Advanced Water and Crop Nutrition Systems – 3.5 Years of Citrus Results

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Fluid Fertilizer Technology Workshop
December 4, 2012
Orlando, FL

UF UNIVERSITY of FLORIDA
IFAS Research
Citrus Research and Education Center

Greetings & Introduction

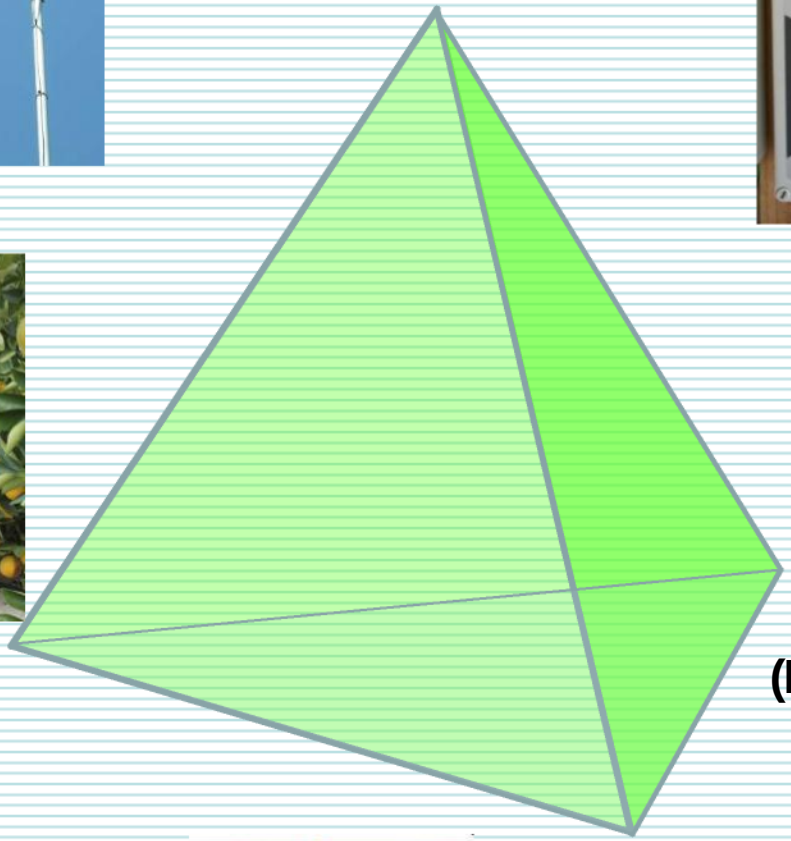
Outline

- Introduction to the Advanced Citrus Production Systems (ACPS) using open hydroponics (OH)
- Huanglongbing (HLB) in the Auburndale ACPS trial
- Summary & take home messages

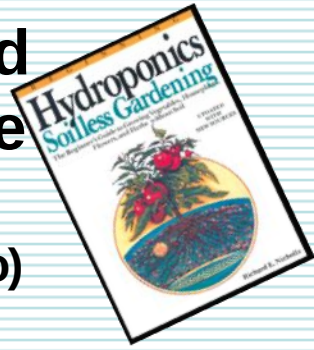
Main components of an ACPS

Intensive fertigation
(controller, sensors)

Higher planting density



Balanced complete nutrition
(N-P-K-Ca...Mo)



Adapted rootstocks
('dwarfing')

(AWS,

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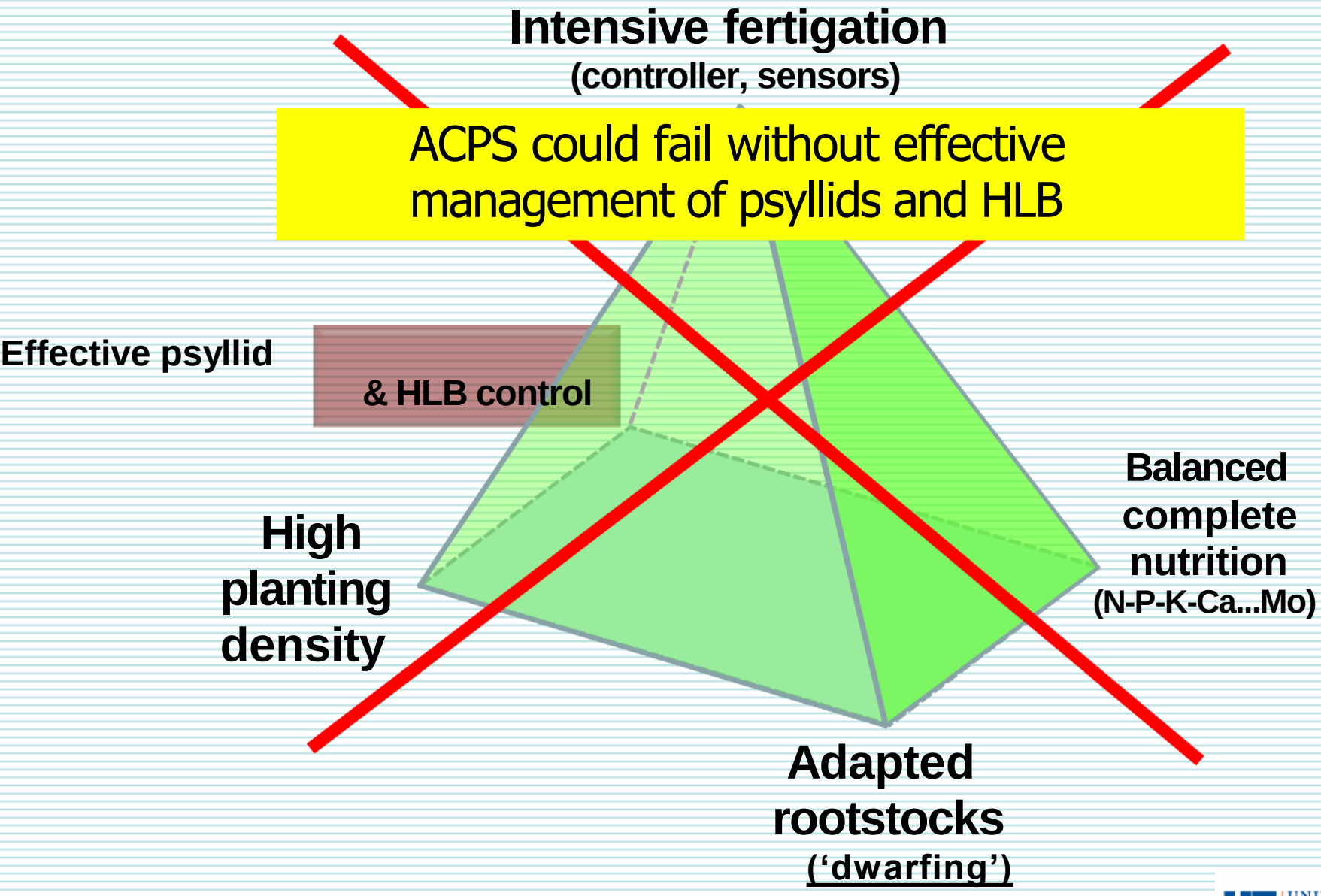


