

Results after 5-years of Foliar Nutritional Therapy to HLB Valencia Trees

Bob Rouse, UF/IFAS SWFREC, Immokalee

Update on the Orange Hammock Grove

- 330 acres planted 1992
- Hamlin (125 ac) & Valencia (205 ac)
- Rootstocks Swingle & Carrizo
- Spacing: 22' x 12' (165 trees/acre)
- Flatwoods bedded grove
- Two row beds
- Maxijet emitters
- Psyllid control sprays aerial
- Dry ground applied fertilizer
- Foliar applied nutritionals & SARs

Nutrition Program

Foliar Spray:

Serenade
Sonata
Renew (N-P-K)
K-Phite (Phosphite)
SAver (SA)
Magnesium Sulfate
Manganese Sulfate
Zinc Sulfate
Sodium Molybdate
44 Spray Grade (KNO₃)
435 Citrus Spray Oil
AgPro (mined earth elements)
Hydrogen peroxide

Ground Applied:

Calcium Nitrate
Triple Super Phosphate
DAP
SPM
MOP
Magnesium
Iron
Boron w/herbicide application
Copper – as nutritional only 13-0-
when needed

Orange Hammock Grove Production

Season	Hamlin				Valencia			
	Wt. Boxes	Lb. slds/bx	Bx/ac	Avg.	Wt. Boxes	Lb. Slds/bx	Bx/ac	Avg.
2012-13	79,637	5.74	656	589	93,957	6.77	457	462
2011-12	72,697	5.62	599		87,587	6.37	514	
2010-11	70,996	5.67	586		74,223	6.36	436	
2009-10	54,942	5.52	453		70,660	6.43	415	
2008-09	87,938	5.67	725		75,580	6.63	444	
2007-08	73,671	6.14	608		105,045	6.64	617	
2006-07	65,495	5.73	540		68,791	7.10	404	
2005-06	65,981	5.49	544		69,423	7.36	408	
2004-05	73,381	6.00	605	569	86,104	7.22	506	460
2003-04	83,403	4.97	688		107,933	6.56	634	
2002-03	65,004	5.17	536		76,911	6.15	452	
2001-02	66,565	5.33	549		80,376	6.23	472	
2000-01	67,425	5.39	556		57,659	5.89	339	
1999-00	58,206	5.21	480		61,602	6.51	362	

HLB Symptom Rating Systems

100 trees (10 trees x 10 rows) in 2 blocks

0 = Vigorous, no symptoms

1 = Vigorous, slight symptoms

2 = Slight decline (symptomatic)

