



Knowledge grows

# California Citrus Farmers: Prepare Your Groves for Citrus Greening

Yara has been actively involved in the citrus greening issue in Florida, working with researchers to help find a way to mitigate or reduce the severity of the disease. We are sharing this knowledge to help California citrus farmers learn from this experience and hopefully avoid the devastating impact Florida farmers endured.

Not long ago, HLB infection of a Florida citrus tree was considered a death sentence for the tree. The entire industry was threatened. Sadly, many groves were lost. But, today, many innovative farmers with 100% HLB infected groves have productive trees with many reporting quality fruit production near pre-HLB levels. Many are planting new groves as quickly as possible. What is happening in Florida? How have some farmers been able to prosper?

Millions of dollars have been spent to find a "silver bullet" cure for citrus greening. Foliar application of antibiotics, heat treatment and multiple foliar source additions have all been tried and all have failed.

Farmers say that balanced nutrition and psyllid control are the reasons for their success until a new resistant variety, developed through plant breeding, produces a permanent cure. Have farmers changed their plant nutrition program? You bet they have.



Asian Citrus Psyllid

## The Problem

HLB bacteria do not manufacture toxins or attack cell walls like many pathogens. They enter the plant's phloem (conducting tissue) as the psyllid feeds. There they alter the metabolism of the citrus trees.

Nutrients that pose a potential harm to psyllids via initiation of a plant protection response are sequestered in leaves



Citrus Greening Symptomatic Leaves

with high quantities of starch. Calcium, magnesium and boron were the first to be identified as deficient in HLB trees. Over time, the citrus tree canopy and roots are damaged by HLB. Tree stress exacerbates the problem. Hence, we must apply a balanced nutritional program that removes stress and supplies adequate additional nutrition for productive and healthy trees.

## Impact of Ca on shoot and root

Hydroponic trial: after 2.5 months the symptoms of Ca deficiency are visible in the trees without Ca supply



Ca deficiency (0 mg/L)

Ca supply (160 mg/L)

REF: Hydroponic trial conducted by Research Centre Hanninghof, Yara International, 15-DE-CT-18

Finally, calcium and potassium play a vital role in the plant's immune system for mitigation of many diseases. Yara is currently conducting a detailed scientific investigation to determine the benefits of a combination of a balanced tree nutrition program coupled with an aggressive psyllid control program to document tree health, fruit production and HLB disease mitigation.

## Calcium and Nitrate Nitrogen are Key Components to Citrus Tree Health

Previous research has established that calcium nitrate is the best nitrogen source for citrus production. Today, it performs extremely well in 100% HLB infected groves in Florida.

Secondly, HLB infected roots develop high root resistance that limits uptake of water and nutrients. Therefore, we must continually grow new roots. Root growth is severely limited without calcium.

## HLB Infected Citrus Trees Respond Favorably to Balanced Plant Nutrition

By making YaraLiva Calcium nitrate the only source of N we were able to improve the canopy density and overall tree health thus allowing the citrus trees to recover and start producing higher yields.

**2010**

Yara dry application Calcium Nitrate, YaraLiva, an excellent source of plant available soluble calcium and nitrate nitrogen, became only source of Nitrogen in ground program.



**2012**

Weak areas "filled" in with denser canopies.

# YaraLiva®

More than calcium nitrate

Contact your local Yara representative for information and product availability:  
[www.yara.us/crop-nutrition/contact-us](http://www.yara.us/crop-nutrition/contact-us)

To learn more about citrus balanced nutrition and tree health, please go to:  
[www.yara.us/crop-nutrition/citrus/newsletter](http://www.yara.us/crop-nutrition/citrus/newsletter)