Protecting Young Trees from Psyllids and HLB

Michael E. Rogers
Associate Professor of Entomology

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

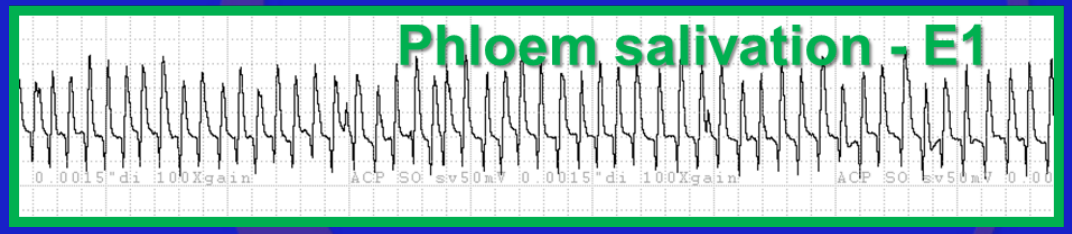
Soil-applied neonicotinoids

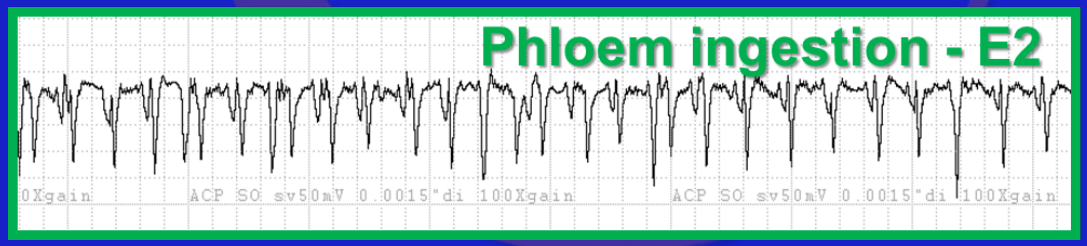
- **Foundation of young tree psyllid control programs**
  - –Admire Pro (imidacloprid)
  - –Platinum 75 SG (thiamethoxam)
  - –Belay 50 WDG (clothianidin)
    - Non-bearing use only (Belay)

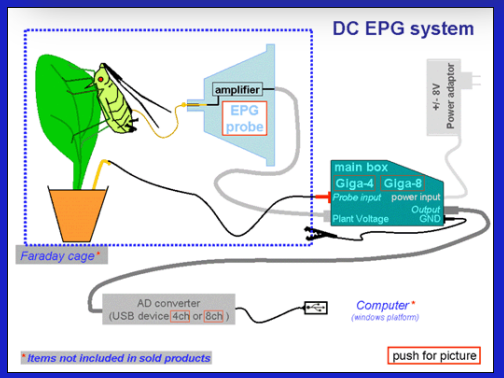
UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

