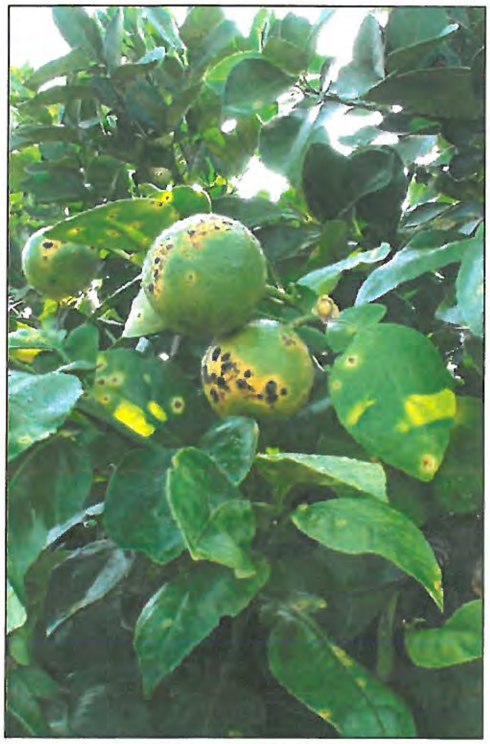
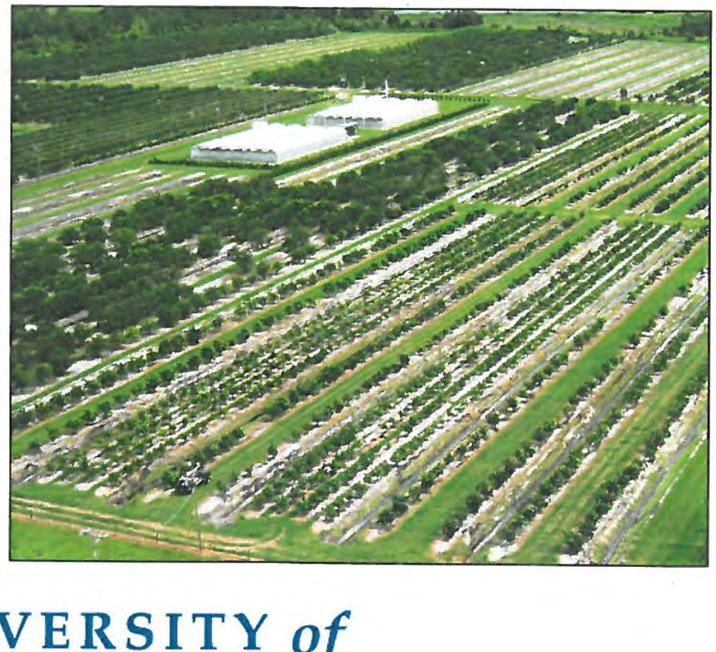
UF/IFAS Citrus Field Day

SWFREC—Immokalee



June 23, 2011

9am-2:15pm



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IFAS

Southwest Florida Research and Education Center

Established in 1958 as a University of Florida support facility, the Southwest Florida Research and Education Center (SWFREC) was dedicated in 1986 as a UF/IFAS station. Situated on 320 acres, the center serves growers, farmers, and other clientele in Collier, Charlotte, Glades, Hendry, and Lee counties. It supplies decision-makers with specific knowledge to sustain and enhance agricultural, human, and natural resources through nationally and internationally recognized research, extension, and teaching programs.

SWFREC faculty members study in nine disciplines:

Agricultural Economics—Dr. Fritz Roka (fmroka@ufl.edu)

Citrus Horticulture—Dr. Bob Rouse (rrouse@ufl.edu)

Citrus Physiology—Dr. Bob Ebel (rcebel@ufl.edu)

Entomology—Dr. Phil Stansly (pstansly@ufl.edu)

Plant Pathology—Dr. Pam Roberts (pdr@ufl.edu)

Soil and Water Science—Dr. Kelly Morgan (ktm@ufl.edu); Dr. Ed Hanlon (eahanlon@ufl.edu)

Vegetable Horticulture—Dr. Monica Ozores-Hampton (ozores@ufl.edu)

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SWFREC

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Dr. John Dunckelman

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Field Day Sponsors

Eric Waldo, Haifa North America

Fred Lozo, Florida Phosphorus

Larry Bridge, Plant Food Systems, Inc.

Ryan Atwood and Heath Prescott, KeyPlex

Scott Houk, Dow AgroSciences

Field Day Agenda

9am—Welcome (Dr. John Dunckelman / Dr. Mongi Zekri)

9:30-11:30am—Grove Tour:

Stop 1: (Stay on Trailer)
Rooted Cutting Trial (Dr. Bob Rouse)
Screenhouses (Dr. Bob Rouse)

Stop 2: Insecticide Trials for Psyllid and Leafminer Control (Dr. Phil Stansly / Barry Kostyk)
Tree Rehabilitation through Pruning and Foliar Nutrition (Dr. Bob Rouse)

Stop 3: (Stay on Trailer)
Suppression of Citrus Canker (Dr. Pam Roberts)

Stop 4: (Stay on Trailer)
New Trial for Interaction of Rootstock, Spacing, and Tree Size (Dr. Bob Rouse)

Stop 5: Nutritional/SAR Programs (Dr. Bob Rouse)

Stop 6: OHS and High-Density Planting (Dr. Kelly Morgan)

11:30am-12:30pm—Auditorium Presentations:

- Search for Psyllid Economic Thresholds (Dr. Cesar Monzo)
- Early-season Leafminer Control (Dr. Moneen Jones)
- Mass release of Tamarixia radiata for Psyllid Biocontrol (Dr. Jawwad Qureshi)
- Economics of HLB Management Programs (Dr. Fritz Roka)
- SARs and Nutrition for Mitigation of Canker and HLB (Dr. Bob Ebel)

12:30-1:15pm—Lunch

1:15-2:15pm—Lab and Greenhouse Demonstrations:

- Entomology Lab: Insecticide Bioassays for Psyllid Control (Dr. Moneen Jones) / Tamarixia radiata Production (Dr. Jose Castillo)
- Citrus Physiology Greenhouse: Interaction of HLB and Nutrition on Valencia and Hamlin Tree Health (Dr. Bob Ebel)
- HLB Lab: Diagnostic Overview (Dr. Pam Roberts / Dr. Katherine Hendricks / Shea Teems)

STOP #1

Rooted Cutting Trial
Screenhouses

TRIAL USING CITRUS ROOTED CUTTINGS IN THE PRESENCE OF HLB

Bob Rouse
SWFREC Citrus Field Day June 23, 2011

The use of rooted cuttings of commercial varieties has captured the imagination of some citrus growers in this era of Citrus Greening in Florida. Cuttings offer an opportunity for early production and high density using close spaced trees. Questions remain about soil borne diseases (Phytophthora), cultural management, yield, harvesting, etc. We are establishing a trial on beds in the flatwoods using rooted cuttings at the IFAS Southwest Center in Immokalee to evaluate these issues.

