Citrus Greening Disease: A 5- and 20-year Perspective

M. S. Irey and L. W. Timmer
The Talk

- Based largely on an article in The Citrus Industry Magazine written by Pete Timmer (January 14, 2010)
  - HLB a Public Health Problem by L. W. Timmer

(You always think that people are smart when you agree with them…….)
Citrus huanglongbing (HLB) has been in Florida since 2005 and probably much earlier and is becoming worse. Many groves in South Florida are now severely affected and disease incidence is increasing in Central Florida. The recommended program of clean nursery stock, aggressive psyllid control with inspection and removal of affected trees seems to be working for those that began early and don’t have a lot of neighbors ignoring the problem. But, many growers either didn’t realize how serious the problem was, didn’t discover they had a problem until it was too late, or didn’t want to spend the money. In addition, many Central Florida growers who have low disease incidence still don’t fully appreciate how aggressive the tree removal and psyllid control

Florida, are in a very difficult situation. Current incidence is too high for tree removal to be effective and replanting is probably futile. Classic rock and a hard place. I understand the desire of growers to keep trees, even infected ones, in place to obtain some profit from the groves to maintain a viable operation. But, all those trees will decline in the next five years. Then what? The only future I see for those areas is to remove citrus from large areas to reduce the inoculum load and to provide some separation from heavily infested groves and begin replanting. That will usually require cooperation among neighbors and some means to remove abandoned or poorly managed groves that are the sources of inoculum.

The various nutritional programs that make HLB trees look good are not likely to provide sustainable control. If trees must be maintained, aggressive
The Talk

• Conclusions largely based on an article in The Citrus Industry Magazine written by Pete Timmer (January 14, 2010)

– HLB a Public Health Problem by L. W. Timmer

• Long introduction but necessary to get to the conclusions…….
A Few Basics

• HLB
  – Bacterial disease
  – Insect vectored
  – Considered to be the most serious disease of citrus

• In this hemisphere
  – 2004: Brazil
  – 2005: Florida
  – 2008: Cuba, Dominican Republic, US-Louisiana, Georgia, South Carolina
  – 2009: Belize, Mexico, Puerto Rico, Jamaica
  – 2010: Nicaragua, Honduras, Guatemala......
We went from this in October 2005......

2 counties
To this in February 2008

30 counties
From this in November 2005
To this in October 2007
From this........

April 19, 2007
To this……

December 16, 2008
Situation in Florida – looking back

• In the absence of HLB, ACP was not controlled, however it is obvious that HLB was present prior to the initial discovery
  – Most people think 3-7 years is a reasonable guess

• Most people think that HLB was first introduced in the urban areas
  – Spread from south to north, coastal regions first and then towards the center of the state

• No mechanisms in place to limit the movement of material (nurseries, commercial fruit)
Situation in Florida – what should we have done?

• We should have been controlling the psyllid
  – Biocontrol not effective enough
  – ACP populations were high and widespread
  – HLB was there and being spread unchecked
    • Long latent period (months to years)
  – We had an effective system to move both the ACP and HLB
    • Movement of fruit
    • Movement of trees
• Had we been controlling the ACP, it is likely that the spread of HLB across the state would have been much slower.
So we have it, now what?

- Surveys
- Research
- Management
  - Initially most everybody on the same page
  - Traditional approach was recommended by most (all?) of the world experts

- Traditional approach
  - Control the psyllid
  - Scout for and remove infected trees
  - Use of disease-free trees
Traditional approach – Southern Gardens as an example

- Grove inspection program – 4X per year
- Aggressive roguing of infected trees
- Full-time scouting for the ACP
- Aggressive ACP control program
- Growing costs have increased by ~50%
Nursery Location
Criticisms of “Traditional Approach”

- Do we know if it even works?
- If I remove all of my trees I won't have anything left!
- Even if it does work, I can't afford it.
- What if your neighbors don't do anything?

"Obstacles are those frightful things you see when you take your eyes off your goal."

