	100	58	33	71
Cleopatra	67	83	33	71

US SuperSour 3 (SS3)

- Selection from a cross of Sunki mandarin × [US-802].
- Superior performance with sweet orange on the East coast flatwoods.
- Induction of superior scion yield and good scion fruit quality in presence of HLB.
- Released by USDA on 2 November 2018. Clean plant material available; no restrictions.

Table 2. Yield of Valencia on **SS3** and **SS1** in a RCB trial in St Lucie County. Trees planted in 2014.

Rootstock	Fruit yield per tree (as percent of yield on Sour orange)		
	2017	2018	Cumulative
SuperSour 3	415	186	239
SuperSour 1	138	146	141
Sour orange	100	100	100
Swingle	100	100	98
Ridge	108	57	69
Cleopatra	62	68	65