Experimental designs and treatments

<u>Experiment 1 (Row 1)</u>

Hamlin orange
2-row bed
12 x 22 spacing
6 replications

<u>Treatments</u>

1. Hamlin cuttings
2. Hamlin cutting stagger set
3. Hamlin/Hamlin cutting (budded cutting)
4. Hamlin/Swingle

<u>Experiment 2 (Row 2)</u>

Hamlin orange
3-row bed
12 x 12 spacing
4 replications

<u>Treatments</u>

1. Hamlin cutting
2. Hamlin cutting stagger set
3. Hamlin/Hamlin cutting (budded cutting)
4. Hamlin/Swingle

<u>Experiment 3 (Row 3)</u>

Hamlin orange
3-row bed
12 x 12 spacing
12 replications

<u>Treatment</u>

Cuttings solid set

Advantages of cuttings

- Early fruiting – 1 year
- Inexpensive tree
- Easy replacement of tree

Disadvantages of cuttings

Soil borne diseases (Phytophthora)
Cultural management
Harvesting

STOP #2

Insecticide Trials

Tree Rehab

Insecticide Efficacy Trials for ACP Control

Phil Stansly, Barry Kostyk, Moneen Jones and Jawwad Qureshi

Foliar trials are usually done in this block of 16-yr-old sweet orange 'Valencia' trees. Trees are pruned with a hand held hedger to induce new shoots and encourage psyllid infestation. Treatments including an untreated check and a grower standard are randomly distributed across 4 replicates that include a buffer row between each treated row in plots of 5 trees each. Treatments are applied to both bed and swale sides of the trees usually with a Durand Wayland 3P-10C-32 air blast speed sprayer, although we have done some trials comparing results with the Proptec^{TM} rotary atomizer sprayer . Three central trees per plot are included in post treatment evaluations and are normally made 3 days after treatment (DAT) and at weekly intervals subsequently, until no significant treatment effects are observed. Between 10and 15 randomly selected shoots per plot are collected and examined under a stereomicroscope in the laboratory to count psyllid nymphs. Adult psyllid density is estimated from three central trees in each 5-tree plot by counting the insects falling on a clipboard covered with an 8 ½ × 11 inch white paper sheet placed under randomly chosen branches which were then tapped 3 times with the PVC pipe to make a count for one tap sample. Four tap samples are conducted per tree. Data are subjected to ANOVA and treatment means separated using LSD ($P = 0.05$). Drench trials are conducted on young trees and follow a similar sampling procedure except that it lasts much longer.

The present trial is being conducted here in the "long rows". The beginning and the end of each plot is marked out with flagging whose color represents the particular treatment. All treatments are repeated 4 times, once in each replicate or "block". The treatments and representative colors for this particular trial are listed in Table 1. Treatments were applied on Thursday using the speed sprayer. In this trial we are testing rates of two new products not yet labeled for citrus, sulfoxaflor a neonicotinoid-type insecticide reportedly not cross resistant with those now on the market, and a numbered compound from Bayer that has shown good results in past. A complete list of products we have field tested or plan to field test in 2011 is given in Table 2.

We have been field testing insecticides for ACP control since 2002. All trials are reported in "Arthropod Management Tests" a publication of the Entomological Society of America, as well as on our website: www.imok.ufl.edu/entomology. While this information is thus available to the public, digesting all the results and coming to general conclusions regarding the relative efficacy of individual products is a major undertaking. We are endeavoring to facilitate this task by ranking each active ingredient according to the maximum number of days after treatment (DAT) that significant differences from the untreated check were observed. When a particular active ingredient was trialed more than once and/or at more than one rate, results are averaged over DATs and rates. Insecticides tested as foliar applications are listed in Table 3. Examples of ranked results for adults and nymphs respectively following drench applications are given in Tables 4 and 5.

Table 1. Flagging color and treatments for present insecticide trial. Treatments applied 16 June 2010.

Flagging	Code	Product	Rate
white	untreat		
red	danitol	Danitol	16 oz
		Citrus Oil	2%
reddot	delegate	Delegate	4.0 oz
		Citrus Oil	2%
blue	sl285	Sulfoxaflor	2.85 oz
green	s285oil	Sulfoxaflor	2.85 oz
		Citrus Oil	2%
yellow	sl428oil	Sulfoxaflor	4.28 oz
		Citrus Oil	2%
pink	sl57oil	Sulfoxaflor	5.7 oz
		Citrus Oil	2%
purple	by14	Bayer 1	14.0 oz
		Induce	0.25%
orange	by105oil	Bayer 1	10.5 oz
		Citrus Oil	3%
[illegible]	by12oil	Bayer 1	12.0 oz
		Citrus Oil	3%
[illegible]	by14oil	Bayer 1	14.0 oz
		Citrus Oil	3%
black	Movento	Movento MPC	16.0 oz
		Citrus Oil	3%

Table 2. Products tested or to be tested in 2011	
Trade Name	**Active Ingredient**
Danitol	Fenpropathrin
Delegate	Spinetoram
Sulfoxaflor	Sulfoxaflor
Bayer 1	Unknown
Movento MPC	Spirotetramat
Imidan	Phosmet
Nexter	Pyridaben
Lorsban Advanced	Chlorpyrifos
Stallion	Chlorpyrifos/Zeta-Cypermethrin
Mustang	Zeta-cypermethrin
Baythroid	Cyfluthrin
Agrimek	Abamectin
Admire Pro	Imidacloprid
Tolfenpyrad SC	Tolfenpyrad
NNI-0101	Pyrifluquinazon
platinum 75 SG	Thiamethoxam
HGW 86 20 SC	Cyantraniliprole
MB1-206	Burkholderia multivarens
Dibrom 8 Emulsive	Naled
Voliam Flexi	Thiamethoxam/Chlorantranilprole
Actara	Thiamethoxam
Agri-flex	Thiamethoxam/Abamectin
M-pede	Fatty acid (soap)
Addit	Vegetable Oil/Surfactant
Orocit	Orange Oil

Table3. Insecticides tested as foliar applications to mature trees with citation From Arthropod Management Tests (AMT), year and No. = page.

