Scouting for Huanglongbing (HLB; Citrus Greening)[1]

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Scouting for huanglongbing (HLB; citrus greening) is an essential practice for citrus production in areas with known incidences or threats of HLB. The disease affects all varieties of citrus and is widespread in the Florida citrus industry. When HLB-affected trees are not removed, they serve as an inoculum source for the HLB bacteria, as well as a source for transmission by the Asian citrus psyllid to surrounding healthy trees. As a result, scouting for citrus HLB is an important pest-management component for reducing the incidence and spread of this disease.

This publication describes the following: 1) symptoms of HLB and how to distinguish these symptoms from those of other diseases/disorders; 2) when to scout; 3) different methods of scouting; and 4) what to do when an HLB-affected tree is identified.

In Florida, few growers continue scouting and tree removal due to the high level of trees that are affected by HLB. However, in areas where the level of HLB trees are at a low level, scouting and tree removal is still a valuable production practice.

Once the level of HLB-positive trees reach a high level, removal is no longer economically viable.

HLB Symptoms

HLB symptoms are not always prominent or easily distinguished from other tree health problems. When scouting a grove for HLB the first time, scouts should be looking for trees that do not look normal and should examine these trees carefully. Overall, an HLB-affected tree may have a general yellow appearance with shoot die back, sparse foliage, and a thin canopy.

Generally, yellow shoots with upright, small, and narrow leaves displaying yellow veins and blotchy-mottle symptoms are seen on affected trees (Figures 1 and 2). Blotchy mottle is the best diagnostic symptom and the earliest leaf symptom (Figure 1). However, HLB affects all parts of the tree—leaves, fruit, and roots. Early in disease development, symptoms may be restricted to a single branch or a small segment of the tree. Yellow veins (Figure 2), vein corking (Figure 3), and green islands (Figure 4) are all common leaf symptoms found on trees affected with HLB, but alone these symptoms are not necessarily diagnostic of HLB. If these symptoms are found, the tree should be inspected further in an attempt to locate the characteristic blotchy-mottle symptom. As the disease progresses, the entire tree will be affected, and symptoms will become more prominent.

HLB fruit may be affected externally and internally. Externally, fruit can be lopsided, misshapen, smaller than average, and/or have an abnormal color change (Figure 5). Internally, the fruit may exhibit aborted seeds, a curved central core, and a yellow stain beneath the calyx (button) (Figure 6). The fruit may have an off flavor. Often fruit affected with HLB will abscise prematurely and, as a result, can be seen on the ground surrounding an affected tree (Figure 7). An additional symptom may be seen when

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fruit may remain on the tree and are attached to dead stems just above the fruit. These fruit will begin to exhibit decay symptoms, possibly resulting in quality issues at the processing plant. This symptom can be easy to spot when scouting, particularly near harvest time. Note that not all fruit on an affected tree will necessarily be affected, and it is possible to find symptomatic and asymptomatic fruit on the same tree or even on the same limb.

Figure 1. Diagnostic blotchy-mottle leaf pattern of HLB.

Figure 2. Yellow veins are possible HLB symptoms.

Symptoms Commonly Mistaken for HLB

Additionally, nutrient deficiencies can be mistaken for HLB. However, scouts can easily distinguish the symptoms of HLB infection from symptoms of nutrient deficiencies by determining whether the chlorosis (yellowing) is asymmetrical or symmetrical (Figure 8). Nutrient deficiencies result in a symmetrical pattern, but HLB is apparent in asymmetrical yellowing. If only a few trees in a grove display the symptoms of nutrient deficiencies, those trees should be carefully inspected as this may be an early indication of something wrong with those trees even if not diagnostic of HLB (refer to EDIS document PP328 for further information).

Figure 3. Vein corking and blotchy mottle in HLB-affected leaves.

Figure 4. Green islands commonly found on leaves on HLB-affected trees.

Insect damage can also be confused with the symptoms of HLB. Upon closer inspection, insect damage can be easily distinguished from HLB. Insect damage, such as the damage resulting from leafminers, can cause a blotchy or off-color appearance on the top side of the leaf as shown in Figure 9. However, looking at both sides of the leaf reveals

Figure 5. Abnormal color change (left) and lopsided fruit (right), indicating HLB.

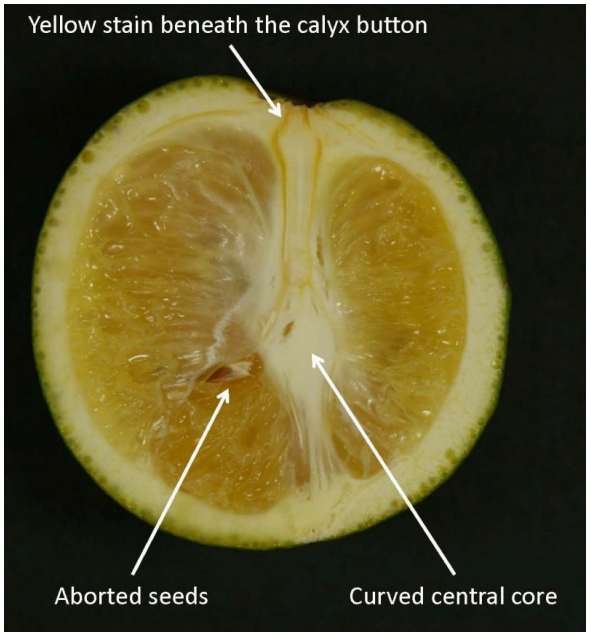

Figure 6. Internal fruit symptoms of HLB-affected fruit.