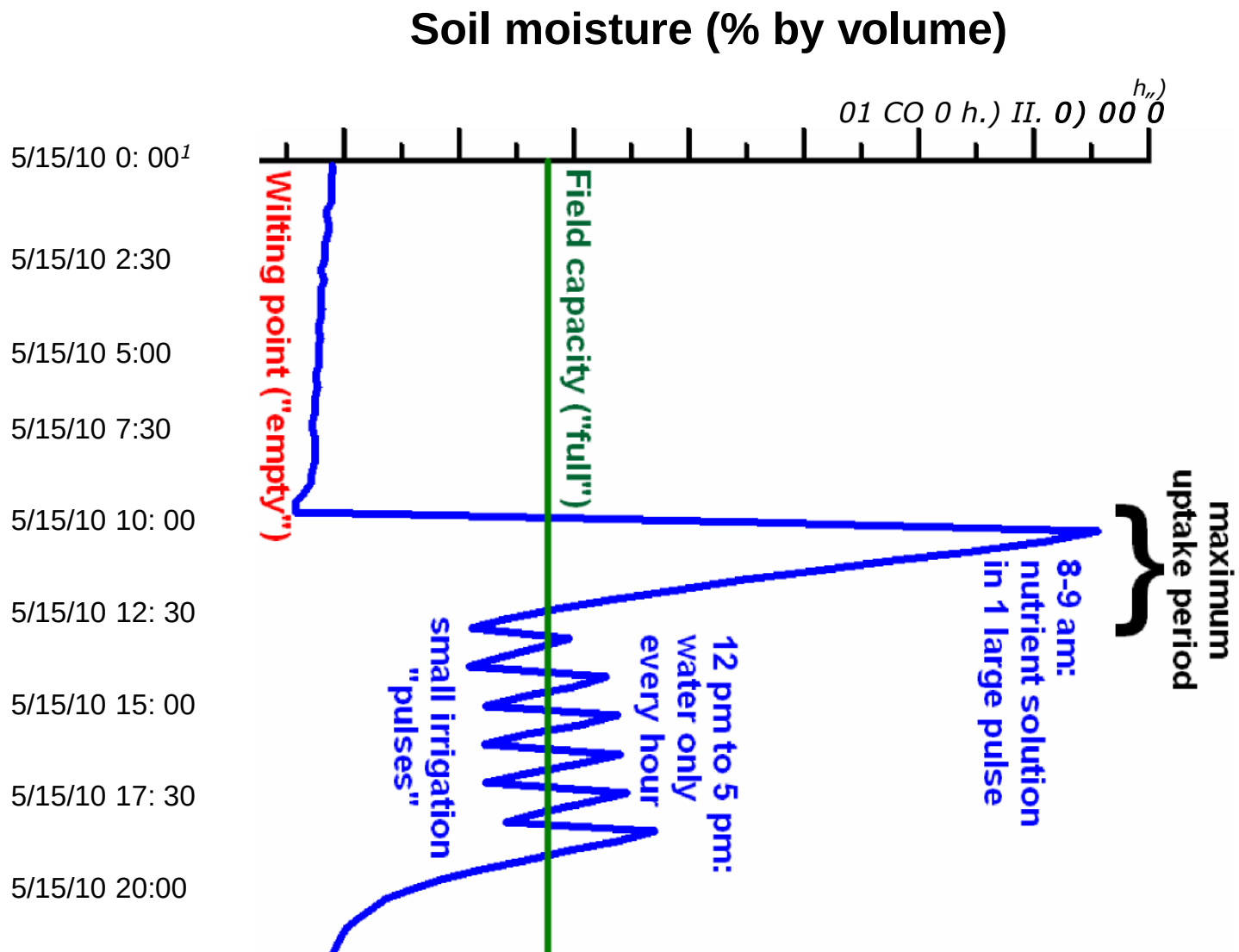
(AWS,

Replant configuration – drip OH

Water / EC sensor

Sensors:
04” depth
18” depth

Profile moisture sensor


Soil moisture (% by volume)
5/15/10 0: 00
5/15/10 2:30
5/15/10 5:00
5/15/10 7:30
5/15/10 10: 00
5/15/10 12: 30
5/15/10 15: 00
5/15/10 17: 30
5/15/10 20:00
Wilting point ("empty")
Field capacity ("full")
8-9 am:
nutrient solution
in 1 large pulse
maximum
uptake period
12 pm to 5 pm:
water only
every hour
small irrigation
"pulses"

Selected research results spanning 3.5 years

‘Hamlin’ orange trees, Ridge - 16 December 2008 (0 weeks)