--- Henry Ford (1863-1947)
Traditional Approach

- Goal: Minimize the inoculum load and the amount of infection to the point that we can go back to “normal”
  - Costs would be up
  - Grove life would be shorter
  - But after a period of time (i.e. learning what to do, and actually doing it), acceptable levels of loss are achieved and sustainable plans can be developed
So does the “Traditional Approach” work?
Psyllid Control at Southern Gardens

- Program 1 - min control
- Program 2 - mod control
- Program 3 - max control
Psyllid and Infection Data Together

2.5 Yrs
- 2 Yrs
- 5.2%
- 2.5%
- 1.3%
- 0.5%
- 1.6%
- 3.6%
- 0.8%
- 0.1%
- 0.5%
Duda

% Infection by Inspection Cycle

2.5 Yrs
• South Africa
DEVELOPMENT AND SPREAD

1ST PERIOD: 1928 – 1965

Started in North-West Province near Rustenburg

- Did not realize Greening was caused by a pathogen
- Thought it was a mineral deficiency or toxicity

Psylla marks

Blotchy mottle

Blotchy mottle
DEVELOPMENT AND SPREAD

2ND PERIOD: 1965 – 1970/80’s

- Citrus psylla shown to be the vector
- Provinces infected included North West, Gauteng, Limpopo, Mpumalanga and KwaZulu-Natal
- Emphasis on “healing” of sick trees, not vector control
- Number of sick trees and orchards increased rapidly
- No new orchards were established
- 4 of 11 million trees (36%) infected !!!!!!!!!!!!!!
DEVELOPMENT AND SPREAD

2\textsuperscript{ND} PERIOD: 1965 – 1970/80’s

- Psylla control neglected because:
  - 1) Organophosphate resistance against the Californian red scale \textit{(Aonidella aurantii)}
  - 2) Short residual effect of foliar sprays

- Predictions: With the exception of the Eastern and Western Cape, citrus production in South Africa would cease.

- Legislation to limit the movement of citrus planting material from infested to non-infested areas
DEVELOPMENT AND SPREAD

3rd PERIOD: 1980’s – 2010

- More effective chemical programmes to control psylla
- Citrus Improvement Scheme established (1971)
- Reduction of inoculum

- Citrus plantings increased to 58 000 ha
• Brazil
HLB MANAGEMENT LESSONS –
Improvement of HLB control in farms with insufficient initial management followed by aggressive management since 2007 (Farms 6 to 9)

- Very large and large farms
- 5 and 11 years-old trees in 2004
- Region of high HLB incidence
- Neighboring “no-management” groves
- HLB management greatly improved at low HLB incidence (<2%)
- Inspections: 3 ground (06); 12 pf4 inspections (07-09)
- Insecticide: 5 foliar (06); 15 foliar + 3 aerial insecticide sprays (07-09)
- Solid blocks with high incidence were completely eliminated

HLB incidence increased sharply in 2007, but with accomplishment of much stronger measures at low incidence the disease incidence decreased
Final Remarks

HLB control is hard and costly, but it is possible!

The efficacy of HLB control can be greatly increased with the establishment of a regional approach and policy to HLB management.
Consistent Data

- Data consistent
  - Multiple countries
  - Multiple groves with different but similar approaches
  - Time frame similar
  - Large groves and small groves

Data to this point indicate that the program works
• "All truth passes through three stages. First, it is ridiculed. Second, it is violently opposed. Third, it is accepted as being self-evident."

— Arthur Schopenhauer (1788-1860)
Criticisms of “Traditional Approach”

• Do we know if it even works?
• If I remove all of my trees I won't have anything left!
• Even if it does work, I can't afford it…….
• What if your neighbors don't do anything???

