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UNITED STATES DEPARTMENT OF AGRICULTURE
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RELEASE OF US SUPERSOUR 2, CITRUS ROOTSTOCK

The Agricultural Research Service, U.S. Department of Agriculture hereby releases to nurserymen and growers the US SuperSour 2 citrus rootstock. This rootstock selection originated from a 2000 cross of Benecke trifoliolate orange (*Poncirus trifoliata*) × [Chinotto sour orange (*Citrus aurantium*) × *Citrus ichangensis*] 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). The pollen parent of US SuperSour 2 is a selection of Chinotto × *Citrus ichangensis*, and was itself a hybrid produced by Dr. Bowman at the Whitmore Farm in 1994, grown to fruiting, and evaluated at the Whitmore Farm as BS94-T6. Hybrid seed from the cross that became US SuperSour 2 was planted in the greenhouse at USHRL, Ft. Pierce in 2001, 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 2 was identified as BS00-A1-8 and US-1777, with an original source tree identified as FT06-76. Field, greenhouse, and laboratory testing of US SuperSour 2 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 2 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 2 rootstock has been primarily in two Lake County replicated trials with Hamlin scion (planted in 2011 and 2012). Both 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 which had symptoms of huanglongbing (HLB). Trees in the trials with US SuperSour 2 were observed to begin developing widespread symptoms of HLB in the second to third year after planting. In both trials, the standard rootstocks used for comparison were Swingle, sour orange, Cleopatra,

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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 a 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, Hamlin trees on US SuperSour 2 had a cumulative yield of 46 kg fruit per tree, which was a 92 percent higher yield than trees on sour orange, and a 53 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, fruit productivity of trees on US SuperSour 2 was similar to productivity of trees on Swingle, and sour orange rootstocks, while yield of trees on Cleopatra and Ridge was less than these. The reasons for the notably better performance US SuperSour 2 in one of the trials were unclear, and will require additional field testing.

Fruit quality was examined in detail for the 2016 harvest of Hamlin in Lake County (2011 planting). At harvest time (December 15) individual fruit weight of Hamlin on US SuperSour 2 rootstock was 151 g, and about 30 percent and 12 percent heavier than Hamlin fruit on sour orange and Swingle rootstocks, respectively. 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 2 rootstock was similar to or superior to fruit on sour orange and Swingle rootstocks. It could be noted that fruit soluble solids was higher for Hamlin fruit on the rootstocks Ridge and Cleopatra, as compared with those on sour orange, Swingle, and SuperSour 2 rootstocks. Although higher soluble solids is generally desired for citrus fruit, the much wider use of sour orange and Swingle rootstocks in the Florida industry is reflective of the greater importance place on higher yield than on higher soluble solids. Since the soluble solids value for Hamlin fruit on SuperSour 2 was equal to or better than fruit on sour orange and Swingle, this is not considered an important fault for the new rootstock, when combined with superior fruit yield. In other measurements of trees in the two trials, including assessments of tree size, tree health, and tree survival, trees on US SuperSour 2 rootstock were similar to or superior to trees on Swingle, Sour orange, Cleopatra, and Ridge rootstocks.

Performance information from field trials with US SuperSour 2 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 and sour orange, when trees are heavily affected by huanglongbing (HLB). However, it should be noted that the duration of the 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 2 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 two trials described above, US SuperSour 2 rootstock was propagated by

For field testing in the two trials described above, US SuperSour 2 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 2, sour orange, Swingle, and Cleopatra, the proportion of single node cuttings that rooted and grew to make healthy nursery liners was 52 percent, 34 percent, 88 percent, and 21 percent, respectively. Source plant material for US SuperSour 2 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 regulations. Seed has never been observed on the clone US SuperSour 2, so for propagating trees on this rootstock to be planted into the field, cuttings or micropropagation from the tested Florida Department of Agriculture & Consumers Services (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 2 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.

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Signature:



Acting Deputy Administrator, Crop Production and Protection
Agricultural Research Service, U.S. Department of Agriculture

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