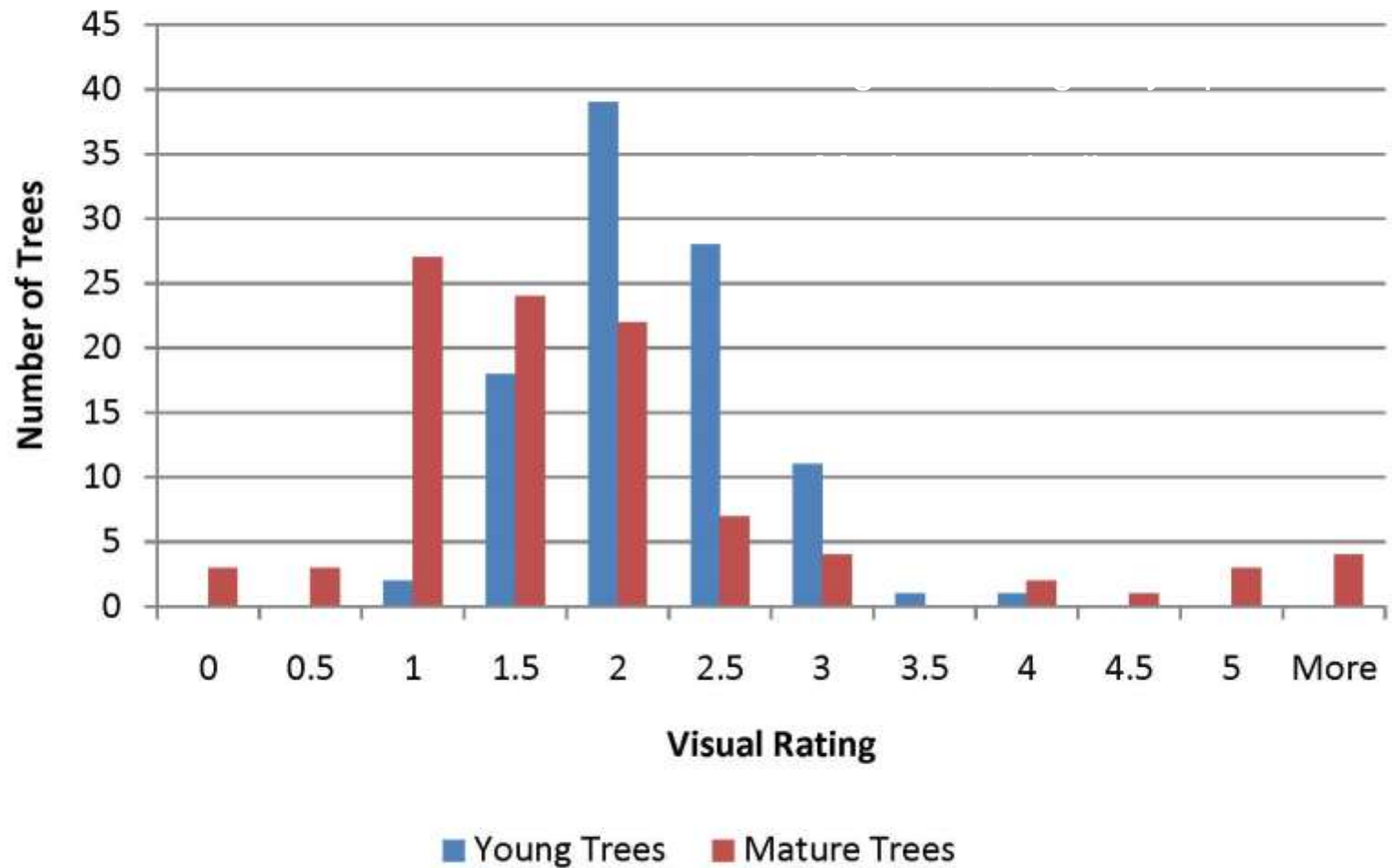
3 = Moderate decline (symptomatic)

4 = Sever decline (symptomatic)