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Alternative approaches
Infection by county - 2008

<table>
<thead>
<tr>
<th>County</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brevard</td>
<td>0.14%</td>
</tr>
<tr>
<td>Charlotte</td>
<td>0.36%</td>
</tr>
<tr>
<td>Citrus</td>
<td>0.14%</td>
</tr>
<tr>
<td>Collier</td>
<td>4.62%</td>
</tr>
<tr>
<td>DeSoto</td>
<td>0.57%</td>
</tr>
<tr>
<td>Glades</td>
<td>1.24%</td>
</tr>
<tr>
<td>Hardee</td>
<td>0.17%</td>
</tr>
<tr>
<td>Hendry</td>
<td>5.77%</td>
</tr>
<tr>
<td>Hernando</td>
<td>0.06%</td>
</tr>
<tr>
<td>Highlands</td>
<td>1.15%</td>
</tr>
<tr>
<td>Hillsborough</td>
<td>0.15%</td>
</tr>
<tr>
<td>Indian River</td>
<td>2.96%</td>
</tr>
<tr>
<td>Lake</td>
<td>0.00%</td>
</tr>
<tr>
<td>Lee</td>
<td>1.89%</td>
</tr>
<tr>
<td>Manatee</td>
<td>0.47%</td>
</tr>
<tr>
<td>Marion</td>
<td>0.01%</td>
</tr>
<tr>
<td>Martin</td>
<td>6.09%</td>
</tr>
<tr>
<td>Okeechobee</td>
<td>2.34%</td>
</tr>
<tr>
<td>Orange</td>
<td>0.29%</td>
</tr>
<tr>
<td>Osceola</td>
<td>0.32%</td>
</tr>
<tr>
<td>Palm Beach</td>
<td>8.28%</td>
</tr>
<tr>
<td>Pasco</td>
<td>0.27%</td>
</tr>
<tr>
<td>Polk</td>
<td>0.47%</td>
</tr>
<tr>
<td>Putnam</td>
<td>0.01%</td>
</tr>
<tr>
<td>St Lucie</td>
<td>3.71%</td>
</tr>
<tr>
<td>Sarasota</td>
<td>0.09%</td>
</tr>
<tr>
<td>Seminole</td>
<td>0.28%</td>
</tr>
<tr>
<td>Volusia</td>
<td>0.01%</td>
</tr>
<tr>
<td>Other Counties</td>
<td>0.09%</td>
</tr>
</tbody>
</table>

Total: 2.24%
Alternative Approaches

- Growers are by nature optimists
- They are also by nature resourceful
- As infection has spread, the goals of many have changed
- Has lead to the adoption of alternative approaches – "Nutritionals"

- "What we see depends mainly on what we look for."
  — John Lubbock
Nutritional Approaches

• Goal: Extend the life of the current planting
  – Trees are not removed
  – Replanting may not be an option
  – Hopefully a sustainable cure will be found in the future
Nutritional Approaches

- Many different “programs”, many share some common components (at least 15 different programs that I know of)
- Most are a combination of foliar nutritional applications, phosphorous acids, and products said to be elicitors of SAR responses

"Three Spaniards, four opinions"
Spanish Proverb
Nutritional Approaches

• The nutritional approaches cost more than pre-HLB growing costs but may be less than the traditional approach (psyllid control and roguing)
  – Increased fertilizer costs offset by no scouting or tree roguing

• Being adopted even though there is very little hard data
  – Mostly anecdotal data from block-scale grower demos
  – Many are fairly recent
  – Few replicated trials – Virtually NO quantitative data!
  – Not the first time these approaches have been tried
Nutritional Approaches

• Most growers are still controlling psyllids

• In many instances, the trees do look better

• A strong nutritional program should be a part of every good management program (regardless of which approach you take)!
Nutritional Approach – Versions 2 and 3
Exception or the Rule
HLB severity progress curves according to the tree age at first symptoms appearance in non-controlled groves

Bassanezi & Bassanezi (IRCHLB, 2009)
What has HLB taught us?

