

Utilizing Advanced Production Systems for New Plantings

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Advanced Citrus Production Systems

Efficiencies increase due to:

- Reduced fertilizer requirement
- Reduced water requirement
- Faster growth - quicker economic production
- Agrochemical savings? – compressed time?



What is an “Advanced Citrus Production System” (ACPS)?

- ACPS borrows advanced fertigation + higher density planting from “**Open Hydroponics**”
- Main goals are early, high production, early return on investment, disease avoidance?, longevity. Built-in redundancy compensates for HLB-removal and canker infection
- Other goals: Increased water and nutrient use efficiencies (partial rootzone drying), reduced environmental impacts
- Good flush protection, especially psyllid control is essential during establishment phase
- Synonymous with computerized fertigation, using pulsed drip emitters, frequent monitoring and remote control

Main components of an ACPS

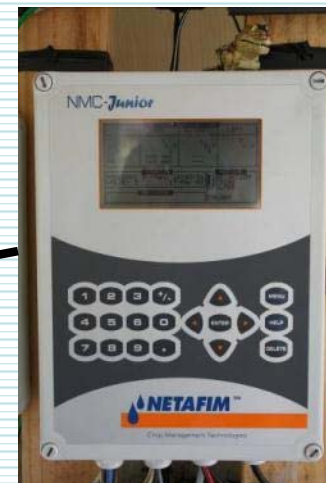


Monitoring equipment

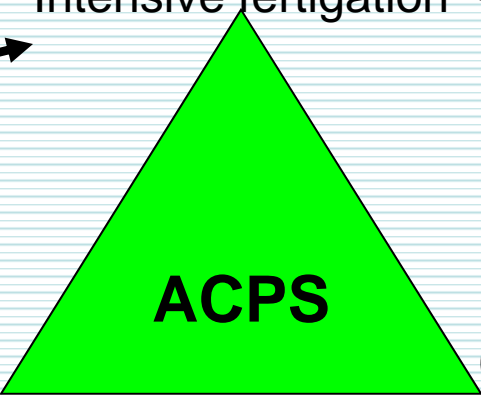


(1)
Intensive fertigation

Pulse
irrigation



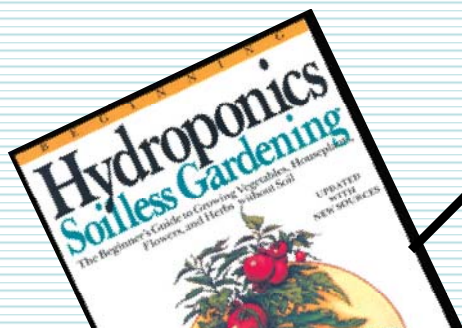
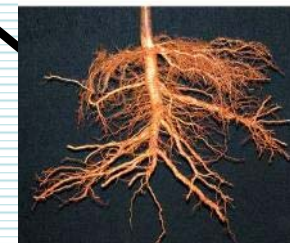
Computer control



