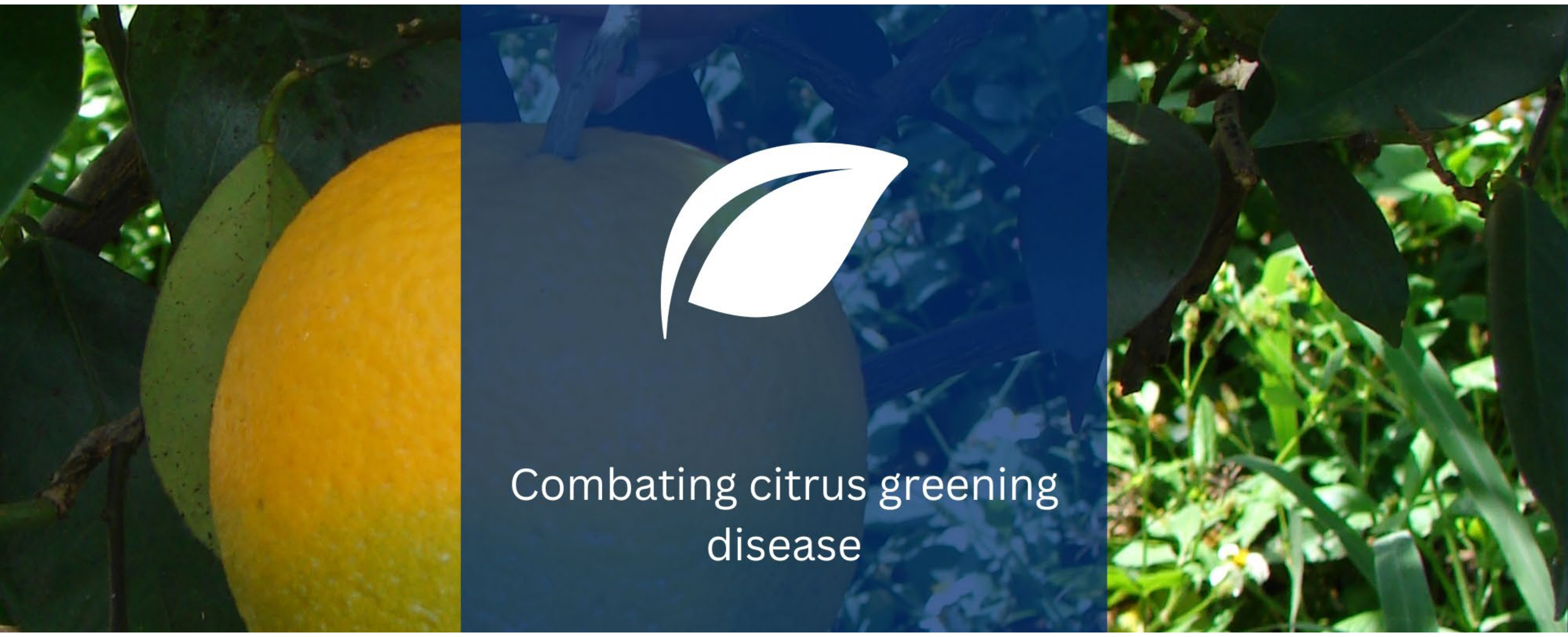
USDA Agricultural Research Service
U.S. DEPARTMENT OF AGRICULTURE

How ARS Does It:
Prioritizing Animal, Human, Plant, and Environmental Health

Citrus greening disease, also known as Huanglongbing (HLB), is a bacterial disease that affects citrus trees. The Asian citrus psyllid, a small insect that feeds on the sap of citrus trees, spreads HLB. The bacterium interferes with the tree's ability to transport nutrients, causing the tree to produce misshapen, bitter fruit and eventually die. HLB was first detected in Florida in 2005. Since then, it has spread to all commercial citrus-producing states in the United States, including California, Arizona, and Texas.



The disease has devastated the U.S. citrus industry and caused a sharp decline in production and exports; in Florida alone, orange production has fallen by more than 50 percent since HLB was first detected. ARS is fighting HLB's spread with disease detection, prevention, and mitigation research. ARS research efforts are focused on studying how pests and preservatives affect the sustainability of citrus farming and on conducting research on Asian citrus psyllid behavior and breeding patterns to prevent and control the spread of HLB. The following ARS advancements in 2022 highlight ongoing HLB control efforts.

Deep learning algorithms improve detection of the Asian citrus psyllid. Early detection of the Asian citrus psyllid on young trees and in orchards can facilitate tree protection and targeted control efforts. ARS scientists in Gainesville, Florida, used deep learning methods to identify and characterize differences between male and female psyllid courtship calls. In addition to providing a method to differentiate males and females in infestations, this data has potential for the development of vibration-based control methods of mating disruption. Such a behavior-based control approach can help reduce pesticide use for managing the psyllid. (NP 304)

New method for tracking the citrus greening pathogen in single insects. The disease comes from plant infection by the bacterium CLas, which is acquired by the Asian citrus psyllid when it feeds on infected citrus trees and then transmits the pathogen to other trees. ARS scientists in Ithaca, New York, developed a method to enrich CLas cells from single psyllid insects for direct genome sequencing. The data generated allowed assembly of CLas genomes from single insects and the identification of differences in CLas DNA sequences that permits strain identification. This method allowed for tracking the strain of CLas from a single insect, which might help trace the origin of new outbreaks. (NP 304)

Plant symbiont systems deliver crop protectants. A major challenge in plant disease control is delivering protectants to the plant vascular system to control pathogens and the insects that transmit them via feeding on plant vessels. A plant symbiont-based system (SymbiontTM) developed by ARS researchers promises to be a cost-effective method for delivering biological therapeutic molecules that control citrus greening disease (Huanglongbing, or HLB) devastating the citrus industry in Florida. Traditionally, scientists use Agrobacterium, a common bacterium, to modify plant genes to generate transgenic plants that enable farmers to protect their crops against harmful insect pests and pathogens. However, transgenic plant adoption in agriculture has been limited, largely due to concerns over potential environmental impacts and the cost and time associated with environmental impact studies needed for regulatory approval of transgenic crops. ARS researchers in Fort Pierce, Florida, and Ithaca, New York, worked with a small Florida agribusiness to develop a method that, for the first time, used Agrobacterium to engineer independently growing plant cells, referred to as 'Symbionts', to produce molecules that can modify plant traits. When transplanted onto a plant, these engineered symbionts provide real-time delivery of desirable plant traits, eliminating the need to make the plant transgenic. Their results demonstrated that symbionts on citrus trees lasted more than 2 years without producing harmful effects to the trees, and improved symbiont transplantation and inoculation methods to produce more uniform and rapid growing symbionts. The results show that the Symbiont system has potential to efficiently deliver therapeutic molecules to the difficult-to-reach vascular system where it is needed most for controlling vectored plant diseases. (NP# 304)

Improved regulatory sampling for HLB infection. HLB infection has been found in urban settings in southern California and the first line of defense to control the spread of HLB is to eradicate infected trees. ARS researchers in Parlier, California, working with the California Department of Food and Agriculture and Central California Tristeza Eradication Agency, improved CLas detection by sampling the stems that support the flower or fruit and using real-time polymerase chain reaction for consistent isolation and detection of CLas DNA. Improving CLas detection and rapid eradication of infected trees reduces CLas spread. (NP 303)

Learn more about National Program 303

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