Figure 7. An HLB-affected tree, in which the symptomatic fruit have abscised and fallen to the ground at the base of the tree; note the healthy fruit still hanging on the tree.

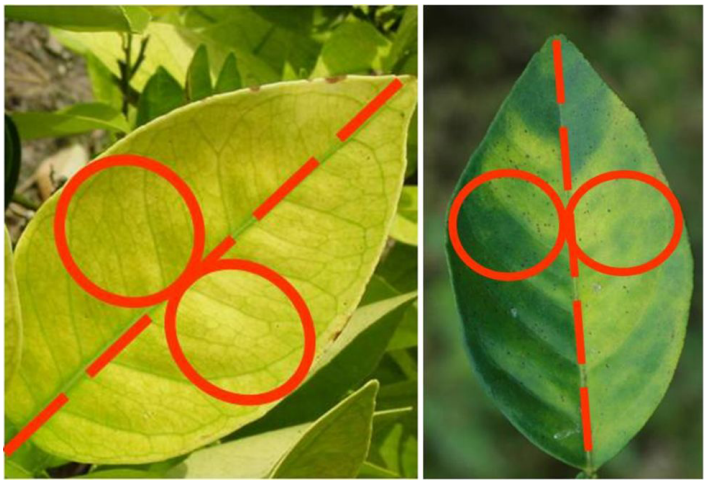

Figure 8. Nutrient deficiency (left) compared to HLB symptoms (right); notice the symmetry on either side of the midvein in the nutrient-deficient leaf compared to the asymmetrical pattern of the symptoms on the HLB-affected leaf.

Figure 9. A leaf with apparent blotchy mottle on the upper leaf surface (top) caused by significant leafminer damage on the lower leaf surface (bottom).

the blotchy pattern is actually associated with leafminer mines on the underside of the leaf (Figure 9).

Leaf damage resulting from herbicide or other chemical sprays is often apparent in yellow patterns that cross the midvein. Mottling patterns resulting from HLB will not cross the midvein. (Herbicide damage is typically seen in the lower canopy, whereas other chemical toxicities may be seen anywhere in the canopy.)

Various diseases or physical damage can cause trees to exhibit symptoms similar to HLB. Yellow veins can be

caused by Phytophthora (foot rot) or by a broken limb. If yellow veins are found, the tree should be inspected further to identify the possible cause of the symptom.

Scouting Frequency

Citrus groves should be inspected for HLB when the number of positive trees are low, early in the infection cycle. If HLB has previously been found in a grove or has been confirmed nearby, scouting more frequently is strongly recommended.

HLB symptoms are most visible during the fall and winter months, but they can be observed year round. During the spring flush, scouting becomes more difficult because new leaves typically do not express HLB symptoms, and the older, symptomatic leaves become hidden behind the new flush.

Scouting Methods

Various methods can be used to scout for HLB, including walking through groves or riding on all-terrain vehicles (ATVs) or on elevated platforms (Figure 10). Multiple types of elevated platforms are available, including tractor- or truck-mounted platforms. Choosing or designing an ideal platform for individual situations will vary based upon grove conditions and tree size. However, simply driving through row middles will not be sufficient to thoroughly scout for HLB as symptoms are difficult to see and properly identify from a distance.

Figure 10. Walking, ATV, and elevated platform used to scout for HLB.

HLB symptoms can be found on the inner or outer edges of the canopy, thus making the symptoms difficult to locate. The size of the trees and acreage to be scouted will determine the most practical method to use, but walking the grove will allow for the most thorough inspection of trees. Small, young trees can easily be surveyed by walking, and medium trees can be surveyed by both ATV and walking. Large trees can best be scouted by using a combination of elevated platforms, which allow for maximum viewing of the upper canopy, combined with ATVs and walking for more close-up inspection of the lower canopy.

The row chosen to scout in a grove will determine the subsequent middle to travel the next time the grove is scouted (Figure 11). For example, in a block of large, mature trees, the first inspection may consist of every other row being scouted from an elevated platform with alternate rows being scouted from an ATV. The method used to scout each row would be switched during the next scouting, thus alternating the scouting method in each row with each subsequent inspection. This pattern ensures over the course of two scouting events, each side of each row is inspected from the ground and from an elevated position.