(2)
Balanced,
complete
nutrition

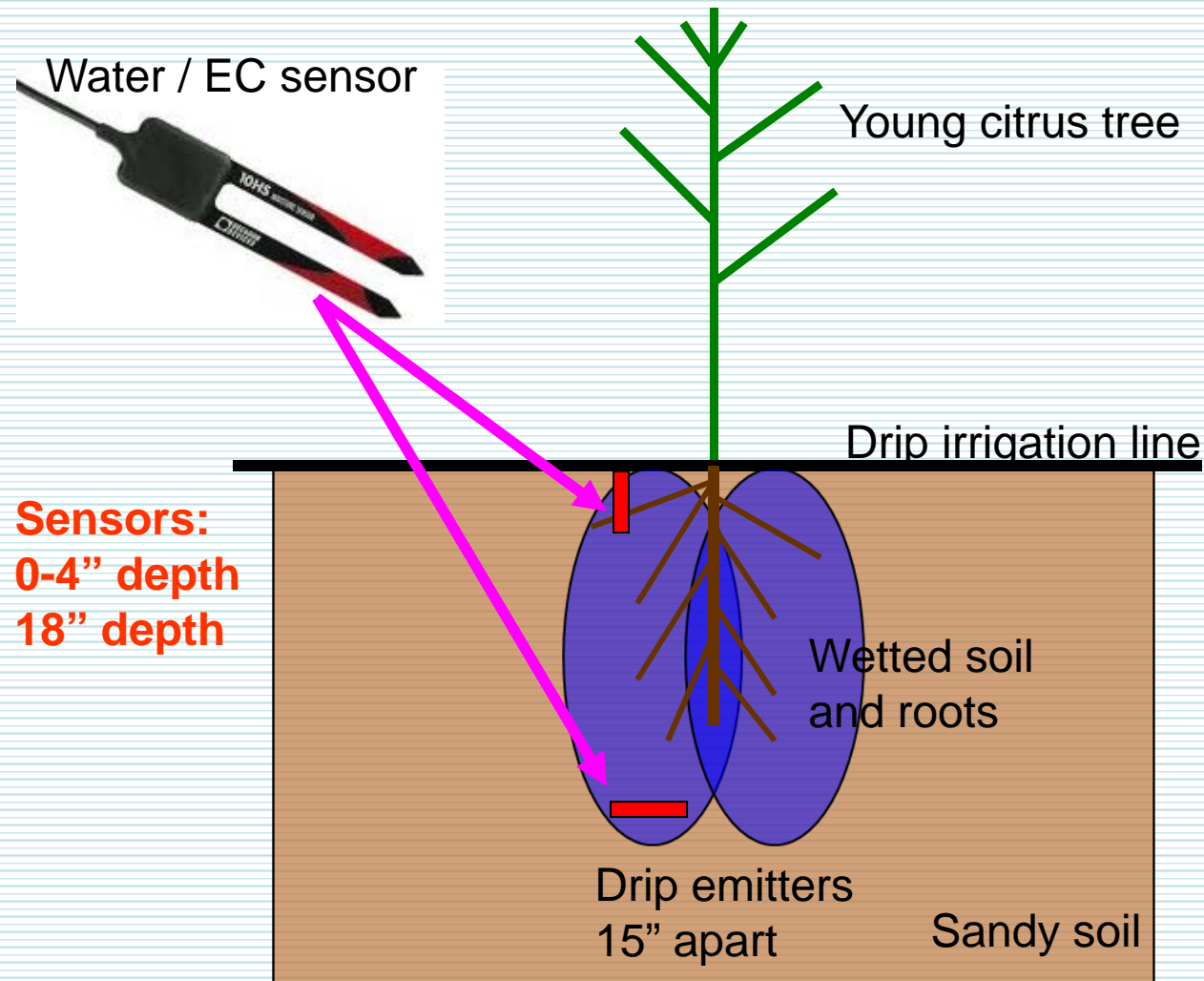
(3)
High density
planting

Adapted
rootstocks

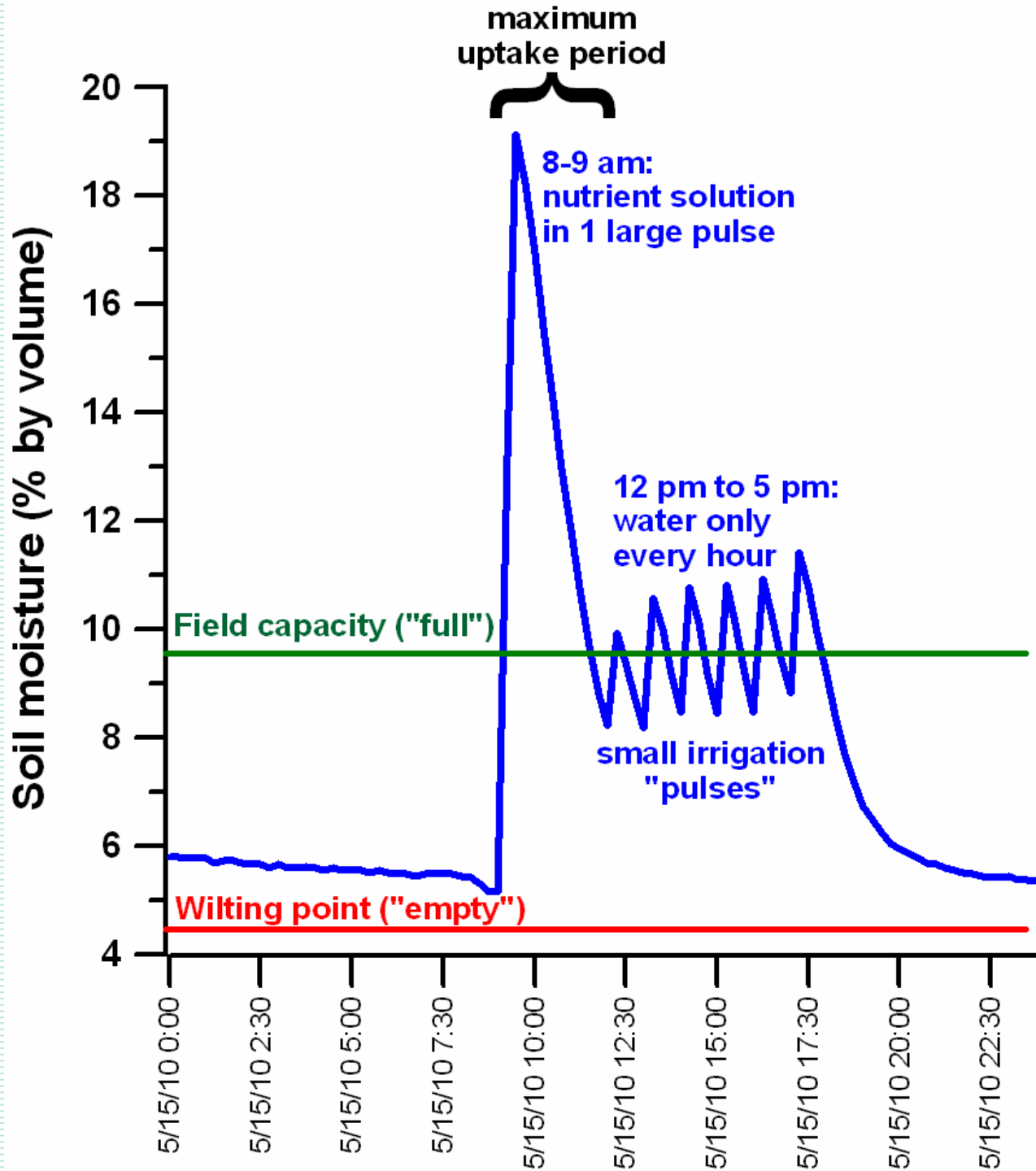


N,P,K,Ca,Mg,S
Mn,Fe,Zn,Cu,B,Mo,Cl
(100 ppm nitrogen)

Replant configuration - Ridge







Steps being used to implement ACPS in Florida

- **Keep soil near field capacity (~zero water tension) with short duration frequent (drip) irrigations to wet the top 18 inches of soil**
- **Inject fertilizer with most irrigations (100 - 150 ppm N)**
- **Use complete balanced nutrient formula to maximize growth rates and improve disease resistance**
- **Skip fertigation on rainy days, while soil is already near field capacity**
- **Flush excess salts during the dry season with plain irrigation (3 to 4x normal irrigation amount every 2 weeks)**

