Advanced Citrus Production Systems: What You Need to Know to Install a System Today

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IFAS Research Citrus Research and Education Center 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



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 ppm N)
- Use complete balanced nutrient formula
- 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)



Soil wetting with drip irrigation





Replant configuration - Ridge





Typical fertigation system



Balanced nutrition – 13 elements

	S	pecific form	nulations	for differei	nt growing	months	of mature o	itrus (mg/	L)		
		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	N	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	P	14.3	14.3	15.7	15.7	15.7	20.0	20.0	24.0	24.0	24.0
	K	57.1	57.1	71.4	85.7	85.7	100.0	108.3	140.0	140.0	120.0
for bloom	Ca	100.0	100.0	85.7	85.7	57.1	33.3	33.3	40.0	40.0	40.0
	Mg	14.3	14.3	17.1	20.0	17.1	20.0	23.3	28.0	24.0	20.0
	S	20.6	20.6	24.6	24.6	24.6	28.7	33.7	40.4	34.4	28.8
	Fe	1.714	1.714	1.714	1.714	1.714	2.000	2.000	2.400	2.400	2.400
	Mn	0.857	0.857	0.857	0.857	0.857	1.000	1.000	1.200	1.200	1.200
for bloom	Zn	0.857	0.857	0.571	0.286	0.286	0.333	0.333	0.400	0.800	1.200
	Cu	0.029	0.029	0.029	0.029	0.029	0.033	0.033	0.040	0.040	0.040
for bloom	В	0.857	0.857	0.571	0.286	0.286	0.333	0.333	0.400	0.400	0.400
	Mo	0.020	0.020	0.020	0.020	0.020	0.023	0.023	0.028	0.028	0.028
	CI	49.7	49.7	62.0	62.0	68.3	87.0	94.0	121.6	121.6	104.4

Final nitrogen concentration ~ 100 ppm

Focus on bloom enhancement and fruit set

Manipulate leaf flushes?

Avoid leaching in summer rainy period



Computerized control and monitoring

🔚 Netafim 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	Irrig	gation Proce	255				×	
Water Actual	N/A	40.0	Hot Key2 Irrigation Process - Gapway							
Water Set	50.0	80.0		Program	1	Valve	1	Time	10:14:20	
Flow Rate Actual	N/A	19.496			Set	Actu	al	Flow	Valve	
Flow Rate Set	12.480	16.400		Water	80.0	50.0		17.058	ON	
EC Actual	N/A	N/A	Channel 1							
EC Set	Not Set	Not Set		Channel 2	0.75	0.62	1		ON	
PH Actual	N/A	N/A		Channel 3				- dededede de de		
PH Set	Not Set	Not Set								
Irrigation	OFF	ACTIVE				Close				
Desing	OFF	ACTIVE	-	T		1				
Dusing	AFE	OFF								
Filtration	UFF	011	1			1				
Filtration Misting	OFF	OFF								
Filtration Misting Cooling	OFF OFF OFF	OFF OFF								
Filtration Misting Cooling Next Program Start At:	OFF OFF OFF 11:40:00	OFF OFF N/A								

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



Ridge - 13 August 2009 (+32 weeks) Conventional MS fertigation Drip fertigation

unin- anual rest (2)



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)







Ridge – 7 December 2009 (+1 year)



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Early results from ACPS in Florida (7.5 months age)



Early production – growth acceleration

Feasibility testing -extrapolating from current monthly growth rates



Early production – putting it all together

Growth acceleration + high density, using simplified economics

Conventional 15 x 20 ft spacing = 145 tpa Conventional production methods = 250 boxes/ac at 5 years* = 1.72 boxes/tree

*economically viable production point (250 boxes/ac x \$5.5/box = \$1,375 /ac); assuming production costs at \$1,300 /ac

> ACPS production methods = 1.72 boxes/tree at 2.5 years ACPS 8 x 18 ft spacing = 303 tpa ACPS production = $1.72 \times 303 = 521$ boxes/ac at 2.5 years ACPS fruit revenue = 521 boxes/ac x 5.5/box = 2.866 /ac



Water applied to young trees -Ridge





Pulse drip fertigation - Ridge

After 9 months (March to December 2008) Average 550 boxes/ac (up to 5 boxes per tree)



Pulse drip fertigation - Ridge



Pulse drip fertigation - Ridge



Water applied to mature trees -Ridge



Problems – salt accumulation





Problems – Psyllid control

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



Precision spraying for IPM



Reduce production costs, extend the use of rate-limited products, especially at high planting density

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Problems – N deficiency in spring

Daily fertigation may not cope with high nutrient demand of <u>mature trees</u>; SOLUTION: Apply 15 to 25% of annual fertilizer as dry granular in February



Possible alternatives? – controlled release fertilizers

Using nursery-grade coated granular fertilizer

1.73-inch trunk diameter @ 16 months



Additional information

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



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Home

Objectives

Contacts

Design/Layout

Data

Publications

Photos

Acknowledgements Technology

Links

Advanced Citrus Production System

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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Demonstration blocks (1/2) in commercial growers' groves (Schumann, Hostler, Castle, Spann)



Well + pump
8x18 trees
Old boundary





Conclusions

- For mature trees, a hybrid method of pre-bloom granular fertilization (15-25%) followed by intensive fertigation is proposed
- Water and fertilizer use is reduced by drip fertigation
- Salinity must be managed in the dry season
- Mature trees can be converted in one year to drip fertigation on the Ridge
- Intensive microsprinkler fertigation improves over conventional microsprinkler irrigation + granular fertilization; drip fertigation is better
- Rootstock differences are large and exploitable
- Data from planting densities will only be available after more years





 Growth acceleration for early production using intensive fertigation and balanced nutrition, is an essential component of the ACP package

•Without earlier yields, high density planting alone would not likely recover the costs of production, shown in past experiments





ACPS, based on OHS, appears to work well in Florida conditions

ACPS is based on conventional Biology, Chemistry, Physics





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