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# 2025–2026 Florida Citrus Production Guide: Huanglongbing (Citrus Greening)[1]

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Huanglongbing (HLB; citrus greening) is caused by the bacterium *Candidatus* Liberibacter asiaticus (*C*Las). The name huanglongbing means "yellow shoot disease," and it derives from the bright-yellow shoot symptom that commonly occurs on a sector of an infected tree. HLB is an extremely serious citrus disease because it causes tree decline and affects all citrus cultivars. The HLB-causing bacterium found in Florida is the Asian species, which occurs in warm low-altitude areas and is transmitted by the Asian citrus psyllid (*Diaphorina citri* Kuwayama). The Asian citrus psyllid was discovered in Florida in 1998 and is now found throughout the state wherever citrus is grown.

Early HLB symptoms on leaves include vein yellowing and an asymmetrical chlorosis referred to as "blotchy mottle." The blotchy mottle of the leaf is the most diagnostic symptom of the disease, especially on sweet orange. For a visual representation of HLB symptoms, please see PP327, "Huanglongbing Leaf and Fruit Symptom Identification." The blotchy mottle symptom also may be confused with other diseases or damage such as severe forms of citrus tristeza virus (CTV), Phytophthora root rot, waterlogging, citrus blight, leafminer tunnels, or citrus stubborn disease (an exotic disease to Florida). Leaves may be small and upright with a variety of chlorotic patterns that often resemble mineral deficiencies such as those of zinc, iron, and manganese. Some leaves may be totally devoid of green or exhibit green islands. Young trees decline quickly and rarely become productive if they are infected shortly after planting. As mentioned above, early symptoms of yellowing may appear on a single shoot or branch. The yellowing usually spreads throughout the tree canopy over several years. It is common for affected trees to show twig dieback. Fruit are often few in number and small, may be lopsided with a curved central core, and fail to color properly, remaining green at the stylar (flower) end. Many fruit drop prematurely from afflicted trees in the month prior to harvest. A yellow stain may be present just beneath the peduncle (stalk) on a cut fruit. The affected fruit often contain aborted seeds and have a salty, bitter taste reminiscent of unripe fruit. Root systems are heavily damaged by HLB, with 30%–50% root loss occurring in the early phases of the disease. More than 70% root loss has occurred by the time canopy decline is visible. Current information about the effects of HLB on root systems is available in chapter 17, "Root Health Management."

The causal bacterium present in Florida, *C*Las, has not been cultured, and formal diagnosis is done by PCR. Detection of the bacterium is usually only possible from blotchy mottle symptomatic tissues. The host range of the *Ca.* Liberibacter spp. that cause HLB includes all citrus

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species regardless of rootstock. Normally symptoms are severe on sweet orange, mandarins, and mandarin hybrids and moderate on lemon and sour orange. Grapefruit symptoms are moderate initially but become suddenly severe after several years. Lime, pomelo, and trifoliate orange are listed as more tolerant, but this does not mean that the bacterium is unable to infect and multiply in those cultivars. Severe symptoms have been observed on pomelo and lime.

The consequences of unmanaged HLB can be grave. Mature trees start to decline slowly and eventually become nonproductive after infection. The outcomes are worse for young trees. In most cases, the trees never reach full production, and in the worst case, the trees die within one to two years of planting. Because HLB also can be transmitted with infected budwood, the use of certified disease-free planting materials is essential to maximize planting success.

Psyllids are the primary vector for HLB spread and are present in Florida year-round, so their management is a necessary part of an integrated management program. Peak activity and movement occur in the spring and summer with the development of new flush. Because HLB is very common in Florida citrus, psyllids are likely to carry the bacterium between plants when they move, increasing the disease pressure in plants that are already infected and establishing the bacteria in young plants. Despite the high pest and disease pressure, citrus can still be productive thanks to nutritional inputs to maintain the health of trees. New tools are also under evaluation to determine the best way to protect young trees from HLB. In addition to management within the field, noncrop hosts for psyllids require attention because they can be a source of this pest. The Asian citrus psyllid feeds on many rutaceous plant species. Of these plants, orange jessamine (*Murraya paniculata*) and orange boxwood (*Severinia buxifolia*) serve as hosts for both the psyllid and *Ca.* Liberibacter spp. Movement of these ornamentals is restricted under state compliance agreements, and they should not be moved from areas where the disease occurs.

# Recommended Practices

Overall, integrated pest management strategies should focus on the following: use of disease-free nursery trees, an optimal nutritional regime, reduction of the inoculum by frequent disease surveys, removal of symptomatic trees, and focused management of Asian citrus psyllid populations. Specific recommendations based on tree age are listed below.