Product	AMT Year	No.
435 Oil	2009, 2010	D7, D9, D13, DE, DF
Actara 25 WG	2009, 2010	D12, D8
Agriflex + 435 Oil	2010	D8, DF
Agri-Mek 0.15 EC + 435 Oil	2009	D12
AZA-direct 1.2%, Supracide 2E	2009	D9
Baythroid XL 1EC	2010	DA
BY102960 + 435 Oil	2010	DE
Danitol 2.4EC	2008, 2009, 2010	D13, D8, D9, D12, D10
Delegate WG	2009, 2010	D7, D8, D9, DE
Dimethoate 4EC	2010	D10
Fenazaquin + 435 Oil	2009	D9
Imidan 70W	2009, 2010	D9, D10
Lorsban 4E	2009, 2010	D8, D10
Micromite 80 WGS + 435 Oil	2009, 2010	D7, D13, D12, DF
Movento 240SC + 435 Oil	2010	DA, DF, D7, D8, D9
Mustang 1.5EC	2009, 2010	D8, DA
Portal 0.4EC	2010	DF, D7
Requiem 25EC + 435 Oil	2008, 2009, 2010	D7, D9, D13
Sevin XLR	2009	D13
Sil-Matrix	2010	D9
Tolfenpyrad + 435 Oil	2010	DF
Vydate 2L	2008	D13
Warrior 1SC	2009, 2010	D12, D10

Table 4. Composite results on suppression of ACP adults using insecticides applied to young trees by drench

Product	Rate (per ac)	DAT Adult	AMT Year	No.
Venom 70SG	3.8 oz	55	2009	D2
Cyazypyr 20 SE	20.3 oz	70	2010	DD
Platinum	0.2 lb ai	73	2006, 2007, 2009, 2010	D19, D10, D2, DD
Temik 15G	33 lb	115	2009	D11
Imidacloprid	0.4 lb ai	137	2006, 2007, 2009	D19, D2, D10, D11

Table 5. Composite results on suppression of ACP nymphs using insecticides applied to young trees by drench.

Product	Rate (per ac)	DAT Nymphs	AMT Year	No.
Venom 70SG	3.8oz	55	2009	D2
Cyazypyr 20SE	20.3oz	70	2010	DD
Platinum	0.2 lb ai	71	2006, 2007, 2009, 2010	D19, D10, D2, DD
Temik 15G	29.7 lb ai	73	2009	D11
Imidacloprid	0.4 lb ai	121	2006, 2007, 2009	D19, D10, D11, DD

Rejuvenation of HLB trees,

or what can growers do to stay in business?

MATERIALS & METHODS

- 5 acres planted 1995 (15 yr. old trees)
- 4 treatments, 7 replications, 10 tree plots
- Valencia/Swingle
- Spacing: 15' x 22' (132 trees/acre)
- Flatwoods bedded grove
- Two row beds
- Maxijet emitter irrigation
- Psyllid control sprays based on scouting
- Dry ground applied fertilizer (170 lbs. N/yr.)
- Foliar applied nutritionals & SARs

Treatments: Began February 2010 with severe hedge & top using commercial machine

A. Buckhorn pruned and standard un-pruned trees.

B. Foliar Nutritionals to feed regrowth.

1. Boyd cocktail (N, P, K, Mg, Mn, Zn, Mo, B, Phosphite, SAR)
2. Fortress (Mg, Zn, Mn, Mo, Ca, Cu, Co Phosphites, + B, Ni) *In 2011 added 20 lbs/ac KNO3 + Calcium Nitrate ground applied*
3. Energy (Mg, Zn, Mn, Mo, Cu, Co Phosphites, + B, high Ni) *In 2011 changed to Fortress & added Trizone Urea + Calcium nitrate ground applied*
4. Untreated *control with no foliar nutrition*

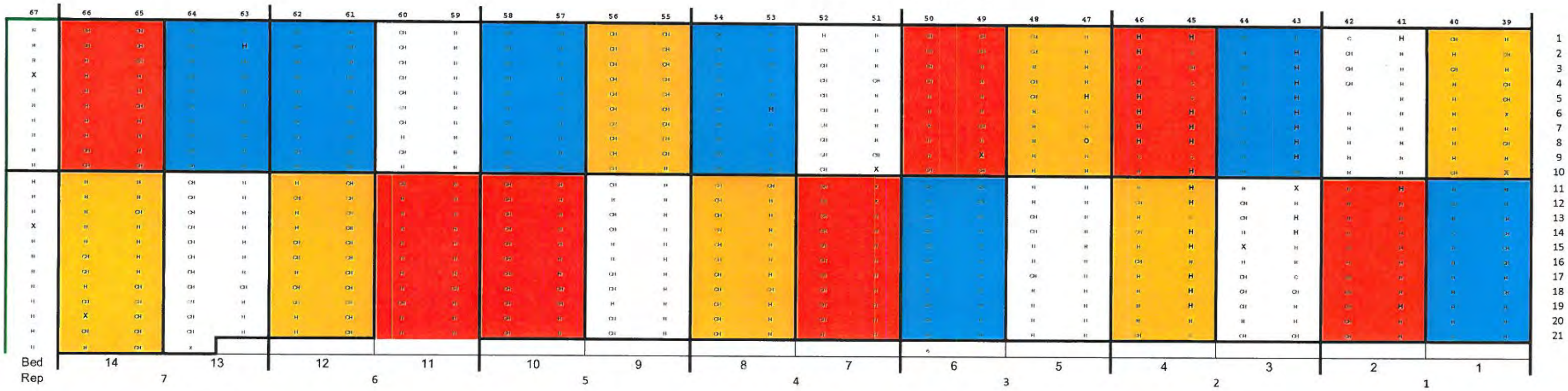
Strategy: Rebalance the shoot:Root ration to salvage existing HLB tree.

