UF / IFAS / Citrus Programs: Recent Advances on HLB & ACP Research

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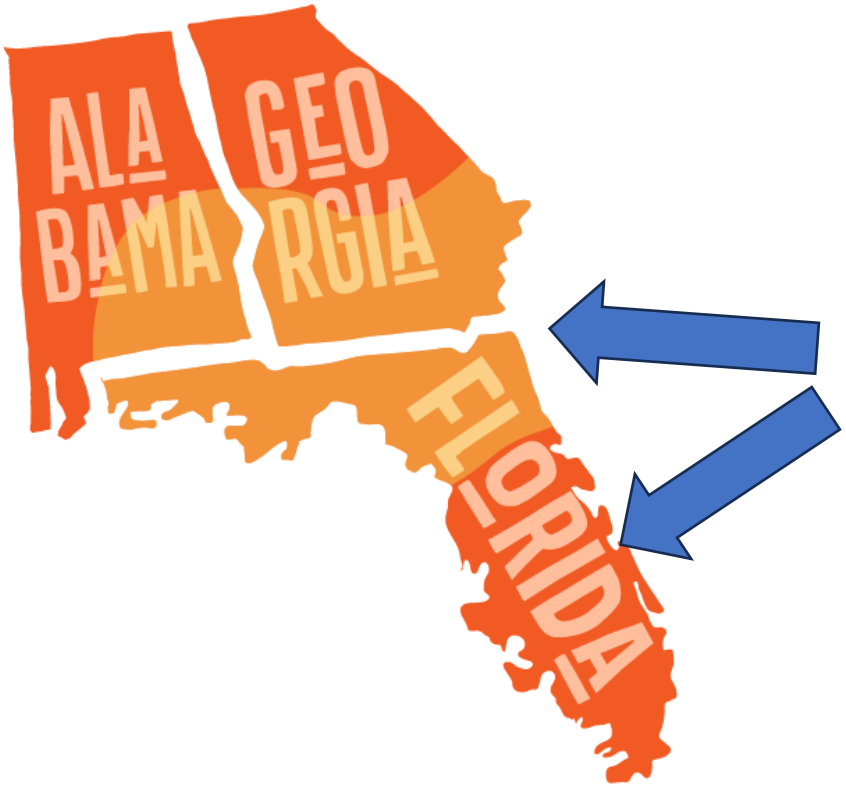

Citrus management recommendations will be different…completely different situations!

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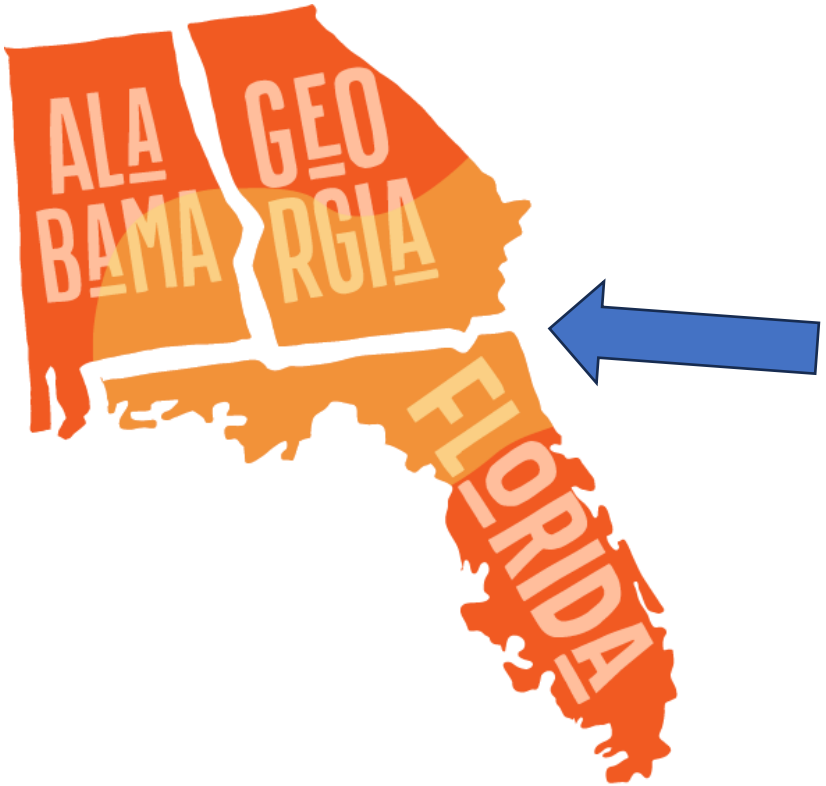

