Studying Soil Microbes and Microbial Amendments

This article addresses the idea that beneficial, naturally occurring soil- and root-based bacteria might aid in the management of HLB. The background for field trials described below is work by Nian Wang of the University of Florida Institute of Food and Agricultural Sciences, funded in part by the Citrus Research and Development Foundation (CRDF).

Wang hypothesizes that bacteria in commercially available microbial soil amendments could act as antimicrobials to control HLB bacteria. In his work, some surviving citrus trees appear relatively healthy, even in heavily HLB-diseased groves. There were only minor differences, however, between soil properties and associated bacteria of surviving and declining trees. Several bacterial isolates increased grapefruit seedling emergence and growth of root systems in pots in the greenhouse. By comparing healthy and HLB-infected root/soil samples, several bacteria types were enriched in the healthy roots.

Effects of application of potentially beneficial bacterial isolates on plant defenses and attractiveness to psyllids have also been tested with little success. Application of a few beneficial bacteria seems to suggest that manipulation of soil microbes had no effect on HLB disease control once the infected trees become severely symptomatic. The beneficial microbes seem to delay, but do not prevent infection when applied on healthy, asymptomatic trees or symptomatic trees at the early stage of infection. This is consistent with the nature of delayed HLB symptom development of HLB escape trees.

After several growers observed tree improvements following soil applications of microbial amendments, CRDF designed field trials at three locations to test the idea that commercially available, soil-applied microbial amendments can mitigate the effects of HLB on citrus tree health and yield. There were five replicated soil-amendment treatments, plus an untreated control applied to Valencia/Swingle trees in a Ridge site with 19-year-old trees, an East Coast site with 6-year-old trees and a Southwest Florida site with 11-year-old trees. Along with good psyllid control and good water/nutrient management, the soil treatments were repeated over three years (2014–2016) at recommended label rates, and a subset of trees within each treatment were also mulched annually with mature cow manure.

Overall, results were disappointing. At the Ridge and East Coast sites after three years of treatments, all treated trees were HLB positive. There were no treatment effects on canopy volume, fruit yield, fruit size or juice quality. Some treated trees even had more visible disease symptoms than the untreated trees. At the Southwest Florida site, most of the treated trees were HLB negative. Here, two of the soil treatments produced larger trees than the untreated trees, but there were no treatment effects on visible symptoms or fruit yield. The mulched treatment increased yield, but there were no significant effects of mulch anywhere else. Overall, there were no persistent treatment effects on root density or on leaf mineral nutrition as all nutrient values were within optimal ranges. Thus, there were no positive effects of these soil microbial amendments on tree health and yield of HLB-affected trees in these trials.

It is likely that these bacterial products did not survive well in the soil and had little effect on the rhizosphere soil bacterial community of citrus. Detailed results from the 3-year study can be found in "Soil Microbial Product Interactions with HLB in Valencia/Swingle Trees over Three Seasons at Three Contrasting Sites in Florida," to be published in the upcoming 2017 Proceedings of the Florida State Horticultural Society.

Prepared by the CRDF project management team