



Figure 1. Ray Ruby grapefruit on US-897 rootstock in the CREC CUPS, Jan. 12, 2022 (year 7.5).

CUPS update from the Citrus Research and Education Center

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Florida grapefruit production for the 2021–22 season was 92% less than in 2003–04, which was prior to the arrival of huanglongbing (HLB) disease [Source: U.S. Department of Agriculture National Agricultural Statistics Service, (USDA NASS)]. The decrease in Florida tangerine production for the same period was 89%.

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 sustainably optimize the growth, production and quality of HLB-free grapefruit and tangerine varieties for the fresh market. The CUPS system prevents HLB by excluding the Asian citrus psyllid (ACP) insect vector from coming in contact with trees. It is an immediately available, interim solution for HLB.

The Citrus Research and Education Center (CREC) CUPS screen was replaced in February 2020 to finish repairing damage caused in September 2017 by Hurricane Irma. As expected,

some psyllids entered the CUPS during screen replacement and were detected after their population had increased. Psyllids in the CUPS were sampled and tested for CLas bacteria with q-PCR, but the results were negative. The infestation was controlled relatively easily with insecticide sprays. The cumulative HLB incidence in the CUPS from 2014 to 2022 is now 0.56% (average 0.08% per year). Symptomatic trees were removed and destroyed.

In this update to the previous report on CREC CUPS research published in the November 2020 issue of *Citrus Industry* (see [tinyurl.com/CUPS-2020](https://www.tinyurl.com/CUPS-2020)), red grapefruit production in 2021–22 is discussed, which is the most recent of seven consecutive seasons.

ROOTSTOCKS AND YIELD

The growth, yield and fruit quality of Ray Ruby grapefruit plots in the CREC CUPS have been continuously tracked since trees were planted in 2014. The original main experiment compared US-897

Table 1. Average yield and fruit quality measurements of Ray Ruby grapefruit on three rootstocks in the CREC CUPS, Jan. 12, 2022 (year 7.5). The trees on X-639 rootstock are growing in 9.3-gallon pots. US-897 and sour orange trees are in the ground.

Rootstock	Planting density	Fruit yield (boxes/acre)	Fruit diameter (inches)	Size (fruit count per 4/5-bushel carton)	Juice content (%)	Average Brix (%)	Acid (%)	Ratio
Sour orange	5 by 10-foot	855	4.0	35	50.6	9.6	0.77	12.4
US-897	5 by 10-foot	723	3.9	38	52.3	9.1	0.77	11.9
X-639	4 by 8-foot	1,069	4.1	33	49.3	8.7	0.75	11.6

and sour orange rootstocks with trees that were planted on trellises at 5 by 10-foot spacing. Pots of 9.3-, 6.6- and 5.3-gallon volumes were filled with 1:1 Canadian peatmoss and perlite media and fertigated via 0.5 gallon per hour drip emitters.

Additional plots of Ray Ruby on X-639 rootstock were planted in 9.3-gallon pots at 4 by 8-foot spacing. The US-897 and sour orange trees were transplanted into the soil in the fifth year (2020) because fruit size declined, mainly due to pot-bound root conditions. Pulse drip fertigation remained unchanged for the transplanted trees, using one 0.5 gallon per hour drip emitter per tree. Transplanting the grapefruit trees into the ground was 100% successful, yielding larger fruit

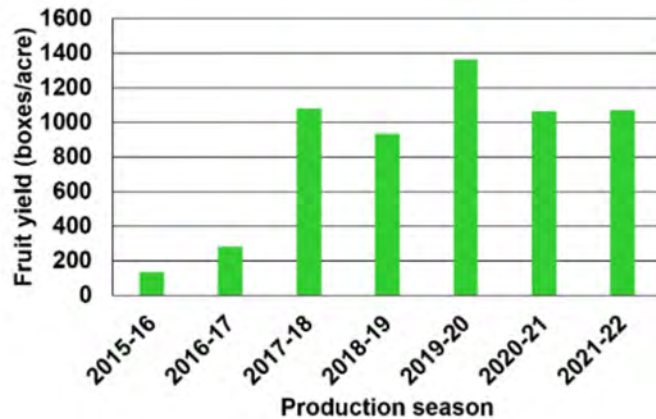


Figure 2. Yield of Ray Ruby grapefruit on X-639 rootstock for each of seven seasons in the CREC CUPS. The cumulative yield in seven years is 5,929 boxes per acre.

set and size in the 2020–21 and 2021–22 seasons (Figure 1, page 18).