Computerized control and monitoring

Metafim NMC Communication - Local Line

File Tools Setup Help

NMC-JR Irrigation	Block9	Gapway	3	4	5	6	7	8
Alarm	OFF	OFF						
Date	07-Jun-09	07-Jun-09						
Time	10:16:11	10:14:20						
Temperature	N/A	N/A						
Humidity	N/A	N/A						
Program	PAUSE	1						
Valve	6	1						
Cycle Actual	N/A	1						
Cycle Set	1 of 1	1						
Water Actual	N/A	40.0						
Water Set	50.0	80.0						
Flow Rate Actual	N/A	19.496						
Flow Rate Set	12.480	16.400						
EC Actual	N/A	N/A						
EC Set	Not Set	Not Set						
PH Actual	N/A	N/A						
PH Set	Not Set	Not Set						
Irrigation	OFF	ACTIVE						
Dosing	OFF	ACTIVE						
Filtration	OFF	OFF						
Misting	OFF	OFF						
Cooling	OFF	OFF						
Next Program Start At:	11:40:00	N/A						
Next Program Time Remain:	01:23:49	N/A						

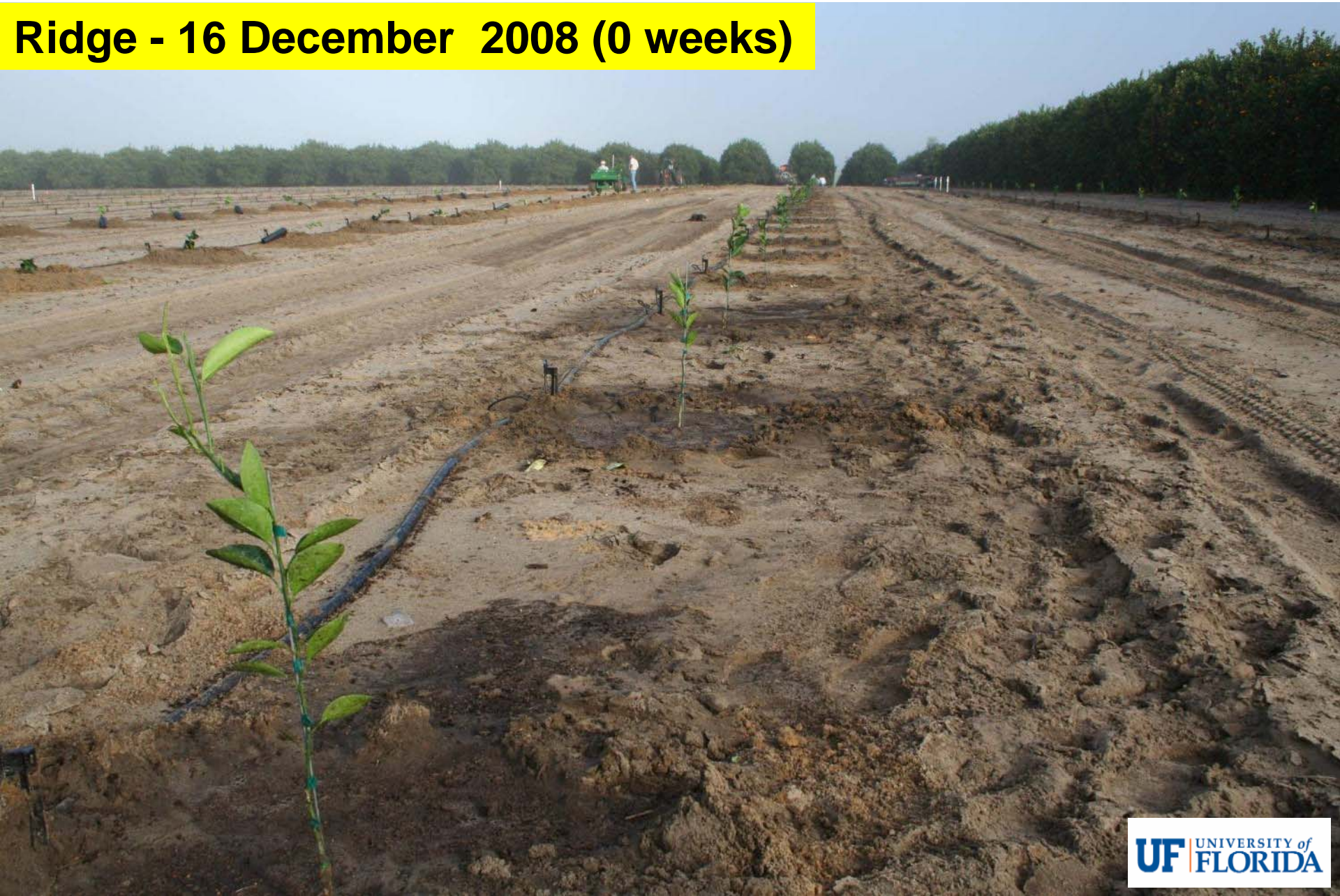
Irrigation Process x

Hot Key2 Irrigation Process - Gapway

▶ Program	1	Valve	1	Time	10:14:20
	Set	Actual	Flow	Valve	
▶ Water	80.0	50.0	17.058	ON	
Channel 1					
Channel 2	0.75	0.62	-----	ON	
Channel 3					

Progress and selected results

Ridge - 16 December 2008 (0 weeks)



Ridge - 26 March 2009 (+13 weeks)



Ridge - 24 May 2009 (+21 weeks)



Ridge - 13 August 2009 (+32 weeks)