Climate
Psyllid Populations
Soils***
Varieties grown

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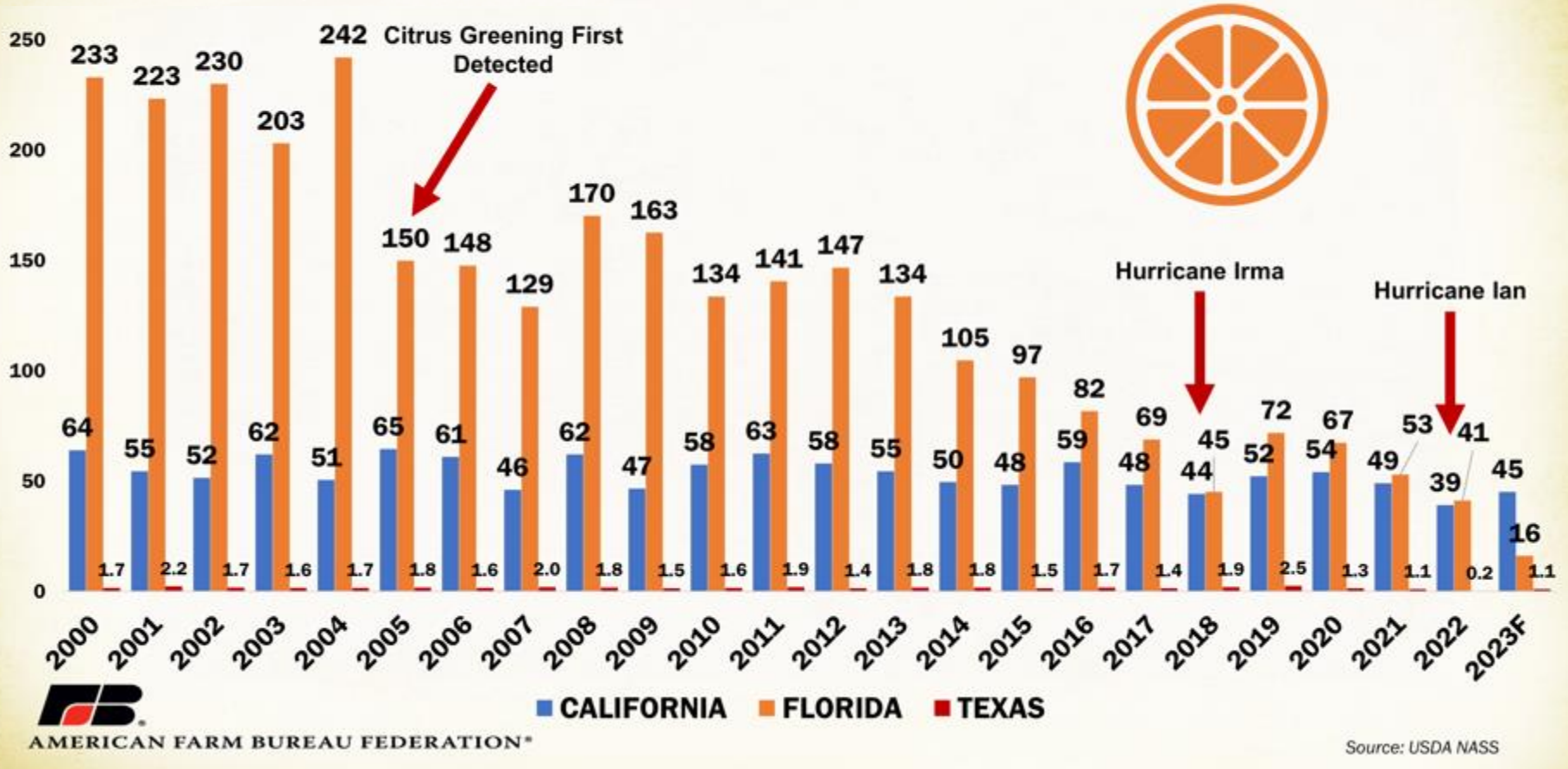
DOMESTIC PRODUCTION OF ORANGES | BY STATE