First fruit harvested in December 2010 – drip ACPS at 2 years

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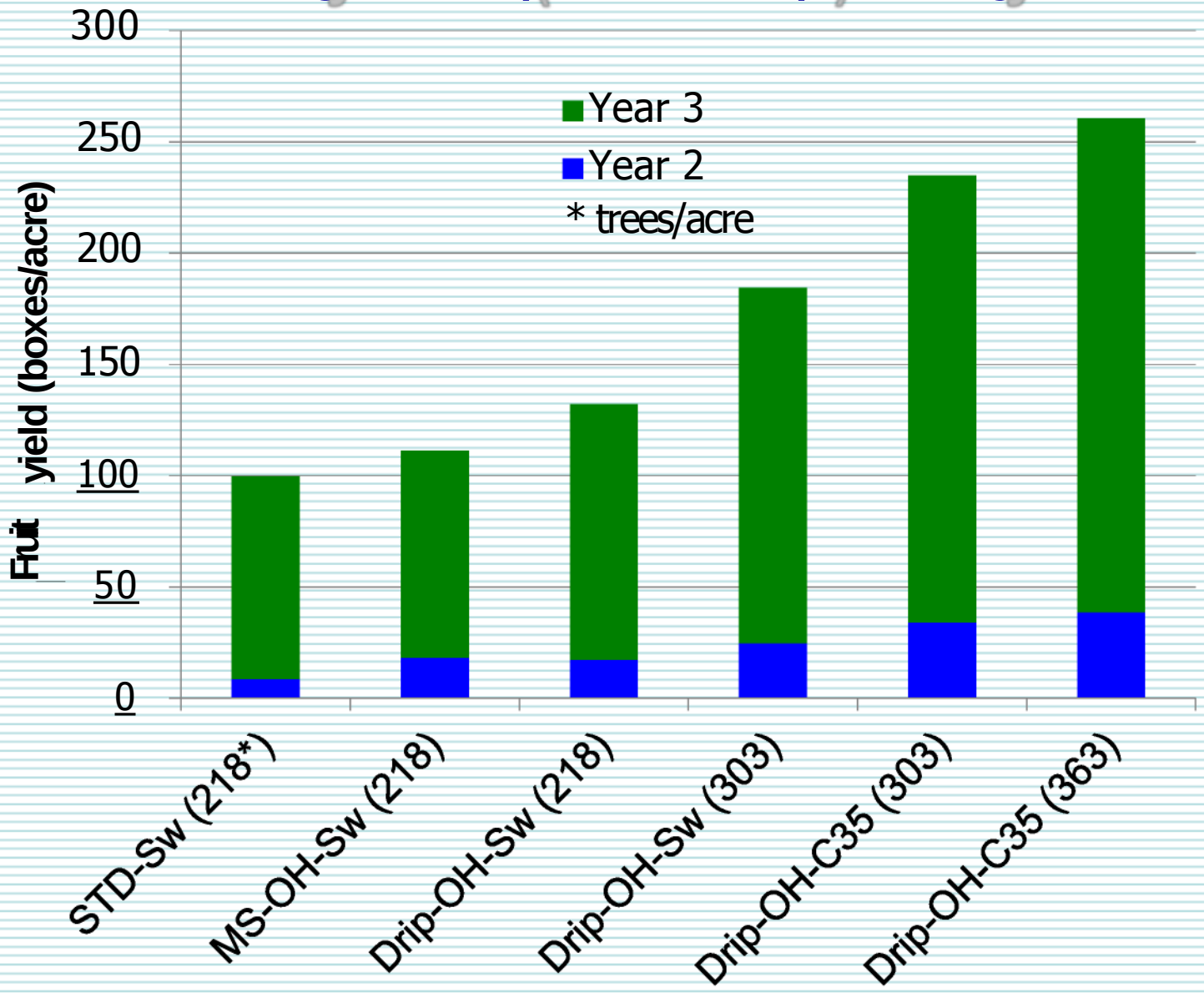
OH: Early fruit production, early ripening, high quality after 24 months

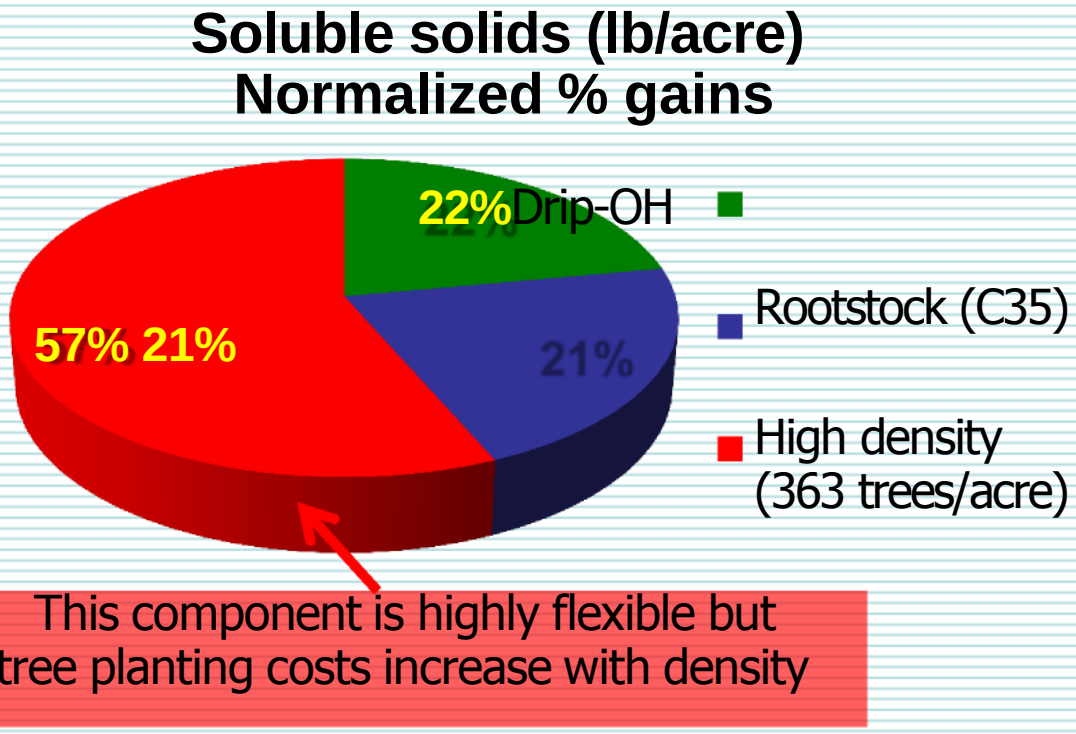
Conventional methods Advanced drip fertigation methods (OH)

