

Asian citrus psyllid management for young trees



Michael E. Rogers

Associate Professor of Entomology

University of Florida

Citrus Research & Education Center

Protection of young trees

- Important to ensure continuity of production in the future



Soil-applied neonicotinoids

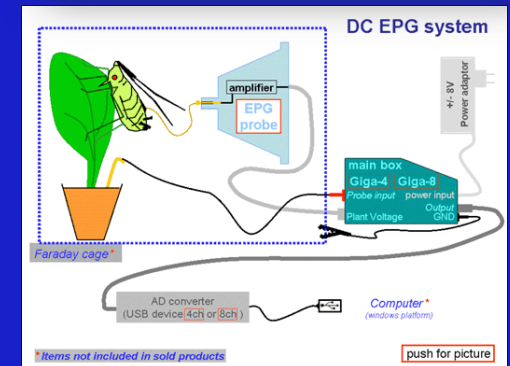
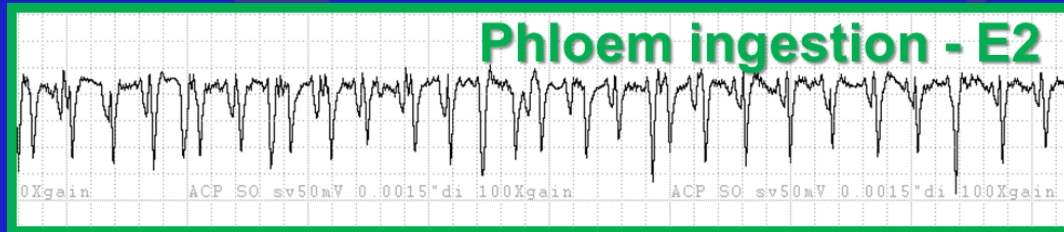
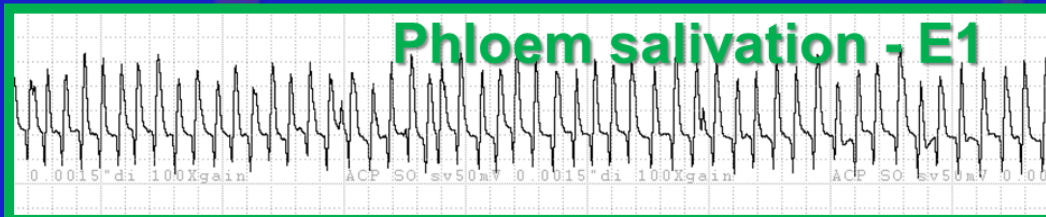
- **Foundation of young tree psyllid control programs**

- Admire Pro (imidacloprid)
- Platinum 75 SG (thiamethoxam)
- Belay 50 WDG (clothianidin)
 - Non-bearing use only (Belay)

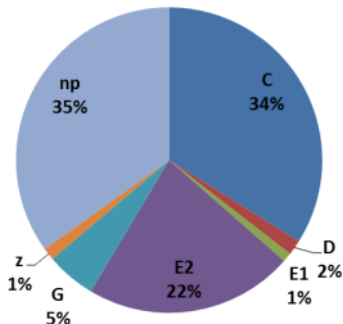


EPG Analysis of ACP Feeding Behavior

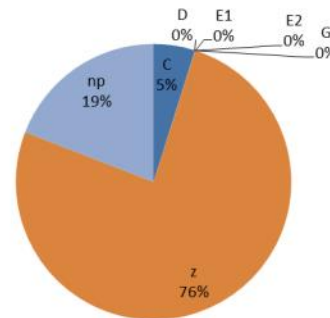
- Can insecticides prevent pathogen transmission from occurring?



Duration of time performing each behavior (untreated)



Duration of time performing each behavior (Imidacloprid)



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*

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

Duration of control dependent on concentration of product within leaf tissues

- Rate applied
- Tree size

Studies are underway to determine how long true protection lasts based on amount applied and tree size

How much protection?

- **Soil-applied neonicotinoids will not provide 100% protection from HLB**
 - Can expect <1-3% infection rate annually depending on local conditions
 - Distribution of product within plant
 - Affected by accuracy of application



How much protection?

- **Soil-applied neonicotinoids will not provide 100% protection from HLB**
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 - Distribution of product within plant
 - Affected by accuracy of application
 - Psyllid population pressure (surrounding areas)
 - The lower the psyllid population, the greater the success will be in keeping HLB spread low
 - “numbers game”
 - Foliar sprays will be important

Foliar sprays

- **Importance**

- keeping psyllid pressure low
- Reduce the chances of pesticide resistance development
 - Maintain effectiveness of soil-applied neonics

- **Limitations**

- Short residual effects
 - Preventing psyllid feeding
 - Duration of psyllid control provided