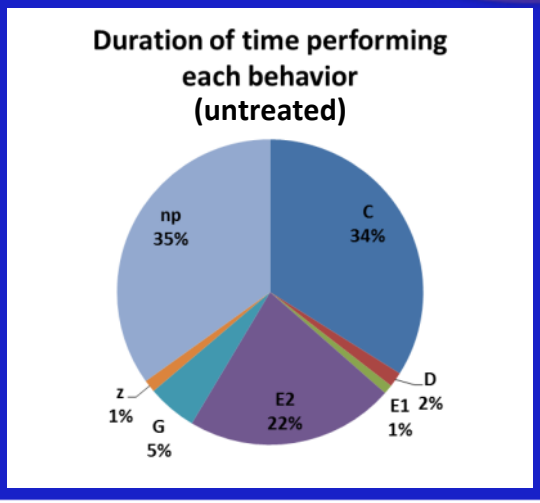
EPG Analysis of ACP Feeding Behavior

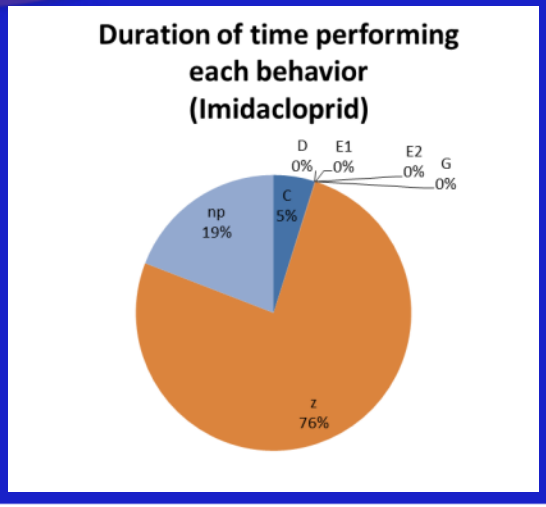
- **Can insecticides prevent pathogen transmission from occurring?**











UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Results of EPG Studies to Date

Product evaluated	Active ingredient	Application method	Duration of psyllid feeding disruption
Admire Pro 4.6F	imidacloprid	Soil drench	At least 6 weeks*
Platinum 75 SG	thiamethoxam	Soil drench	At least 6 weeks*
Belay 50 WDG	clothianidin	Soil drench	At least 6 weeks*
Provado 1.6 F	imidacloprid	Foliar applied	3 weeks
Danitol 2.4 EC	fenpropathrin	Foliar applied	2-3 weeks
Lorsban Advanced	chlorpyrifos	Foliar applied	24 hours
Delegate WG	spinetoram	Foliar applied	24 hours
Movento MPC	spirotetramat	Foliar applied	none

***no evaluations of the soil-applied neonicotinoids have been made beyond 6 weeks.**

The primary benefit of foliar insecticide use is ACP population suppression

Season-long ACP control

(foliar applications to prevent pesticide resistance to neonics shown in orange)

Tree size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Reset (<3')	P		A	A		B	B		A	A		P
1-2 yr (3-5')	P		A	B		B	B		B	A		P
3-5 yr (5-9') bearing				P				A				

A= Admire (imidacloprid); B=Belay (clothianidin); P=Platinum (thiamethoxam); Products are positioned for use at certain times of the year based on water solubility and likelihood for significant rain events.

Young tree protection

- Intensive (Comprehensive) ACP control programs are required to ensure return on investment in new trees…

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Based on what we've learned in lab-based studies, can we apply this information under real-world circumstances to manage ACP/HLB in young tree plantings?

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Multi-year field trial

- **ConservII (Mid-Florida Citrus Foundation)**
  - 10-acre block ‘Valencia’ orange
  - Planted May 15, 2011

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Multi-year field trial

- **Established plots of 20 trees**
  - 4 rows x 5 trees
- **Six treatments (programs) evaluated**
  - 10 replicate plots per treatment
  - treatments began 1 day after planting
- **Pest evaluations every 2 weeks**
  - Psyllid and leafminer counts
- **PCR detection of HLB pathogen**
  - All trees every 3 months

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Multi-year field trial

- **Treatments (programs)**
  - 1) Systemic only
    - Soil-applied neonicotinoids every 6-weeks
    - Admire, Platinum and Belay
  - 2) Foliar applications only
    - Monthly applications
    - Danitol, Delegate, Dimethoate, Imidan, Lorsban, and Mustang
  - 3) Systemic + Foliar applications
    - Systemics every 6-weeks
    - Foliar apps monthly between systemics

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Multi-year field trial

- **Treatments (programs)**
  - 4) kaolin clay (Surround WP)
    - 50 lbs / 100 gal water
    - Monthly applications
  - 5) Systemics + kaolin clay
    - Systemics every 6-weeks
    - Kaolin monthly between systemic applications
  - 6) untreated control

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Kaolin for Pest Control

- Clay-based (alluminosilicate mineral)
- Leaves a white residue on treated plant surfaces
- Demonstrated to deter some insect pest infestations and feeding

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Previous Kaolin Studies

- Surround WP (kaolin) applications reduced ACP nymphs by 31% and adults by 61% over a two-week period

(McKenzie, C.L., S. L. Lapointe, W. B. Hunter and G. J. Puterka. 2002. Efficacy of Surround for control of Asian citrus psyllid on citrus, 2000. Arthropod Management Tests 27: D8.)

