# Study looks at interaction between OTC and soil microbiome

By Frank Giles

A wealth of observations are being recorded by growers and scientists on the effects of trunk injection of oxytetracycline (OTC). Visually, trees have responded with better canopies. Hopefully, higher yields and quality will continue to follow the applications.

But what about below ground? There have been recorded improvements in citrus root mass in treated trees. Sarah Strauss, associate professor of soil microbiology with the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS), has been studying the impact that OTC might be having on the soil microbiome. We asked her about the research, which was presented at the recent International Research Conference on Huanglongbing (HLB).

Sarah Strauss

**Why is it important to consider the plant microbiome when considering any new type of treatment applied to citrus, including OTC?**

**Strauss:** The plant microbiome, or all of the microbes that live in and around the tree, is important for overall soil and tree health. For example, there are microbes in the soil around the roots of trees that can help increase nutrient availability for a tree and increase the tolerance of the tree to different stresses. There are also potentially beneficial microbes that are in the bark of trees that can help with disease resistance and stress tolerance.

**What happens to the plant and rhizosphere when you inject trees with OTC?**

**Strauss:** Citrus trees injected with OTC had reduced abundance of the HLB-causing bacteria — *Candidatus* Liberibacter asiaticus CLas) — in the leaves compared to the control and roots, but only for a short time after injection. However, OTC injection significantly increased the Brix, Brix/acid ratio, fruit weight and fruit color compared to controls.

We found that the abundance and diversity of bacteria and archaea in the rhizosphere and bark decreased after OTC injections, but the abundance of bacteria and archaea in the bark recovered to pre-injection levels three months after the injection. There also were no major changes in the composition of the microbial communities in the bark and rhizosphere with OTC injection.

**What did your study on OTC treatment and the soil microbial community involve?**

**Strauss:** We conducted a study at a commercial citrus grove in Southwest Florida that had 8-year-old Valencia trees on Carrizo rootstock. It was a complete randomized block design with eight replicated blocks. OTC was injected in June 2022 with Chemjet Tree Injectors using Arbor-OTC. Three injectors were used to deliver

a total of 1.2 grams of active ingredient per tree. We collected samples of leaves, bark and fibrous roots (with soil attached) three days, three weeks and three months after the injection. Microbial RNA was extracted from the bark and rhizosphere (soil around the roots). We transformed that RNA into cDNA, and then sent that for amplicon sequencing to determine the diversity and composition of the microbes of the rhizosphere and bark. We also measured CLas and OTC in the bark, leaves and roots and collected fruit quality and yield data in March 2023.

Ute Albrecht, UF/IFAS associate professor of plant physiology, myself, several members of Ute and my labs (Carolina Tardivo, Brittney Monus and Jasmine de Freitas) as well as two colleagues from Spain (Antonio Castellano-Hinojosa and Jesus Gonzalez-Lopez) conducted this study.

**Were there any indications that the OTC was having a positive effect below ground with the roots and the soil microbial makeup?**

**Strauss:** In both the rhizosphere and the bark, we found that several specific bacterial groups were positively correlated with increases in fruit yield and weight and a decrease in OTC concentrations. While correlation does not necessarily mean one thing caused another, it does indicate that OTC injections might result in increases in potentially beneficial bacteria in the bark and rhizosphere.

**Is there anything else you would like to add?**

**Strauss:** Long-term studies are needed to find out if the results we found in the short term (just three months after injection) hold for longer periods after injection and after repeated injections. There are many more questions that we should try and address about how OTC is impacting the microbes in and around citrus, from gaining a better understanding of how these changes in the microbes might help tree performance to whether injections are increasing the resistance of bacteria to this antibiotic. We hope to conduct those studies soon.

# Tracking Plant Breeding Efforts

**By Rick Dantzler, CRDF chief operating officer**

For several months, CRDF committees have been in discussions with John Chater, University of Florida Institute of Food and Agricultural Sciences (UF/IFAS), and Matt Mattia, U.S. Department of Agriculture Agricultural Research Service (USDA-ARS), regarding a three-year plan for the traditional plant breeding programs of those institutions. Gone are the days when CRDF funds plant breeding programs without specific work plans on what it will be paying for or what it expects to receive in return. In its place is a requirement for validation of new creations by comparing their performance to other new creations and industry-standard rootstocks and scions.

Some breeders have done this validation routinely, and they have had little trouble being funded by CRDF. Others, however, under pressure to release new germplasm more tolerant to HLB, have generated little data to back up their recommendations about what to plant. This reliance on the intuition and observation of the breeder has worn thin with growers and, consequently, CRDF. For that reason, CRDF committees and board are seeking specificity with the three-year work plan being discussed with UF/IFAS and USDA-ARS breeders as the parties strive to start a new chapter in traditional plant breeding.

Related is a project with The Coca Cola Company (TCCC) that CRDF funded in which more than 500 accessions created by UF/IFAS and USDA-ARS breeders were evaluated by criteria most important to growers and processors. From this list, the top 55 were selected and will be put in Stage 2 field trials. Weston Johnson of TCCC presented a specific workplan with dates and benchmarks for this scope of work, which CRDF quickly funded because it was tight and specific. Johnson recently updated CRDF on the work going forward, and it is fantastic.

Regarding plant breeding using gene editing, the Crop Transformation Center in Gainesville received $500,000 in funding from CRDF last fiscal year and will receive another $500,000 this fiscal year. The center came about because of a request from growers and CRDF to UF/IFAS for a greater emphasis on this type of plant breeding, and the university responded. The industry is grateful for the speedy and robust action.

The leaders of the center recently held a workshop to kick off the work. Attending were scientists, students, administrators and growers, as well as folks who have worked in industry for decades in bringing gene-edited products to the marketplace. There was a lot of discussion about ways that various labs could work together without sacrificing the creativity of each, as well as the need for a "quarterback" to oversee the overall effort of advancing a gene-edited solution to HLB across the finish line. In a sidebar conversation with a scientist who is on the cutting edge of this work, I was told that the most helpful thing CRDF could do was assist with the regulatory process, a task which I have run up the flagpole with university officials and industry leaders. This has become a high priority.

CRDF Grower Dollars at work for you

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