Million Boxes | 2000 to 2023



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Source: USDA NASS

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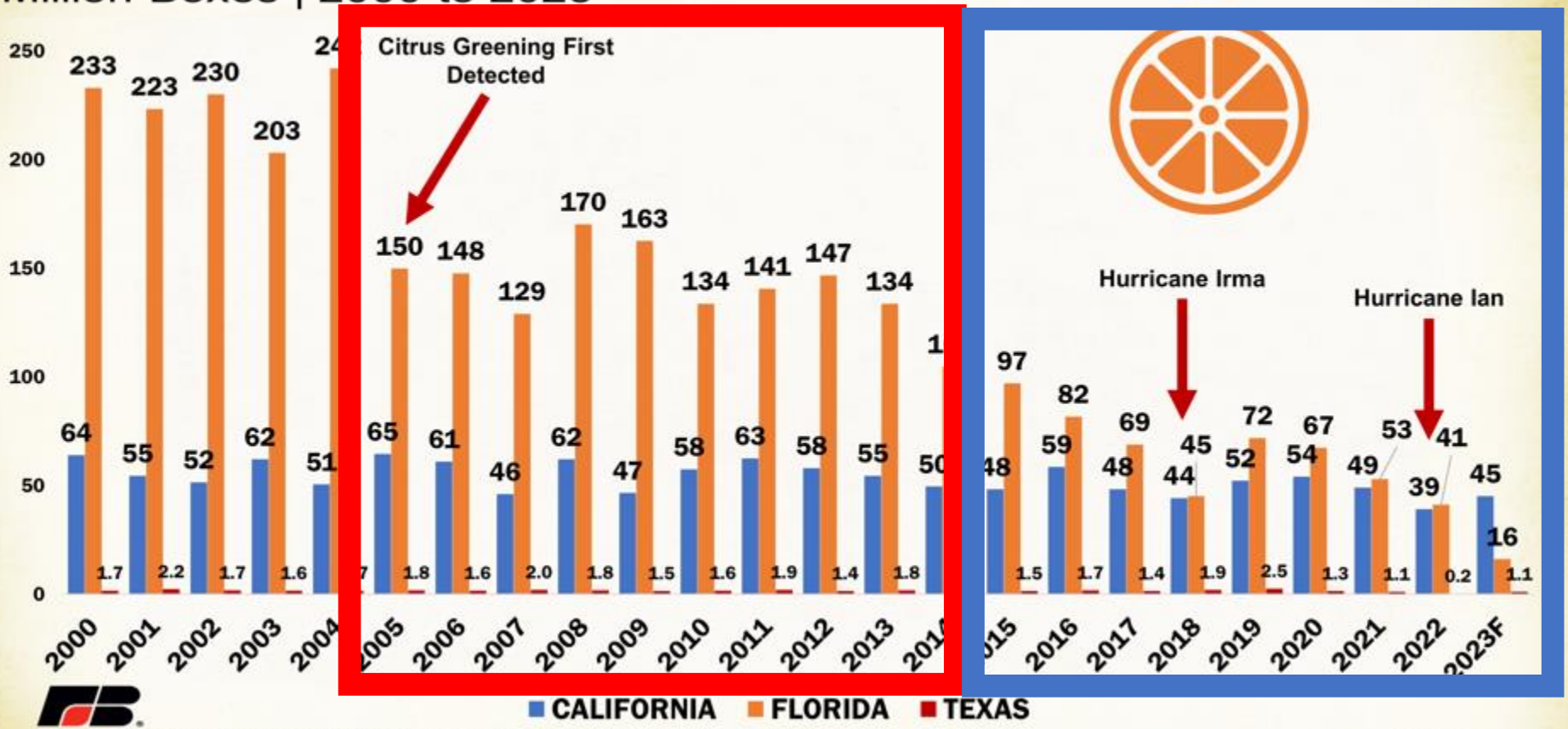