Rationale: 1. Tree removal = \$ 2. New tree = \$ 3. Planting = \$
4. 4-years care till first production = \$ 5. 3-more years till break even = \$

HLB Rejuvenation Study

N

Zone 4 Map Short Rows



TRT

1 Control = White
2 Boyd = Red
3 Fortress = Blue
4 Energy = Yellow

C=CANKER
H=HLB
CH=CANKER AND HLB
X=MISSING TREE
O=NO SYMPTOMS

Appreciation to the Following for Support of our HLB Nutritional Research

- Florida Citrus Production Research Advisory Council (now CRDC, Citrus Research and Development Foundation)
- The citrus growers in Florida
- Diamond R Fertilizer
- Plant Food Systems
- The Scotts Company
- AgraQuest
- Flo-Tec, Inc.
- Bayer CropScience
- Valent USA
- Florida Phosphorus, Inc.
- Triangle Chemical

2010 Shoot Growth by Season

Nutrient Treatment	Spring flush (Buckhorn)	Summer flush (Buckhorn)	Fall flush (Buckhorn)
Control	19.8 a	42.1 ab	26.8 a
Boyd	19.0 a	39.0 b	25.3 a
Fortress	18.8 a	43.1 a	26.5 a
Energy	20.3 a	42.2 ab	26.9 a
	(Standard)	(Standard)	(Standard)
Control	10.1 b	16.6 c	23.3 bc
Boyd	10.5 b	17.3 c	23.3 bc
Fortress	10.4 b	14.9 c	22.0 c
Energy	10.4 b	17.9 c	22.0 c

2010 Shoot Growth Summary

Tree Shape	Spring flush	Summer flush	Fall flush
Buckhorn	19.5 a	41.6 a	26.4 a
Standard	10.4 b	13.7 b	22.7 b

2011 Shoot Growth by Season

Nutrient Treatment	Spring flush (Buckhorn)	Summer flush (Buckhorn)	Fall flush (Budkhorn)
Control	22.8 ab		
Boyd	23.5 a		
Fortress	23.1 ab		
Energy	24.7 a		
	(Standard)	(Standard)	(Standard)
Control	18.8 d		
Boyd	21.0 bc		
Fortress	18.5 d		
Energy	19.3 cd		

2011 Shoot Growth Summary

Tree Shape	Spring flush	Summer flush	Fall flush
Buckhorn	23.5 a		
Standard	19.4 b		

STOP #3

Citrus Canker

Plant Pathology

Dr. Pamela Roberts

Dr. Ryan Donahoo
Jacob Collins

Dr. Katherine Hendricks
Stephanie Teams
Gerard Kearns
Farhat Shaheen
Robert Feldges

Rod Sytsma
David Ballesteros
Chad Grannis

Canker Trial on Grapefruit

SWFREC Plant Pathology Department

Dr. Pamela Roberts

Treatment	(Ribbon color) Product and Rate	Application Dates	Active Ingredient	Manufacturer	20-Jun Hits
1	**(Blue)** Untreated Control				33 a
2	**(Pink)** Kocide 3000 2.5 lb/A	2,3,4,5,6	Copper Hydroxide 46.1 %	Dupont	28 ab
3	**(Red)** Regalia 2 qt/A pre-bloom Regalia 2 qt/A Kocide 3000 2.5 lb/A	1, 2,3,4,5,6 2,3,4,5,6	Extract of Reynoutria sachalinensis 5% Extract of Reynoutria sachalinensis 5% Copper Hydroxide 46.1 %	Marrone Bio Innovations Marrone Bio Innovations Dupont	28 ab
4	**(Yellow)** Koicde 3000 2.5 lb/A Phosmax 2 qts/A	2,3,4,5,6	Copper Hydroxide 46.1 % Phosphorous Acid 27.5 %	Dupont American Ag Products Corp	13 d
5	**(Green)** Kocide 3000 1.25lb/A Phosmax 2 qts/A	2,3,4,5,6	Copper Hydroxide 46.1 % Phosphorous Acid 27.5 %	Dupont American Ag Products Corp	20 bcd
6	**(Yellow Black Checker)** Kocide 3000 1.25 lb/A full season Phosmax 2 qts/A	2,3,4,5,6 1,2,3,4,5	Copper Hydroxide 46.1 % Phosphorous Acid 27.5 %	Dupont American Ag Products Corp	21 bcd
7	**(White)** Actinovate AG at 6 oz /A Kocide 3000 1.25 lb/A Phosmax 2 qts/A	1,2,3,4,5,6 1,2,3,4,5,6 1,2,3,5	Streptomyces Lydicus WYEC 108 0.0371 % Copper Hydroxide 46.1 % Phosphorous Acid 27.5 %	Natural Industries Inc Dupont American Ag Products Corp	19 cd
8	**(Black and Red Stripe)** SA 1 pt/ A Phosmax 2 qts/A	1,2,3,4,5,6 1,2,3,5	Urea and Potassium Citrate, 3 % Urea Nitrogen 6 % Potash Phosphorous Acid 27.5 %	Costal Fertilizer and Supply American Ag Products Corp	28 ab
9	**(Orange)** Phosmax 2 qt/A	1,2,3,4,5	Phosphorous Acid 27.5 %	American Ag Products Corp	35 a
10	**(White with Black dot)** Actigard 6 oz/A Kocide 3000 1.25 lb/A Phosmax 2 qts/A	1,3,4,5,6 2,3,4,5,6 1,2,3,5	Acibenzolar-S-methyl 50% Copper Hydroxide 46.1 % Phosphorous Acid 27.5 %	Syngenta Dupont American Ag Products Corp	23 bc