## A. Young Trees/New Plantings

1. The use of clean budwood and certified healthy trees is essential for successful replanting. It is now mandatory in Florida that budwood sources and nursery production be carried out under psyllid-proof enclosures and certified HLB-free.

2. Preventing psyllid access to flush is important in managing HLB. Systemic insecticides, such as imidacloprid, have traditionally been used for this purpose (see chapter 22, "Asian Citrus Psyllid"). However, resistance to imidacloprid and several other commonly used insecticides has been detected in specific regions in the state. Therefore, it is recommended to contact your local UF/IFAS Extension agent or citrus entomology state specialist to assist in developing insecticide-based management plans. Some biological control for psyllids is available, but the amount of control provided by introduced parasitoids has been insufficient to slow disease spread. Exclusion netting has been demonstrated to be an effective tool to keep psyllids from feeding on trees. For further information on this non-insecticide-based tool, see EDIS publication HS1425, "Individual Protective Covers (IPCs) for Young Tree Protection from the HLB Vector, the Asian Citrus Psyllid."

3. Scouting for HLB-affected trees should be done routinely in young plantings so that infected trees can be removed quickly. It is recommended that scouting be conducted four or more times per year in areas where HLB is not widespread (e.g., north Florida). The frequency of scouting may be higher in areas that have high rates of HLB. Symptoms are the easiest to find from October to March, although they may be present at other times of the year too. The current methods used to scout are walking or all-terrain vehicles. Symptomatic tree numbers and the rows in which they are found should be marked with colored flagging tape. GPS coordinates should be taken or the sites should be marked on a map to facilitate relocation and removal of these trees. In some cases, an HLB PCR diagnostic test may be necessary to confirm the disease (see diagnosis below). Visit the UF/IFAS Citrus Research and Education Center (CREC) webpage on Citrus Greening for HLB scouting resources.

## B. Mature Trees

Diagnosis of HLB by symptoms alone may be difficult because some nutrient deficiency symptoms and other problems are often confused with some of the symptoms associated with HLB. Samples of trees suspected to be infected with HLB may be sent for PCR diagnosis to

the FDACS Division of Plant Industry or the UF Plant Diagnostic Center. Visit the CREC webpage on HLB for contact information or procedures on the submission of suspect samples to labs for PCR testing.

In mature groves, psyllid management will vary based on growers' needs but should be based on the goal of reducing the population to minimize impacts of reinoculation and potential for spread to young plantings. Population reduction is most often achieved using insecticides. When using insecticides, modes of action must be rotated for resistance management (see ENY-854, "Quick Reference Guide to Citrus Insecticides and Miticides"). Insecticide resistance has been detected in several counties; therefore, it is prudent for growers to contact their county Extension agents or state specialist for advice on which materials to use in programs.

Windbreaks in the form of trees have been evaluated and found to reduce psyllid migration into fields. Windbreaks may also provide habitat for predatory insects that can help reduce local psyllid populations. Predatory insects—including lady beetles, lacewings, and the imported parasitoid *Tamarixia radiata*—can help in reducing the young psyllid populations within a field.

## C. Horticultural Management for All Groves

1. Plant nutrition is essential for optimum growth and yield of high-quality fruit. A fertilizer program should include all mineral nutrients. An excess or deficiency of any single nutrient can adversely affect tree performance. HLB-affected trees have smaller and weaker root systems when compared to healthy trees; therefore, nutrient uptake is limited in HLB-affected trees. Hence, it is suggested to apply fertilizer and irrigate in frequent, small doses because this can increase the uptake potential of the tree. Controlled-release fertilizer and fertigation can be strategic alternatives to multiple applications of conventional dry granular fertilizer. Recent research indicates that secondary macronutrients and micronutrients are critical for maintaining tree health of HLB-affected trees; however, these nutrients should not be applied in high doses. The focus should be on balanced and constant application of all nutrients in split doses throughout the year.

   Soil and irrigation-water pH also play an important role in nutrient availability to the plant. HLB-affected trees perform better when the soil pH is around 6.0–6.5. Intensive fertilizer and irrigation management will not cure the tree from HLB but can potentially improve the quality and productivity of HLB-affected trees. It is highly recommended that before making any changes to a fertilizer program for HLB-affected or healthy trees, leaf and soil nutrient analysis is performed and taken into consideration. The goal of the fertilization program should be to have all the leaf nutrients in the high end of the optimum range. Refer to chapter 14, "Irrigation Management of Citrus Trees"; chapter 15, "Nutrition Management for Citrus Trees"; and chapter 17, "Root Health Management," for more information.