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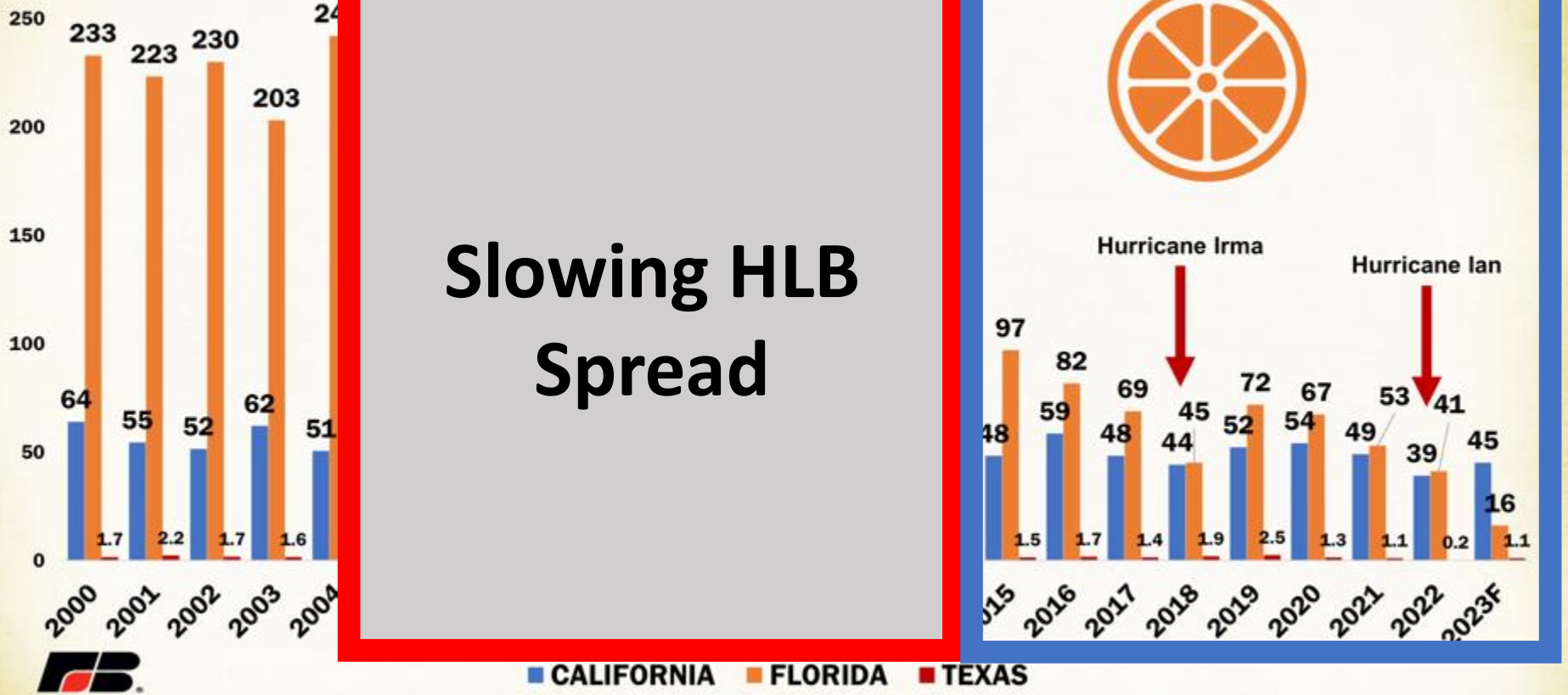