Conventional



MS fertigation



Drip fertigation



Standard practice:
6x granular fertilizer per year;
Infrequent irrigation with
microsprinklers

Microsprinkler fertigation:
Nearly daily fertigation of
balanced nutrients with
microsprinklers

Drip fertigation:
Nearly daily fertigation of
balanced nutrients with
drippers

Ridge – 7 December 2009 (+1 year)



Immature 'Hamlin' with ACPS – August 2010 (age 19 months)

Conventional



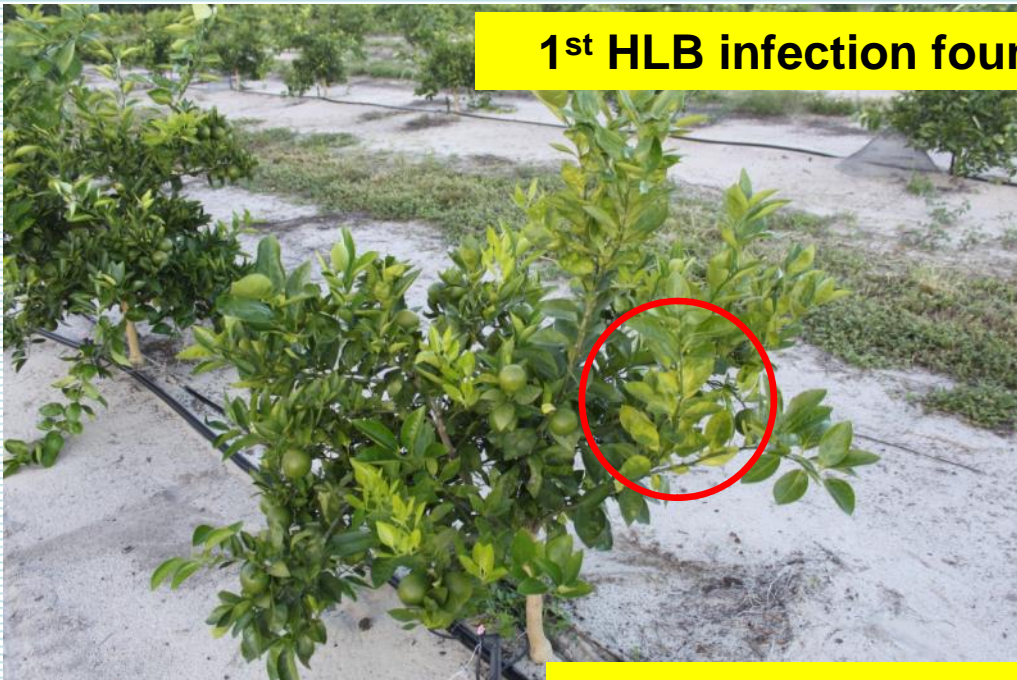
Drip fertigation



Microsprinkler fertigation



1st HLB infection found at 20 months



November 2010 (age 22.5 months)