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Previous Kaolin Studies

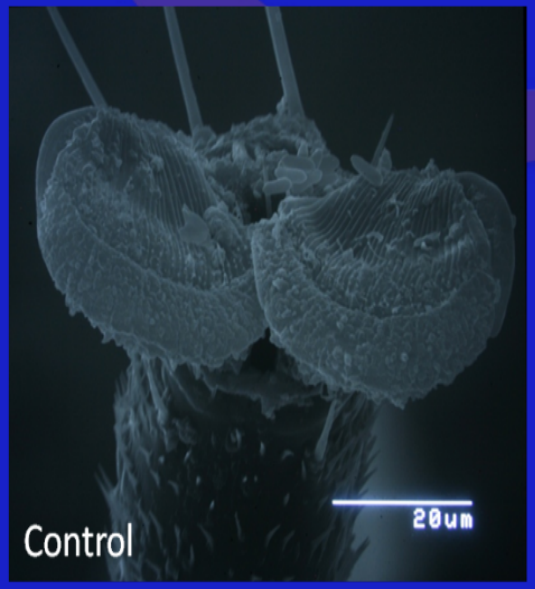
- Surround WP (kaolin) applications inhibited ability of psyllids to grasp, move and oviposit on treated plants…the effects however were degraded by rain.

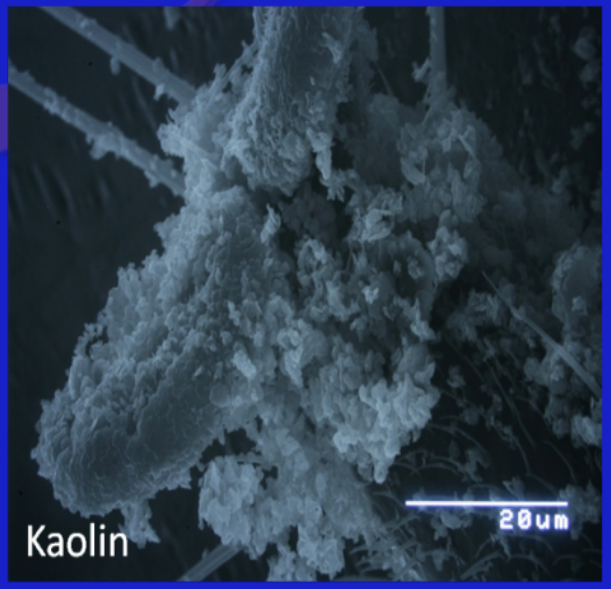
(Hall, D. G., S. L. Lapointe, and E. J. Wenninger. 2007. Effects of a particle film on biology and behavior of Diaphorina citri (Hemiptera: Psyllidae) and its infestation in citrus. J. Econ. Entomol. 100 (3): 847-854.)

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Current Kaolin Studies

- Confirmed Hall et. al 2007…psyllids cant grasp and maneuver on kaolin treated leaves (Kim et. al, unpublished)