1 =24 Feb, 2=17 Mar, 3= 5 Apr, 4 = 26 Apr, 5 = 19 May, 6 =7 Jun

STOP #4

New Planting

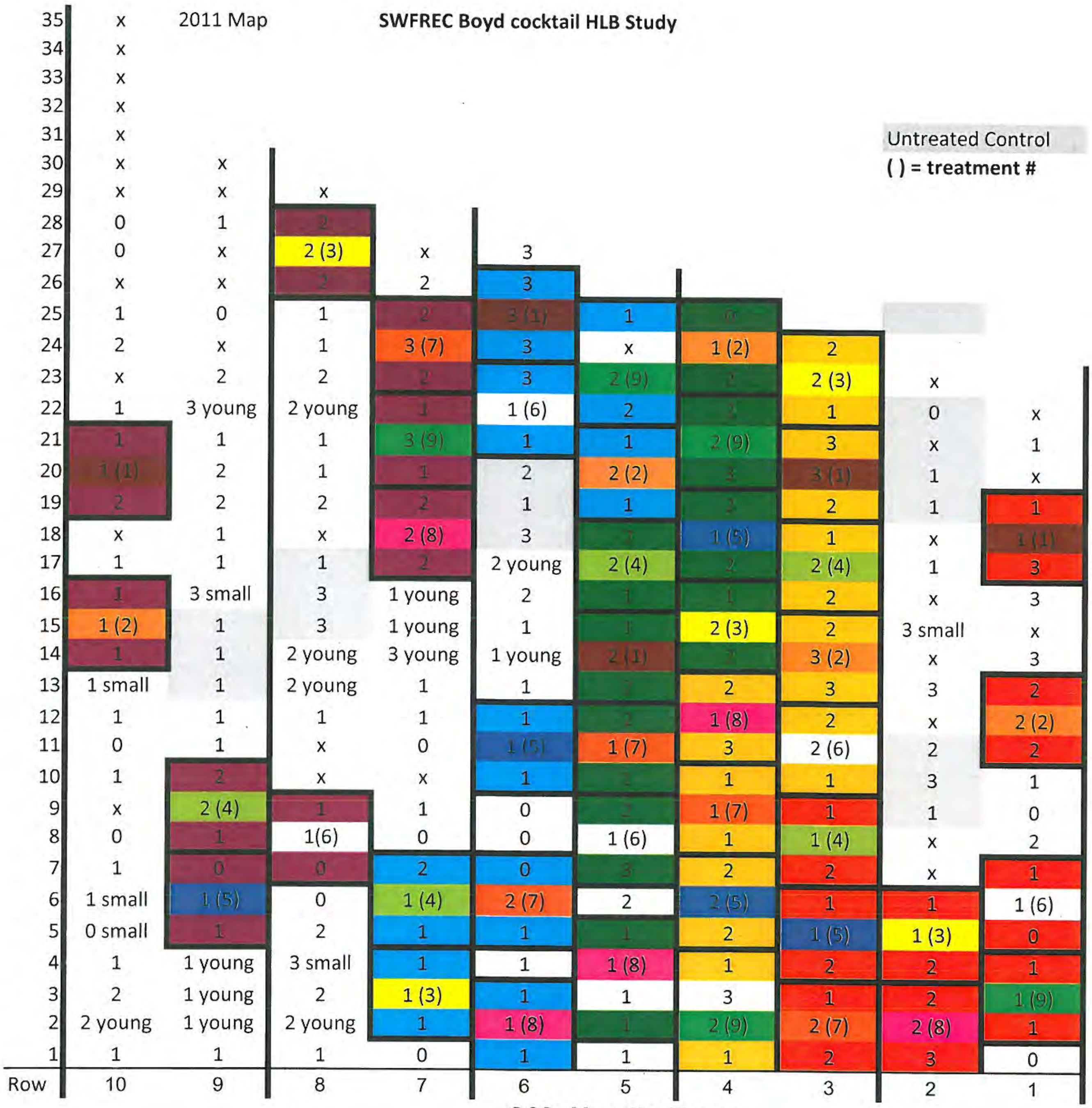
Tree Size & Density Study

Rootstocks
X639
US802
US897
US942
FDT
SWG

Row	Seed trees 84 @ 12'	Hamlin US897 @ 8x11' (103 trees)	Hamlin US897 @ 8x11' (309 trees)			Valencia US942 @ 10x11' (242 trees)			Valencia 15x22'		Valencia US942 12x22'	Hamlin 15x22'		
	x	55	55		55									
55	x	x	x	x	x	54		54						
54	x	x	x	x	x	x	x	x	53					
53	x	x	x	x	x	x	x	x	G					
52	x	x	x	x	x	x	x	x	G	51				
51	x	x	x	x	x	x	x	x	G	G				
50	x	x	x	x	x	x	x	x	897	897				
49	x	x	x	x	x	x	x	x	897	897	48			
48	x	x	x	x	x	x	x	x	FDT	802	x			
47	x	x	x	x	x	x	x	x	FDT	802	x			
46	x	x	x	x	x	x	x	x	SWG	FDT	x			
45	x	x	x	x	x	x	x	x	SWG	FDT	x	44		
44	x	x	x	x	x	x	x	x	802	SWG	x	942		
43	x	x	x	x	x	x	x	x	802	SWG	x	942		
42	x	x	x	x	x	x	x	x	639	942	x	802	41	
41	x	x	x	x	x	x	x	x	639	942	x	802	639	
40	x	x	x	x	x	x	x	x	942	639	x	897	639	
39	x	x	x	x	x	x	x	x	942	639	x	897	SWG	
38	x	x	x	x	x	x	x	x	802	802	x	FDT	SWG	37
37	x	x	x	x	x	x	x	x	802	802	x	FDT	FDT	802
36	x	x	x	x	x	x	x	x	639	SWG	x	897	FDT	802
35	x	x	x	x	x	x	x	x	639	SWG	x	897	SWG	SWG
34	x	x	x	x	x	x	x	x	897	942	x	FDT	SWG	SWG
33	x	x	x	x	x	x	x	x	897	942	x	FDT	942	942
32	x	x	x	x	x	x	x	x	942	639	x	639	942	942
31	x	x	x	x	x	x	x	x	942	639	x	639	897	639
30	x	x	x	x	x	x	x	x	SWG	FDT	x	SWG	897	639
29	x	x	x	x	x	x	x	x	SWG	FDT	x	SWG	639	FDT
28	x	x	x	x	x	x	x	x	FDT	897	x	802	639	FDT
27	x	x	x	x	x	x	x	x	FDT	897	x	802	802	897
26	x	x	x	x	x	x	x	x	SWG	FDT	x	942	802	897
25	x	x	x	x	x	x	x	x	SWG	FDT	x	942	FDT	FDT
24	x	x	x	x	x	x	x	x	639	639	x	639	FDT	FDT
23	x	x	x	x	x	x	x	x	639	639	x	639	639	639
22	x	x	x	x	x	x	x	x	942	802	x	SWG	639	639
21	x	x	x	x	x	x	x	x	942	802	x	SWG	802	802
20	x	x	x	x	x	x	x	x	802	897	x	897	802	802
19	x	x	x	x	x	x	x	x	802	897	x	897	SWG	897
18	x	x	x	x	x	x	x	x	897	942	x	FDT	SWG	897
17	x	x	x	x	x	x	x	x	897	942	x	FDT	942	942
16	x	x	x	x	x	x	x	x	FDT	SWG	x	802	942	942
15	x	x	x	x	x	x	x	x	FDT	SWG	x	802	897	SWG
14	x	x	x	x	x	x	x	x	897	802	x	942	897	SWG
13	x	x	x	x	x	x	x	x	897	802	x	942	897	802
12	x	x	x	x	x	x	x	x	FDT	942	x	SWG	897	802
11	x	x	x	x	x	x	x	x	FDT	942	x	SWG	802	942
10	x	x	x	x	x	x	x	x	639	639	x	639	802	942
9	x	x	x	x	x	x	x	x	639	639	x	639	FDT	639
8	x	x	x	x	x	x	x	x	SWG	SWG	x	897	FDT	639
7	x	x	x	x	x	x	x	x	SWG	SWG	x	897	SWG	SWG
6	x	x	x	x	x	x	x	x	802	FDT	x	FDT	SWG	SWG
5	x	x	x	x	x	x	x	x	802	FDT	x	FDT	942	FDT
4	x	x	x	x	x	x	x	x	942	897	x	802	942	FDT
3	x	x	x	x	x	x	x	x	942	897	x	802	639	897
2	x	x	x	x	x	x	x	x	G	G	x	942	639	897
1	x	x	x	x	x	x	x	x	G	G	x	942	G	G

