

HUANGLONGBING AKA

YELLOW SHOOT DISEASE
YELLOW DRAGON DISEASE
CITRUS GREENING
HLB

HLB – Causal Agent

- HLB is caused by a highly fastidious, phloem-limited bacterium.
- As yet, has not been cultured singularly. Dr. Mike Davis has managed to culture, but always with another bacterium. Speculation that HLB may be caused by a complex of bacteria spp.
- Symptomatic hosts appear to be limited to the plant family Rutaceae (Citrus and its relatives).

THREE HLB SPECIES

- *Candidatus Liberabacter asiaticus* – las
Asian strain
- *Ca. Liberabacter africanus* – laf
African strain
- *Ca. Liberabacter americanus* – lam
americanus strain to-date found only in
Brazil. It was the predominate sp. in Brazil
but now asiaticus is most numerous.

TWO INSECT VECTORS

- *Diaphorina citri* – the Asian Citrus Psyllid
- *Trioza erytreae* - the African Citrus Psyllid

MAJOR OBSTACLES TO MANAGING HLB

- Long latent period
- Foliar symptoms not specific to HLB
- Grower complacency
- Inadvertent role of ornamental growers
- High costs
- No Cure
- No resistance within citrus
- Gaps in knowledge

LONG LATENT PERIOD

- Lack of visual symptoms in early stages
- Young trees – commonly accepted to take 6 months to 1 year from acquisition to visual symptoms and PCR confirmation
- Mature Trees – 1 to 3 years; some think up to 4 to years

FOLIAR SYMPTOMS NOT SPECIFIC TO HLB

- Symptoms alone are not diagnostic
- Symptoms can resemble mineral deficiencies, including zinc, manganese and iron
- Symptoms can resemble other citrus diseases, including blight, stubborn, Phytophthora and Tristeza
- Fruit symptoms, however, are more specific to HLB

GROWER COMPLACENCY

- Prior to discovery of ACP in 1998, growers were not surveying for ACP or HLB. Most had never heard of them
- Widely believed that HLB had not accompanied the ACP to Florida, nor was the disease present in Florida
- Accepted direct ACP feeding damage – did not spray
- Government agencies were not aggressive or thorough in HLB surveys

INADVERTENT ROLE OF ORNAMENTAL GROWERS

- Initially it was believed that Orange Jasmine, *Murraya paniculata*, was a preferred host for ACP but not HLB. We now know better.
- *M. paniculata* commonly grown in Miami-Dade County and planted throughout Florida and the coastal areas of SE USA.
- ACP and HLB moved with *M. paniculata*
- *Severinia buxifolia* another ornamental Rutaceae also hosts the vector and disease

HIGH COSTS

- Citrus growers are spending \$300-\$500+ per acre for multiple pesticide applications to suppress the ACP and to survey for the disease and to remove symptomatic and PCR+ trees. Many simply can not afford these costs.
- High inputs and low returns have led to increasing grove abandonment or minimal cultural programs

NO CURE – HLB IS FATAL

- Many growers are fatalistic as to their economic viability and that of the Florida Citrus Industry. Increasing costs for fertilizer, chemicals, equipment, fuel, labor, taxes, etc. coupled with low returns and the knowledge that there is no cure has led to many growers to 'milk' their groves with minimal horticultural programs or have chosen outright abandonment of their plantings.

HLB – A TRUE TREE KILLER

- Dr. Steve Garnsey, retired USDA Citrus Plant Pathologist, has been quoted as saying, “Canker is like hemorrhoids, a pain in the a*s, but rarely fatal; while Greening is like liver cancer.
- HLB is considered by many to be the most destructive Citrus disease known.

NO RESISTANCE WITHIN CITRUS

- There is no known resistance within citrus. There is some observed field tolerance that is being investigated. Still, scientists and growers should be looking for and testing HLB escape trees wherever HLB is endemic.

