Advanced Production Systems for Florida Citrus and Blueberry Crops

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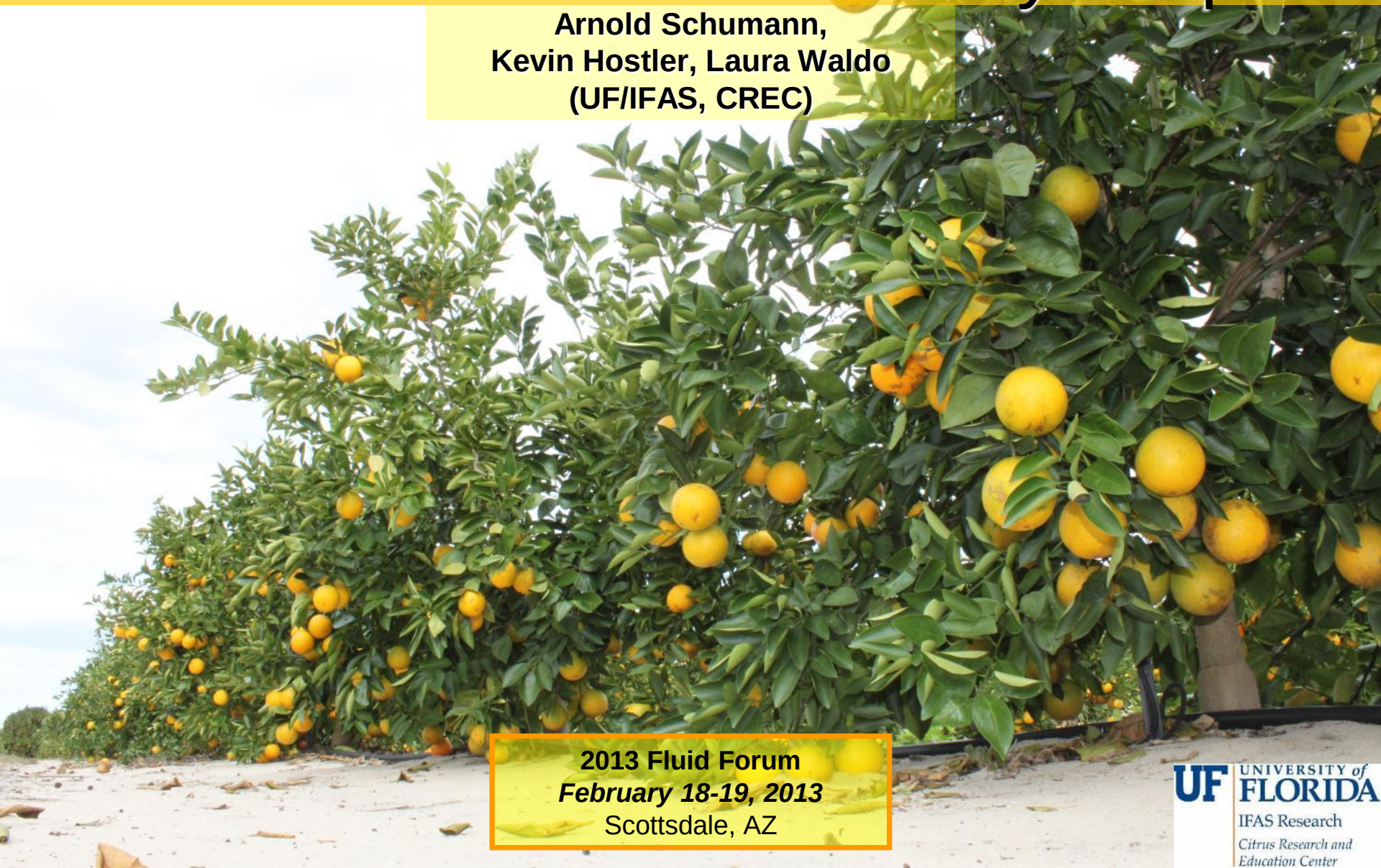

2013 Fluid Forum
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IFAS Research
Citrus Research and Education Center

Introduction

- Florida citrus has an economic impact in Fl amounting to $9.3 billion annually
- Statewide in Fl - > 8,000 growers cultivating more than 500,000 acres of land and employing an estimated 76,000 workers in citrus or related businesses
- This important Florida crop has been under attack from incurable HLB bacterial disease since its discovery in south Florida in 2005
- Advanced citrus production systems (APS) are being developed to help mitigate HLB

Citrus APS Research Goals

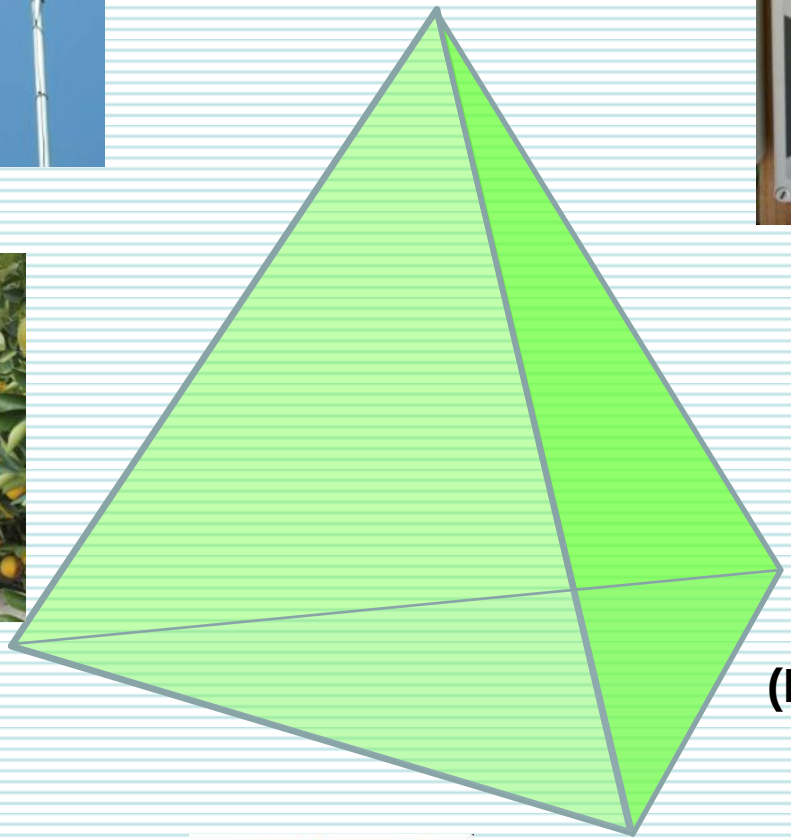
- **HLB:**
- **To maximize early, efficient citrus production,**
- **to minimize HLB infections and**
- **to manage HLB-infected trees for continued partial production**