Grapefruit trees on the X-639 rootstock and 4 by 8-foot planting density continue to perform optimally in 9.3-gallon pots, producing

5,929 boxes per acre cumulative yield in seven harvests (Figure 2) and are looking excellent in year eight. The 2021–22 Ray Ruby grapefruit harvest had consistently good internal fruit quality (Table 1) produced by the three



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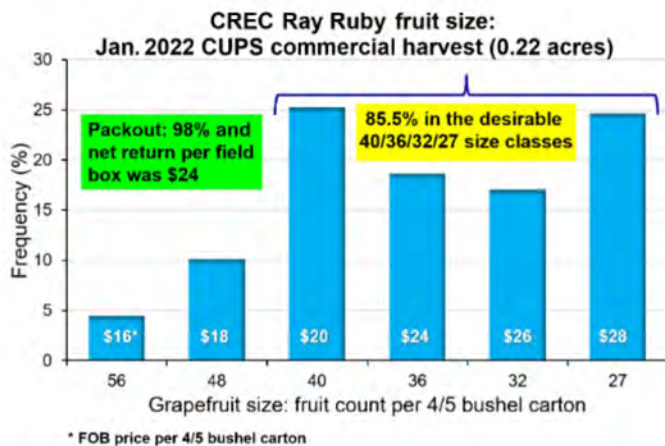


Figure 3. Ray Ruby grapefruit in each size class from the CREC CUPS 2021–22 season, FOB fruit prices received per carton in each size class, average packout and net revenue return per field box.

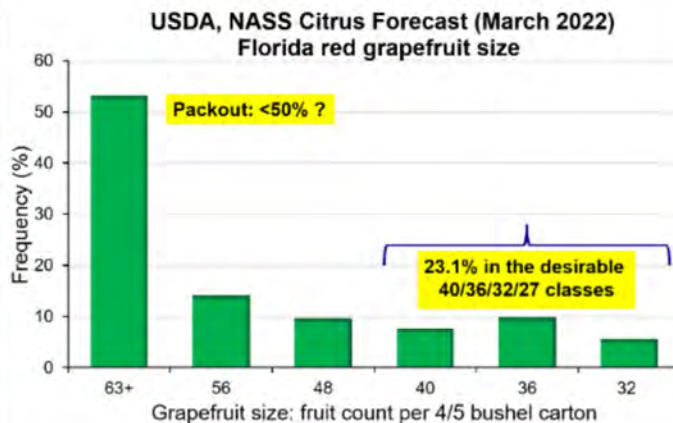


Figure 4. Percentage of red grapefruit in each size class reported in the March 2022 USDA survey and forecast for Florida (HLB-affected trees, not in CUPS).

rootstocks in the seventh season of growth in the CREC CUPS.

STRONG SIZE AND PRICE

Fresh fruit prices are strongly influenced by fruit size. For example, the “sweet spot” of size for Florida red grapefruit is in the 40/36/32/27 range (pieces of fruit per 4/5-bushel carton). The average fruit harvest and size statistics for the 0.22-acre extent of CUPS Ray Ruby grapefruit on three rootstocks for the 2021–22 season are

shown in Figure 3.

The fruit was graded, packed and shipped by a commercial Florida packinghouse. The average packout was 98%, with an average net return of \$24 per field box. Eighty six percent of the CUPS grapefruit was in the most profitable size range (Figure 3). Combining the packout of 98% and the net return of \$24 per box with the average yield of 882 boxes per acre for the three rootstocks, the net fruit revenue was \$20,745 per acre in 2021–22.

A partial comparison of CUPS grapefruit production with conventional open field-grown HLB-affected grapefruit can be made by consulting the USDA NASS Florida citrus forecasts (Figure 4). According to the March 2022 forecast, only 23% of the fruit were in the most profitable size classes, and 53% of the fruit were in size class 63 or smaller. Although specific packouts and accurate net returns could not be determined for open-field grapefruit from the NASS report, the average net



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return per field box was about \$15 due to small fruit sizes and low packout, with eliminations going to juice.

When the low yields of HLB-affected grapefruit reported in Florida (average 267 boxes per acre in 2018–19 per USDA NASS) are also accounted for, the net fruit revenue per acre from open field-grown grapefruit is significantly less than the net fruit revenue of \$20,745 per acre from CUPS.

CONCLUSIONS

During the past eight years, the CREC CUPS research program has achieved its major goal of sustainably producing HLB-free, high-quality grapefruit and tangerine varieties for the fresh market in Florida. Yields, fruit quality and fruit revenue produced by standard unmodified scions and rootstocks have matched or exceeded those of pre-HLB Florida citrus grown without screen houses. In the CUPS environment, both W. Murcott and Sugar Belle varieties are seedless, potentially increasing their market value.

See tinyurl.com/APLU-statement-CUPS for more information on the CUPS project. 🍊

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