Gapway experiment: Drip OH, C-35 rootstock, 3 years
222 boxes/acre with 363 trees/acre

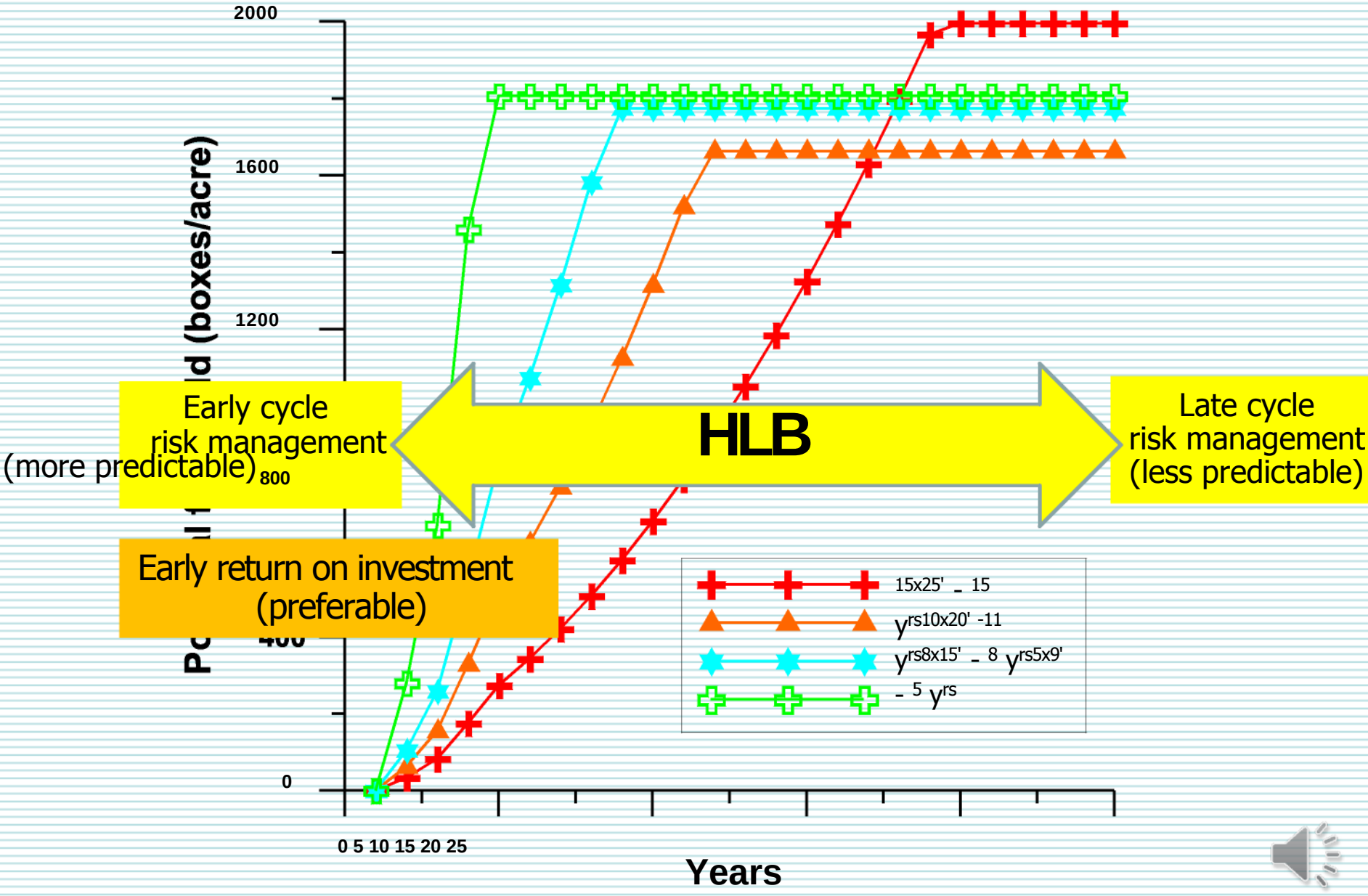
Fruit yields (boxes/ac) at 3 years



Designing ACPS: Horticultural synergies and interactions



The importance of planting density, POTENTIAL YIELD, and early BREAK-EVEN TIME (not HLB infected)

