

Figure 1. Ray Ruby grapefruit was picked inside the Citrus Research and Education Center CUPS in December 2019.

Five years of fresh fruit production in CUPS

By Arnold Schumann, Laura Waldo, Napoleon Mariner and Timothy Ebert

ccording to the U.S. Department of Agriculture (USDA), Florida grapefruit production for the 2019–20 season was only 12 percent of the production recorded in 2003–04, prior to the arrival of huanglongbing (HLB) disease in the state.

A major goal of the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) citrus under protective screen (CUPS) research program is to optimize the growth and production of HLB-free grapefruit for the fresh market. Grapefruit is considered to be one of the most HLB-susceptible citrus varieties. The CUPS system prevents HLB by excluding the Asian citrus psyllid (ACP) insect vector, and is an immediately available, interim solution for HLB. An update to the previous report of CUPS research in the November 2019 issue of Citrus Industry, this article discusses the 2019–20 red grapefruit production after five harvest seasons. It also addresses the challenges of maintaining premium fruit quality for the fresh market as well as the recent yields of W. Murcott, Dancy and Sugar Belle varieties in the Citrus Research and Education Center (CREC) CUPS.

The 1.33-acre CREC screen house was constructed and planted in 2014.

However, in 2017, considerable damage was caused by Hurricane Irma. Fortunately, openings in the damaged 50-mesh, high-density polyethylene screen could be quickly patched. Over subsequent months, the leaning support poles were reset in the ground, and the steel cables were re-tensioned.

The repaired CUPS screen worked well in preventing ACP entry and HLB for another three years. In March 2020, contractors rescreened both the roof and the walls with new 40-mesh screen because maintenance of the old screen was becoming difficult. A recently completed UF/IFAS study determined that 40-mesh screen was as effective as 50-mesh screen for ACP exclusion. In addition, 40-mesh should permit more air flow due to the larger mesh apertures (see academic.oup.com/jee/ article/113/4/2026/5840497).

The contractors started with the roof, removing and replacing one panel at a time, followed by one wall at a time, thus minimizing the number of CUPS trees exposed to pests (especially ACP) outside the structure. During the five months after rescreening, researchers did not detect any ACP in the CUPS. This demonstrates that by careful coordination and planning, the citrus trees inside can remain protected during major renovation work. The original screen had a warranty of five years and lasted six years. It is expected that screen will last longer than six years if there are no major storm events.

Ray Ruby trees in the CUPS showed no alternate bearing, which is very important for ensuring reliable fruit supplies to markets and steady revenue.

GRAPEFRUIT

The Ray Ruby red grapefruit variety has produced reliably high fresh fruit yields for five seasons in the CUPS (Figure 1, page 14). Cumulative yields from the 2015–16 to 2019–20 season are shown in Figure 2 (page 16), reaching 2,975 boxes per acre for the US-897 rootstock trees growing in 25-L pots at a spacing of 5 by 10 feet (871 trees per acre). Ray Ruby trees in the CUPS showed no alternate bearing, which is very important for ensuring reliable fruit supplies to markets and steady revenue.

In season five (year six since planting), researchers noticed a 15 to 23 percent decline in yield from 2018–19 to 2019–20 for the US-897 rootstocks. The trees growing in the smallest pots (20-L) were worst-affected, followed by the 25-L and 35-L pots (Figure 2, page 16). Trees growing on sour



orange rootstocks in 35-L pots continued to show increasing yields, but after six years it is expected that all the container-grown trees will lose vigor from becoming pot-bound.

Declining fruit size was also noticed in 2019–20, and the most severe effects were again seen on the trees growing in the smallest pots. The 2019 summer had a prolonged wet period of at least four weeks in July when it rained nearly every day. The trees could not be properly protected with fungicidal sprays during that critical summer period, and the high incidence of greasy spot disease detrimentally affected the percentage pack-out of harvested fruit. The smaller fruit size also reduced final pack-out percentages, with corresponding lower market prices than the larger fruit seen in previous years.

As a result, the net fruit revenue for the CUPS grapefruit in 2019–20 was only \$9.50 per box, compared with an average of \$26 per box in previous years. Despite the lower revenue in 2019–20, the net five-year cumulative fruit revenue for Ray Ruby on US-897



Figure 2. Five seasons of Ray Ruby grapefruit yield from the Citrus Research and Education Center CUPS with 871 trees per acre. Trees were planted in August 2014. Season 1 is 2015–16, and Season 5 is 2019–20. The volumes of the GroPro pots are 20, 25 and 35 liters.

rootstock in 25-L pots was estimated at \$64,000 per acre. In March 2020, all the Ray Ruby grapefruit trees were replanted in the ground to remedy the yield and fruit size decline caused by the containers.

TANGERINE AND TANGERINE HYBRID VARIETIES

The W. Murcott, Dancy and Sugar Belle tangerine and tangerine hybrid varieties in the CREC CUPS were



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Figure 3. Examples of fresh fruit varieties in the Citrus Research and Education Center CUPS during 2019–20: W. Murcott (left), Dancy (middle) and Sugar Belle (right).

particularly productive in 2019–20 (Figure 3). W. Murcott yields were 971 boxes per acre on C-35 rootstock and 1,226 boxes per acre on X-639 rootstock, both at a high-planting density of 1,361 trees per acre. Dancy yields were 871 boxes per acre, and Sugar Belle yields were 895 boxes per acre, both at a planting density of 871 trees per acre.

The return fruit set of these varieties in 2020–21 will be low due to alternate bearing, a common problem in high-yielding tangerine varieties. The W. Murcott and Dancy varieties both had favorable Brix/acid ratios of 17.7, and acid contents of 0.60 and 0.46 percent, respectively. Sugar Belle reached a ratio of only 10.7 due to a high acid content of 1.23 percent. We could not determine the cause for the high acid content, but anecdotal evidence suggests that outdoor groves of Sugar Belle also had unusually high acid levels during this past season.

CONCLUSIONS

Red grapefruit production in the CREC CUPS has been reliably high for five years. Fruit size declined in year five mainly due to pot-bound root conditions. However, transplanting the grapefruit trees into the ground was successful, with good fruit set and size in 2020. It is recommended that commercial CUPS enterprises plant their trees only in the ground to avoid the problems caused by pots and to reduce production costs.

In addition to the late-season Honey Murcott tangerine hybrid variety grown in the CREC CUPS, W. Murcott, Dancy, and Sugar Belle tangerine and tangerine hybrid varieties are showing high potential for fresh fruit production in the mid-season period. Finally, in the CUPS environment, both W. Murcott and Sugar Belle are seedless, potentially increasing their market value.

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