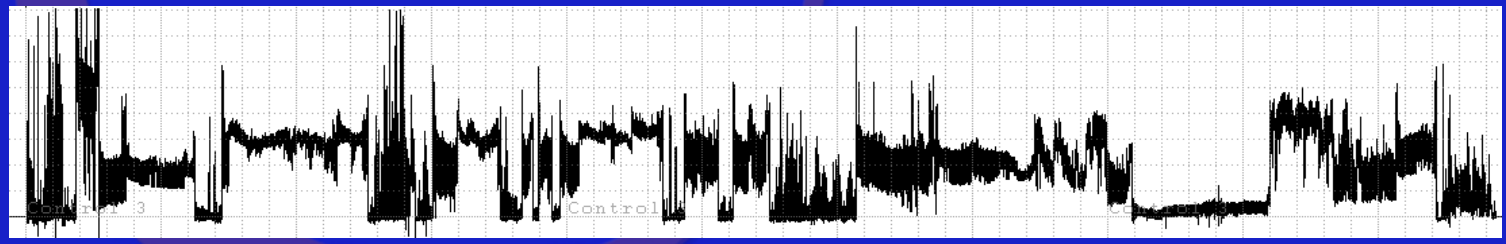




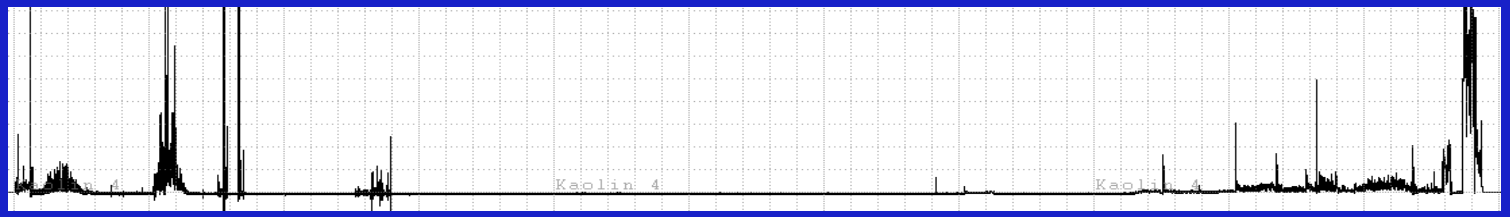
UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Current Kaolin Studies

- **Inability to grasp leaf prevents successful feeding by ACP on Kaolin treated leaf**



Untreated leaf surface



Kaolin-treated leaf surface

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Potential Problems with Kaolin

- **Can create other pest problems**
  - Scale insects – may have negative effects on searching behaviors of parasitoids and predators
- **Mask the symptoms of HLB**
  - White coating on leaf surface prevents observation of HLB symptoms
- **Could increase leaf-wetness?**
  - Exacerbate citrus canker?

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Use of Kaolin in Citrus

- Information is presented based on what is currently known

- No UF-IFAS recommendations for use of Kaolin until more research-based field data has been collected on its use for controlling ACP and potential negative effects.

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Rationale for Kaolin in Trials