2. Irrigation management is crucial for HLB-infected trees because these trees experience a significant reduction in root biomass following infection. This decline compromises their ability to absorb water and nutrients from the soil, making them more susceptible to drought stress. This is particularly concerning during the dry season (October–May), when trees rely heavily on supplemental irrigation for their water needs. Recent field trials have shown that more frequent irrigation, applied in smaller amounts, improves soil water availability throughout the day and leads to higher leaf water potential. The better hydration status of trees receiving frequent irrigation likely helps prevent flowering induced by late-season drought stress. Additionally, this improved water status supports greater reproductive and vegetative growth during the spring flush. As a result, the trees benefitting from more frequent irrigation consistently achieve significantly higher yields over the years. Refer to chapter 14, "Irrigation Management of Citrus Trees."

3. Recent studies suggest that HLB-affected trees undergo an imbalance in plant hormones due to a growth-plant defense trade off. In several multi-year field trials with plant growth promoting hormone, gibberellic acid (GA) showed that it can promote vegetative growth and improve productivity of HLB-affected trees. It is recommended to use GA from August–December to promote vegetative and fruit growth and suppress excessive flowering. However, precautions must be taken as GA-treated fruit stay externally green. GA is thus an additional tool that growers can use to improve the growth of HLB-affected trees, but it cannot substitute for other integrated grove management practices.

   Another field trial on plant growth regulators (PGRs) has demonstrated that single applications of 2, 4-D and GA (alone) are not effective in reducing HLB-associated preharvest fruit drop. Nonetheless, a combination application of 2, 4-D (Citrus Fix; 3.2 oz/acre) and GA (Progibb LV plus; 10 oz/acre) can reduce fruit drop

significantly in HLB-affected 'Valencia' sweet oranges when applied in the November–December period.

Refer to chapter 19, "Plant Growth Regulators," for more information.

### D. Removal or Pruning of Infected Trees

1. Removal of infected trees is the only way to ensure that they will not serve as a source of the bacterium for psyllid acquisition and subsequent transmission. Generally, removal happens when the tree is no longer productive or is infected very early and will never be productive. In regions where HLB is not widely established, infected trees should be treated with a foliar insecticide (e.g., Danitol, fenpropathrin) to kill all adult psyllids feeding on that tree. Failure to control psyllids will result in them dispersing to new plants once the diseased tree is removed, potentially infecting new resets or plantings.

2. Pruning of trees/symptomatic limbs has been attempted; however, because HLB is systemic, pruning is not successful because tree roots are infected before canopies are symptomatic. Additionally, because the tree is still infected after pruning, the new flush produced will serve as a feeding site for adult psyllids to acquire an even higher concentration of the bacterium than before. The infected psyllids may then disperse to uninfected trees once the new flush hardens off. Moreover, pruning can stress the root system even further, resulting in an overall weak tree and reduced root system. Refer to chapter 18, "Canopy Management."

## Note: Oxytetracycline (OTC) Trunk Injection

Oxytetracycline trunk injection for HLB management was widely adopted in 2023 after the registration of two injectable formulations of OTC in Florida. While there are promising results from trunk injections in some locations, this is not universal. Until more information is available on what factors determine success and the long-term outcomes of OTC trunk injection, we cannot make a formal recommendation of the practice. We will evaluate the available data each year to include revisions. Visit the UF/IFAS Citrus Research website for further information about OTC trunk injections.

## Additional Information

Links to resources on HLB and EDIS documents can be accessed through the CREC website at the following addresses:

https://crec.ifas.ufl.edu

https://citrusresearch.ifas.ufl.edu/

OTC Trunk Injections: https://crec.ifas.ufl.edu/citrus-research/hlb-management/trunk-injections/

PCR Testing Resources and Scouting Resources: https://crec.ifas.ufl.edu/research/citrus-production/disease-identification/citrus-greening-huanglongbing/

## Other Web Addresses for Links

EDIS Publication ENY-854, "Quick Reference Guide to Citrus Insecticides and Miticides": https://edis.ifas.ufl.edu/publication/IN807

EDIS Publication HS1425, "Individual Protective Covers (IPCs) for Young Tree Protection from the HLB Vector, the Asian Citrus Psyllid": https://edis.ifas.ufl.edu/publication/HS1425

EDIS Publication PP-327, "Huanglongbing Leaf and Fruit Symptom Identification": https://doi.org/10.32473/edis-pp327-2019