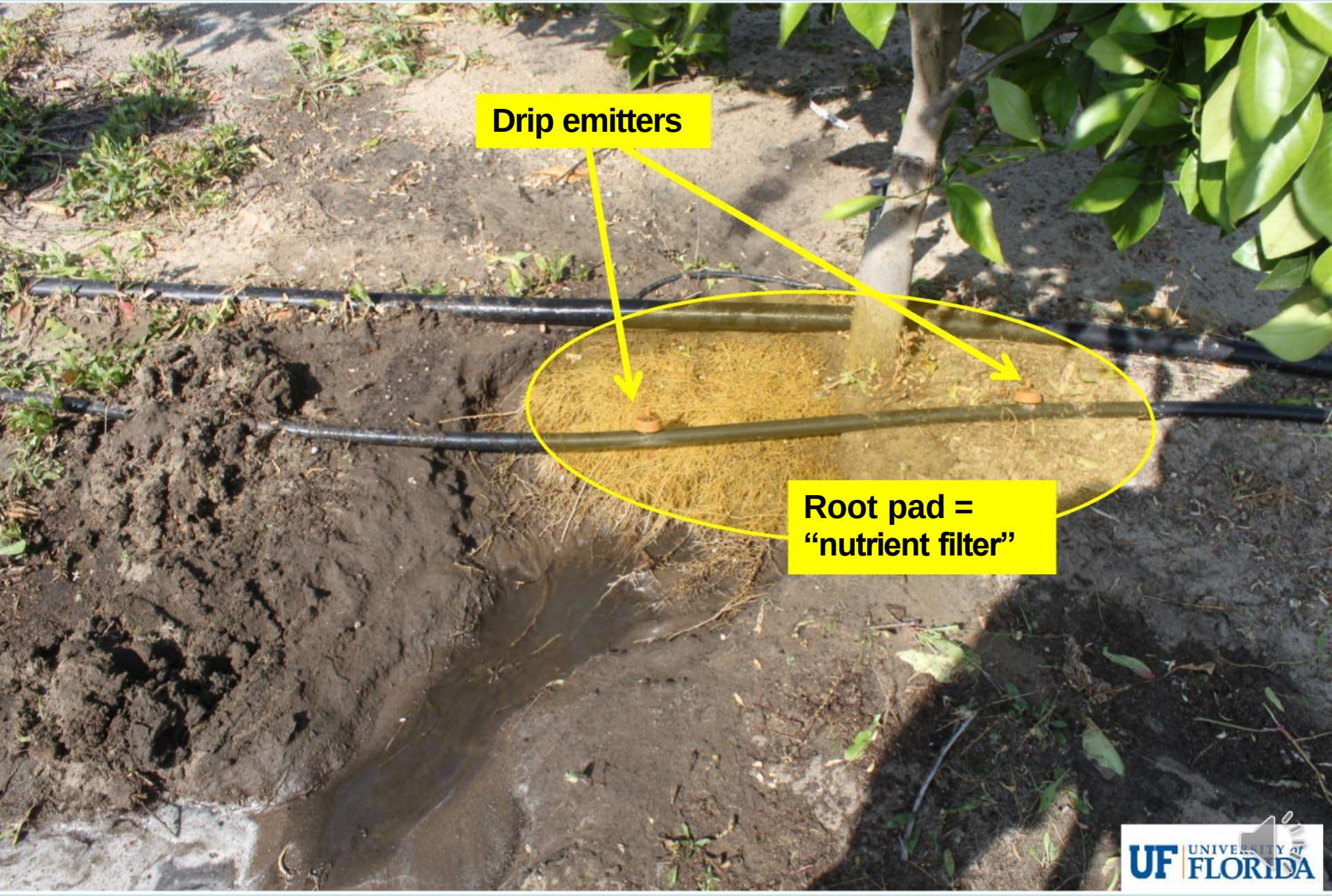


Gapway experiment: Conventional, 36 months

Gapway experiment: Drip OH, C-35 rootstock, 36 months

Gapway grove experiment, 36 months

The unique ACPS root system for efficient nutrient uptake



ACPS develops healthy dense feeder roots

HLB infection – Gapway experiment

1st HLB infection found at 20 months
(0.1% in year 2)

(8.5% in September, year 3)