- **EFFICIENCY:**
- **To maximize profits by increasing resource-use efficiencies, and**
- **to minimize environmental impacts**

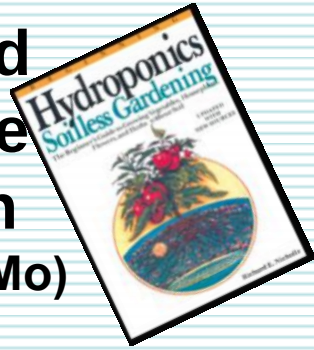
Main components of an ACPS

Intensive fertigation
(controller, sensors)

Higher planting density



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



Adapted rootstocks
('dwarfing')

(AWS, 2012)

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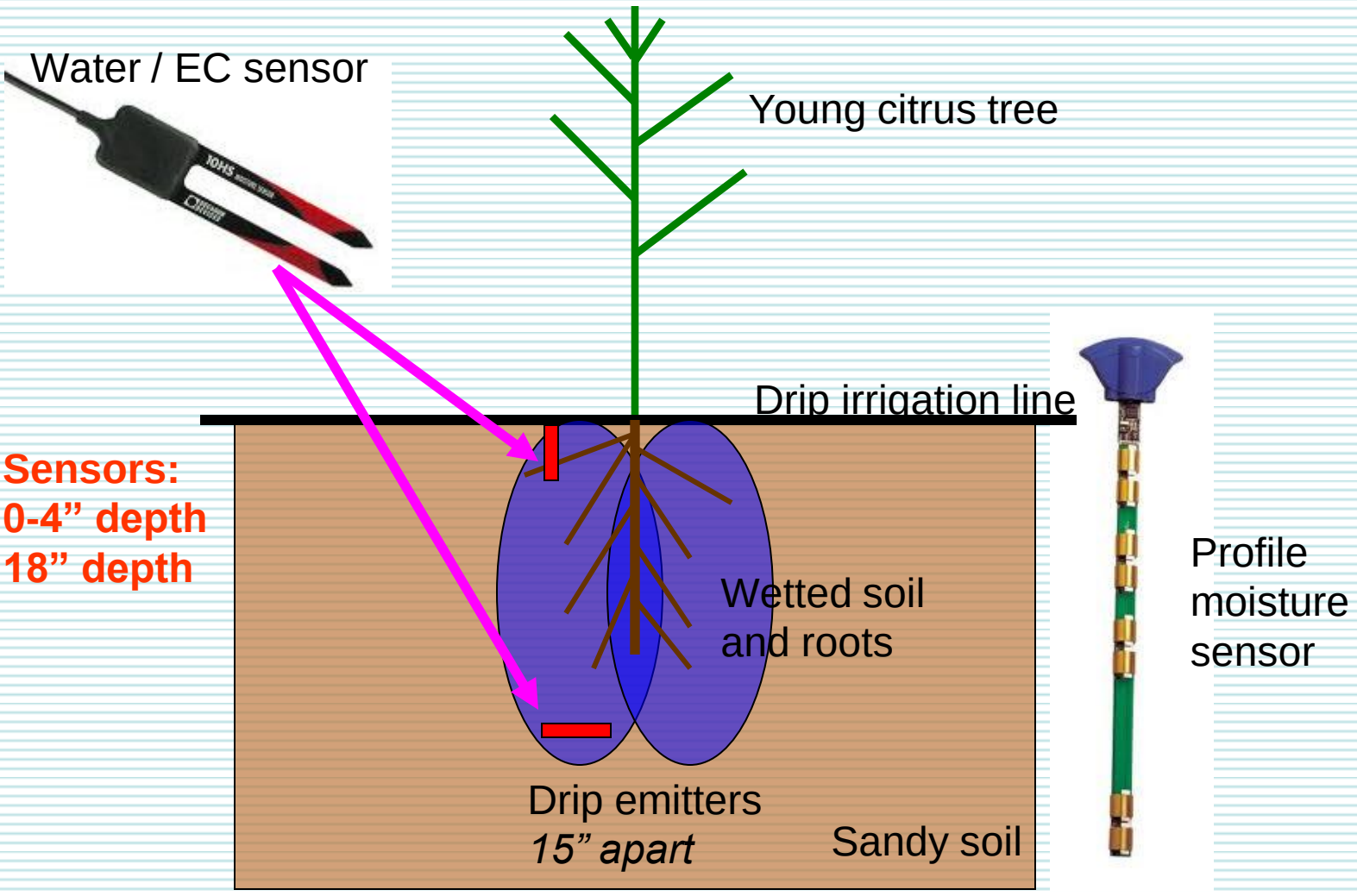
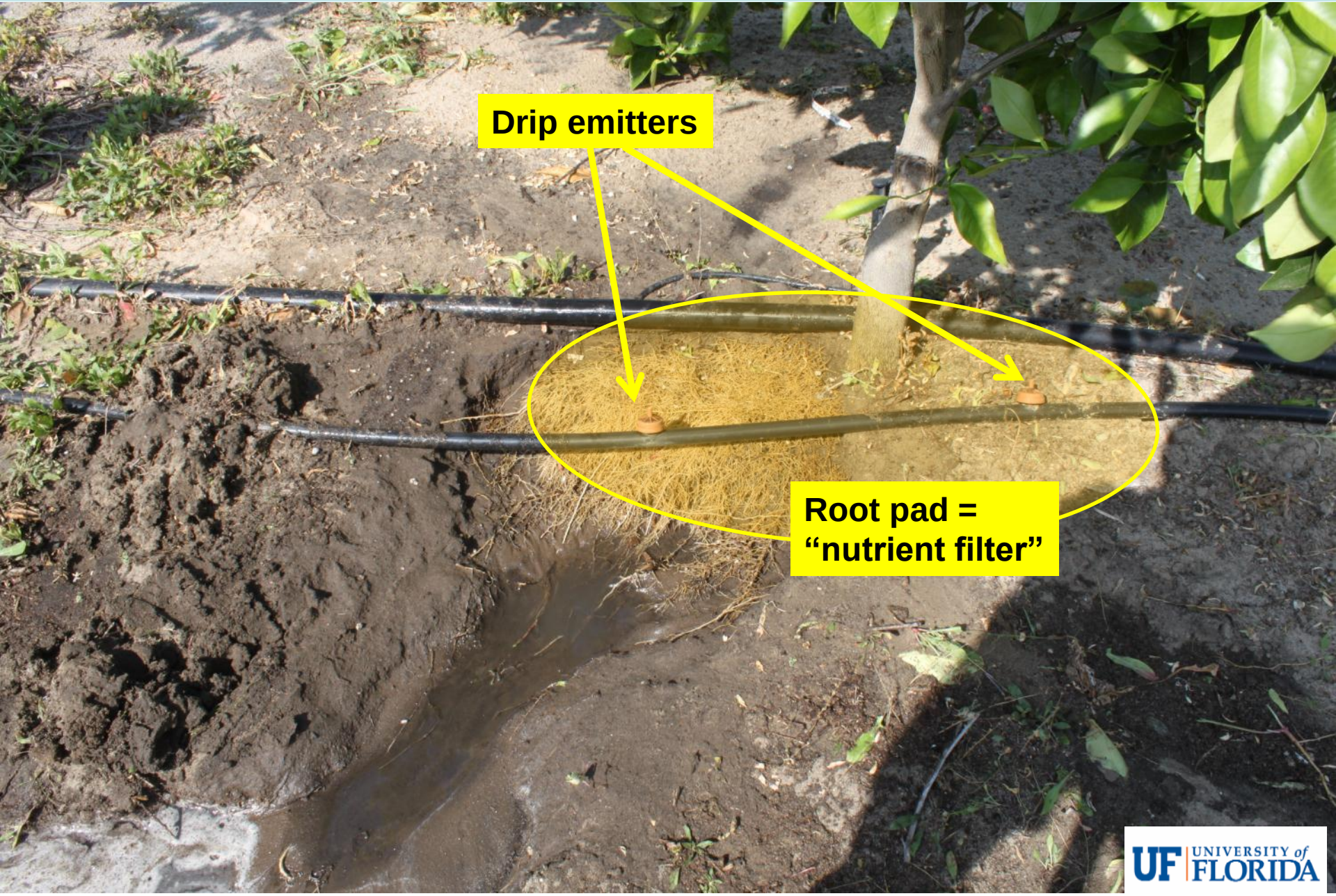
Previous ACPS experiment (2008)