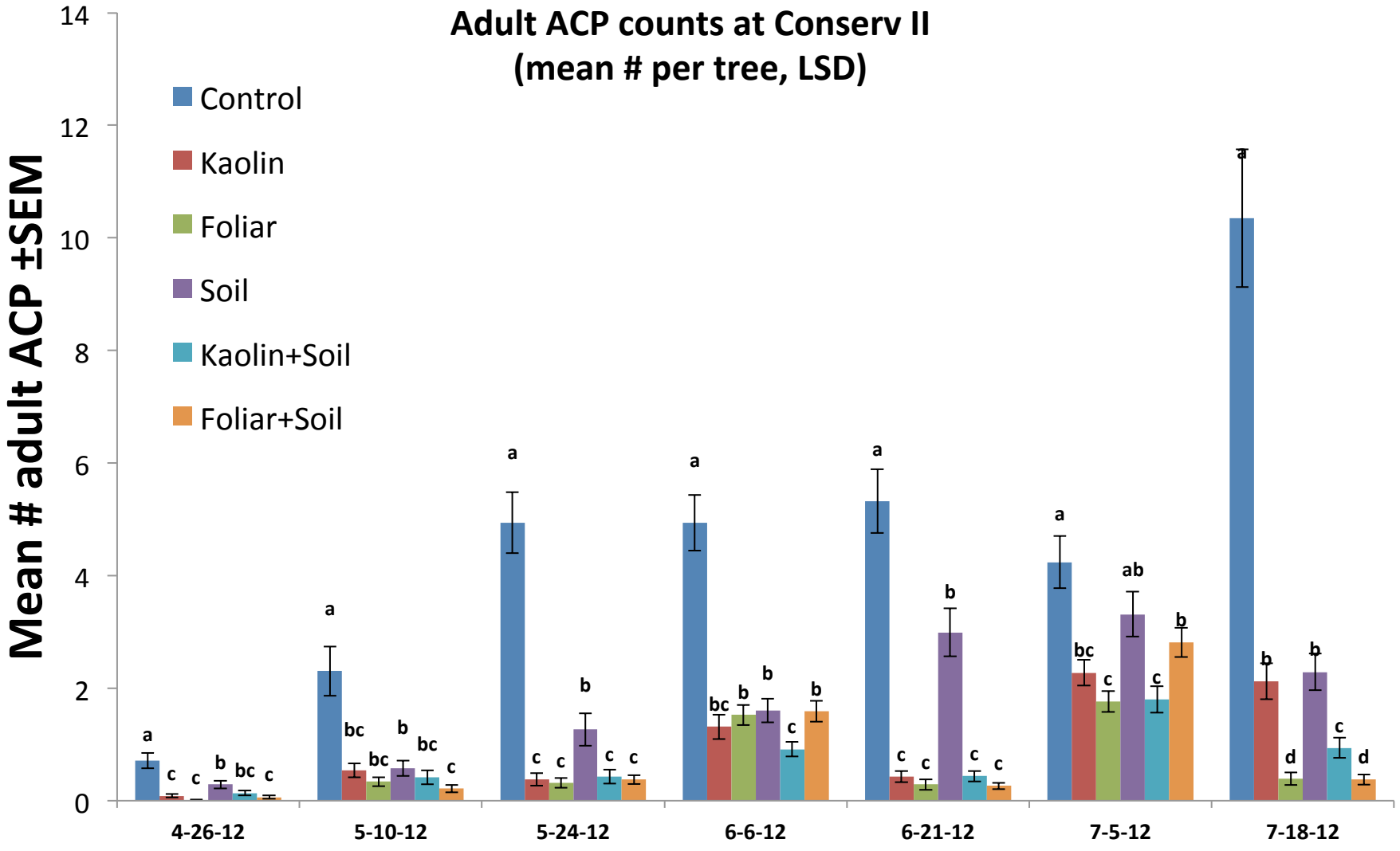
- Can Kaolin be used in conjunction with soil-applied neonics to deter psyllid feeding as the effects of neonics begin to “wear off”?

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Multi-year field trial

- **Treatments (programs)**
  - 1) Systemic only – every 6 weeks
  - 2) Foliar applications only - monthly
  - 3) Systemic + Foliar applications – 6 wk / monthly
  - 4) kaolin clay (Surround WP) - monthly
  - 5) Systemics + kaolin clay – 6 wk / monthly
  - 6) untreated control