STOP #5

Nutritional/SARs



269 Hamlin Trees

Tree Ratings

0 = No visible symptoms
1 = Visible symptoms on at least one branch
2 = Visible symptoms in myltiple locations around tree
3 = Visible symptoms with dieback

History

Treatments began Spring 2008
3 applications per year to the flush;
Spring, summer & fall flushs
Ground fertilizer 180 lbs/acre N
Psyllid sprays as needed by scouting
Experiment Design: 10 treatments, 5 reps

Appreciation to the Following for Support of our HLB Nutritional Research

CRDF (Citrus Research Development Foundation)

- The citrus growers in Florida
- Diamond R Fertilizer
- Plant Food Systems
- The Scotts Company
- AgraQuest
- Flo-Tec, Inc.
- Bayer CropScience
- Valent USA
- Florida Phosphorus, Inc.
- Triangle Chemical

250 gal

Per acre	Product
1.0 gal	Serenade ASO
2 qts	Di-Oxy Solv Organic
8 gal	*14-7-8 w/K-Phite(1-pt/gal)
8 gal	3-18-20 w/K-Phite(1-pt/gal)
8.5 lbs	Epsom Salts (Mg sulfate)
8.5 lbs	Techmangam (Mn sulfate)
2.8 lbs	Zinc Sulfate
0.85 ozs	Sodium molybdate
3.3 lbs	Boron (Beau-Ron D) added fall 2009
8.5 lbs	13-0-44 (spray grade-KNO_3)
1 qt	SAver (Salicylic acid)
5 gal	435 oil

*When using 14-7-8 (spring) eliminate the 3-18-20

Trt	Micro	K-Phite	SARs	Oxidate
1	Y	Y	Y	Y
2	Y	Y	N	N
3	Y	N	N	N
4	N	N	N	N
5	N	N	Y	N
6	N	Y	Y	N
7	Y	N	Y	N
8	N	Y	N	N
9	Y	Y	Y	N
	5	5	5	1

Treatment Groups

Micro	K-phite	SAR	Oxidate	Other
Epsom Salt	14-7-8/K-Phite	Serenade	Di-oxy Solv	13-0-44
Techmangam	or	SAver		435 Oil
Zinc Sulfate	3-18-20/K-Phite			
Sodium Molybdate				
Boron				

Products for each treatment

Trt 1	Trt 2	trt 3	Trt 4	Trt 5
Serenade	3-18-20/K-Phite	Epsom Salt	13-0-44	Serenade
Di-oxy Solv	Epsom Salt	Techmangam	435 Oil	13-0-44
3-18-20/K-Phite	Techmangam	Zinc Sulfate		SAver
Epsom Salt	Zinc Sulfate	Sodium Molybdate		435 Oil
Techmangam	Sodium Molybdate	Boron		
Zinc Sulfate	Boron	13-0-44		
Sodium Molybdate	13-0-44	435 Oil		
Boron	435 Oil			
13-0-44				
SAver				
435 Oil				

Trt 6	Trt 7	Trt 8	Trt 9	Trt 10
Serenade	Serenade	3-18-20/K-Phite	Serenade	untreated
3-18-20/K-Phite	Epsom Salt	13-0-44	3-18-20/K-Phite	control
13-0-44	Techmangam	435 Oil	Epsom Salt	
SAver	Zinc Sulfate		Techmangam	
435 Oil	Sodium Molybdate		Zinc Sulfate	
	Boron		Sodium Molybdate	
	13-0-44		Boron	
	SAver		13-0-44	
	435 Oil		SAver	
			435 Oil	

STOP #6

OHS/High-Density

Irrigation Management to Increase Young Tree Growth and Productivity on Florida Flatwoods Soils

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Introduction

Research data from several studies show that increasing water costs and environmental concerns create a need for more efficient management practices for citrus production. Irrigating to meet crop evapotranspiration (ET) demands and fertigation at optimal nutrient levels have the potential to increase production efficiency. Also, judicious use of the Open Hydroponic System (OHS) for fertilizer management is required in Florida soils with high sand content (>95%) and low organic matter content because leaching and subsequent pollution of groundwater is a likely threat. Additionally, the use of higher tree densities on size controlling rootstocks has potential for improved yields and reduced impact of disease. This study hypothesizes that proper scheduling of irrigation water by drip or microsprinkler using the OHS will improve water and nutrient use efficiency thus helping farmers more efficiently manage inputs in an ecologically sound manner, and attain high citrus growth and/or yields as a result of improved nutrient uptake and reduced incidence of citrus greening.

For optimum citrus tree growth and yield, fertilization rate and timing must be accompanied by efficient water management to avoid decreasing the nutrient use efficiency. An integrated research study that focuses on improved crop growth with improved water and fertilizer use efficiency, and irrigation management optimization can help in (1) realizing lower water and fertilizer use, (2) ensuring sustainable citrus yields and (3) avoiding environmental pollution associated with nutrient leaching from the citrus root-zone.