- Completely randomized design, 4 reps
- ‘Hamlin’ orange on Swingle citrumelo & C35
- Control – grower STD irrig, gran. fertilizer
- Drip OH fertigation
- Microsprinkler OH fertigation

Replant configuration – drip OH



The unique ACPS root system for efficient nutrient uptake



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ACPS develops healthy dense feeder roots

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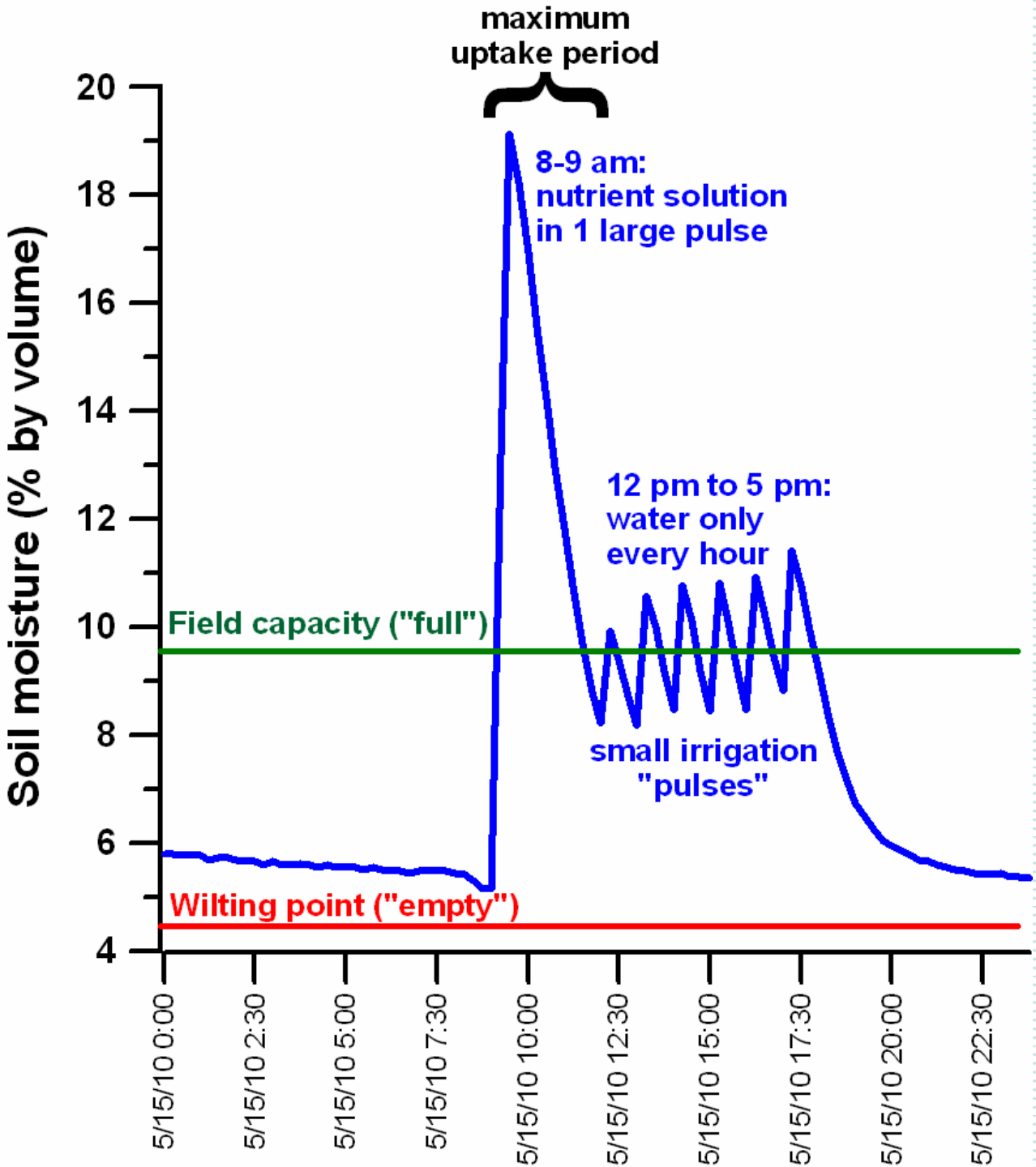