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

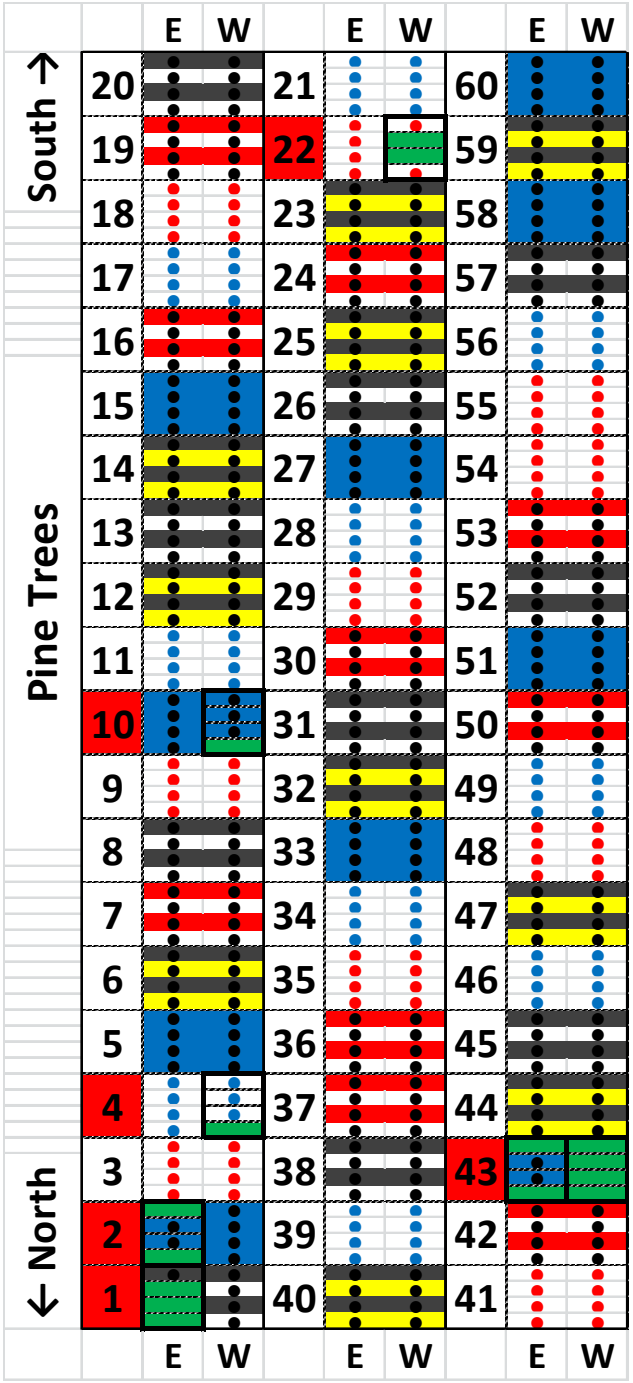

Adult ACP counts at Conserv II
(mean # per tree, LSD)
Mean # adult ACP ±SEM
Control
Kaolin
Foliar
Soil
Kaolin+Soil
Foliar+Soil
0
2
4
6
8
10
12
14
4-26-12
5-10-12
5-24-12
6-6-12
6-21-12
7-5-12
7-18-12

Pesticide Resistance Monitoring

- Resistance Ratio (RR) = LC50 of Field population / LC 50 of lab population

RR = 93.4 – 126.0

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center



PCR Analysis of trees for HLB (May 2012 – 1 year after planting)

Treatments

- Control
- Kaolin Only
- Foliar spray Only
- Soil drench Only
- Soil + Kaolin
- Soil + Foliar

HLB infected

Multi-year trial
(Results after 15 months)

- **HLB infection rates ranged from 1 – 3.8% in untreated, kaolin only and foliar spray only treatments**
  - This was the expected result for these treatments.

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Multi-year trial
(Results after 15 months)

- **Neonic ONLY treatments failed to provide protection**
  - Where no product rotation, control began to fail about 11 months after planting
  - Failure due to local pesticide resistance developed in that psyllid population
  - HLB infection rate higher in neonic only plots compared to other treatments
    - Likely due to more flush on neonic treated trees

