

# Detection of Symptoms of HLB in Orchards

Holly L. Chamberlain  
Pest & Disease Management, LLC  
(PDM, LLC), USA

# PDM, LLC

- The mission of Pest & Disease Management, LLC is to provide timely and accurate information on pest and disease incidence to citrus growers enabling them to make sound production decisions based on quantitative information versus qualitative.



# Company Profile: 2010

- Personnel & Equipment

- 40 employees
- 5 platform trucks
- 8 UTVs



# Cost of Surveying

- Labor (60% cost of survey)
- Equipment
- Office expense
  
- Range between (\$21.00 – 35.00 / acre)
- Published internal cost for one company (\$27.50 / acre)



## 3 E's of Scouting (How To's)

- Exposure
- Experience
- Efficiency

# Exposure

- Learning HLB
  - HLB symptoms
  - Nutrition deficiencies
  - Other pest and disease problems
  - Abiotic problems
    - Chemical
    - Weather



# Tools for Training

- Classroom
  - DVDs
  - Laminated Handouts
  - Field Notebook
  - ID cards
  - Posters
  - Artificial branches



# Learning Tools



**UNIVERSITY OF FLORIDA, IFAS**  
EDUCACION SOBRE LA CANCROSIS DE LOS CITRICOS

**SINTOMAS DE LA CANCROSIS:**

- Lesiones amarillentas elevadas (ambos lados de la hoja) con bordes amarillos y hús amarillos
- Dehiscencia, manchas y caída prematura de frutas

**¿COMO SE DISEMINA?**

- Lluvia y viento
- Equipos contaminados
- Traslado de plantas infectadas o esquejes y de partes de las mismas

**¿PREVENGA LA DISEMINACION!**

- Desinfecte al personal y equipos con productos aprobados
- No trate plantas infectadas o sus partes
- Evite contactos innecesarios con cítricos, sobre todo si están húmedos

NO tiene muestras de plantas sospechosas debido al riesgo de aumentar la diseminación de la cancrisis. Si Ud. sospecha que sus árboles tienen la cancrisis, llame a la línea telefónica de ayuda de su área para más información.

Condados de Miami-Dade/Broward/Palm Beach/Monroe  
Lláme al (800) 850-3781

Otros condados, llame al (800) 282-5253

Citrus Research and Education Center  
Lanark, FL 33830-0001  
Línea de Ayuda: (800) 850-3781  
In Florida: (904) 400-0000  
Midwest Florida Research and Education Center  
Hawthorn, FL 32840

Información adicional:  
www.ifas.ufl.edu  
www.citrus.ifas.ufl.edu  
Proyectos Científicos Apoyados por:  
USDA, ARS, PP0  
www.ars.usda.gov

**SAFETY CITRUS**



**Citrus Canker Self-Survey Training**  
University of Florida, IFAS

Florida Department of Agriculture & Consumer Services, CCEP  
FDACS, Division of Plant Industry  
USDA, APHIS, PP0  
Citrus Industry

University of Florida  
Citrus Research and Education Center Training DVD

**Citrus Canker Self-Survey Training**  
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Citrus Industry

University of Florida  
Citrus Research and Education Center Training DVD

# Field Training

- Equipment, Safety, Protocol
- Field
  - Manager training / supervised learning
    - 1st week
  - Field supervisor training
    - 1-2 weeks
    - Back seat in UTVs
  - Senior scouts
    - 90 day probation
    - In general, 3-4 months for inspector to REALLY learn disease (depends on exposure)



# Competitions and Incentives

IRCS 2008, 2009, 2010

Employee Recognition



# Equipment

- No equipment: WALK
- Mounted platforms
  - Tractor
  - Truck
  - Other
- Utility type vehicles (UTVs)
  - Kubota
  - Gators

## Scouting Platforms

JEEP



## Scouting Platforms

Truck mounted platforms



## Scouting Platforms

Tractor mounted – 3 point hitch



## Scouting Equipment

John Deere Gator



# Other Equipment

- Computers
- Handheld GPS computers
- Flagging Tape
- Markers
- Sample bags



# Experience

- Recognition
  - Time
- Various grove conditions
  - Grove health
  - Nutrition
  - Time of year
- Variety
  - Tangerines
  - Round oranges
  - Grapefruit





