

Figure 2. Rootstock evaluations near the Citrus Research and Education Center include a psyllid barrier experiment.

# Field testing of new HLB-tolerant scions and rootstocks

By Rhuanito S. Ferrarezi, Jude W. Grosser, Fred G. Gmitter, Ed Stover and Kim Bowman

itrus is Florida's most important agricultural commodity. The state produces citrus for different markets: round oranges for juice; navels, mandarins, grapefruit and lemons for the fresh-fruit industry; and lemons for extracting peel oil for processing. Huanglongbing (HLB) disease affects all citrus varieties. Since the discovery of the disease, research continues to identify HLB-tolerant citrus selections.

Field variety trials are simple but effective tools to evaluate plant

horticultural characteristics under different environmental conditions in an attempt to speed up the evaluation, selection, and commercial adoption process for new varieties. Large-scale, rapid testing of HLB-tolerant varietal selections depends on reliable data. Current projects are addressing the need to establish field plantings to generate information of vital importance to growers.

This article provide updates on two large initiatives to test citrus varieties in field trials: the University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS) Indian River Research and Education Center (IRREC) Millennium Block in Fort Pierce, and three U.S. Department of Agriculture (USDA) Multi-Agency Coordination (MAC) Group projects across the state of Florida.

#### **MILLENNIUM BLOCK**

The Indian River citrus district, a narrow strip of land on the eastern coast of Florida, stretching nearly 200 miles from Daytona Beach to West Palm Beach, is considered the premier grapefruit production area in the state. HLB is decimating the Indian River grapefruit industry. Commercial bearing acreage declined from 107,800 in 2000–01 to less than 37,500 acres in 2015–16 due to the disease. During this period, production decreased from 46 million to 10.8 million boxes. This severe impact is caused by the high susceptibility of grapefruit, especially Ray Ruby, to HLB disease.

Upon further evaluation, new grapefruit selections from Florida's citrus-breeding programs may be able to sustain fruit yield and quality due to potentially higher tolerance to HLB. There is a strong demand to find new selections that will sustain the social, economic and cultural importance of high-quality grapefruit to meet domestic and foreign market demands, supporting growers staying in business.

IRREC citrus faculty members and UF/IFAS Citrus Research and Education Center (CREC) and USDA Agricultural Research Service (ARS) citrus breeders met with Indian River Citrus League growers to identify the available selections and collectively decided on the selections to plant and evaluate under high levels of disease pressure. We focused on using Department of Plant Industry clean materials only to make quick planting decisions based on promising results.

Rootstocks are also important in the plant-HLB complex due to their

faculty/castle/pdf/Rootstock\_Options\_ Based\_on\_Field\_Trials.pdf). USDA/ ARS rootstock trials for grapefruit have also been recently published, but yield data was not available.

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influence on scion performance and potential ability to confer HLB tolerance within the scion as well. The UF/ IFAS and USDA/ARS recently released a number of new rootstocks. Several scion and rootstock variety trials have been conducted in the Indian River, mostly pre-HLB. A summary of UF/ IFAS trials was recently published (www.crec.ifas.ufl.edu/academics/ plantings. With the drastic impact that HLB is having on fresh-market grapefruit, navels and mandarins are options for Indian River citrus growers to diversify their portfolio and to manage risk. Rootstock effects on newly released navel oranges and mandarins are currently unknown, particularly with regard to juice quality and granulation. The lack of data further

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supports the independent rootstock trials using navels and mandarins for the Indian River freshfruit industry.

Within these new trials (Figure 1), new grapefruit varieties and rootstocks will be evaluated using statistically valid experimental designs to assess HLB tolerance under local environmental conditions and pest and disease pressure (including psyllids, root weevils and other pests). We will employ regular pest and disease management practices to avoid severe infestations. However, the goal is not to use an aggressive psyl-

lid control program since trees have to be challenged to express their potential against HLB.

Experiment 1's objective is to assess performance of new grapefruit scions in areas where HLB is endemic and extensively present. In the test, 19 grapefruit selections and three rootstocks will be evaluated. Each experimental unit has five-tree plots replicated six times. The experimental area consists of approximately 8 acres, with 227 trees/acre spaced at 8 feet by 24 feet.

The objective of experiment 2 is to evaluate the influence of University of Florida rootstocks (UFR) on grapefruit, navel and mandarin HLB susceptibility. In this trial, Ray Ruby grapefruit, 56-11 navel orange and 950 mandarin will be grafted on 36 to 38 different rootstocks. All tree studies will be arranged on a randomized complete block design consisting of five-tree plots and six repetitions, on 5 acres each at the same density and spacing as mentioned previously.

