

Time to get serious about trialing new scion/rootstock combinations

By Jude W. Grosser and Frederick G. Gmitter



Some trees planted just north of the Citrus Research and Education Center in Lake Alfred include a psyllid barrier (shown in background of photo).

It's no secret that citrus greening disease, or HLB, continues to take a heavy toll on the beloved Florida citrus industry. It has been estimated that the industry will need to replant over 3 million trees per year for the next 10 years just to get back to normal. So the million-dollar question is "What do I plant?" What scion/rootstock combinations are available today that can justify investing in replanting? What production system will bring new trees into sustainable and profitable production? The University of Florida's (UF) citrus breeding team thinks about these questions 24-7.

To expedite large-scale field evaluation of promising new rootstocks and scions in the breeding pipelines, the UF breeders have teamed up with other citrus colleagues in Florida and California to take advantage of the U.S. Department of Agriculture (USDA) Huanglongbing Multi-Agency Coordination (MAC) program. Three major projects have been funded by the MAC program. However, these 2-year projects pay only for tree propagation and planting. These projects are a conduit for testing the most promising selections on a large scale. The breeding team will need help with subsequent evaluations and looks forward

to continued industry and Citrus Research and Development Foundation (CRDF) program support to be able to follow through.

PROJECT 1

The first funded project is the Rogers MAC that is currently being planted just north of the Citrus Research and Education Center (CREC) on property acquired from the city of Lake Alfred. This 55-acre trial will feature 70 sweet orange/rootstock combinations (19 early and 51 late orange combinations), as well as LB8-9 (Sugar Belle®) on four rootstocks, with all new oranges and rootstocks coming



A new federally funded trial of more than 12,000 trees will test 70 sweet orange/rootstock combinations as well as Sugar Belle® on four rootstocks at the Citrus Research and Education Center.

from the UF/CREC citrus improvement program. There will be 50 trees per plot, four plots for most combinations and more than 12,000 trees in the trial.

This trial will also feature a psyllid barrier experiment. Part of the trial (70 50-tree reps) will be planted with a roofless screen windbreak/psyllid barrier structure. Four rootstocks will be replicated both inside and outside the structure (four reps inside and four reps outside). Arnold Schumann, CREC professor, and Troy Gainey, CREC grove manager, are engaged in the design and management of the trial.

PROJECT 2

For the second funded project, UF breeders Jude Grosser and Fred Gmitter teamed up with USDA-Agricultural Research Service (ARS) rootstock breeder Kim Bowman. This MAC project will evaluate Vernia and new sweet orange clones Valencia B9-65 and OLL-8 on 48 promising rootstock candidates, propagated from seed, cuttings and tissue culture.

Phase 1 will feature 24 rootstock candidates (12 from UF/CREC and 12 from the USDA) along with six commercial control rootstocks. Phase 1 will be planted at six locations across Florida, including 12 four-tree reps at five locations with industry

cooperators, and six four-tree reps at the USDA Picos Farm in Fort Pierce, for a total of 7,920 trees.

Phase 2 will have the same design, but will feature 24 different rootstock candidates, again 12 from each agency.

PROJECT 3

The third funded project, the Vidalakis/McCollum MAC is a collaboration between California and Florida. Grosser and Gmitter are involved, but also Greg McCollum, Ed Stover and Bowman from the USDA-ARS, along with Georgios Vidalakis (University of California-Riverside) to initiate field evaluation of HLB-tolerant varieties in California.

Florida Experiment 1 of this project will study HLB-tolerant rootstock effects on fruit quality. This experiment will pair five representative scions [Bearss lemon, LB8-9 (Sugar Belle®), US Early Pride, Ray Ruby and Glenn Navel] on 12 diverse rootstocks (five new HLB-tolerant rootstock candidates each from the UF/CREC and the USDA breeding programs, and US-942 and x639 as controls). There will be three trial sites in Florida consisting of seven three-tree replications and a total of 1,300 trees planted per site. Industry cooperators are needed for these three sites.

Florida Experiment 2 will focus on the evaluation of putatively HLB-tolerant scions. This trial will include four control scions [Valencia, Hamlin, Tango and LB8-9 (Sugar Belle®)] and 25 promising new experimental scions. These include 12 sweet orange/sweet orange-like selections (seven from UF/CREC and five from the USDA) and 13 mandarin selections (six from UF and seven from the USDA). All trees will be grafted to US-942 rootstock. There will be three field sites, 18,900 total experimental trees (630 trees/scion; approximately 6,500 trees per site) and a total of 42 total acres planted (14 acres per site). Industry cooperators are also needed for these sites.