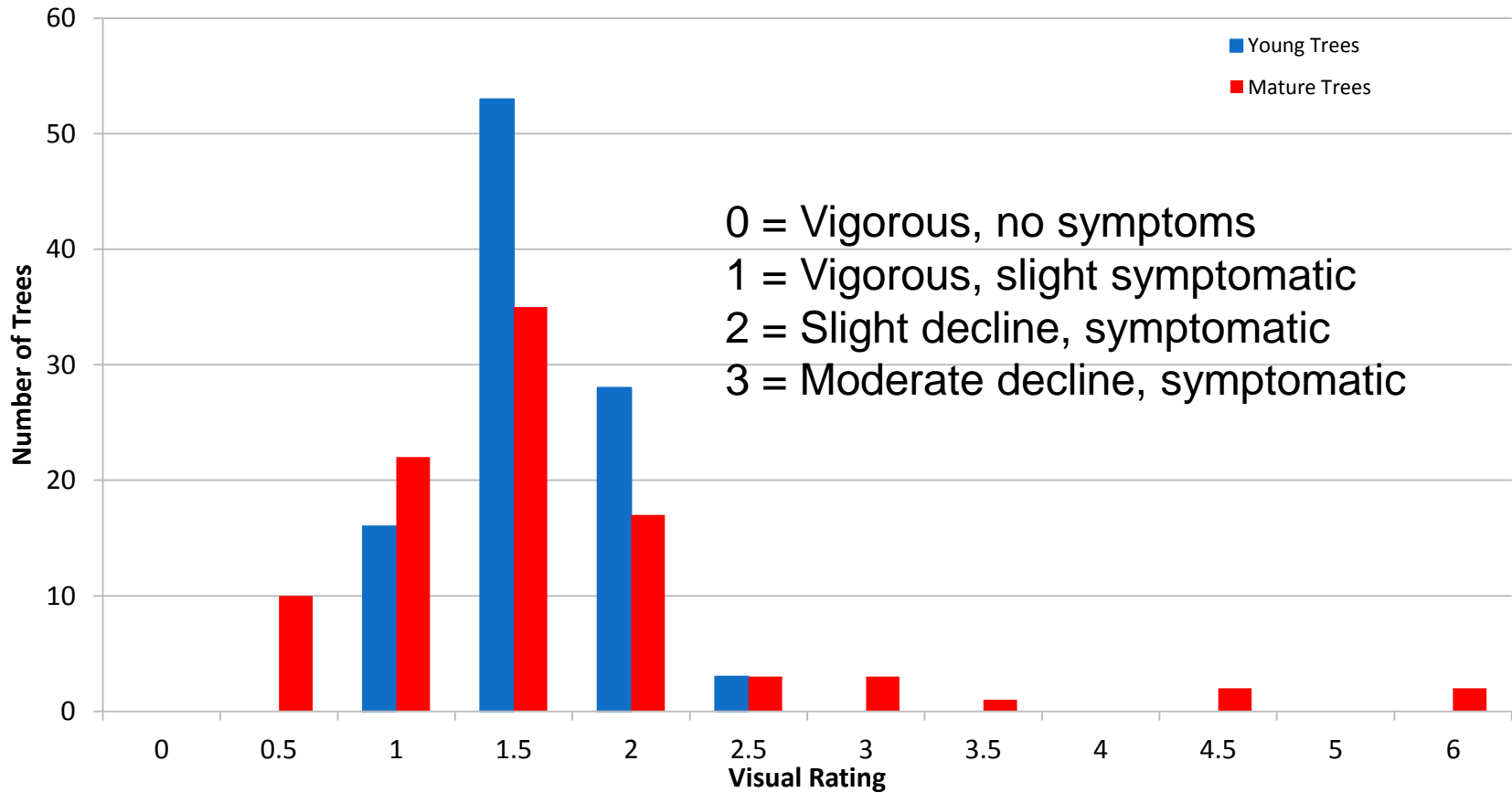
5 = Won't recover

6 = Missing tree

Visual Ratings of Orange Hammock 1/10/10



Visual Ratings of Orange Hammock 1/06/12



Conclusions on Boyd's Nutritional Therapy Program

- ✓ Trees with HLB have been maintained for 8 seasons
- ✓ Yield has maintained for 8 years since HLB confirmed
- ✓ HLB in mature Valencia increased from 40%, 91% to 95% between 2008 and 2012, respectively
- ✓ HLB in young Valencia increased from 81%, 100%, 100% between 2008 and 2012, respectively
- ✓ Symptom ratings and tree condition improved in both mature and young Valencia from 2010 to 2012

Test Site in Southwest Florida

- Barron Collier Silverstrand North Grove
- Block B-9 (32 acres planted 2003)
- Valencia/Swingle
- Spacing: 12' x 24' (151 trees/acre)
- Flatwoods bedded grove 2-row beds
- Maxijet emitters
- Trees defoliated in 2005 due to canker (Gramoxone)
- Trees defoliated in 2006 and abandoned due to HLB
- Psyllid control sprays by ground
- Dry ground applied fertilizer
- Foliar applied nutritionals & SARs

Experimental Methods

- Randomized replicated complete block experiment
- 10 treatments, 4 replications, 120 trees per plot
- 3 applications per year (spring, summer, fall flushes)
- Applied with John Bean citrus speed sprayer

TREATMENTS

TREATMENT	TREATMENT PRODUCTS
①	Micro+Macro+H3PO3+SAR+H2O2
②	Micro+Macro+H3PO3
③	Micro + KNO3+H3PO3
4	KNO3
5	SAR + KNO3
6	Macro+H3PO3+SAR
⑦	Micro+KNO3+SAR
8	Macro +H3PO3
⑨	Micro+ Macro +H3PO3+ SAR
10	Grower control liquid micros w/summer oil

VALENCIA FRUIT DROP 2012-13 CROP

Treatment	Fruit Drop (lbs.)
7	45 a
4	28 b
5	28 b
6	22 c
1	21 c
2	10 d
3	10 d
8	10 d
9	10 d
10	10 d