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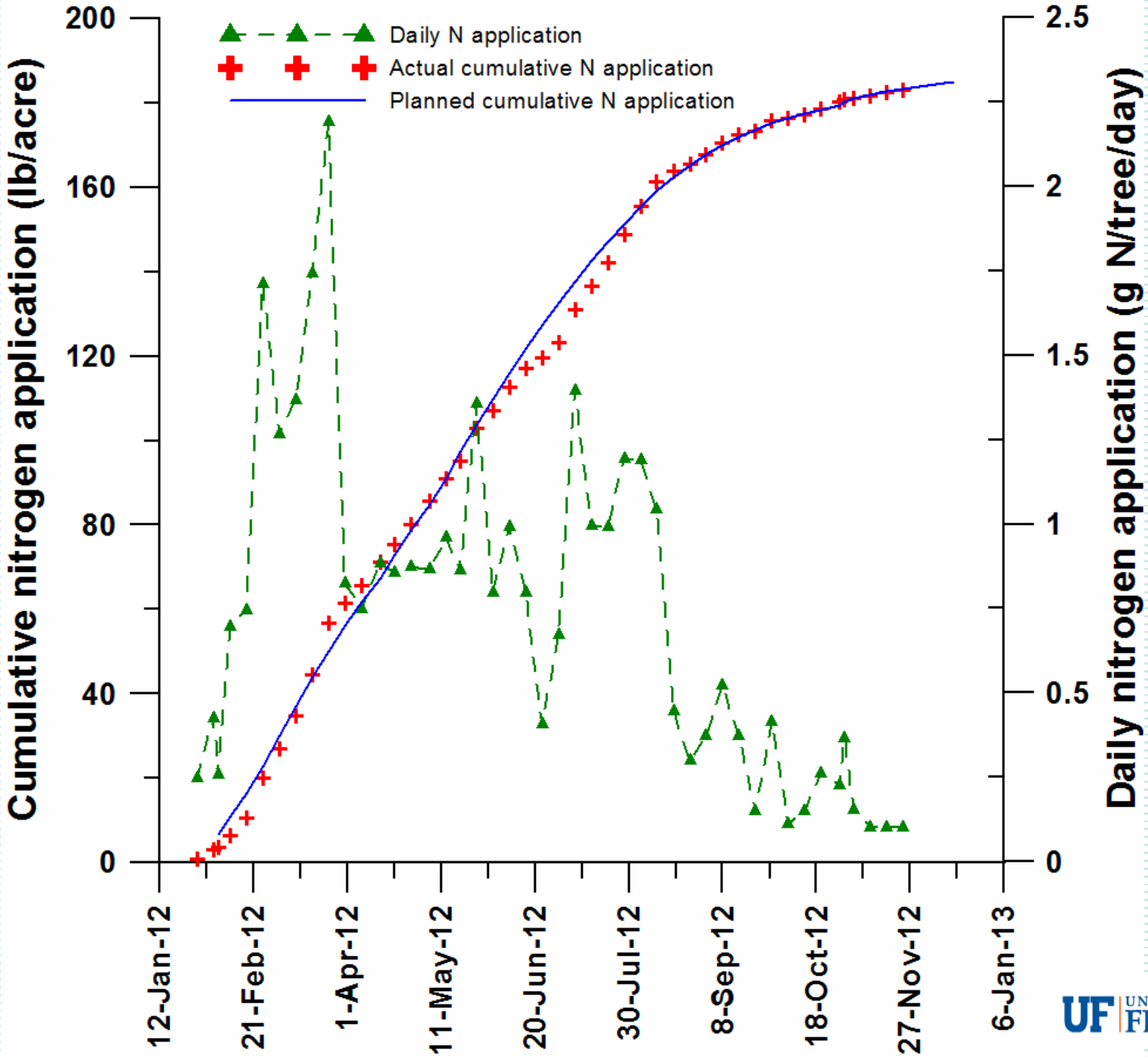

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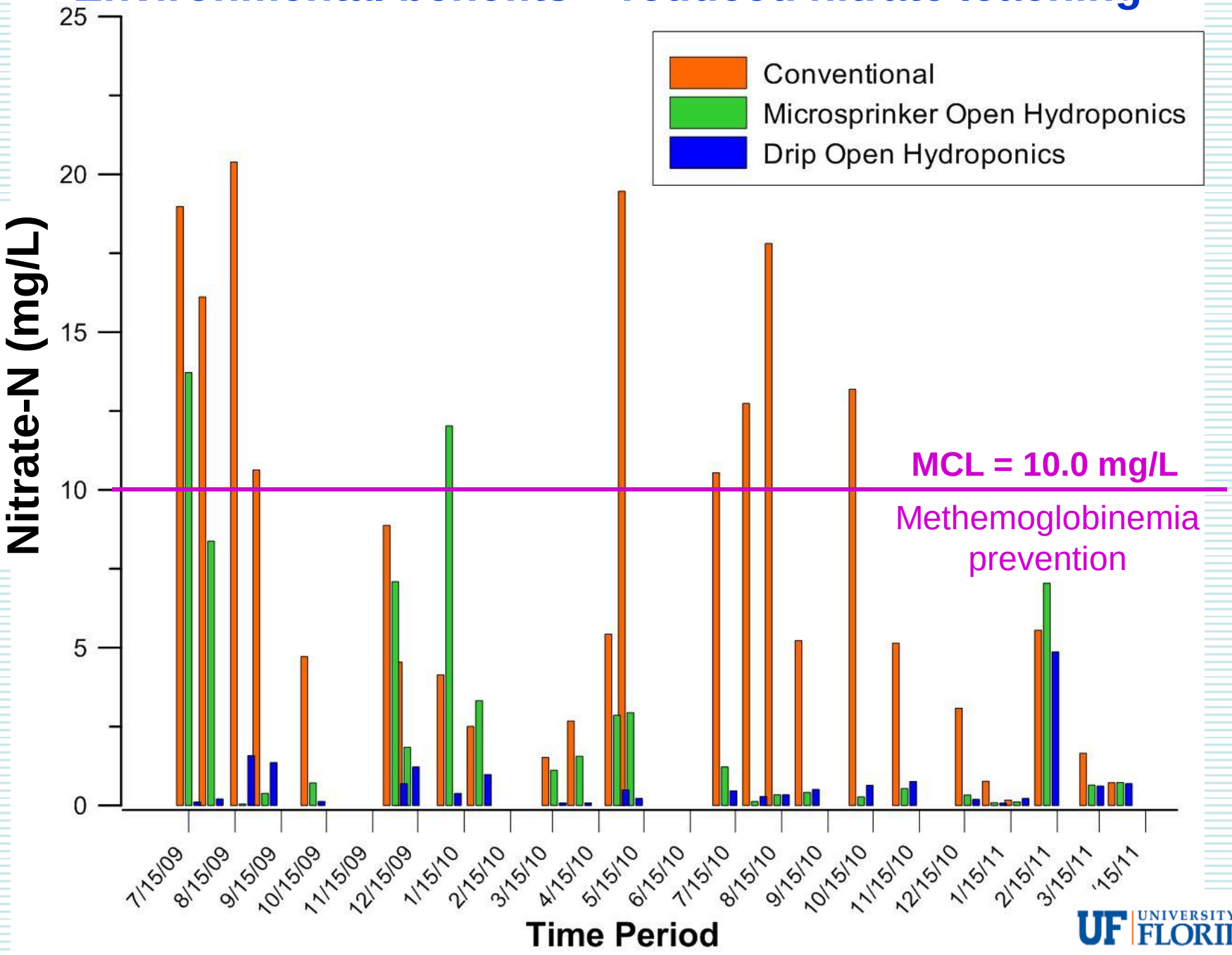
Environmental benefits – reduced nitrate leaching