Drip ACPS

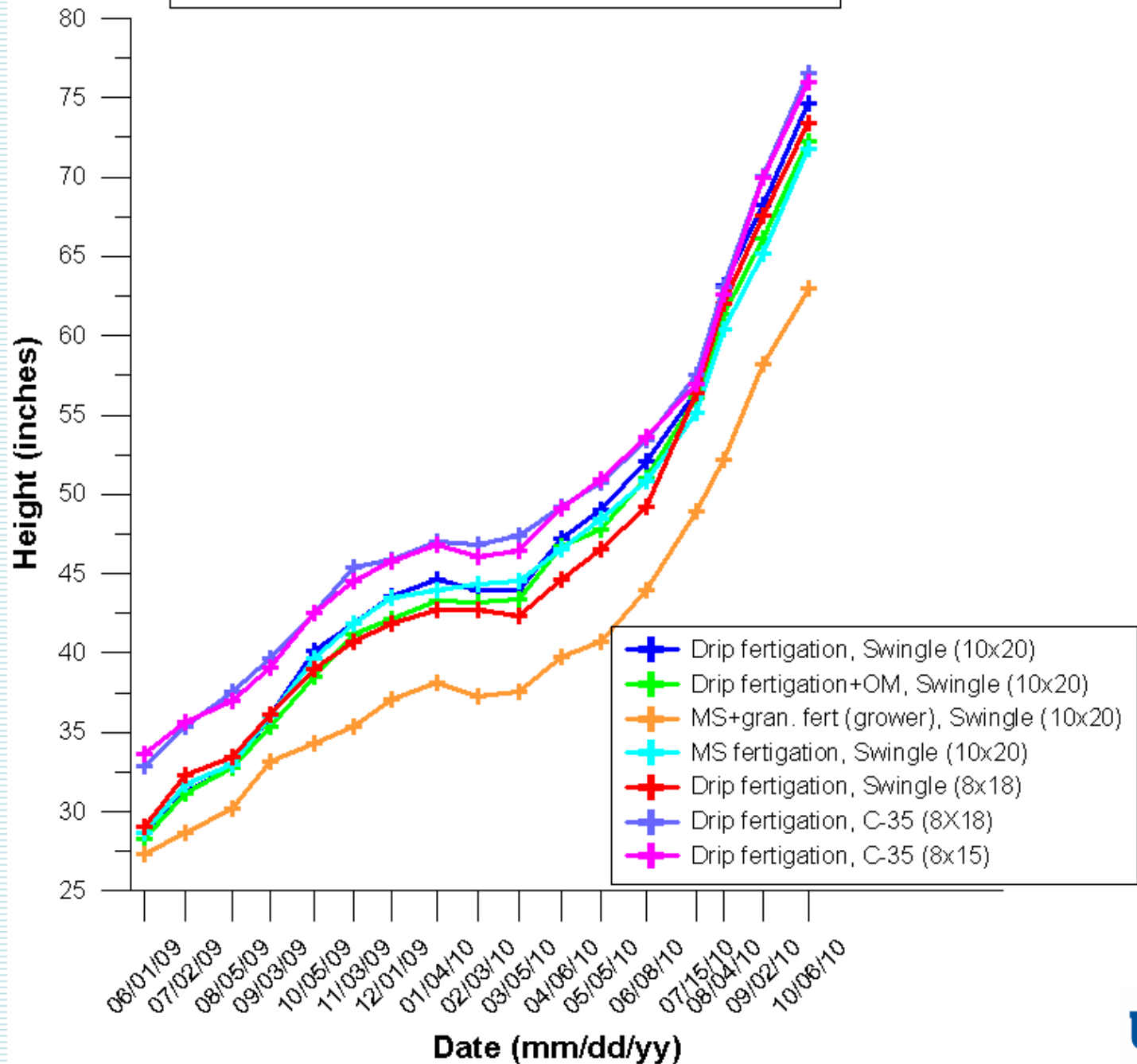


Conventional



**Gapway Grove
Experiment
22.5 months**

Growth curves at the young tree Ridge site



Harvest time at 24 months



Harvest time at 24 months



Harvest time at 24 months



Freeze protection using microsprinklers