• With the nutritional programs, you have to separate the agronomic effects from the disease management aspects
• We can correct disease-induced micronutrient problems
• We probably weren’t doing as good a job as we thought we were with our fertility programs…. 
Nutritional Programs

• Little analytical data
  – Mostly grove demonstrations
  – Mostly anecdotal
  – Few replicated trials
  – How long will it work?

• Active ingredients?
  – Many programs
  – Some share things in common, however they also have many differences – what is the active ingredient?
  – All being pushed as a management solution
  – Are they all going to work?
The million dollar question……

• Will you be able to replant resets or develop groves under the inoculum load that will result from leaving infected trees in the field?

• Most people think not, others are trying, but either way there are no data to support that replanting efforts will be successful……
Concerns with Alternate Approaches

• These are “forever” decisions
  – Can’t go back
• Accepting 100% infection
  – Will we be able to grow off young trees under high inoculum load?
• How long is your time horizon?
  – Extract equity or in it for the long term?
• If you stick with the “traditional” program, you can always change your mind, but not the other way around….
Informal Survey

• Approximately 75000 ac represented
  – All with HLB
  – Most with HLB detected in 2007

• Surveys
  – Only 18% conduct 3-4 grove surveys a year
  – 36% are not surveying at all

• Tree removal
  – Only 18% are removing immediately
  – 36% following normal tree removal program

• Psyllid control –
  – All over the board (none to area wide)
• End of the Introduction...........
Summary

- Traditional program
  - Goal: to get back to normal
  - Long term approach
  - It works
  - It is tough to implement
  - Costly

- Nutritional programs
  - Goal: extract equity of current plantings
  - Short term approach
  - Uncertainty as to how long the effects can be sustained
  - Costly
5-Year Perspective

- Most trees in south Florida are infected and many are declining
- Early attempts to replant appear to be failing
- HLB incidence in central FL is much higher
- Production is beginning to drop
- Plantings in south Florida with aggressive control are surviving but control is difficult and costly because of the high inoculum load
5-Year Perspective

- Nutritional and other treatments do not appear to be sustainable
- Some growers are beginning to replant large areas after removal of all citrus in the vicinity
- Production costs have risen substantially

- Area-wide psyllid control programs appear to be working
- Fewer sprays are needed
- Better information is available for management decisions
5-Year Perspective

• Management programs have improved considerably
• Scouting methods are improving
• Genetically enhanced cultivars are being tested but they are not approved and are largely unproven
• HLB damage in Brazil and other areas and is also reducing supply
• Prices for processed and fresh fruit are excellent
20-Year Perspective

- Much of the citrus in the southern areas of the state has declined from HLB unless it was under intensive management.
- Some central FL original plantings with intensive management exist but many/most are replanted.
- Large companies have replanted extensive areas with citrus and are still managing the groves with the traditional method.
- Most small growers except those in COOPs have abandoned citrus.
20-Year Perspective

- Resistant cultivars are now approved or available and are widely planted
- The resistant cultivars are doing well but they still must be extensively managed to avoid resistance (stewardship)
- Despite the danger of freezes, citrus is moving into the more northerly growing areas (Pasco, Lake, Marion, etc.)
- Fresh fruit is being produced in high density plantings
- Successful plantings are large and contiguous
20-Year Perspective

- Psyllid populations are much lower due to better management.
- Inoculum levels are low (manageable levels) in many areas of the state making control easier.
- Citrus acreage is a viable option.
- Production of sweet oranges is going back up despite the intense management needed.
- Prices are still solid.
If you’re serious about staying in the citrus business, get with your neighbors and figure out how to keep HLB to a minimum in your area. Join cooperative efforts to remove abandoned and worse, badly managed groves, and residential trees. One thing works — reduce psyllids and infected trees. Forget the magic bullets! Get ’ur done, guys! Get ’ur done!

*L.W. Timmer is professor emeritus, University of Florida, Citrus Research and Education Center, Lake Alfred.*
"Sometimes it is not enough to do our best; we must do what is required."

- Sir Winston Churchill (1874-1965)
Thank you for your attention

Questions?