For all of the trials, standard growth parameters such as tree size, yield and fruit size will be evaluated. Researchers will also measure juice quality, pest and disease incidence, HLB incidence and severity, and leaf nutrient content for each selection. The goal is to rank the disease progression in the tested selections to identify a potential scion and rootstock combination that will make citrus production attractive for fresh



Figure 1. Research trials in the Millennium Block will test the HLB tolerance of fresh-fruit varieties in the Indian River district.

grapefruit growers.

A comprehensive rootstock variety trial, including most UFR rootstocks, will also be performed to evaluate grapefruit, mandarin and navel. This study is the first of a kind at the IRREC since the 2005 canker eradication program. Full HLB tolerance will be assessed over a 6-year period.

#### **MAC PROJECTS**

There are currently three HLB MAC Group projects in which principal investigators (PI) will collaborate on policy decisions, establish priorities, allocate critical resources, and collect, analyze, and disseminate information to the citrus industry regarding HLB infection and tree impact. Below is a summary of the MAC projects focusing on scion and rootstock field testing.

"Widespread field testing of new HLB-tolerant rootstocks" (PI Jude Grosser with Kim Bowman and Fred Gmitter). This project features robust field testing of 48 promising new rootstock selections (available for propagation) from the UF/IFAS CREC and USDA/ARS rootstock breeding programs. The scions are processing sweet oranges Vernia, B9-65 Valencia and OLL-8. Rootstocks were propagated by seed, cuttings and tissue culture.

Phase 1 consists of 12 UF/IFAS candidate rootstocks, 12 USDA candidate rootstocks and six commercial control rootstocks planted at six locations across Florida (five commercial industry cooperators and the USDA Picos Farm). These trials will include 12 four-tree repetitions at five locations, with six four-tree repetitions at Picos Farm, for a total of 7,920 trees. Five phase 1 trials have been planted to date. Phase 2 trials (same scope and size of phase 1) are expected to be planted in the fall of 2018.

"High-intensity management of small citrus groves utilizing ACP control, clean plant material, scouting, inoculum removal and the tenets of area-wide management" (PI Michael Rogers with Arnold Schumann, Troy Gainey and Jude Grosser). This project consists of more than 55 acres just north of the CREC, planted in summer 2017. The trial consists of 70 sweet orange/rootstock combinations (19 early oranges and 51 late oranges), Sugar Belle® on four rootstocks and all new rootstock candidates from the CREC citrus improvement program. It encompasses more than 12,000 trees, 50 trees/plot and four plots for most combinations.

This project includes a psyllid barrier experiment (Figure 2, page 12). Part of the trial (70 fifty-tree repetitions) was planted within a roofless, screened windbreak/psyllid barrier structure. Four rootstocks were replicated both inside and outside the structure. The west wall of the structure was blown down during Hurricane Irma, but has since been repaired. It is not clear what impact this may have had regarding inadvertent HLB infection.

**"Rapid propagation of HLBtolerant scions and rootstocks for U.S. citrus"** (PIs Georgios Vidalakis (University of California, Riverside) and Greg McCollum, with Fred Gmitter, Jude Grosser, Ed Stover and Kim Bowman).

Experiment 1: HLB-tolerant rootstock effects on fruit quality. Numerous promising new rootstocks will be tested with five standard scions to assess fruit quality in interaction with HLB. Scions include: Bears lemon, Sugar Belle<sup>®</sup>, U.S. Early Pride, Ray Ruby grapefruit and Glenn navel orange. Twelve experimental rootstocks (six each from UF/IFAS and USDA) and two commercial control rootstocks will be tested representing a range of genetic backgrounds. There will be three trial sites across Florida, with seven replications per site and 73 trees of each scion/rootstock combination for a total of 3,780 trees. Trials are expected to be planted either in late 2018 or early 2019.

**Experiment 2: Evaluation of putatively HLB-tolerant scions.** This trial will test four control scions (Valencia, Hamlin, Tango and Sugar Belle<sup>®</sup>) along with 13 seemingly HLB-tolerant mandarin hybrids (six from UF/IFAS and seven from USDA), and 12 seemingly HLB-tolerant sweet orange or sweet orange-like selections (seven from UF/ IFAS and five from USDA). All trees are being propagated onto US-942. There will be three test sites, 630 trees/scion and approximately 18,900 trees.

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