Project Goals and Objectives

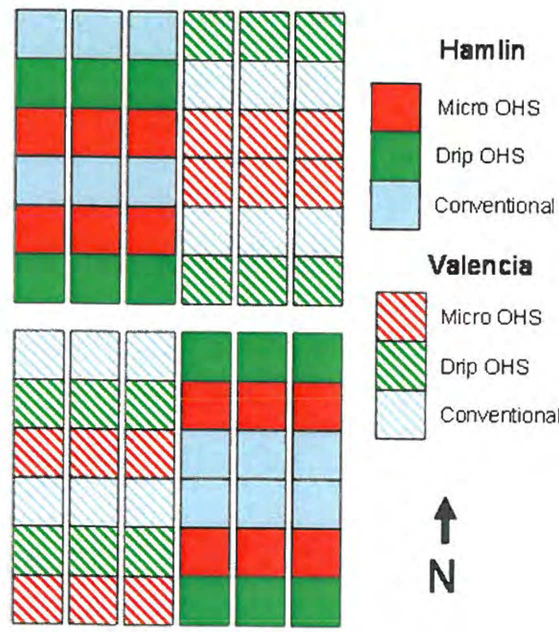
The goal of this project is to provide information to growers that would allow them to reduce water use, potentially improve the use efficiency of applied plant nutrients in fertilizer, and ultimately protect surface and ground water quality through reduced leaching and runoff. The objectives of this project are to:

1) Measure the impact of intensive management of irrigation and nutrient inputs on early tree growth rates and yields,
2) Evaluate the potential water savings of restricted irrigation pattern with microsprinkler,
3) Compare growth and yield increases and water savings between flatwood and ridge soils, and
4) Calculate the economic advantage and rates of return for groves with intensive production management systems.

Advanced Production Systems Treatments

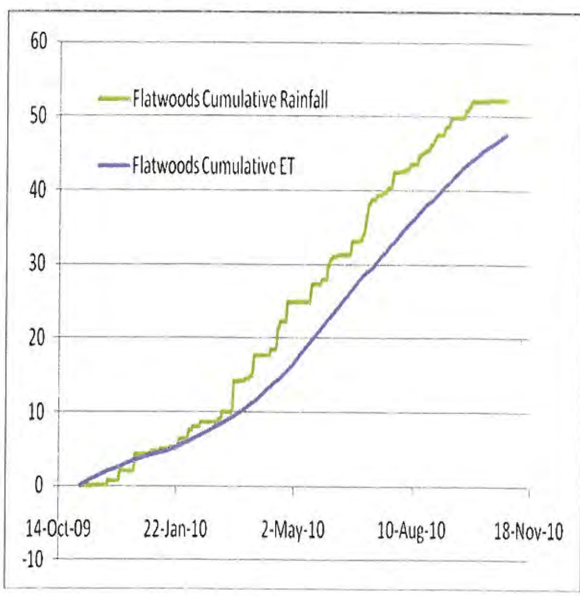
Spacing	Density	Bed width	Rows per bed	Rootstock
8 x 10	545	48 feet	4	Flying Dragon
10 x 22	198	44 feet	2	Swingle
12 x 24	151	48 feet	2	Cleo and Volkamer

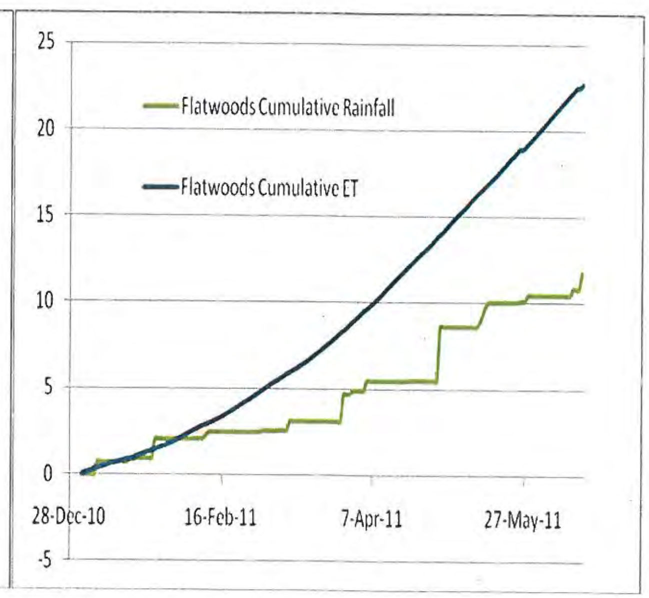
Treatments	Emitters	Frequency	Number	Fertigation
OHS Drip	2-4 drippers/tree	Multiple daily	1-6	Daily
OHS Microsprinkler	2x8 pattern	Once weekly	1	Weekly
Conventional	360 degree	Weekly	1-3	Monthly



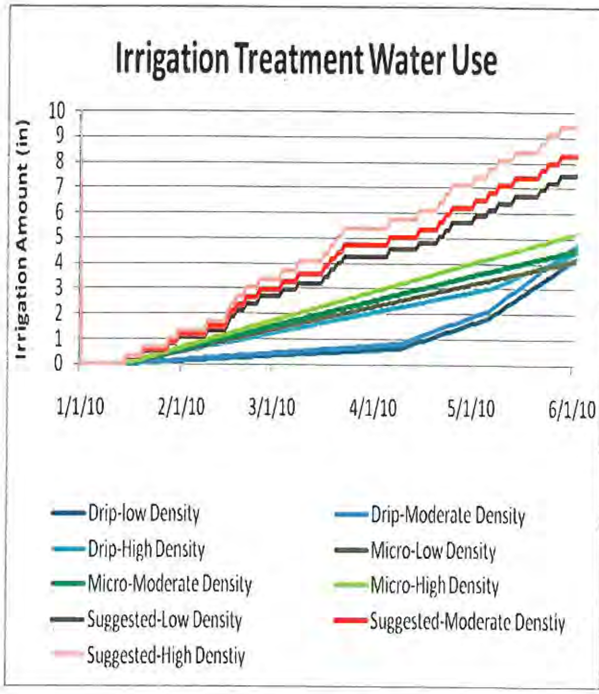
Water Use

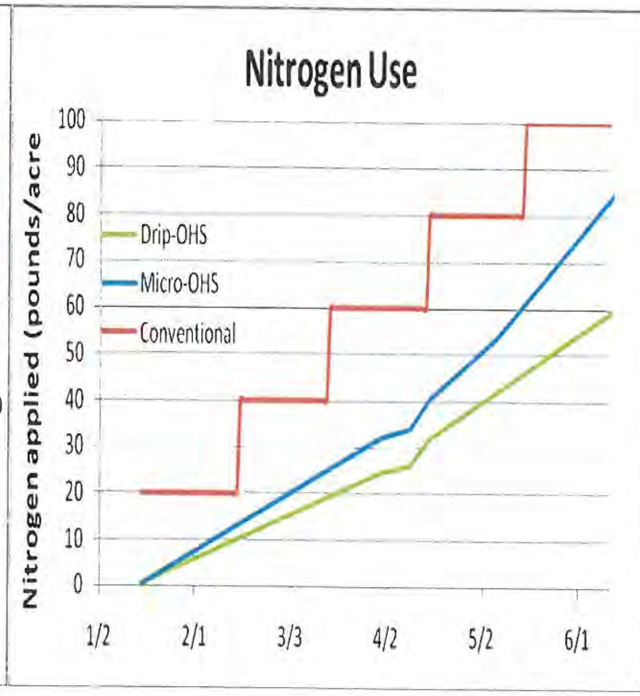
2010 was a wetter than average year, in 2011 we have received less rainfall than normal requiring more irrigation most of the years.