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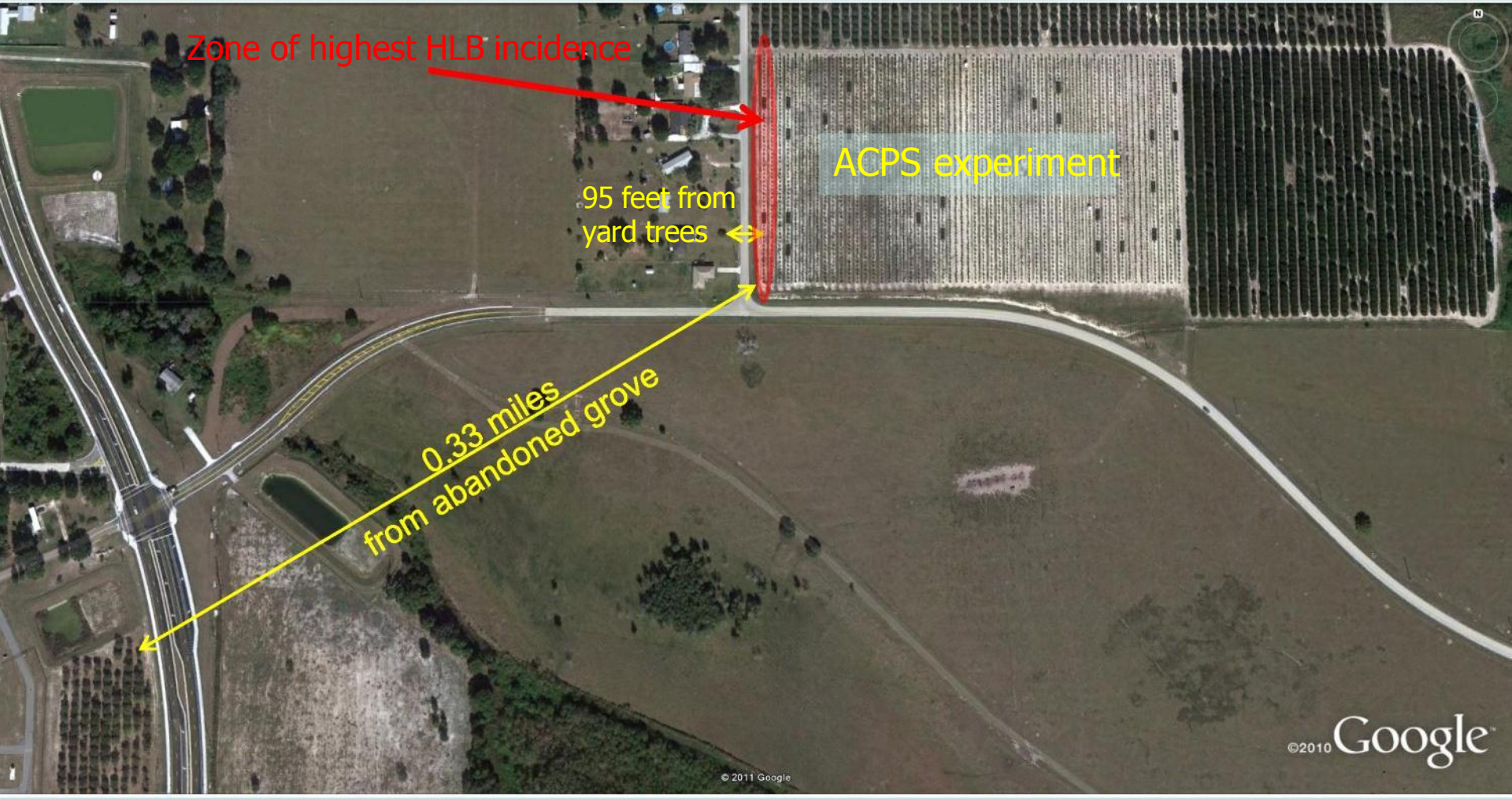
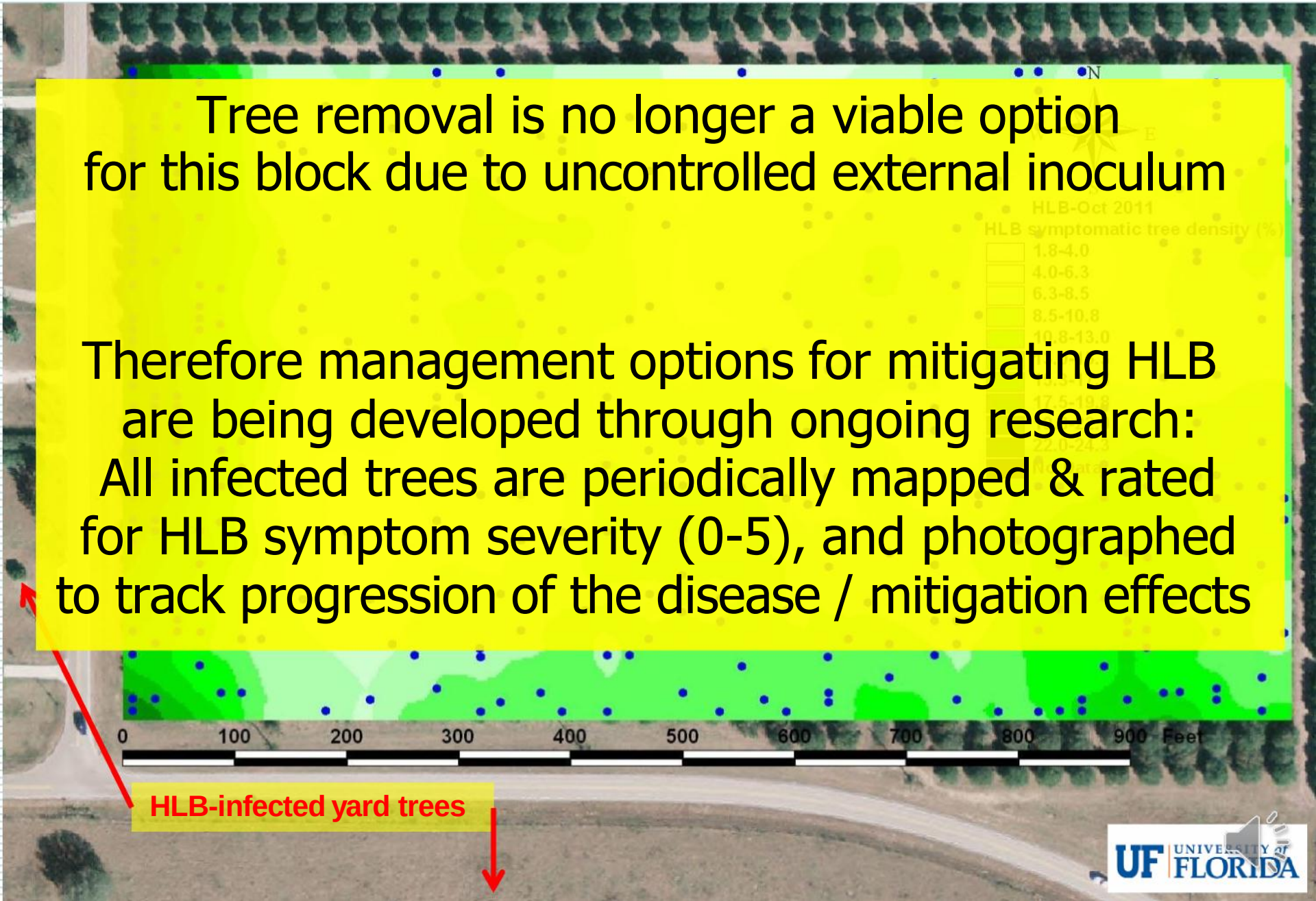
View SW from last row on W side: 10/01/11

Situation analysis: 10/01/11



View NNW from SW corner: 10/01/11

HLB infection density map: 10/01/11



Tree removal is no longer a viable option for this block due to uncontrolled external inoculum

Therefore management options for mitigating HLB are being developed through ongoing research: All infected trees are periodically mapped & rated for HLB symptom severity (0-5), and photographed to track progression of the disease / mitigation effects