Slowing HLB Spread

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Source: USDA NASS

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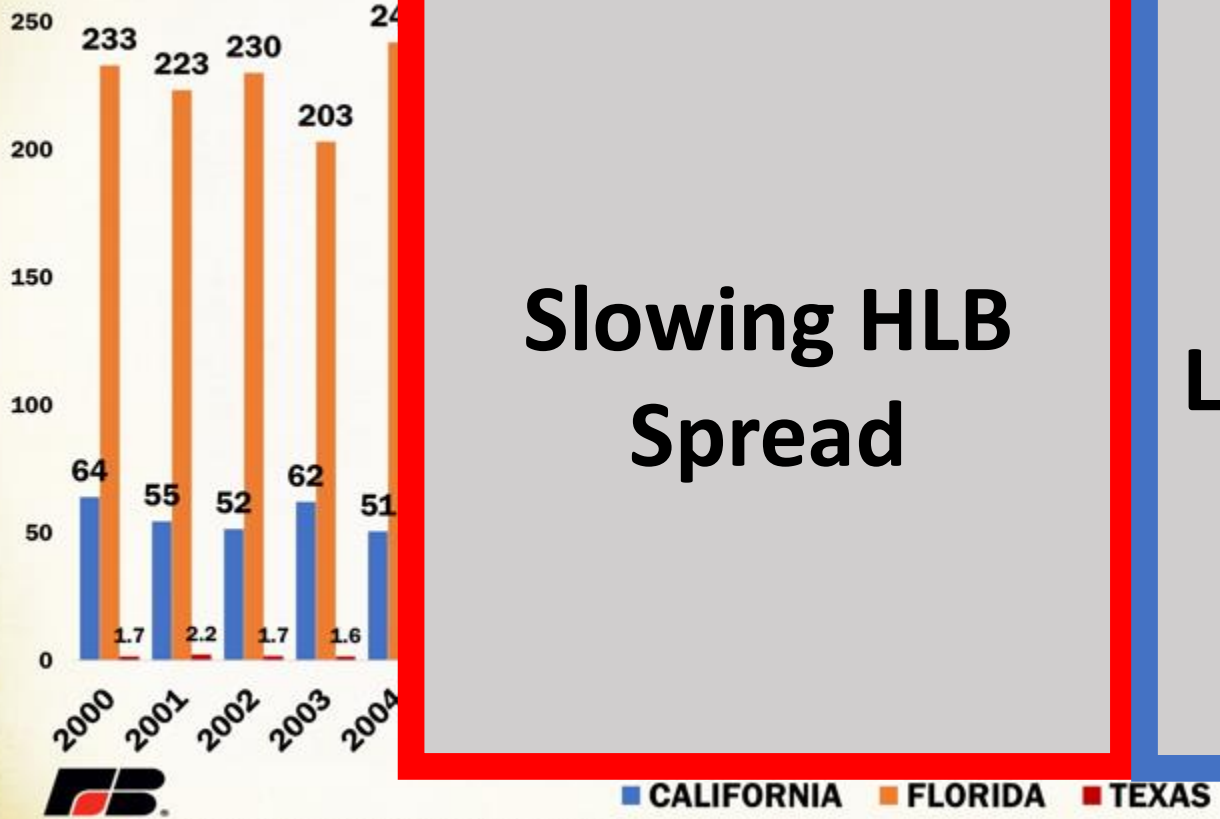

Slowing HLB Spread

Living with HLB

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Source: USDA NASS

Florida's Initial Response to HLB

Scouting & removal of HLB-symptomatic trees

Psyllid control

Protected Nurseries

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Psyllid Management

What's the best approach for managing psyllid populations?