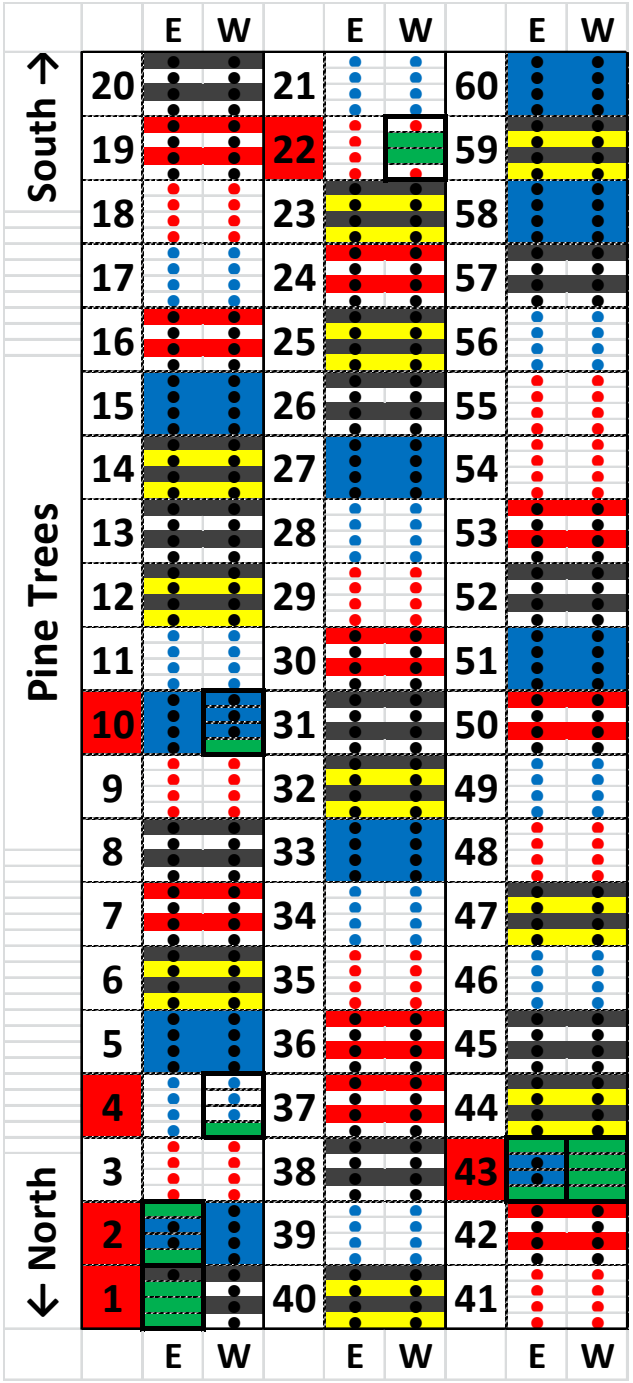
UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

15 months after planting

untreated

Neonic only

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center



PCR Analysis of trees for HLB (May 2012 – 1 year after planting)

Treatments	HLB infected
Control	3.8%
Kaolin Only	1.3%
Foliar spray Only	2.5%
Soil drench Only	11.3%
Soil + Kaolin	0%
Soil + Foliar	0%

Multi-year trial
(Results after 15 months)

- **Neonic + rotation of foliar sprays or Kaolin remained remain HLB-free thus far**
  - Use of additional pesticide modes of action between neonics prevented buildup of resistant psyllids and subsequent HLB infection

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

What does this mean?

- **In young tree plantings, relying solely on soil-applied neonics can result in increased rates of HLB infection**
  - Pesticide resistant populations can develop in a small block or at a more local level
  - The idea of a refuge strategy where psyllids from surrounding areas breed-out resistance will not work…at least for protecting a young block
  - **Pesticide rotation must be practiced!**

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

What does this mean?

- **Proper product rotation can provide the expected level of protection of young trees from HLB**
  - Neonic + either foliar applications or Kaolin have kept trees HLB free thus far, 15 months after planting.

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center

Season-long ACP control

(foliar applications to prevent pesticide resistance to neonics shown in orange)

Tree size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Reset (<3')	P		A	A		B	B		A	A		P
1-2 yr (3-5')	P		A	B		B	B		B	A		P
3-5 yr (5-9') bearing				P				A				

A= Admire (imidacloprid); B=Belay (clothianidin); P=Platinum (thiamethoxam); Products are positioned for use at certain times of the year based on water solubility and likelihood for significant rain events.

Acknowledgements

- **Funding for this work provided by the Citrus Research & Development Foundation**

- **Lab Members:**
  - Tim Ebert, Post-doctoral assoc.
  - Ki Duk Kim, Ph.D. Candidate
  - Rhonda Schumann, Sr. Chemist
  - Harry Anderson, Sr. Biol. Sci.
  - Dalia Shawer, visiting entomologist (Egypt)
  - Christine Weaver, M.S. Candidate
  - Gouping Liu, OPS
  - Percivia Mariner, OPS

UF UNIVERSITY of FLORIDA
IFAS
Citrus Research and Education Center