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Selected research results spanning 4 years

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

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

Conventional methods

Advanced drip fertigation methods (OH)

Auburndale experiment: Drip OH, C35 rootstock, 3 years
222 boxes/acre with 363 trees/acre

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June, 2012: 3.5 years


December, 2012: 4 years
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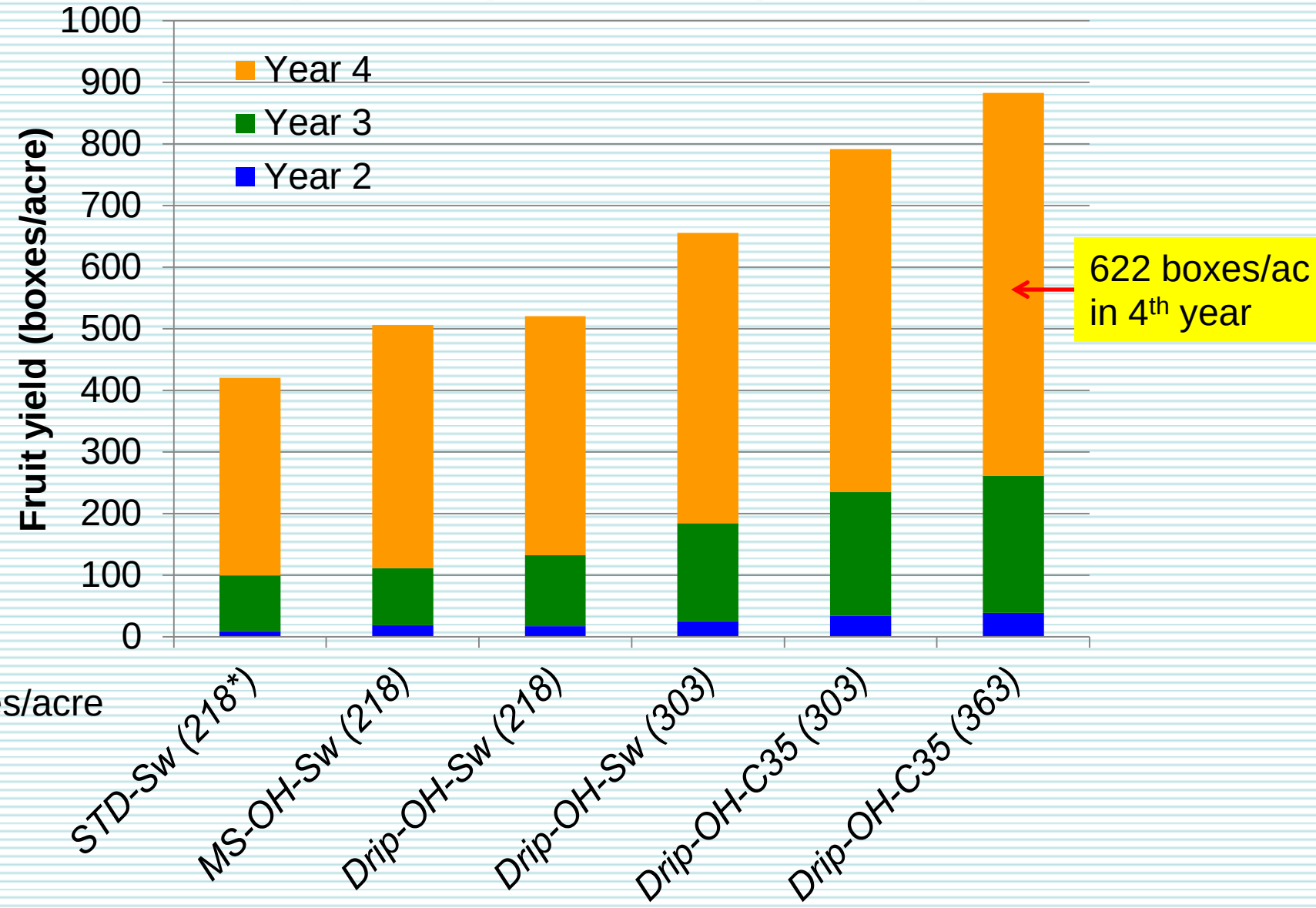
Fruit yields (boxes/ac) at 4 years



* trees/acre

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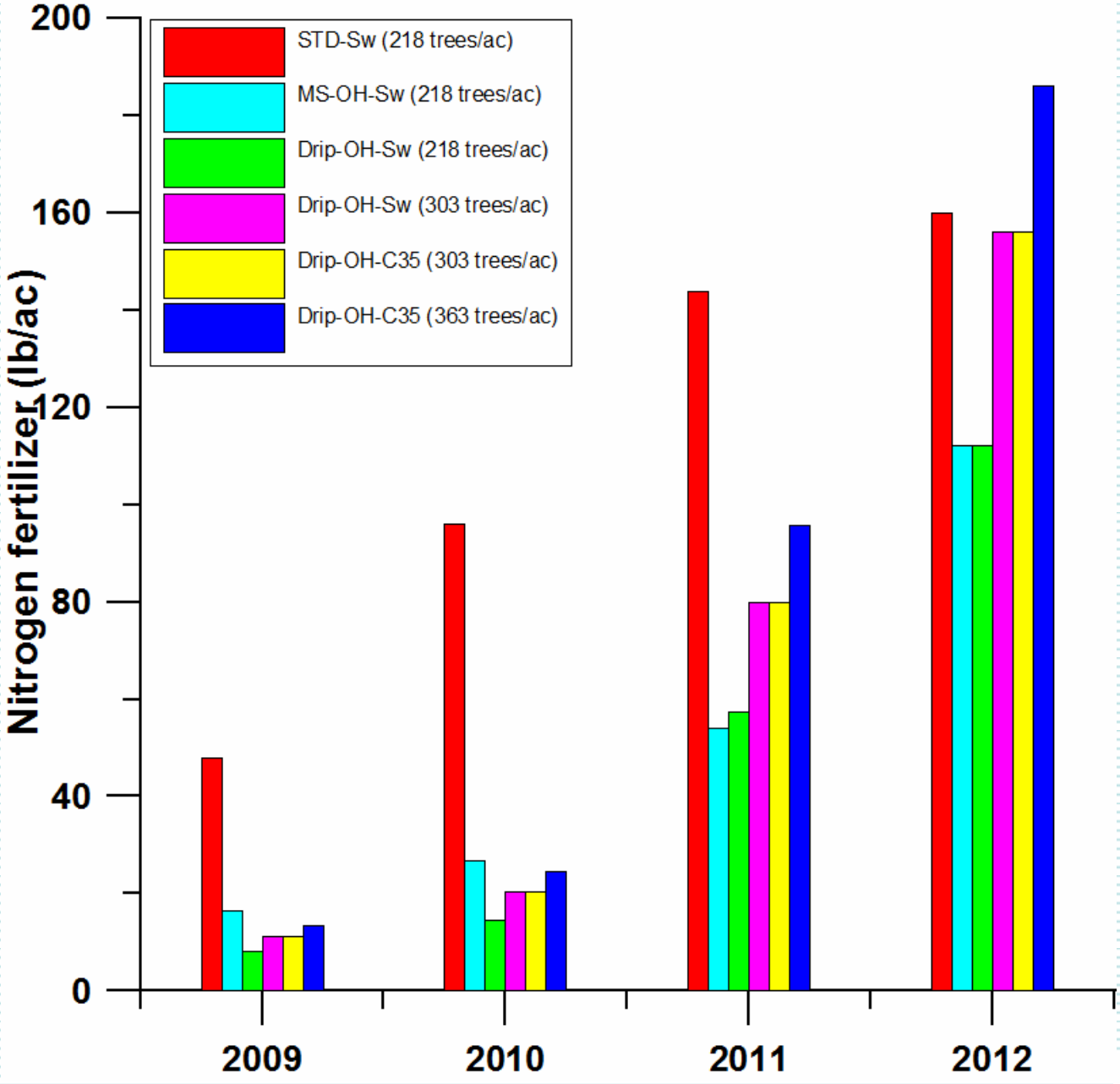