# Grove Condition

## Mature Trees

- Require platforms for scouting
- Necessary to see down in the tree
- Slower!! Less efficient, but **NECESSARY!**

## Young Trees

- Depending on spacing, should walk
- Should also be aware of psyllid pressure



# Grove Conditions

- General grove care
- Tree age
- Mixed versus solid planting
- Knowledge of surrounding groves and area
- Grower spray programs
  - REIs
    - Dimethoate changed to 10 day REI
- Time of year
- Ridge versus Flatwoods
- Hedged or not hedged
- Inspector safety – PARAMOUNT!

# Grove Condition

**Mowed**

**Not Mowed**



# Grove Conditions



## Grove Condition

Poor grove health



# Grove Condition

**Uniform Stands**



**Mixed Age Stands**





# Efficiency

- IMPORTANT!!
- Inspectors have to be able to recognize, flag, and move on
  - Ability to discern HLB from other problems (exposure & experience)
- Efficiency related to profitability
  - Equipment
  - Procedure!



# Scouts / Inspectors

- “Call it as you see it mentality” (comes with exposure and experience!)
- Honesty
- Chain of command
- Information
  - How can a grower or production manager make decisions without correct information?

# Flagging



- Block completion sheet
- 2 color system
  - SUSPECT
  - VISUAL CONFIRMED
- Both row ends
  - Total number in row
  - Date
  - Inspector names
- Both sides of the trees
  - Date
  - Inspector name



Visual confirmed tree,  
inspector name, date



Row end marked with date,  
inspectors, total row count





# Data Management

- Recording information is vital to success of program
- All visually confirmed / suspect trees GPS
- Inspector name & symptomology recorded as part of the GPS record
- Block completion sheets are also filled out
- Serveon Inc. software package
- iPAQ hardware
- User friendly
- Wireless data sync

**PDM SCOUTING SERVICES**

**INSPECTOR NOMBRE:  
BLOCK COMPLETION SHEET**

COMPANY NAME

GROVE NAME

BLOCK NAME / NUMBER

DATE(S) SURVEYED

DATE GPS'D & SAMPLED

**TOTAL GREENING TREES**

SUSPECT

VISUALLY CONFIRMED

ABSENT

**TOTAL CANKER TREES**

ABSENT

Pysllid Pressure (Low, Moderate, High)

Adults Only, Nymphs Only, Both

NUMBER OF SAMPLES

ARE THE TREES GPS'D?

IS THE BLOCK BOUNDARY COMPLETE?

**DITCHES SURVEYED (YES or NO)**

**GPS Numero ID Y Nombre:**

Describe the grove condition (weeds, wet/dry, type of irrigation, nutrition)

# Grower Report

- Spreadsheet
  - Block name
  - Date of survey
  - HLB tree count
  - CC tree count
  - Sample count
- Map
  - HLB
  - CC
- Lab Results
  - Starch results
  - qPCR results

Blocks	Date Surveyed	Acres	HLB Suspect	HLB Visually Confirmed	Canke Sample r	Sample s
Davis 1	6/17/2009		0	0	0	0
Davis 2	6/17/2009		0	0	0	0
Davis 3	6/17/2009		0	0	0	0
Davis 4	6/17/2009	47.69	0	2	0	2
Davis 5	6/17/2009		0	0	0	0
Davis 6	6/17/2009		0	0	0	0
Davis 7	6/17/2009		0	7	0	7
Whitehurst A	6/17/2009		0	0	0	0
Whitehurst B	6/16/2009	108.98	0	4	1	4
Whitehurst C	6/17/2009		0	2	56	2
Skipper South - A	6/18/2009		0	1	0	
Skipper South - B	6/18/2009		0	2	0	2
Skipper A.M	6/18/2009	93.6	0	0	0	0
Skipper B.M	6/18/2009		0	5	0	5
Skipper A N	6/18/2009		0	2	1	2
Skipper B. N	6/18/2009		0	2	0	2
<b>TOTALS</b>		<b>250.27</b>	<b>0</b>	<b>27</b>	<b>58</b>	<b>26</b>

