

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service
Washington, D.C.

RELEASE OF US-1281, Citrus Rootstock

The Agricultural Research Service, U.S. Department of Agriculture hereby releases to nurserymen and growers the US-1281 citrus rootstock. This rootstock selection originated from a 1995 cross of Cleopatra mandarin (*Citrus reticulata*) × Gotha Road #6 Trifoliolate Orange (*Poncirus trifoliata*) made at the A.H. Whitmore Foundation Farm by Dr. Kim D. Bowman of the USDA, ARS, USHRL, Florida. Field testing of US-1281 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, Florida Citrus Research and Development Foundation, and Mid-Florida Citrus Foundation. Dr. Greg McCollum (also of USDA, ARS, USHRL) collaborated in the evaluation of fruit quality from field trials. During field testing, this hybrid rootstock was identified by code numbers BS95-V5-10 or US-1281. The major positive attributes of this new rootstock are induction of superior fruit productivity and fruit quality on sweet orange trees grown in the Florida flatwoods and infected with *Candidatus Liberibacter asiaticus* (Las), the causal agent of huanglongbing (HLB). This rootstock is being released for commercial use in Florida because of the urgent need for new citrus rootstocks that have improved tolerance to HLB.

Field testing of the US-1281 rootstock has been primarily at two locations and with 'Hamlin' sweet orange scion. The longest field test involving this rootstock is a replicated trial in St. Lucie County Florida at the USHRL research farm in Ft. Pierce. The site is typical Florida flatwoods with a soil characterized as Riviera fine sand, and trees were planted in double row beds at 3.0 m x 7.6 m spacing and irrigated by microjet. In this trial, seven 'Hamlin' sweet orange trees on US-1281 were compared with a similar number of trees on 25 other rootstocks planted in 2000 and using a randomized complete block statistical design. Trees in this trial were damaged by hurricanes Frances and Jeanne in 2004, and both HLB and citrus canker (*Xanthomonas citri* subsp. *citri*) began to affect the trees in 2007-8. Fruit production of 'Hamlin' on US-1281 in this trial was first measured in the 2006 and 2007 harvest seasons, before HLB symptoms were widespread. During the 2006 and 2007 seasons, fruit production on US-1281 was numerically higher than production of trees on Swingle, the most common rootstock used in Florida, but the difference was not statistically significant. In the following years, Las spread rapidly throughout the trial, and overall tree health declined. From 2008 to 2012, cropping on all rootstocks declined from the pre-HLB yields, but cropping on Swingle rootstock suffered more dramatically than cropping on US-1281 and some other rootstocks. The average fruit production during this period on US-1281 was measured at 2.2 times the fruit production on Swingle. As a result of increased application of plant nutrients, overall tree health in the trial improved during 2012-14. In the 2013 harvest season, trees on US-1281 produced 52 kg fruit per tree, or about 66 percent of the annual crop produced on those trees during the 2006 and 2007 seasons (before HLB impact). In comparison, trees on Swingle rootstock in the 2013 harvest season continued a very low fruit production, yielding 19 kg fruit per tree, or about 17 percent the annual crop produced on those trees during the 2006 and 2007 seasons. The significantly higher fruit

production of trees on US-1281 than trees on Swingle following tree infection with Las, and also following the implementation of an improved nutritional program, indicates a greater tolerance of US-1281 to HLB disease.

Fruit quality was assessed on samples from the replicated trial at the USHRL farm in St. Lucie County just before harvest in December 2012 and 2013. Fruit weight from trees on US-1281 rootstock was 161 g and significantly higher than the 115 g fruit on Swingle in 2012. During the 2013 season, fruit from trees on US-1281 were numerically heavier than fruit on Swingle, but differences among the rootstocks were not significant. During both the 2012 and 2013 seasons, fruit total soluble solids were numerically higher for trees on US-1281 than for trees on Swingle, but differences between US-1281 and Swingle were not statistically significant. During both the 2012 and 2013 seasons, TSS:acid ratio were significantly higher for trees on US-1281 than for trees on Swingle. Significant differences among the rootstocks for other fruit quality traits, such as juice color, were not observed. Two characteristics of fruit quality, fruit size and TSS:acid ratio, were significantly better for trees on US-1281 in comparison to trees on Swingle.

Canopy size was measured on the trees in the replicated trial at the USHRL farm in St. Lucie County in August 2014. Canopy height, canopy width, canopy area, and canopy volume were slightly larger for trees on US-1281 than trees on Swingle, but the differences were not significant. To assess whether measured differences in performance of 'Hamlin' trees on US-1281 and Swingle rootstocks were due to differences in infection rate with Las or bacterial titer in plant tissues, trees were tested by canopy sampling and PCR in August 2014. All trees on all rootstocks in the trial were observed to be PCR positive for Las at that time. The amount of Las (Las genome copy number per gram of plant tissue) detected in random leaf samples from the canopy of trees on US-1281 and Swingle were similar and not significantly different. It can be inferred that improved yield and other traits of trees on US-1281 in comparison with Swingle were not because of an induction of increased resistance to Las infection or reduced Las growth in the scion tissues, but rather to an increased tolerance of the tree to HLB following Las infection.

The rootstock US-1281 was also tested in a trial with 'Hamlin' scion planted in 2003 at the Water Conserv II research grove in Orange County, Florida. The trial contained 5-6 trees on each rootstock and was planted in a randomized statistical design. This site is on soil characterized as Candler fine sand, and trees were planted at 4.5 m x 7.5 m, and irrigated with microjets. Crop yield measurements were taken from the trial in 2009, 2011, and 2013. By 2013, the effects of HLB and reduced tree care in this trial resulted in declining yields for all rootstocks, in comparison to 2009. In all years, crop yield of trees on US-1281 were numerically higher than those on Swingle and Carrizo, but these differences were not statistically significant. The comparison of results from the two trials suggest that US-1281 is clearly superior to Swingle rootstock for use on a Florida flatwoods site with HLB, but not clearly superior to Swingle at a Florida ridge site with HLB. Further definition of the advantages and faults of US-1281 rootstock will be resolved through additional field testing.

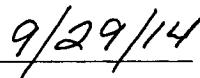
For field testing, US-1281 was propagated by cuttings. It is anticipated that US-1281 will produce nucellar seed that can be used for uniform nursery propagation, but a mature seed source is not available and nursery performance of seedlings has not been assessed. Source plant

material for US-1281 has been tested and found free of Las and CTV. Source plant material for US-1281 has been 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. Plant tissue for research and additional information on US-1281 may be obtained from Kim D. Bowman, 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.

Signature:



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



Date