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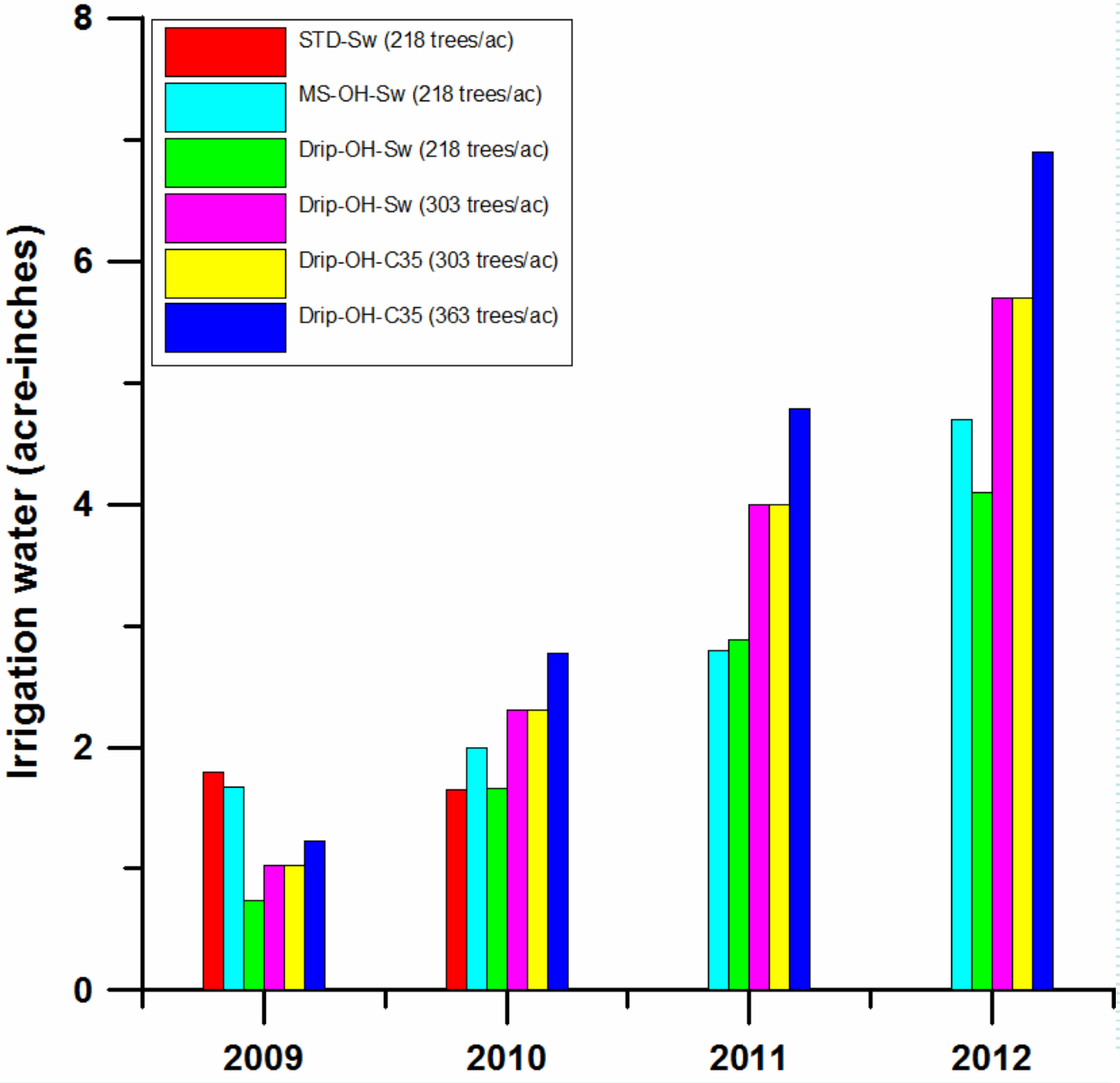

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Tree size control for high density planting

- With short distances between trees planted at high densities, detrimental inter-tree competition can harm yields if trees grow uninhibited

- There are three main methods of tree size control:
  - 1) High fruit setting and yields
  - 2) Dwarfing rootstocks
  - 3) Hedging & topping