Measurement Prevalence Map (Please use 'Landscape' setup for print)



Citrus Greening  
Visually Confirmed ■

RPB CITRUS  
RANCH GROVE

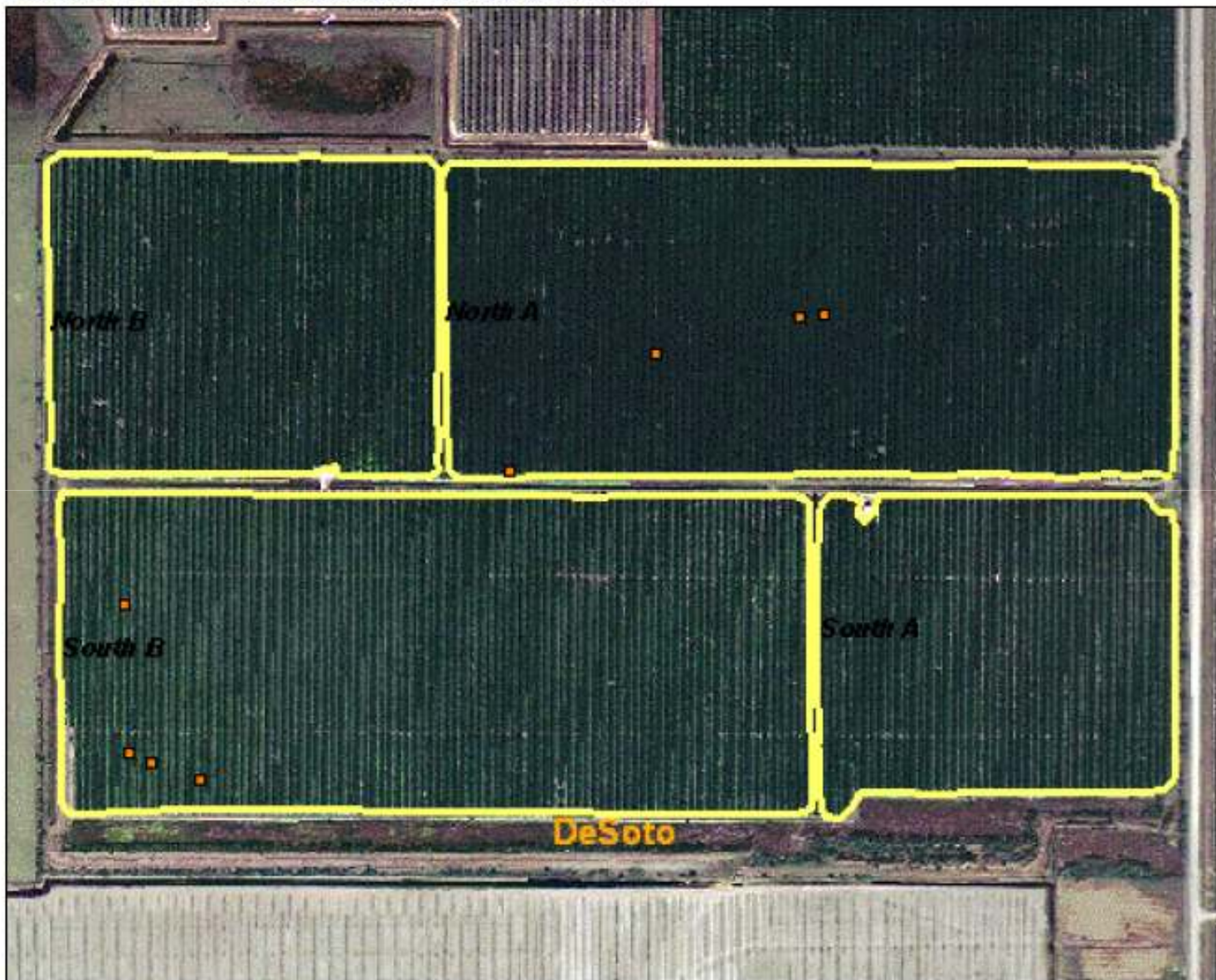
HARDEE COUNTY

JULY 2009

HLB TREE COUNT:  
BLK A: 20  
BLK B: 1  
BLK C: 9  
TOTAL: 30

\*DATA POINTS ARE  
NOT TO SCALE

Measurement Prevalence Map (Please use 'Landscape' setup for print)