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

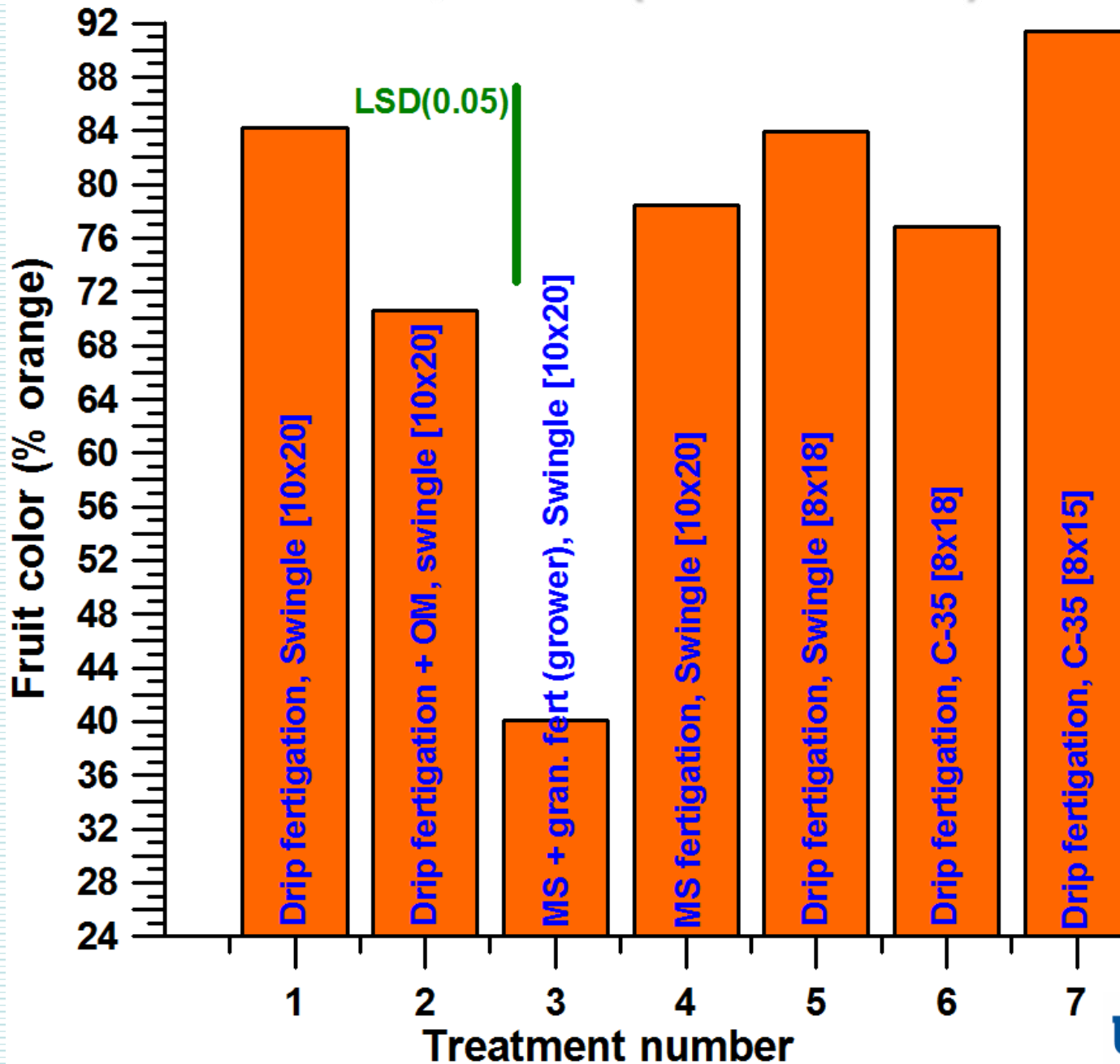


Conventional methods

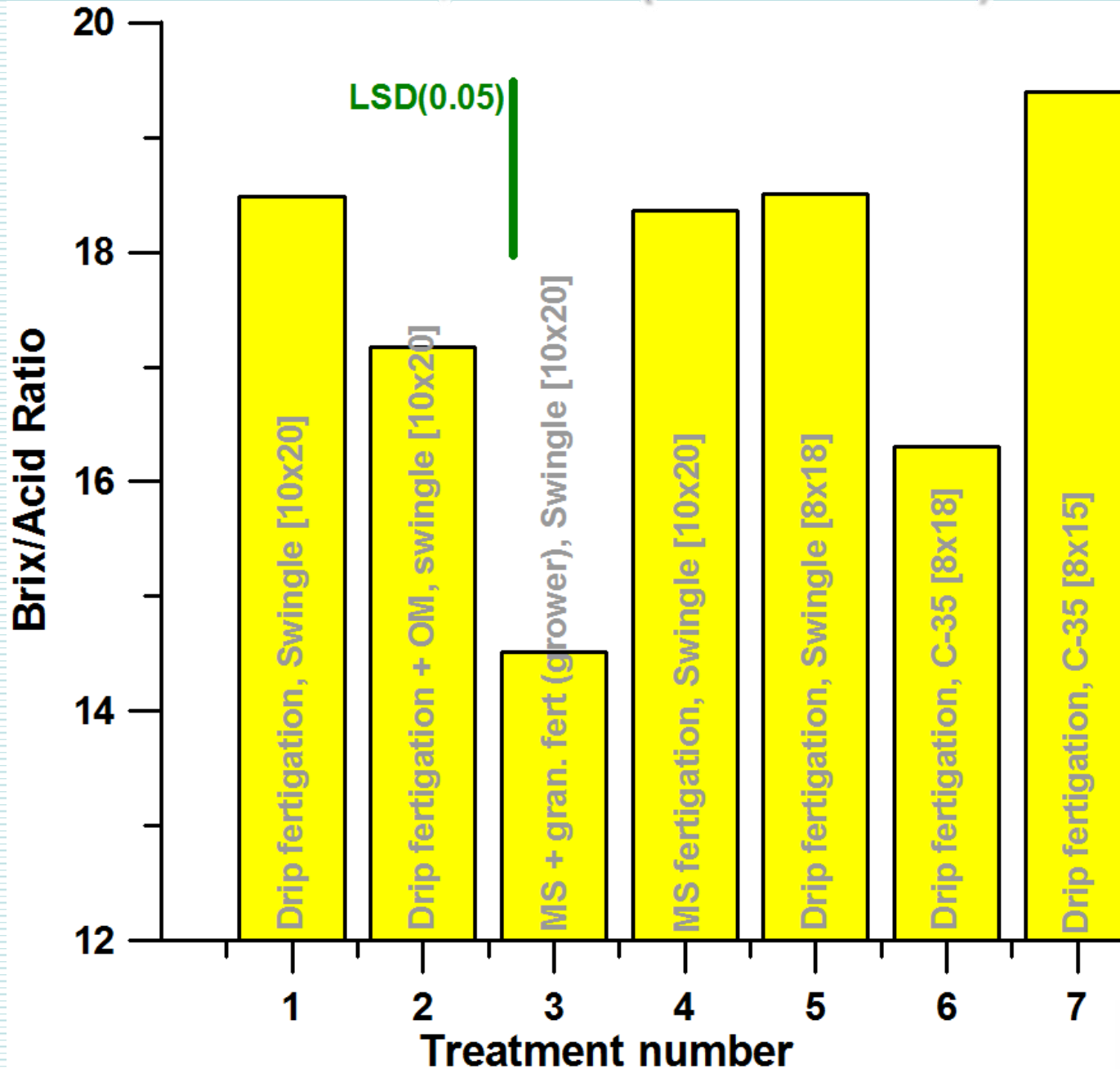


Advanced drip fertigation methods (OH)

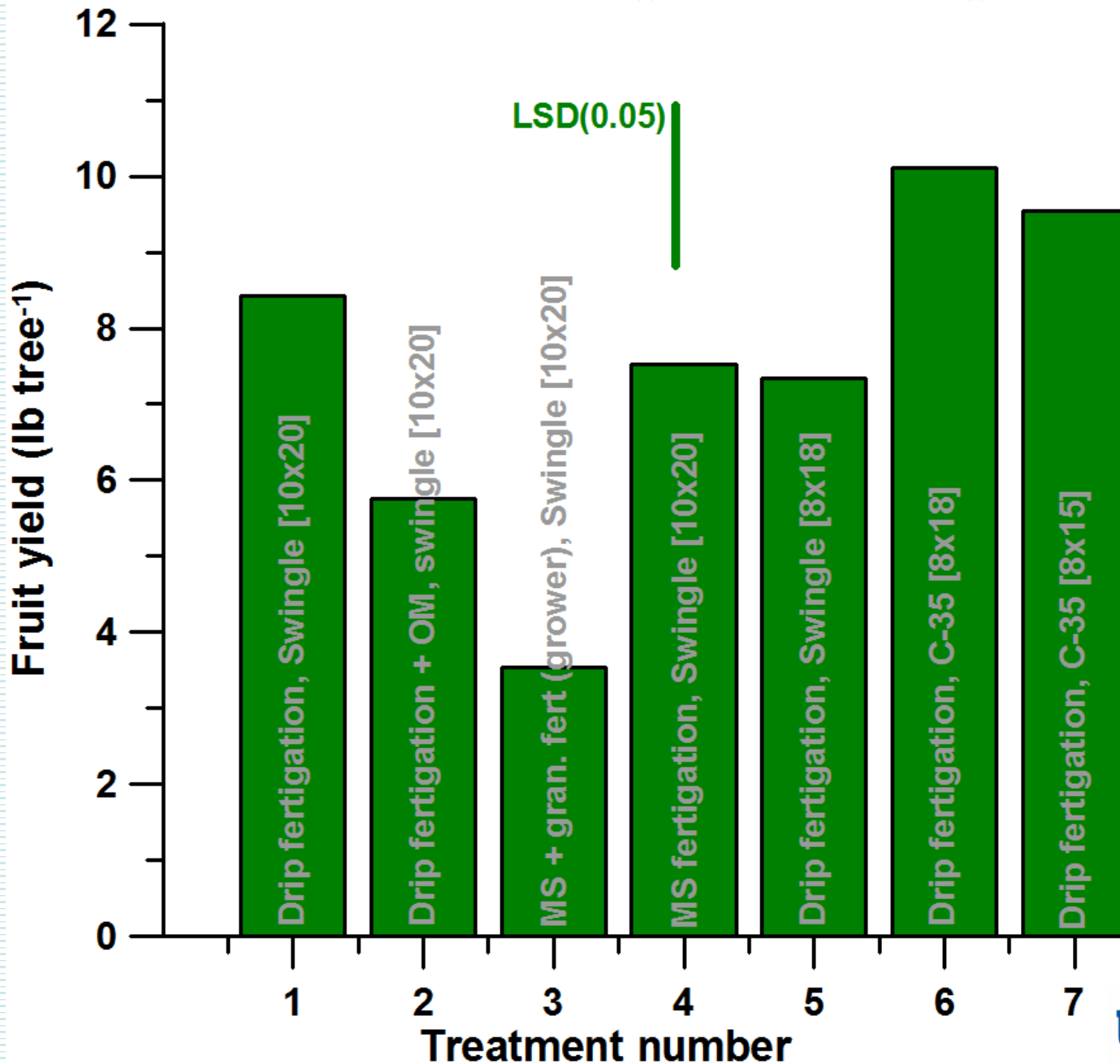
December, 2010 (24 months)