Water use in 2011 has been greater than the first six months of 2010. The conventional full circle microsprinkler applied approximately eight inches of water and Microsprinkler and Drip OHS treatments have applied less than five inches. Water use in the drip irrigated plots were lower to maintain soil water content prior to April when ET was lower but increased in April, May and June as ET increased. To maintain similar water use per acre the emitter output was reduced from 0.5 gal per hour to 0.3 gal per hour for the low density and 0.2 gal per hour for the medium density, resulting in 1050, 951, and 900 gal per hour per acre for the high, medium and low density blocks. Yearly water use in 2010 for all drip treatments were 10 to 12 inches compared with 16 to 21inches for the Suggested treatment.





Tree Size and Fruit Yield

Annual tree canopy height and width measurements for both Hamlin and Valencia were taken in January 2011. Canopy volumes were estimated assuming a spheroid shape (Table 1). Fruit form the Hamlin trees were harvested and weighed. Weight of Hamlin fruit per acre was estimated assuming 100% of tree density per acre (Table 1). Fruit samples were collected at time of harvest and analyzed for Brix and pounds solids per acre to determine fruit quality (Table 1). Results of the canopy volume measurements were mixed. Hamlin canopy volumes were significantly greater for the Drip OHS treatment compared to the Microsprinkler OHS and conventional treatments. However, Valencia tree canopy volume measurements indicated no difference in tree height or canopy height among the three irrigation treatments. Canopy volume did were not significantly different among tree densities for the two scions used in this study. Fruit yield and juice quality measurements for the Hamlin blocks indicated significantly greater yield in boxes per acre for the Drip OHS irrigation treatment but the lowest Brix and soluble solids per box. These would indicate that the weight of fruit was greater for the drip treatment but greater water uptake reduced fruit quality. This has been demonstrated using larger volumes of water by microsprinklers or maintenance of high soil water content in the Fall as fruit are expanding. Valencia fruit have been harvested but yield nor juice quality have not been determined.

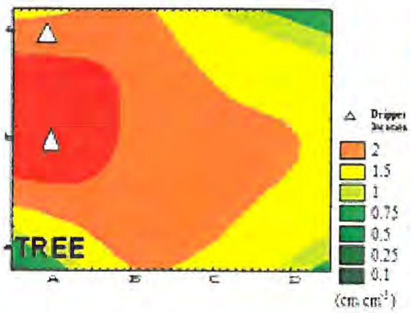
Table 1. Results of tree measurements and fruit yield samples taken in January 2011 by tree density, scion, and irrigation treatment.

	Hamlin				Valencia	
	Canopy Volume (ft^3)	Yield (boxes per acre)	Brix (deg)	Soluble Solids (pounds per box)	Height (ft)	Canopy Volume (ft^3)
Drip OHS	350.0A	184.9A	9.3C	3.8	7.8	496.2
Micro OHS	271.6B	124.6B	9.9B	4.1	7.2	402.2
Conventional	313.4B	100.4B	10.5A	4.1	7.5	423.1
Significance	0.002	0.032	0.048	0.334	0.068	0.057
Low Density (155/acre)	329.5	36.0C	9.2AB	3.8B	7.2	448.3
Mod. Density (196/ac)	307.8	132.8B	9.9B	4.1A	7.4	417.1
High Density (525/ac)	304.8	226.8A	10.4A	4.1A	7.2	423.1
Significance	0.103	<0.0001	<0.0001	0.034	0.159	0.222

Root Distribution

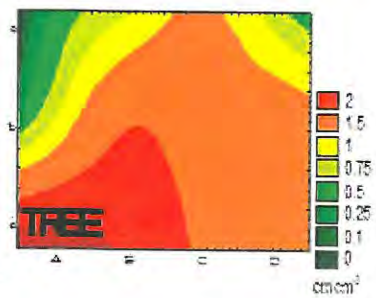
Root Length density (cm root/cm^3 of soil) for drip OHS (A), Microsprinkler OHS (B) and conventional (C) irrigation. The white triangles in A indicate the drip emitter locations. The location nearest the tree trunk (lower left corner) was the original emitter placed in 2007. The triangle in the upper left corner is the emitter that was inserted into the line in April 2009. The map indicates that root density was greatest at the original emitter site, but increasing toward the emitter installed less than 60 days prior to sampling. Root length density patterns in the Microsprinkler OHS (B) and Conventional (C) treatments correspond well with the irrigation zone of these two treatments.

The Microsprinkler OHS emitter delivers water in a strip approximately 24 inches wide and 6 to 10 feet long centered to one side of the tree, whereas the Conventional treatment emitter provides water in a nearly 360 degree circle with the tree near the center of the circle.



A

B



C

Root length densities by irrigation treatment (average of 0 to 6 and 6 to 12 inch depths) and soil depth measured in early June (pre rainy season) and late August (end of rainy season) 2009. No significant increase or decrease in root length density after the rainy season indicates little affect on root distribution due to change in soil wetting pattern.

	June 2009		**August 2009**	
	Root Length Density (cm root/ cm^3 soil)			
Treatment	**Irrigated Zone**	**Non-irrigated Zone**	**Irrigated Zone**	**Non-irrigated Zone**
Drip OHS	0.29±0.13	0.17±0.03	0.27±0.04	0.16±0.04
Micro OHS	0.18±0.05	0.13±0.03	0.25±0.06	0.13±0.04
Suggested	0.15±0.02		0.14±0.03	
Soil Depth (in)	**Irrigated Zone**	**Non-irrigated Zone**	**Irrigated Zone**	**Non-irrigated Zone**
0 to 6	0.18±0.03	0.19±0.04	0.22±0.04	0.19±0.04
6 to 12	0.15±0.04	0.11±0.02	0.16±0.03	0.09±0.04