PCR Ct values for B. Collier test sites

Site	Year	Range	Mean	Incidence
B.Collier	2008			>15%
	2009	34.27 -30.22	32.234 a	40%
	2010	26.88 - 25.18	25.896 b	85%
	2011	27.04 - 23.99	25.226 b	98%
	2012	27.81 – 22.38	25.095 b	98%

TREATMENTS

TREATMENT	TREATMENT PRODUCTS
①	Micro+Macro+H3PO3+SAR+H2O2
②	Micro+Macro+H3PO3
③	Micro + KNO3+H3PO3
4	KNO3
5	SAR + KNO3
6	Macro+H3PO3+SAR
⑦	Micro+KNO3+SAR
8	Macro +H3PO3
⑨	Micro+ Macro +H3PO3+ SAR
10	Grower control liquid micros w/summer oil

Valencia 30 acre Commercial Trial

Barron Collier (Valencia Yield)									
2008		2009		2010 (freeze)		2011 (freeze)		2012	
Trt.	Lb. tree	Trt.	Lb. tree	Trt.	Lb. tree	Trt.	Lb. tree	Trt.	Lbs. tree
2	72.3 a	1	63.3 a	1	60.4 a	3	148.3 a	7	180.3 a
8	67.2 a	2	63.1 a	2	60.0 a	2	148.2 a	5	163.2 ab
1	65.4 a	9	50.2 ab	9	55.9 ab	1	144.8 a	1	162.8 ab
9	65.1 a	5	46.2 ab	7	52.2 ab	7	144.7 a	4	156.2 ab
5	63.3 a	8	45.7 ab	5	45.6 ab	9	139.8 a	2	151.5 ab
10	62.2 a	7	42.3 ab	3	44.0 ab	5	129.3 ab	3	146.8 ab
3	59.1 a	3	41.8 ab	4	39.8 ab	4	121.2 ab	9	144.1 ab
7	59.1 a	4	33.4 b	8	37.0 ab	8	110.4 b	8	140.6 ab
6	49.8 a	10	32.1 b	6	32.9 b	6	108.9 b	6	131.9 b
4	38.4 a	6	27.2 b	10	28.9 b	10	91 c	10	108.3 c

What Appears to be Working?

- Micronutrients (Mg, Mn sulfate, Zn sulfate, Mo, B)
- Macro nutrient (KNO₃, Urea, DKP)
 - Phosphite for disease
 - Salicylic acid for growth flush stimulation

Economics of Foliar Nutritionals to Manage HLB

Fritz Roka, Bob Rouse

UF/IFAS - SWFREC

1. Cost matters
2. Profit is the Goal
not just keeping HLB trees productive

Annual added cost (material only)

TRTMTs	Description	\$/a-yr
4	Oil+KNO3	(\$31)
10	Control -liquid micros w/summer oil	\$0
5	Oil+KNO3+SAR	\$65
7	Oil+KNO3+ MICRO +SAR	\$121
3	Oil+KNO3+(H3PO3)+ MICRO	\$121
8	Oil+KNO3+(DKP+H3PO3)	\$225
2	Oil+KNO3+(DKP+H3PO3)+ MICRO	\$281
6	Oil+KNO3+(DKP+H3PO3)+SAR	\$321
9	Oil+KNO3+(DKP+H3PO3)+ MICRO +SAR	\$377
1	Oil+KNO3+(DKP+H3PO3)+ MICRO +SAR+H2O2	\$419

2008-12 cumulative YIELD gain

TRTMTs	Description	boxes/acre
1 ^{\$}	Oil+KNO3+(DKP+Kphite)+ MICRO +SAR+H2O2	292.8
2 ^{\$}	Oil+KNO3+(DKP+Kphite)+ MICRO	290.1
7 ^{\$}	Oil+KNO3+ MICRO +SAR	262.4
9	Oil+KNO3+(DKP+Kphite)+ MICRO +SAR	223.0
5	Oil+KNO3+SAR	210.4
3	Oil+KNO3+(Kphite)+ MICRO	197.6
8	Oil+KNO3+(DKP+Kphite)	132.0
4	Oil+KNO3	112.1
6	Oil+KNO3+(DKP+Kphite)+SAR	47.8
10	Control -liquid micros w/summer oil	0.0