High fruit setting and yields

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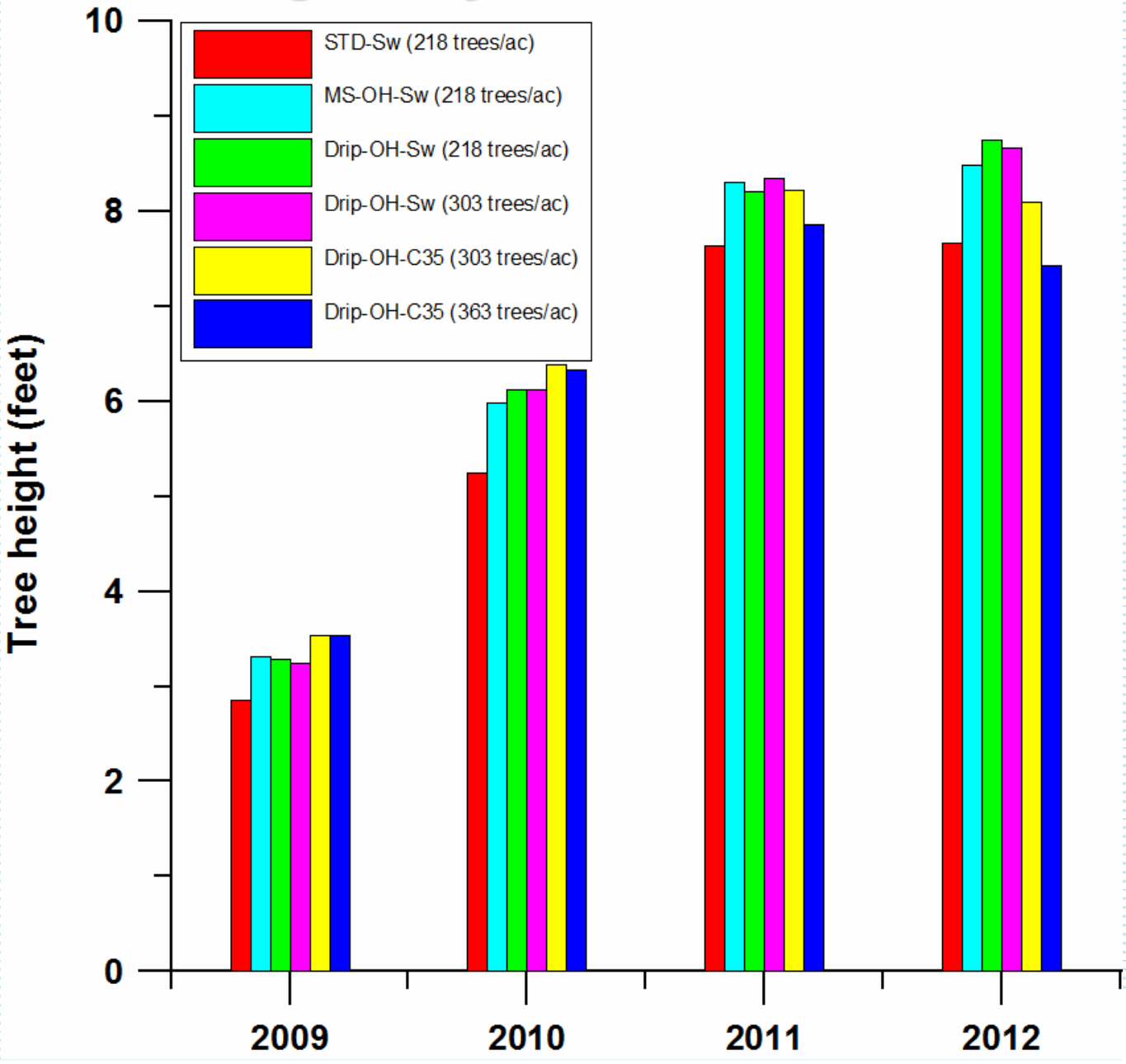
High fruit setting and yields – effects on tree height



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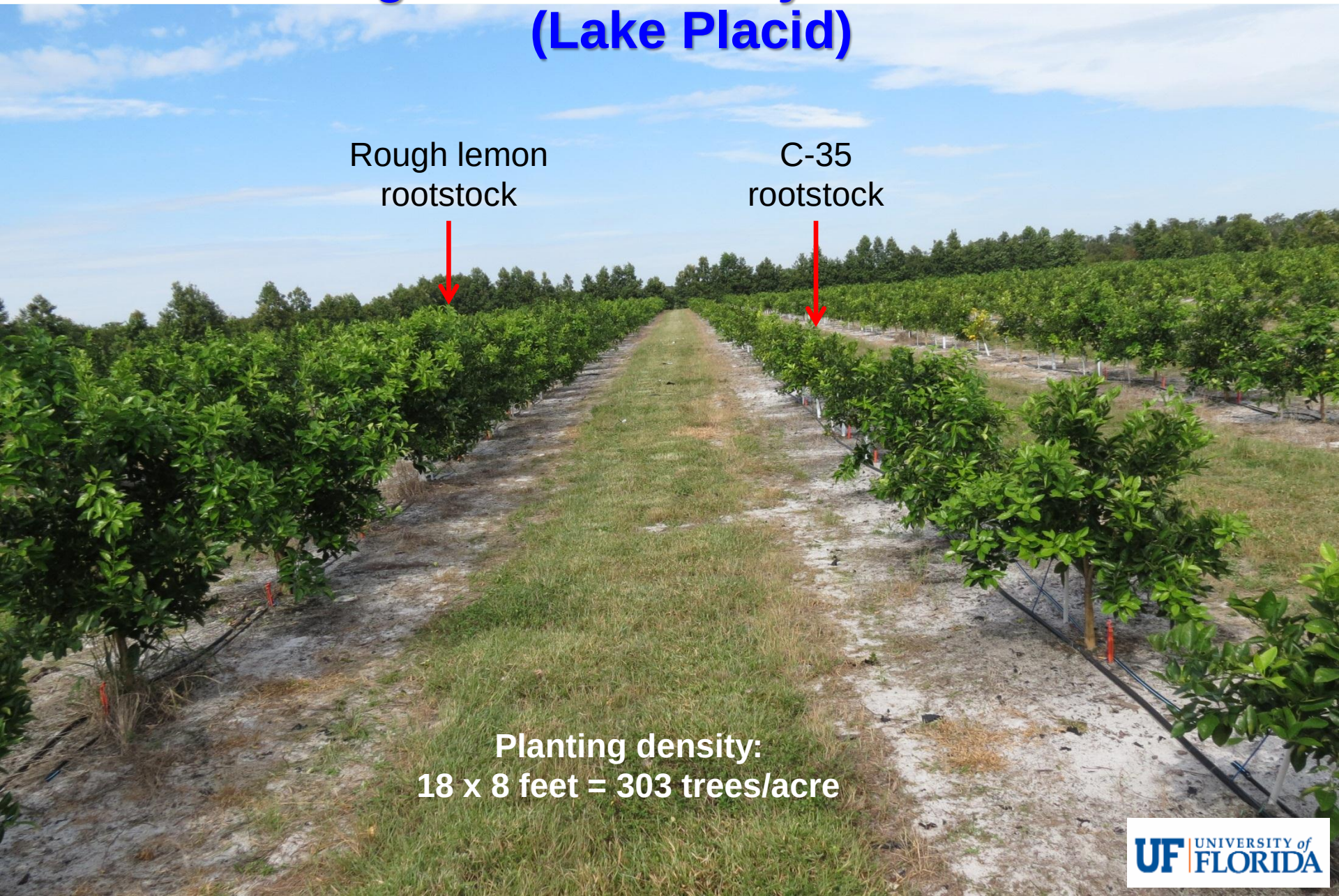
Achieving high fruit setting and yields