Citrus Greening  
Visually Confirmed 

BARBEN GROUP  
TRICOUNTY GROVE

JANUARY 2009

HLB TREE COUNT:  
NORTH YOUNG: 4  
SOUTH YOUNG: 4  
TOTAL: 8

\*DATA POINTS ARE  
NOT TO SCALE

\*CANKER PRESENT  
IN GROVE

# HLB Testing Report

Premier Sunray  
Hwy 70  
Lake Placid  
Highlands County

Fax: 863-465-7301  
Email: hlchamberlain@embarqmail.com

Assay Date Range:  
 7/27/2009 to 7/27/2009

USSC/Southern Gardens Diagnostic Lab

Diagnosis	HLB Positive		CT	Local Id:	Lab Id	Collected	Received	Assayed	Sample submitted by:
Block	Row	Tree							
B2N	1	6	21.34	0714091203915	97098	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	1	11	23.44	0714091203916	97097	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	2	14	20.51	0714091203917	97096	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	2	18	22.86	0714091203918	97095	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	3	2	21.68	0714091203919	97094	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	3	6	21.13	0714091203920	97093	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	4	8	20.97	0714091203921	97092	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	4	12	20.85	0714091203922	97091	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	5	4	23.11	0714091203923	97090	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	6	6	22.32	0714091203924	97089	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	7	18	20.45	0714091203925	97088	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	8	19	21.04	0714091203926	97087	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	9	1	17.58	0714091203927	97086	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	10	2	22.50	0714091203928	97085	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	10	3	23.89	0714091203929	97084	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	11	1	22.13	0714091203930	97083	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	11	2	19.94	0714091203931	97082	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	12	6	20.59	0714091203932	97081	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	14	2	23.70	0714091203933	97080	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2N	14	13	19.99	0714091203934	97079	7/14/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2S	1	6	19.89	0715091204674	97078	7/15/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2S	1	12	21.47	0715091204675	97077	7/15/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2S	2	6	20.47	0715091204676	97076	7/15/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2S	2	14	20.80	0715091204677	97075	7/15/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2S	3	14	19.97	0715091204678	97074	7/15/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2S	5	2	24.47	0715091204679	97073	7/15/2009	7/17/2009	7/27/2009	Holly Chamberlain
B2S	5	14	23.85	0715091204680	97072	7/15/2009	7/17/2009	7/27/2009	Holly Chamberlain

B3S	3	9	21.12	0713091203574	97036	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	4	1	22.01	0713091203575	97035	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	5	1	22.17	0713091203576	97034	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	5	3	22.54	0713091203577	97033	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	6	1	23.57	0713091203578	97032	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	6	3	24.06	0713091203579	97031	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	7	3	23.26	0713091203580	97030	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	7	4	22.28	0713091203581	97029	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	7	6	23.26	0713091203582	97028	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	8	6	26.18	0713091203583	97027	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	8	8	28.06	0713091203584	97026	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	8	9	23.02	0713091203585	97025	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	9	6	20.75	0713091203586	97024	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	9	8	21.13	0713091203587	97023	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	10	4	23.47	0713091203588	97022	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	10	5	22.80	0713091203589	97021	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	11	4	22.19	0713091203590	97020	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain
B3S	11	5	22.22	0713091203591	97019	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain

Diagnosis	No HLB Found								
Block	Row	Tree	CT	Local Id:	Lab Id	Collected	Received	Assayed	Sample submitted by:
B3N	14	8	32.03	0713091203571	97039	7/13/2009	7/17/2009	7/27/2009	Holly Chamberlain

<b>Number Positive</b>	79	<b>Number Questionable</b>	0	<b>Total samples</b>	80	<b>Total Positive (+ and questionable)</b>	98.8%
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# Iodine Starch Test



