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Laurel Wilt in Avocados—History, Current Strategies and a Look to the Future

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A battle is being waged in the avocado groves of South Florida where the region's largest and most economically important fruit crop is under attack. Avocados account for approximately 7500 acres in Miami–Dade County and have an economic impact of $54 million to the regional economy. The avocado industry has already lost over 2500 trees due to laurel wilt since the introduction of the disease to Miami–Dade County in 2011. Laurel wilt is disease that affects plants in the *Lauraceae* causing rapid wilt and sudden death. It is caused by a fungus, *Raffaelea lauricola*, that was accidentally introduced, along with its original vector, the redbay ambrosia beetle, *Xyleborus glabratus,* to the United States in May of 2002 in Port Wentworth, Georgia. The state of the battle against laurel wilt is in constant flux. Current recommendations are evolving rapidly as we gain more knowledge and funding becomes available for further research. Laurel wilt continues to advance and new strategies are necessary to lessen the economic blow of the continued loss of trees due to this disease. Methods currently being assessed for the future are varied and include the use of detector dogs and or drones to scout for the disease as well as a multitude of other viable options.

A battle is being waged in the avocado groves of South Florida where the region's largest and most economically important fruit crop is under attack. Avocados account for approximately 7,500 acres in Miami–Dade County and have an economic impact of $54 million to the regional economy (Evans et al., 2012; Evans and Crane, 2013; Crane, 2012). The estimated cost of replacing dooryard and commercial avocado trees in south Florida is $206 and $216 million, respectively. The avocado industry has already lost over 3500 trees due to laurel wilt since the disease was detected in a commercial avocado grove in south Miami–Dade County in 2012.

Laurel wilt (LW) affects plants in the Lauraceae causing rapid wilt and sudden death. It is caused by the fungus *Raffaelea lauricola* Arx & Hennebert, that was accidentally introduced, along with its original vector, the redbay ambrosia beetle, *Xyleborus glabratus,* to the United States in May 2002 in Port Wentworth, GA (Crane, 2012). Unfortunately, other ambrosia beetle species (e.g., *X. volvulus* and *X. ferrugineus*) have now been shown to be contaminated with the pathogen and are capable of further transmitting the disease (Carrillo et al., 2013).

Trees become infected when female ambrosia beetles carrying *Raffaelea lauricola* bore into a host tree to create galleries in which they cultivate the fungus as food source for their young. Once the fungus infects a tree, the tree attempts to wall off its vascular tissue as a defense mechanism. This unfortunate strategy effectively interrupts all water and nutrient transport in the xylem of the infected areas and causes rapid mortality of the infected tree (Fig. 1, Fig. 2).

Laurel wilt is spread by three mechanisms: through root grafts among adjacent avocado trees, by ambrosia beetle vectors, and by movement of beetle infested wood. Disease movement through root grafts among adjacent trees has been the most rapid and devastating method of LW spread to date (Jonathan Crane, personal communication). Beetle and infested wood movement has been responsible for short to long distance spread within and among groves. Symptoms of the disease in avocados include large areas of the tree's upper canopy rapidly wilting and turning brown. The leaves die so quickly that they remain on the tree (i.e., do not detach from the stems). Other symptoms include a discoloration of sapwood (vascular tissue) and evidence of beetle bore holes on the trunk and limbs; tiny sawdust straws are symptomatic of beetle boring. In groves where LW has not been detected previously it is important to take a sapwood sample for LW analysis to positively identify the cause of the tree decline. This will also help distinguished them from trees that exhibit similar symptoms caused by lightning, heavy fruit load or trees infected with *Phytophthora* root rot.

Current Recommendations

Once an avocado tree is infected with laurel wilt, there is no known remedy to save the tree. A tree that has been positively identified as LW infected tree should immediately be removed by pushing it out of the ground or cutting and destroying the tree's stump (Fig. 3). The resulting debris should not be transported as it likely contains infected beetles. Debris should immediately be destroyed through chipping and/or burning (Fig. 4). The wood

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Fig. 1, Vascular discoloration. Photo: Jeff Wasielewski.

Fig. 2: Sawdust straw. Photo: Jeff Wasielewski.

Fig. 3: Removed stump. Photo: Jeff Wasielewski.

Fig. 4: Woodchips. Photo: Jeff Wasielewski.

chips are attractive to ambrosia beetles and the wood chips and adjacent trees should be treated with Malathion immediately to kill any beetles attracted to the chips. The stump is often difficult to destroy because of its size and may take time to burn.

Recently, systemic fungicide treatment of a ring of two trees in each direction adjacent to the infected tree (called spot treatment) through injection or infusion with the fungicide Tilt® (propiconazole) has been recommended to discourage the root-graft spread of the disease. The cost of infusion has declined over the past 18 months to the point that spot treatment to control the spread of LW may be economically feasible (Edward Evans, personal communication). Comprehensive research studies on other more economically feasible and long lasting fungicides are currently underway. In some cases it may be efficacious to sever the root systems among adjacent trees by trenching in an attempt to prevent the spread of the disease among root grafted trees.

The Future

The spread of LW in the commercial avocado production area continues, but new advances and strategies are being developed to lessen the economic blow of the continued loss of trees due to this disease. Current methods being assessed for the future include the use of canine detection (Fig. 5) of the LW pathogen in trees and the use of drones (Fig. 6) outfitted with specific spectral cameras to detect and scout for the diseased trees before they show visible symptoms. Visual identification of trees suspected of LW by aerial helicopter surveys is already being used. The use of beetle traps and repellents to reduce ambrosia beetle populations and to thwart the movement of the beetles and the use of more efficacious fungicides are under investigation. Long term solutions include identifying avocado cultivars or germplasm with genetic LW resistance and plant breeding LW resistant cultivars.

Fig. 5. Detector dog. Photo: FIU.

Fig. 6. Drone. Photo: Jeff Wasielewski.

Fig. 7. Laurel Wilt mortality. Photo: Jeff Wasielewski.

At present, there is no silver bullet for stopping the advance of laurel wilt as it continues to take an economic toll on avocado growers of Miami–Dade County and the state of Florida (Fig. 7). It is only through continued research, scouting and persistent removal of infected trees that we can hope to lessen the effect of this devastating and economically impactful disease.

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