- Excellent grove care, including optimal nutrition and irrigation
- Precocious varieties
- Pre-bloom sprays of urea or phosphite can increase the bloom
- Pre-bloom sprays of boron, calcium and magnesium benefit the pollination process and fruit set

Tree growth after 1.5 years in ACPS (Lake Placid)



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Hedging


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Other integrated systems for ACPS

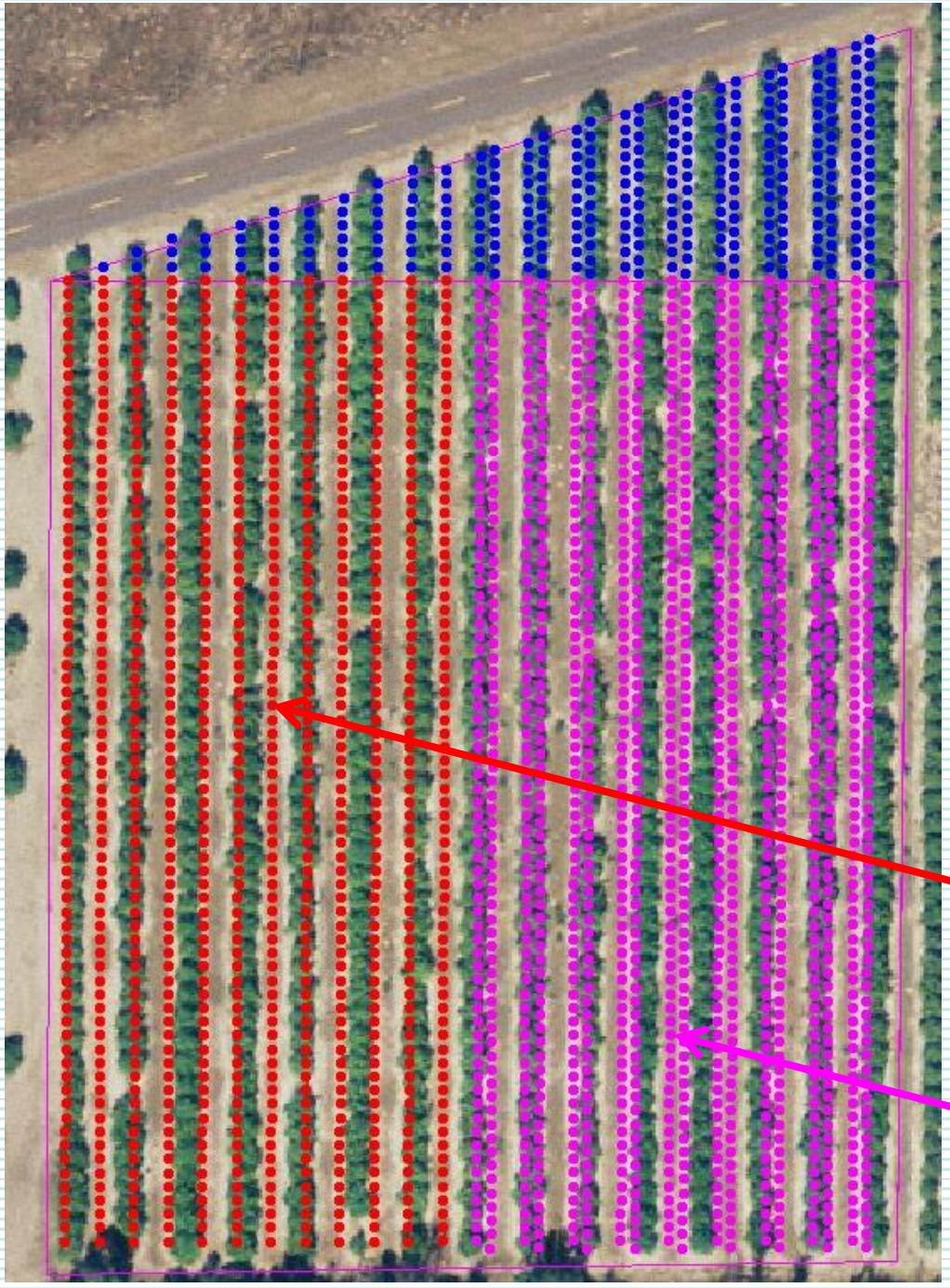
- Narrow equipment, novel “tramline” planting and other innovations are being tested to maximize planting densities of small trees to rapidly grow canopies

538 trees/acre = 9 x ½(3+15) feet

New Research Project Objectives

- **1) To test innovative super-high density citrus grove replanting configurations with a drip fertigation open hydroponics (OH) system for maximizing early return on investment in a canker and HLB-endemic disease environment.**

- **2) To develop sustainable high yielding OH solutions for highbush blueberry cultivation in Florida which will eliminate the need for expensive mulching with pine bark.**



1) Citrus APS

- **Source of nitrogen:**

1) calcium nitrate

2) ammonium nitrate

- **Rootstocks:**

1) Swingle

2) US897

single tree rows (6x15'=484 trees/acre)

tramline rows (9 x ½(3+15)'
= 538 trees/acre

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Measurements:

Soil pH in the drip zone, and leaf and soil nutrients obtained from quarterly sampling

SPAD leaf color, tree height and canopy width measured quarterly

Nutrients in leached soil solution below the root zone – collected with vacuum lysimeters

Fruit yield and quality measured annually from year 2 (manual harvesting of a subsample of each plot). External (color) and internal (brix, juice %, acid %) quality will be measured


November 2012, Lake Alfred, Fl
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2) Blueberry APS

Treatments:

- **Blueberry bushes grown in native mineral soil with standard NPK fertigation**
- **Blueberry bushes grown in standard mulched pine bark beds and standard NPK fertigation with only ammonium nitrogen**
- **Blueberry bushes grown in native mineral soil with enhanced OHS fertigation and comprehensive major, secondary and minor nutrient supply. Nitrogen will be supplied as nitrate and ammonium.**
- **Blueberry bushes grown in native mineral soil with enhanced OHS fertigation and comprehensive nutrient supply as above, PLUS dissolved organic leached derivatives of pine bark delivered through fertigation**

Pinebark amended layer

Roots prefer to grow in the pine bark only

Native soil layer

Saturated zone

Photo courtesy of Wije Baranayake

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Photo courtesy of Wije Baranayake

Pine bark mulch is an essential component for production of highbush blueberries grown in FL

- **Low pH of pine bark**
- **High organic matter content**
- **Problems:**
  - **Needs replacement ~3-4 yrs**
  - **Restricted rooting zone**
  - **Irrigating pine bark is difficult**

Can customized liquid fertigation substitute for pine bark?

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Acknowledgements

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

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YARA

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