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May 25, 2012


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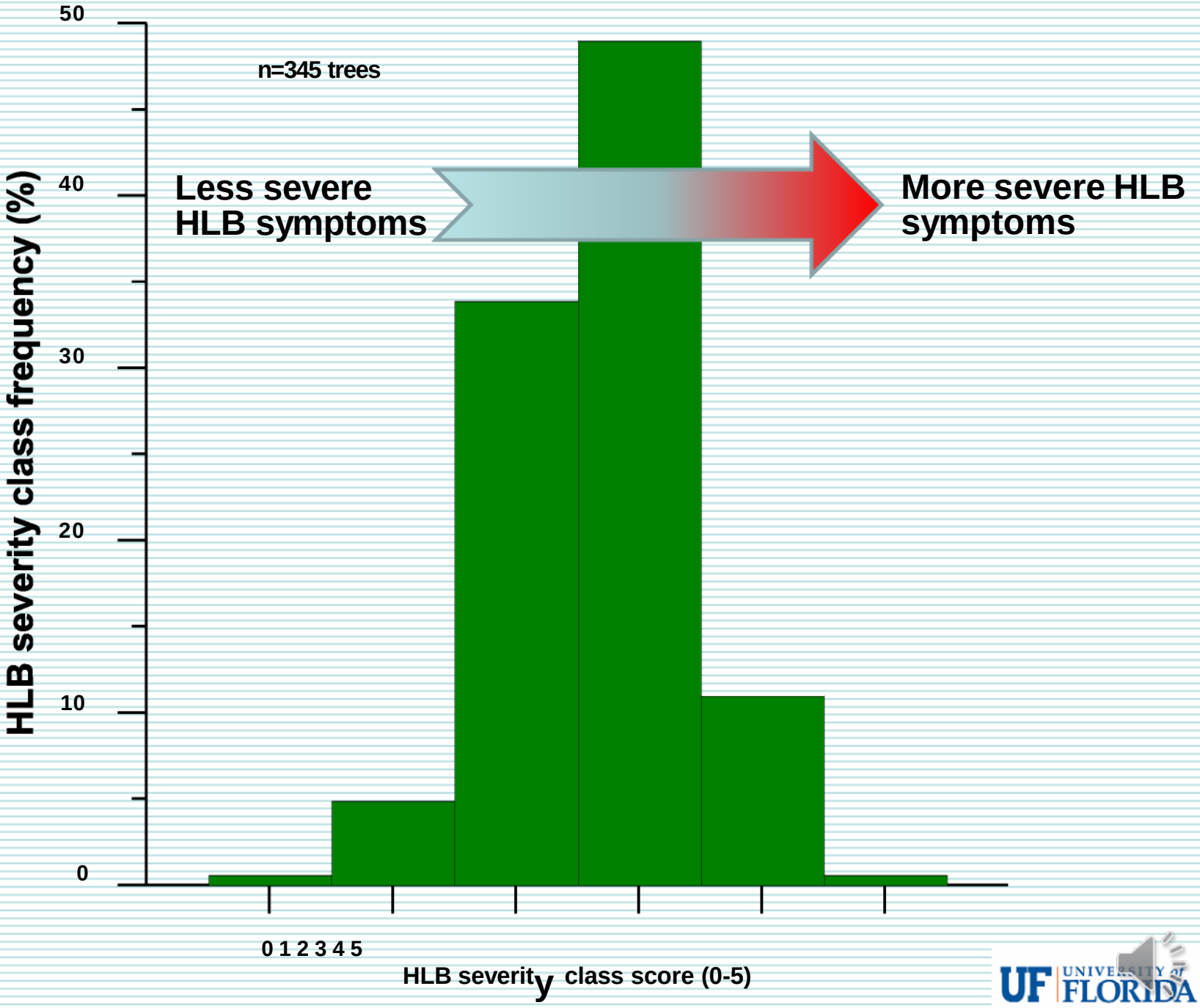

50
40
30
20
10
0
n=345 trees
Less severe HLB symptoms
More severe HLB symptoms
HLB severity class frequency (%)
0 1 2 3 4 5
HLB severity class score (0-5)

=88%

mild to moderate

Severity score = 4

Severity score = 5

=12% severe to very severe
(1.2% of block)

HLB incidence and severity: Statistical analysis

- HLB *incidence* was significantly lower in ACPS-grown plots than in standard-grown plots
- HLB symptom *severity* was significantly lower on the ACPS-grown trees using C35 rootstock than on the standard-grown trees using Swingle rootstock

June, 2012

Subsequently HLB-affected trees improved during the summer

June, 2012: asymptomatic trees

June, 2012: symptomatic tree

June, 2012: symptomatic tree

June, 2012: symptomatic tree

- HLB symptoms identified September 2011 (11 months before)

- 'Hamlin' orange, C35 & Swingle rootstocks
- Scout and spray to manage psyllid and other pests
- Daily complete nutrient fertigation (open hydroponics)
- Drip or microsprinkler delivery of nutrients to trees
- Sensor- and computer- based precision irrigation

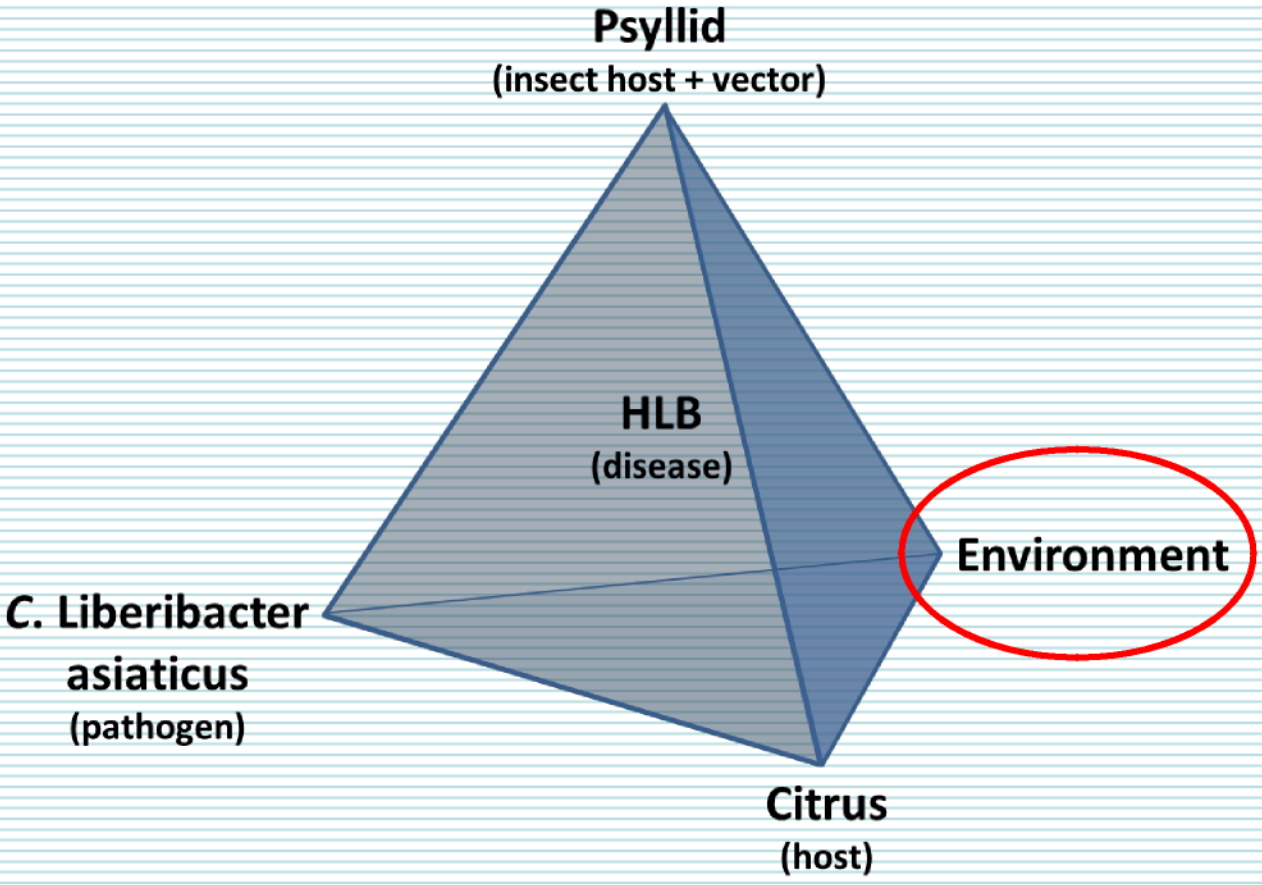
- K-Phite + DKP spray every 8 weeks (Plant Food Systems)