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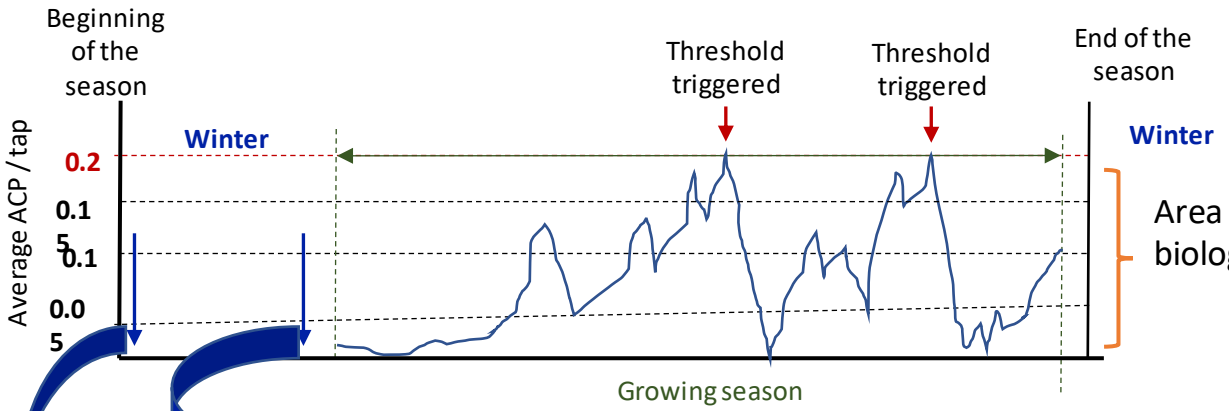
Timing using thresholds (Stelinski Lab)

Economic Injury Level of 0.2 ACP/ tap = average of 10 trees sampled



Area under the threshold line is where biological control provides benefit

Spray on visible flush if/when ACP reappear

Spray at budbreak and before new flush is present

Dormant sprays should achieve 60+ days of low ACP populations

Keep in mind

- Idea is to minimize stress on trees to boosts yield via improved health
- This graphic will look very different depending on when your grove flushes; the technique is meant to be malleable to changing conditions

Citrus Management in Florida prior to introduction of HLB

Very Low Production Costs

- 3 fertilizer applications per year (N,P,K only)
- 2-3 petroleum oil sprays (mites & fungal diseases)
- Herbicide applications (largest cost)

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Citrus Management (Current)

- New grove management practices
- Maintain fruit production on HLB-diseased trees
- ‘Living with HLB’

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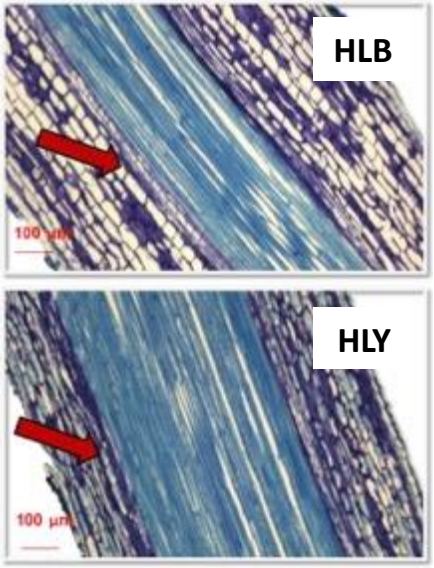
HLB Effects on Root Health

UF/IFAS researchers discovered 30-40% root loss before above-ground symptoms apparent; limiting nutrient and water uptake (Johnson et al 2014)



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Current Research

- Root Health
- Proper Fertilization
- Reduce Tree Stress

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Improving Root Health / Performance

Proper soil pH (5.8 – 6.5) needed for maximum nutrient uptake by root system

2 ½ years after soil acidification, yields in HLB infected grove improved significantly
(Graham & Johnson)