CAMBUHY FARMS MODEL

- Adopted and promoted by USDA, FDACS and IFAS and many Florida growers
- Three fold approach
 1. Survey for HLB infected trees minimum of 4xs/year and remove them promptly.
 2. Spray to suppress the ACP
 3. Replant with HLB disease-free trees



Monitoring vector population



Healthy young plant



Scouting by well trained staff

**HLB
Management**



Vector control



Eradication of symptomatic trees

INFECTED TREE REMOVAL

- Most growers have moved from entire tree removal (pushing trees) to clipping or sawing trees
- Stumps and sprouts must be killed
- Mulching or grinding trees in-place or after they are clipped is also being tried

CITRUS NURSERY REGULATIONS

- Use only disease-free plant material
- Grow within ACP proof screened structures
- Regular 30 day FDPI inspections – plants, structures and records
- Regular sampling and PCR testing of propagative material
- Periodic treatments with imidocloprid
- Double-door, atrium entrances with positive air pressure
- New nurseries must be isolated away from citrus plantings





















Progression of symptoms



PROGRESSION OF HLB SYMPTOMS IN 3 YR OLD ORCHARD

Hamlin

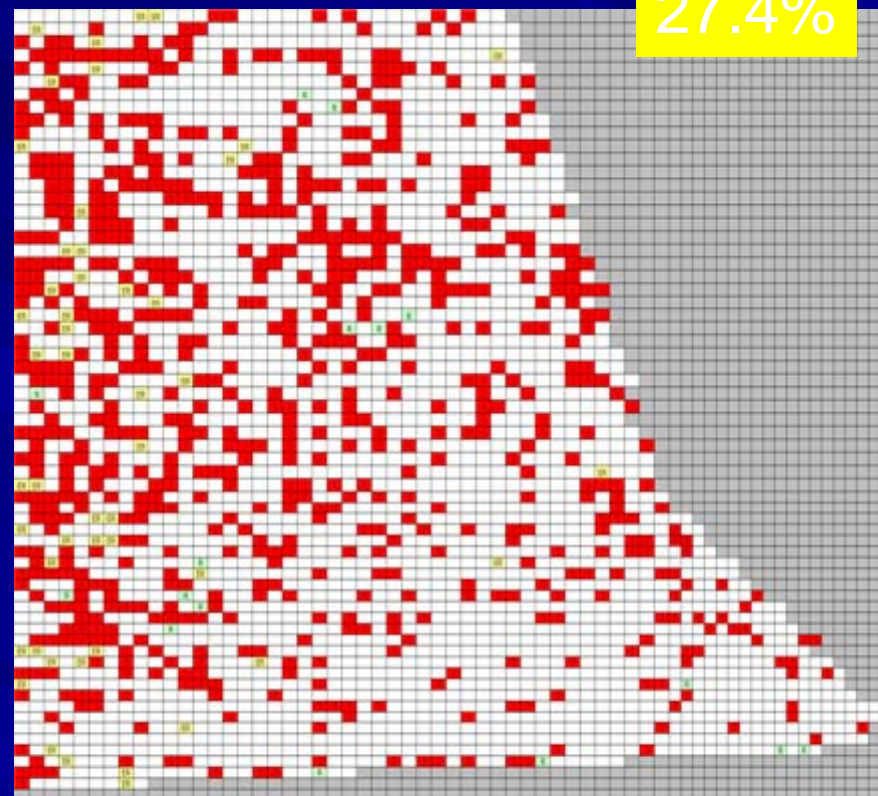
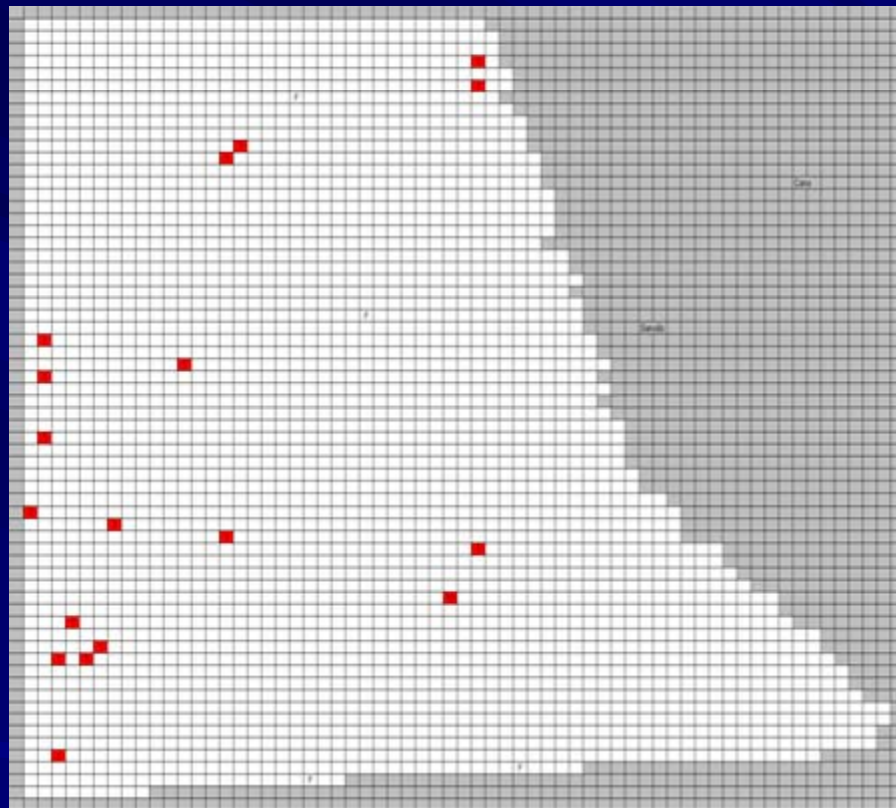
9 months later