- 3 nutrient sprays on major leaf flushes /year (Chemical Dynamics),

  with CN9 (Yara N. America) and KNO_3

Interactions of citrus nutrition with HLB

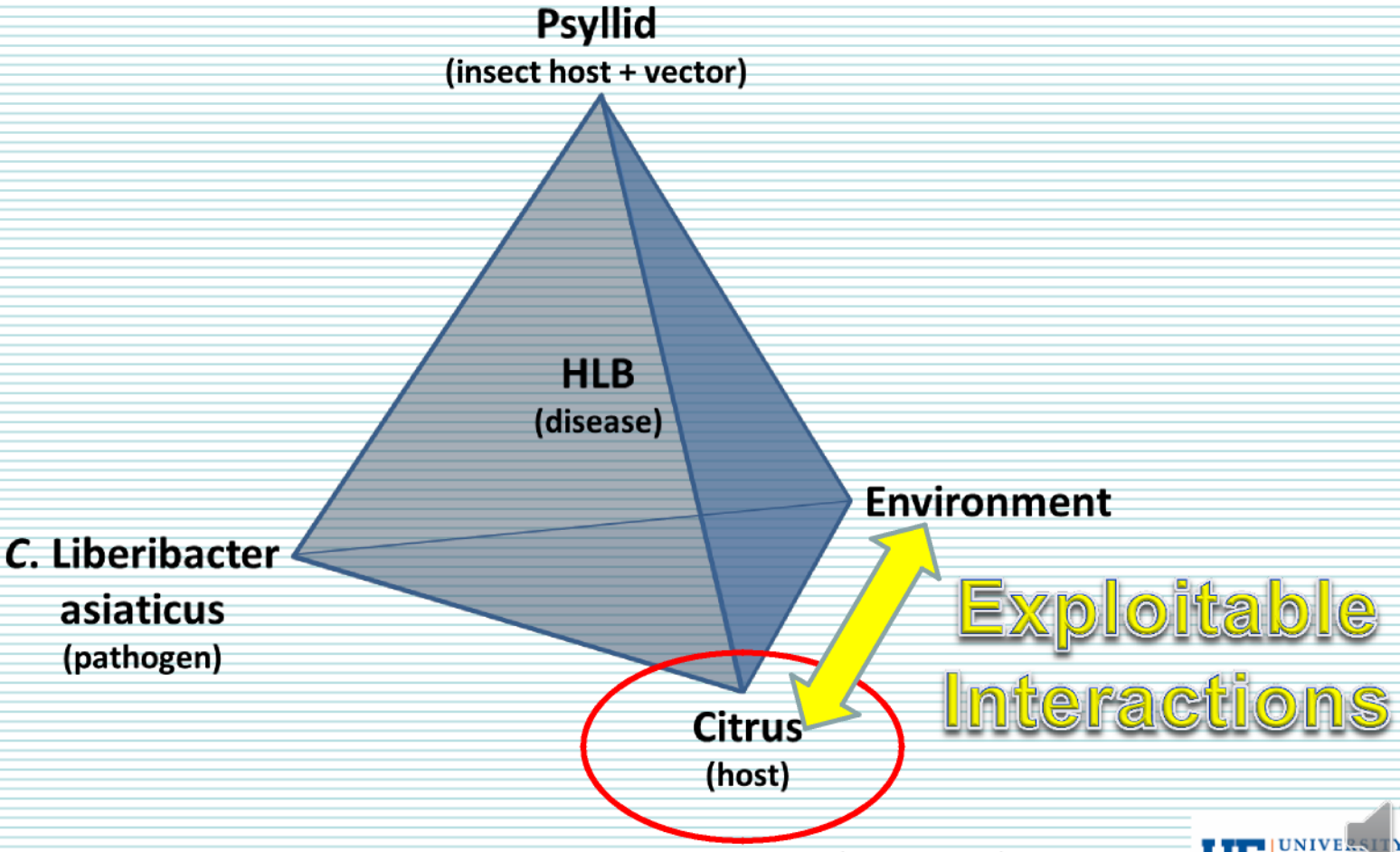
- Nutrients from foliar and soil fertilizer affect
  HLB through the "Environment" component of the tetrahedral disease schematic



(AWS, 2011)

Interactions of citrus rootstocks with HLB

- Rootstock genotypes affect HLB through the "Citrus host" component of the tetrahedral disease schematic



(AWS, 2011)

Conclusions after 3.5 years

- HLB appeared at 1.5 yrs; 10%+ at 3 yrs (exponential)
- Standard methods of inoculum reduction impossible
- Host tolerance to HLB improved by ACPS
- Continued fruit production possible despite HLB?

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PROBLEMS:

Fruit drop caused by HLB is severe
Long-term tree survival?

Acknowledgements

Gapway Grove Corp.

Griffin Fertilizer, Plant Food Systems, Tiger-Sul, Growers Fertilizer, Harrell's

IFAS Research
Florida Agricultural Experiment Station

YARA

CRDF Citrus Research and Development Foundation, Inc.

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