ADDITIONAL PROJECT FUNDING

Three years ago, Congress approved a 5-year, \$125 million federal funding for the USDA National Institute of Food and Agriculture/Specialty Crop Research Initiative program funding projects addressing the HLB problem. Each year, the citrus breeding community formed strong teams and submitted proposals to develop solutions using citrus breeding and genetics approaches. Finally, on its third try, the team was successful in getting a 5-year project funded in the amount of \$4.7 million. The project is titled “An Integrated Approach to the Accelerated Development of Rootstocks that Impart HLB Tolerance to Trees Grafted with Commercial Scions.” Funding for this project was recently released, and the project is now getting underway.

The project team consists of Grosser (UF/CREC, rootstock breeding and genetics), Gmitter (UF/CREC, rootstock breeding and genomics), Bowman (USDA-ARS, rootstock breeding and genetics), Ute Albrecht (UF/Southwest Florida Research and Education Center, scion/rootstock metabolomics), Tripti Vashisth (UF/CREC, rootstock nutrition/Extension), Liliana Cano (UF/Indian River Research and Education Center, plant pathology), Yu Wang (UF/CREC, fruit

quality, juice flavor and metabolomics) and Yue Niu (University of Arizona, statistics/meta-analysis).

The goal of this project is to develop and deploy new HLB-tolerant or -resistant rootstocks to ensure the future vitality of the U.S. citrus industry. This will be accomplished through partnership of long-term, successful, comprehensive, citrus-rootstock breeding programs at the UF/CREC and the USDA-ARS U.S. Horticultural Research Laboratory, in combination with a team of accomplished specialists. Their objective is to identify genetic, transcript, metabolic and physiological differences between HLB-tolerant and -susceptible rootstocks to uncover tolerance mechanisms and to develop efficient, selectable markers that will facilitate the breeding process.

The project will utilize extensive collections and existing field trials with novel and diverse citrus germplasm planted throughout Florida that have seen increasingly intense pressure from HLB, and thus have undergone a natural screening process. The germplasm resources and the team's collective experience in its evaluation provide a very solid basis for advanced breeding, directly targeting the industry's need for HLB-tolerant trees through rootstock effects on scion performance.

New rootstock candidates will be

created using complementary, HLB-tolerant parents already shown to transmit this characteristic to offspring. Candidate rootstocks will be identified in greenhouse and field studies, and then planted in replicated field trials for evaluation of tree survival and overall performance, fruit yield and quality.

This information will be made widely available through interaction with industry partners and project outreach, to support HLB-tolerant rootstock selection decisions for new plantings. Finally, candidates selected for release will be channeled through state and national agencies responsible for certified nursery production programs and extensively propagated to ensure wide availability.

Because this is a project with national scope, we will be expanding the scions currently used for rootstock HLB screening (only sweet oranges at present) to also include Murcott, Tango and red grapefruit. Murcott is highly sensitive to HLB and might serve as the best indicator scion to quickly identify rootstocks that can transmit high levels of HLB tolerance. Tango and red grapefruit will facilitate the identification of rootstocks that will work for the California, Florida and Texas fresh-fruit industries.

Since current psyllid control measures are too costly and unsustainable in the long run, a goal is to identify scion/rootstock combinations that can

be affordably and profitably grown under an optimized production system that features more traditional integrated pest management enhanced with psyllid biocontrol agents. To accomplish this, both HLB-free and HLB-infected trees of all four scions on emerging elite HLB-tolerant rootstocks will be planted in replicate at a protected, fairly remote site. The UF/CREC citrus breeding team currently has 50 acres assigned for citrus breeding at the Gulf Coast Research and Education Center in Balm and is proposing to utilize this site for this important evaluation.

INDUSTRY COLLABORATION

The UF/CREC and USDA-ARS citrus breeding programs are fortunate to serve an engaged and cooperative citrus industry. The breeders are also fortunate and thankful to have continuous financial support from CRDF and the New Varieties Development & Management Corporation. Much of the citrus improvement progress to date has benefited from wonderful collaborations with industry partners.

Considering the current status of the HLB problem, a significant portion of the funding invested to solve the problem has been spent on laboratory and greenhouse research. Real answers have to come from established field trials that clearly demonstrate successful results. When growers can come to a site and see scion/rootstock combinations succeeding in today's HLB environment, they will gain the confidence they need to invest in replanting. In the spirit of the late, great Orrie Lee, we look forward to the increasing industry-wide collaboration and support necessary to make these projects happen, all contributing to a vibrant future for the citrus industry. 🍊

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