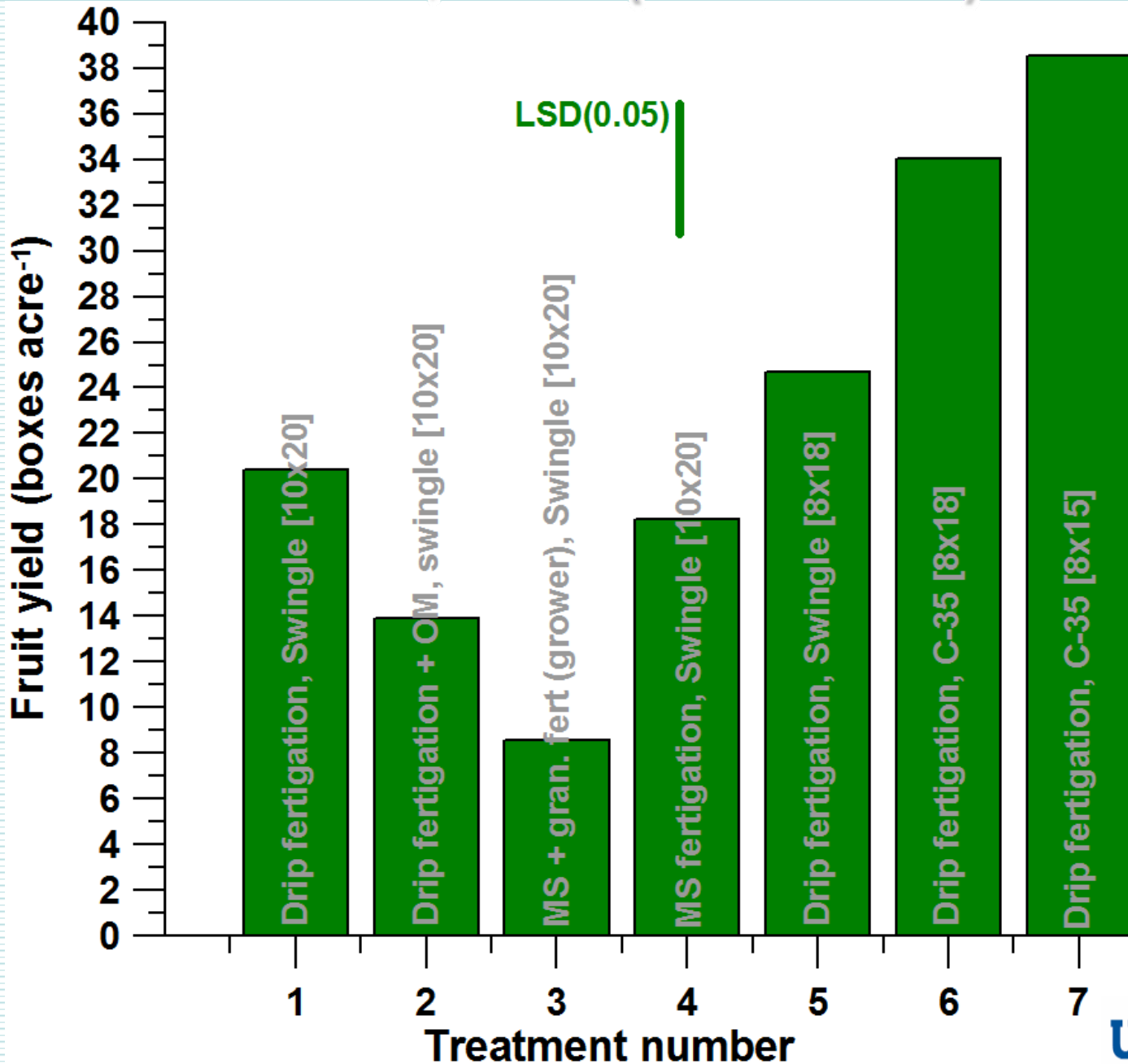
December, 2010 (24 months)



December, 2010 (24 months)



December, 2010 (24 months)



Reality Check – Past Experience

	3 (grower; 2 yrs)	7 (drip, C35; 2 yrs)	Ft. Meade 8 (Grower*; 2.5yrs)
Yield, lb/tree	3.5	9.6	18.7
Yield, box/ac	8.6	38.5	37.3
Brix	10.42	10.66	10.67
Acid, %	0.72	0.55	0.65
Ratio	14.52	19.39	16.42
SS, lb/box	5.18	5.29	5.19
SS, lb/ac	44	204	193
Juice, %	55.3	55.1	54.2
Fruit/tree	9.2	27.6	48.9
Orange, %	40.1	91.4	na

*(John Strang, production records, Gapway Grove)

Efficiency gains: 4 to 10x

Table 1. Water and fertilizer N applied and tree canopy growth in year 1. Water for freeze protection was not included.