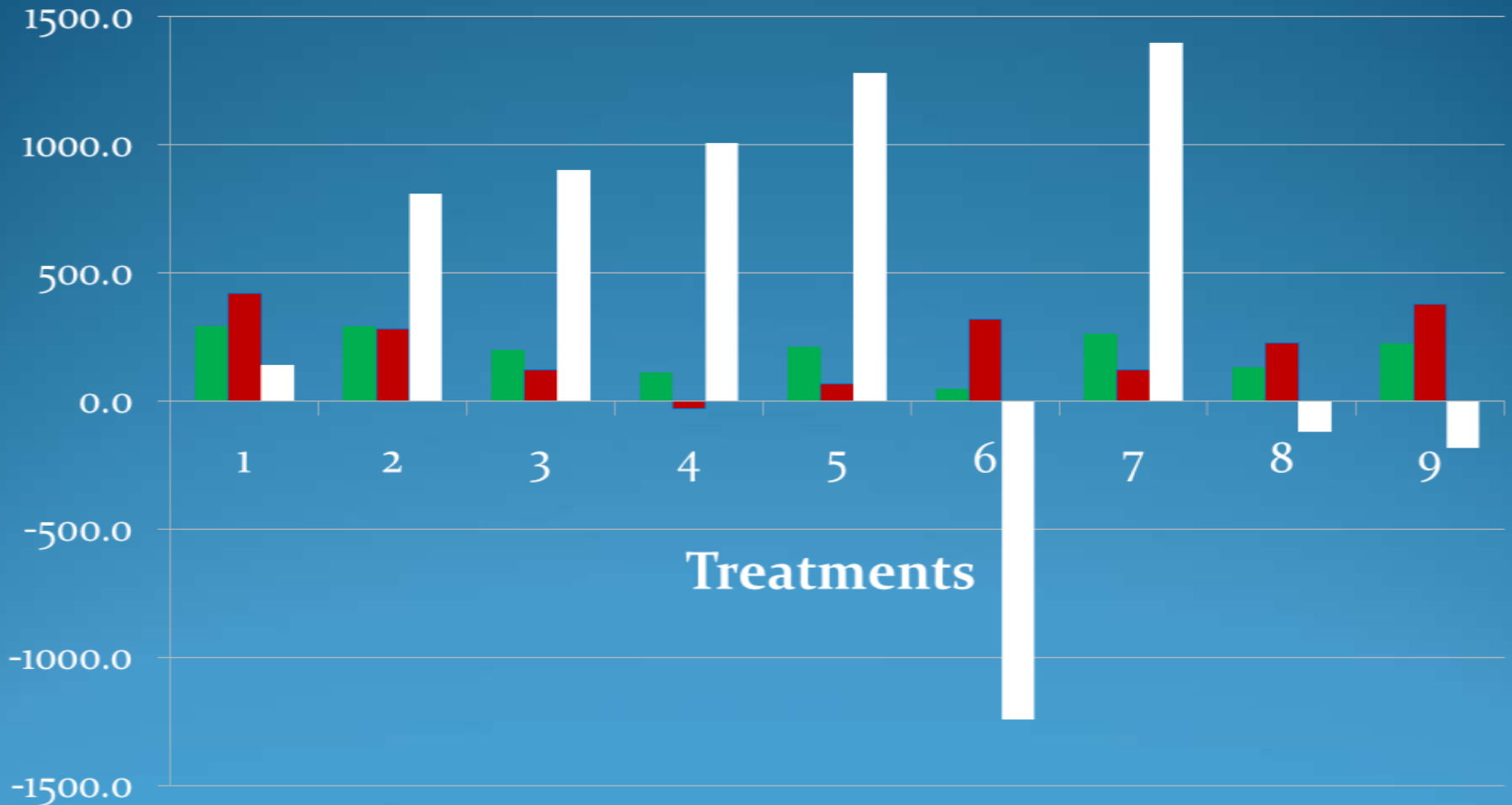
2008-12 cumulative INCOME gain

(\$1.70/ps, \$3/bx harvest + DOC, 6.25 ps/bx)