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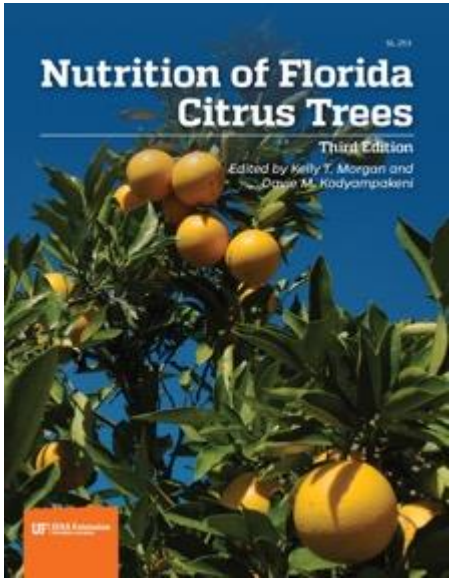
Importance of Proper Fertilization

Proper balance of macro- and micro-nutrients

- Improve canopy growth
- Increase fruit size and quality
- Reduce plant stress



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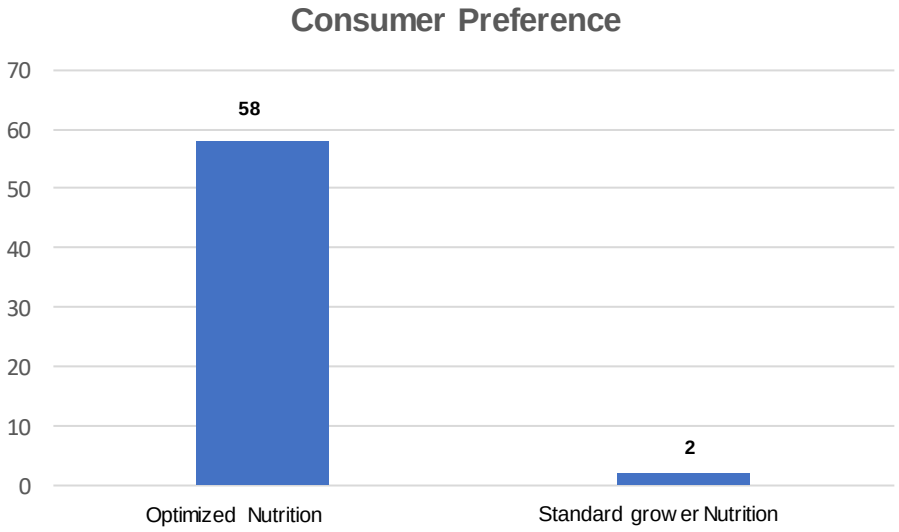
Fertilization Affects Fruit Quality

Ensuring proper nutrient balance can improve fruit quality on HLB-diseased trees (Vashisth & Wang)



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Reducing HLB-Induced Oxidative Stress

Can be mitigated with properly timed application of plant hormones (Vashisth)

- Gibberellic acid
- 2,4-D
- cytokinin

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Results of new grove management practices

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Mandarin Production (India 2023)

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Research Goal for the Future

Development of HLB Resistant Citrus Varieties

- Conventional citrus breeding
- Biotech approaches
  - Transgenics, Cisgenics, etc…
  - CRISPR (gene-editing)

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Conventional Breeding

‘Sugar-Belle’ mandarin

‘OLL-8’ sweet orange

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Transgenic HLB-Tolerant Varieties

- Numerous transgenic lines have been developed and are being evaluated for tolerance / resistance to HLB
  - Scions and rootstocks

- Florida citrus industry now supportive of transgenic citrus if it works!

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Efforts to Release First Transgenic Citrus Varieties

‘Hamlin’ sweet orange (5 lines); ‘Duncan’ grapefruit (1 line)

- Expressing Arabidopsis NPR1 protein
- Do become infected with HLB-causing bacterium
- Significantly fewer HLB symptoms observed in field
- Request in process to deregulate and release these lines (Mou & Triplett)

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1st gene edited (non-transgenic) citrus lines developed

Canker-resistant 'Hamlin' orange

- Performance in the field TBD
  - Never been in field or produced any fruit

<u>Plans for 2024 season</u>

- Plant replicated field trials with these new lines
  - Evaluate for both HLB and canker tolerance/resistance
- Plants were entered into DPI program for cleanup in 2023

University of Florida Online Citrus Resources

https://citrusresearch.ifas.ufl.edu

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