# Iodine Starch Test





## 3 I's of HLB Management (Grower)

- Initiate
- Implement
- Invest

# Initiate

- START inspection now!!
  - Inoculum load
  - Lost production
- Too many growers in FL have delayed in getting started
  - Not in their grove yet
  - Not taking HLB seriously
  - Absentee owners
- Grower responsible, not government



# Grove Inspection

- Timing
  - Seasonality of HLB
  - All year is no longer appropriate (\$\$)
- Number of inspections
  - Economics (\$\$)
  - When did you start?
    - 1<sup>st</sup> X or been through several inspection cycles
  - What are your current levels of HLB?
    - Low level situation (0 – 10%)
    - Medium level (10 – 25%)
    - High level of inoculum (> 25%)
  - Grove size
- Maintaining profitability in the face of HLB



# Implement

- NOT just about scouting
- Incorporate information gathered into short and long term business plan
- HLB management is 3-pronged approach
  - Tree Scouting
  - Psyllid control!!!
  - Healthy nursery trees



# Psyllid Scouting

- Integral part of HLB tree scouting!
- Necessary to monitor psyllid populations on grove by grove basis
  - Efficacy of applications
  - Citrus Health Management Areas
  - Rotation of products and MOA
  - Systemics

# Tree Removal

## LOADER



## TREE CHOPPER

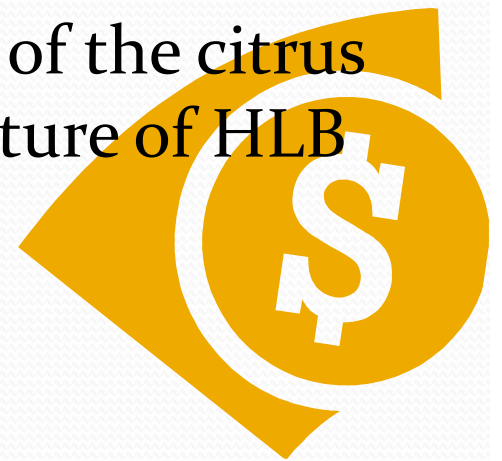


# Tree Removal



# Invest

- Long range plan for future citrus production
- “Sometimes the best investment is the one you already have”
- AGAIN, government is not going to be able to “manage” or “suppress” HLB in YOUR grove...IT IS A GROWER DILEMMA!
- R & D...we need research for sustainability of the citrus industry in FL, implement genetics into future of HLB management





# RECOMMENDATIONS!

- NO ONE **RIGHT** WAY
- Complexion of citrus industry has changed over time and will continue to change both global and local



# Economics of Scouting (Grower)

- Why scout?
  - Viable agricultural business
- Land management vs economics of farming
  - Happy medium
- With inspection, cannot paint broad brush across industry
  - Mission is the same, getting there maybe different
  - Scouting is a tool as 'part' of a long range plan

# Pitfalls of Survey Work

- Equipment maintenance
- Weather
- Wildlife
- Disease Incidence
- Abandoned groves



# Wildlife



# Abandoned Groves

## Abandoned Grove Defined:

No commercial fruit harvest during last two seasons

No production care during the past two years, including weed control and mowing

Grove use transferred to other uses (pine or livestock)



# “The Orange-Co. Complete HLB Program”

- 17,000 acres under HLB Scouting Program
- Visually Inspect each tree 3 times a year (34 Full Time employees)
- Remove Visually confirmed HLB infected trees within 24 to 72 hours (3 F.T. employee)
- Treat stump with herbicide (2 F.T. employee)
- Reset space with clean tree
- Visually inspect resets and 2-3 year old trees for psyllid feeding and leafminer tunneling damage
- Sweep net or tap, and visually inspect flush for *Diaphorina citri* adults, nymphs, and eggs
- Insecticidal control of Asian Citrus Psyllid when populations reach action threshold

**SHAWRON WEINGARTEN, ORANGE CO.**



# Florida Citrus

- Complexion of the industry is changing
  - Disease incidence dictates grove management
- PDM, LLC client group are citrus growers who have been long time citrus growers and will be well into the future
- Cannot go part way with greening program...if you are going to battle greening, you have to implement all parts of the program
  - Tree scouting 2X / year
  - Pysllid suppression
  - Tree removal
  - Healthy resets