TRTMTs	Description	\$/a
7^{\$}	Oil+KNO3+ MICRO +SAR	\$1,398
5	Oil+KNO3+SAR	\$1,278
4	Oil+KNO3	\$1,008
3	Oil+KNO3+(H3PO3)+ MICRO	\$904
2^{\$}	Oil+KNO3+(DKP+H3PO3)+ MICRO	\$808
1^{\$}	Oil+KNO3+(DKP+H3PO3)+ MICRO +SAR+H2O2	\$140
8	Oil+KNO3+(DKP+H3PO3)	(\$120)
9	Oil+KNO3+(DKP+H3PO3)+ MICRO +SAR	(\$182)
6	Oil+KNO3+(DKP+H3PO3)+SAR	(\$1,241)
10	Control -liquid micros w/summer oil	\$0

HLB Nutritional Field Trial

Cum Yield Gain Added Cost Income Gain



Cost per pound for added yield gain

Trt.	Cost/ acre	Lbs/acre	Cost/lb	Income gain \$/acre
1	\$419	292.8	\$4.22	\$140
2	\$281	290.1	\$2.84	\$808
7	\$121	262.4	\$1.26	\$1,398

Take Home Message Bottom Line

1. HLB Trees can be Rehabilitated
2. Observation: (Most citrus growers are practicing a foliar nutrition program and seeing positive results)
3. Psyllid Management + Foliar Nutritional Reduces Continued Inoculations & Allows Foliar Nutrition to Improve and Maintain Tree Health while Maintaining Economical Production.

Appreciation to:

- CRDF (Citrus Research & Development Foundation)
- The citrus growers in Florida
- Diamond R Fertilizer
- Plant Food Systems
- AgraQuest
- Flo-Tec, Inc.
- Yara

Controlled Release Fertilizer

Dr. Jude Grosser

- Appears to allow impacted HLB root systems to take up critical nutrients from the soil solution
- “Mega-doses” of certain minor elements

Batch #: 1406-1122

FERTILIZER ~ CREC Mix with Tiger micros

GUARANTEED ANALYSIS

* Total Nitrogen (N).....	12.0000%
6.8800% Nitrate Nitrogen	
4.5200% Ammoniacal Nitrogen	
0.6000% Urea Nitrogen	
** Available Phosphate (P2O5).....	3.0000%
*** Soluble Potash (K2O).....	8.0000%
Calcium (Ca)	4.5270%
Magnesium (Mg)	0.9850%
0.9850% Water Soluble Magnesium (Mg)	
Boron (B)	0.0240%
Copper (Cu)	0.0400%
0.0400% Water Soluble Copper (Cu)	
Iron (Fe)	1.0980%
0.1100% Water Soluble Iron (Fe)	
0.2200% Chelated Iron (Fe)	
Manganese (Mn)	0.9160%
0.0690% Water Soluble Manganese (Mn)	
Molybdenum (Mo)	0.0060%
Zinc (Zn)	0.7150%
0.0400% Water Soluble Zinc (Zn)	

Derived From: Polymer Coated Ammonium Nitrate, Polymer Coated Calcium Nitrate, Polymer Coated Copper Sulfate, Polymer Coated Iron EDTA, Polymer Coated Magnesium Sulfate, Polymer Coated Manganese Sulfate, Polymer Coated Monoammonium Phosphate, Polymer Coated Sodium Molybdate, Polymer Coated Sulfate of Potash, Polymer Coated Sulfate of Potash-Magnesia, Polymer Coated Urea, Polymer Coated Zinc Sulfate, Elemental Sulfur, Ferrous Sulfate, Iron EDTA, Iron Humate, Iron Oxide, Iron Sucrate, Manganese Oxide, Sodium and Calcium Borate, Zinc Oxide

* 11.556% slow release NITROGEN derived from Polymer Coated Ammonium Nitrate, Polymer Coated Calcium Nitrate, Polymer Coated Monoammonium Phosphate, Polymer Coated Urea

** 3.195% slow release PHOSPHATE derived from Polymer Coated Monoammonium Phosphate

*** 8.01% slow release POTASH derived from Polymer Coated Sulfate of Potash, Polymer Coated Sulfate of Potash-Magnesia

Warning: — This fertilizer is to be used only on soils which respond to Molybdenum. Crops high in Molybdenum are toxic to ruminants.

Questions?

Thank you

gke@ufl.edu