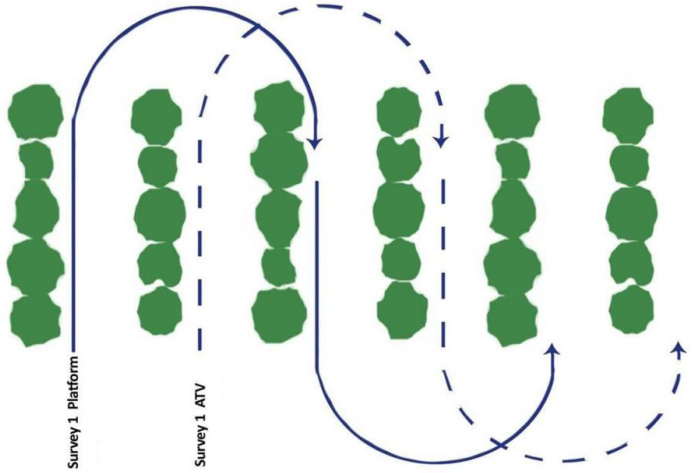

Figure 11. A diagram depicting how to use two scouting methods to thoroughly scout a grove. During each scouting, alternating rows are scouted either from a platform or ATV. The method used to scout each row will alternate during each subsequent scouting to ensure trees are viewed from several angles.

Grove Conditions and Scouting

Scouting is more difficult when a grove is poorly maintained. Grove middles should be mowed and easily accessible by walking or equipment so scouts can focus on the trees instead of watching the ground for potential hazards.

Nutrient deficiencies can easily be confused with HLB symptoms; therefore, a grove expressing numerous nutrient deficiencies is more difficult to scout for HLB than is a properly fertilized grove.

A well-kept grove is also easier to scout for HLB. Tree size and canopy volume can affect safe movement of scouts through a grove, especially on elevated platforms. Open hedged rows allow easier access and prevent scouts having possible contact with limbs or branches, which can cause slips or falls from elevated platforms.

Marking Suspect Trees

Scouts should mark suspect trees with flagging tape. Once a tree branch has been flagged, the scout's name and date should be clearly written on the flagging tape. After an entire row has been scouted, a flag on each end of the row with the number of suspect trees in that row will assist with relocating the trees at a later time (Figure 12). Although a wide selection of flagging tape is available, use only one color or pattern to identify suspect HLB trees. Use a different tape color or pattern to identify trees positively confirmed by laboratory analysis.

Figure 12. Flagging to mark HLB-suspect trees.

To locate HLB-affected trees again after scouting, so the trees can be removed, a GPS system or grove map may be helpful. Even with GPS mapping, however, a physical flag or other marker on the tree is recommended.

Safety while Scouting

The goal of the scouting crew is to locate and identify suspect trees with HLB symptoms while remaining safe. If a grove has recently had a chemical application, follow the chemical label directions regarding the re-entry interval (REI). Weather is also an important part of a safe scouting program. Heat stress, sunburn, lightning, and rainy weather can impact the health and safety of scouts.

Operators of ATVs or elevated platforms are responsible for transporting the survey crew safely and efficiently. If the driver approaches a dangerous area (such as a canal, hog routing, sandy area, or fallen limb), the scouting crew should exit the equipment until the operator can safely pass the hazard. Once the operator passes the hazard, the scouting crew can safely return to the elevated platform.

Operators of elevated platforms must also be careful of electrical lines and other such obstacles and hazards.

The potential for slips and falls is always present when working in a grove. A first aid kit should be kept in a central location, including vehicle or equipment, and employees should be instructed on the proper procedures in case of injury, with a well-defined emergency safety plan in place, including numbers to call for emergency assistance.

Diagnostic Testing

At this time, Polymerase Chain Reaction (PCR) is the only procedure to positively identify HLB. Three sites are equipped to receive samples from growers and positively identify the HLB bacterium using PCR analysis. Please contact the facility directly to determine the proper procedure and requirements for submitting samples for testing.

HLB Diagnostic Labs

Southern Gardens Diagnostic Laboratory, 111 Ponce de Leon Avenue, Clewiston, FL, 33440, 863-902-2249

Florida Division of Plant Industry, P.O. Box 147100, Gainesville, FL, 32614-7100, 1-800-282-5153

UF Plant Diagnostic Center, Building 1291, 2570 Hull Rd., Gainesville, FL 32611, 352-392-1795

Additional Information

Citrus Greening, Blight and Tristeza Comparison Identification Sheet: https://edis.ifas.ufl.edu/pp263

Citrus Greening (Huanglongbing): A Serious Threat to the Florida Citrus Industry: https://edis.ifas.ufl.edu/ch198

Citrus Research and Education Center Greening website: https://crec.ifas.ufl.edu/hlb-information/greening/

Florida Citrus Production Guide: Huanglongbing (Citrus Greening): https://crec.ifas.ufl.edu/resources/production-guide/

Huanglongbing (HLB; citrus greening) Leaf and Fruit Symptom Identification: https://edis.ifas.ufl.edu/pp327

Huanglongbing (HLB; Citrus Greening) and Nutrient Deficiency Identification: https://edis.ifas.ufl.edu/pp328