May/2005

27.4%

August/2004

0.6%









03/19/2008



OTHER MANAGEMENT STRATEGIES

- Higher density plantings, CCLP, IFAS/SWFREC
- Open Hydroponic Systems from RSA
- Micro-budding – Mani Skaria, TAMU
- Area-wide sprays
- Nutritional products promoting plant health and SARs – Maury Boyd program
- Biological control ? – *Tamarixia radiata*
- Trap plants – pruned to induce flush and then sprayed or drenched with pesticides

NEW BIOPESTICIDE

- Dr. Pasco Avery, IFAS/Ft. Pierce is investigating an entomopathogenic fungus, *Isaria fumosorosea*, also known as PFR 97. There is a commercial greenhouse product produced in California and used in Europe and Japan. Large scale trials are in the process of being conducted in Florida for ACP suppression on Citrus

ACP REPELLENTS

- Report of guava – citrus inter-plantings in Viet Nam
- Discovery of DMDS in guavas and its commercialization
- Interest in Alliums including commercial and native onions

Pheromones

- Identification and commercialization
- SPLAT
- Attract and kill technologies

THE HOLY GRAIL HLB RESISTANT CITRUS

PROBLEMS

- TIME
- GOVERNMENT APPROVAL
- CONSUMER ACCEPTANCE

INDIVIDUAL GROVE DATA

Trees Infected						% Infected			
Grove	Current Mo.	2007 YTD	2008 YTD	Current YTD	Grand Total	2007 YTD	2008 YTD	Current YTD	Grand Total
Alpine	15	0	6	62	153	0.0%	0.0%	0.0%	0.1%
Crow's Nest	0	121	2,815	0	45,374	0.0%	0.7%	0.0%	11.7%
Desoto	208	0	165	677	2,355	0.0%	0.0%	0.1%	0.5%
Gopher Ridge	4167	555	12	13,119	57,234	0.1%	0.0%	2.5%	10.8%
Hickory	4034	0	2,390	9,090	30,984	0.0%	0.7%	2.6%	8.7%
Immokalee	1127	433	6,077	3,673	53,060	0.0%	0.5%	0.3%	4.6%
Manatee	0	0	4	0	21	0.0%	0.0%	0.0%	0.0%
Summerland	0	281	785	0	19,016	0.1%	0.3%	0.0%	7.8%

TO RESET OR NOT TO
RESET?

THAT IS THE QUESTION