	Conventional* (218 tpa) [‡]	Microsprinkler OH [§] (218 tpa)	Drip OH [¶] (218 tpa)	Drip OH (363 tpa)
Irrigation water (gal/acre)	49,177 (1x)	45,997 (0.94x)	19,684 (0.40x)	32,777 (0.67x)
Fertilizer nitrogen (lb/acre)	48.0 (1x)	16.5 (0.34x)	8.0 (0.17x)	13.4 (0.28x)
Tree height (feet)	3.18 (1x)	3.67 (1.15x)	3.92 (1.23x)	3.92 (1.23x)
Tree canopy volume (feet³/acre)	2,507 (1x)	3,837 (1.53x)	4,129 (1.65x)	6,875 (2.74x)
Water efficiency (feet³/1000 gal)	51.0 (1x)	83.4 (1.64x)	209.8 (4.11x)	209.8 (4.11x)
Nutrient efficiency (feet³/lb N)	52.2 (1x)	232.5 (4.45x)	516.1 (9.89x)	516.1 (9.89x)

* Conventional = granular fertilizer in six split applications

[‡] tpa = trees per acre

[§] Microsprinkler OH = open hydroponics through inverted microsprinklers (1/tree)

[¶] Drip OH = open hydroponics through drip emitters

Problems – salt accumulation



Problems – Psyllid control

More frequent pest control will be required to protect the constantly flushing young trees

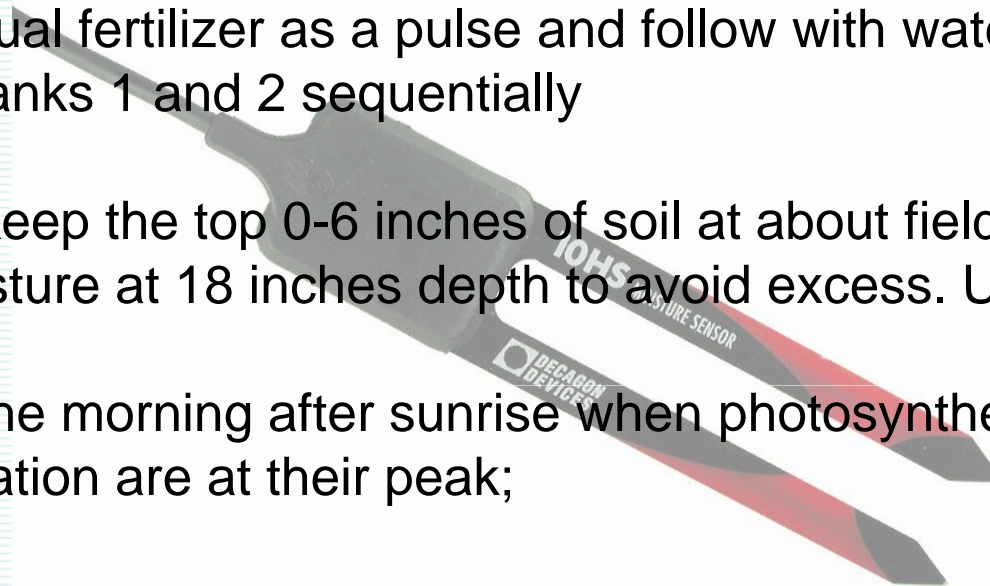


Successful fertigation strategy for immature trees

- Fertigate “daily” at 100 to 150 ppm N concentration in final water volume; Use **calcium nitrate** to provide ample Ca (see recipe on WWW)
- Inject the actual fertilizer as a pulse and follow with water; Inject from tanks 1 and 2 sequentially
- Fertigate to keep the top 0-6 inches of soil at about field capacity Monitor moisture at 18 inches depth to avoid excess. Use sensors.
- Fertigate in the morning after sunrise when photosynthesis and transpiration are at their peak;

DRIP ONLY:

- During long dry periods in the first year, flush salts from the root zone with plain irrigation (3 to 4x normal irrigation amount) every 2 weeks



Conclusions after two years

- ✓ Reduced fertilizer + water requirement
- ✓ Early yields and quality are above average, reliable
 - maximum potential for Florida, Brazil?
- ✓ Higher production may be possible – pest control, nutrients, PGRs



Additional information


Citrus R Advanced Citrus Production System - Microsoft Internet Explorer provided by IFAS-CREC

http://128.227.177.113/ACPS/Index.html

Live Search

Advanced Ci... x Advanced Citr...

Page Tools




Advanced Citrus Production System

- Home
- Objectives
- Contacts
- Design/Layout
- Data
- Publications
- Photos
- Acknowledgements
- Technology
- Links

Welcome to the Advanced Citrus Production System Web Site

What is the Advanced Citrus Production System (ACPS)?

The **ACPS** incorporates elements of "open hydroponics" or intensive fertigation, high planting density, and a suitable rootstock capable of developing a compact tree and an efficient root system in the fertigated zone. Other enhancements are being added through research.



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