

Update on Thermotherapy Research

As early as 1965, high-temperature treatments were shown to reduce HLB bacterial infection without killing the tree. Trials [Ehsani, University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS)] using portable, semi-transparent, plastic houses were placed over trees, achieved temperatures of above 120 F for several hours over several days, and reduced *Candidatus Liberibacter asiaticus* (CLAs) bacteria. Some leaves were killed, but after tree recovery from the heat stress, HLB symptoms improved and tree growth recovered.

Heating entire potted seedlings in growth rooms to a constant 10 F for two days completely eliminated CLAs bacteria from HLB-affected citrus seedlings for 24 months [Hoffman, U.S. Department of Agriculture/Agricultural Research Service (USDA/ARS), 2013]. By 2014, there was optimism about the usefulness of canopy heat treatments for improving growth and yield of HLB trees. Efforts to optimize heat treatments incorporated steam generators and portable tents that could achieve even better results in as little as 30 seconds to two minutes at 132 F, depending on tree size and age. Polymerase chain reaction analysis showed a decrease in CLAs in leaves after treatment, but there was no reliable technique for detecting live vs. dead bacteria in the tree. Roots and shoots of heat-treated trees were never completely free of HLB. Subsequent psyllid and leafminer infestations were a problem, which impacted regrowth leaves.

There was no psyllid acquisition of CLAs from thermal-treated potted citrus trees compared with 75 percent of psyllids acquiring CLAs from untreated HLB trees (Pelz-Stelinski, UF/IFAS). Practical methods are yet to be developed for whole-tree thermal therapy on both psyllid acquisition and long-term HLB status.

Although fruit yields are lower in HLB trees, juice quality taste panels (Baldwin, USDA/ARS) said that juice from heat-treated HLB fruit was sweeter, less acidic, less bitter and had more flavor and body than the juice produced from unheated trees.

A large, multi-year Citrus Research and Development Foundation project evaluated impacts of thermotherapy treatments at 14 Florida sites on various tree ages, rootstocks and scions. Thermotherapy trials used a variety of steam heat treatments from different portable machinery delivering a range of temperature/duration combinations in support of potential scale-up to commercial thermal therapy treatments. Tree health, foliar nutrition, disease rating, HLB status, fruit drop, yield and fruit quality were evaluated before and after thermotherapy heat treatments of 127 F to 132 F for 30 seconds to one minute.

Thermotherapy treatments only achieved short-term improvements in tree appearance and CLAs reductions, which lasted from two to several months. Reductions in fruit drop or increases in yield generally did not occur after treatment. Some heat treatments reduced tree size and yield. Based on these results, several commercial participants revised designs and deployed next-generation steam machines. Overall participation slowed, however, as most potential solvers did not participate. All of the treated trees that displayed previous short-term responses to thermotherapy are now similar to non-treated control trees. CRDF has thus discontinued monitoring tree status as there was no evidence of any lasting positive effects of thermotherapy alone on HLB. Studies are continuing, however, on potential synergistic effects of thermotherapy plus bactericide treatments on the health of HLB-infected trees.

Prepared by the CRDF project management team



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