Results of EPG Studies to Date

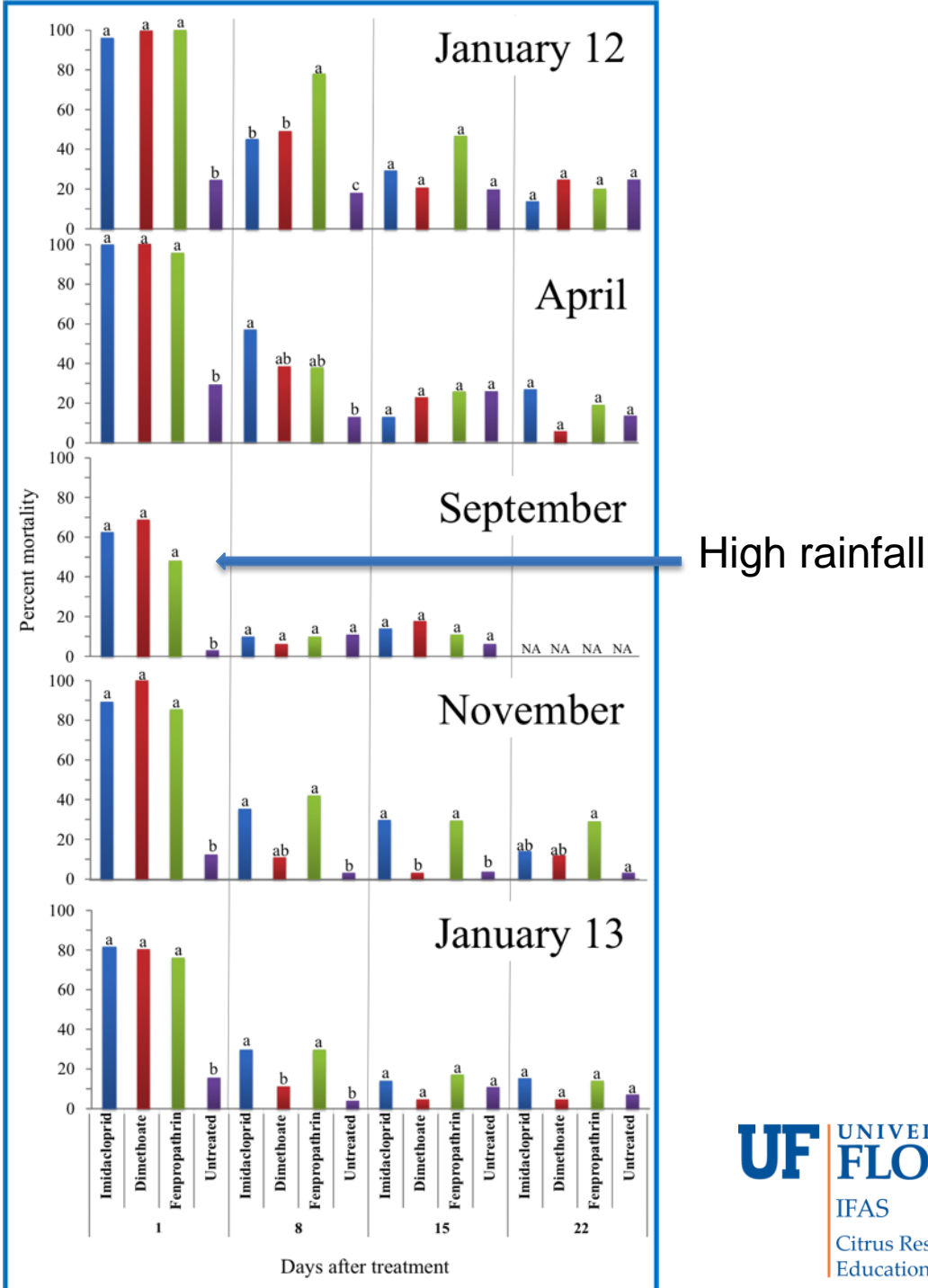
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Provado 1.6 F	imidacloprid	Foliar applied	3 weeks
Danitol 2.4 EC	fenpropathrin	Foliar applied	2-3 weeks
Lorsban Advanced	chlorpyrifos	Foliar applied	24 hours
Delegate WG	spinetoram	Foliar applied	24 hours
Movento MPC	spirotetramat	Foliar applied	none

The primary benefit of foliar insecticide use is ACP population suppression

True Residual Psyllid control



**Christine Weaver
(M.S. Student)**



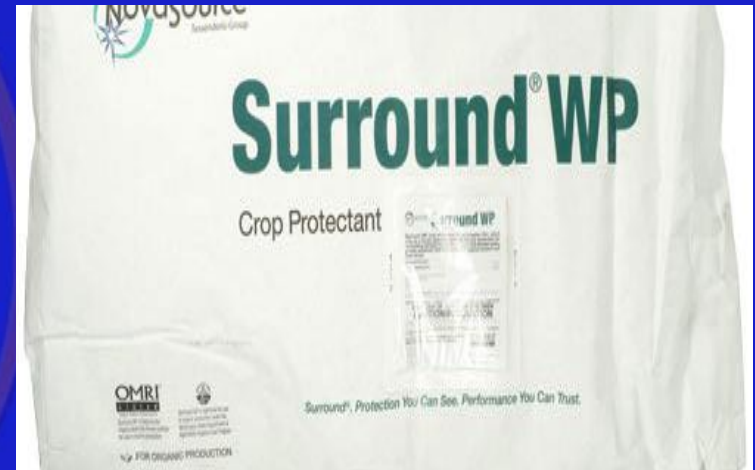
Foliar Insecticide Applications

(Residual Control)

- **Actual residual control of populations can be very short; affected most by rainfall**
- **Comparative effectiveness of products does not change at different times of the year (field conditions)**
 - Example: Pyrethroids vs. organophosphates
- **Product choice should be based on the need to rotate MOAs**

Kaolin for Psyllid Control

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





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.)

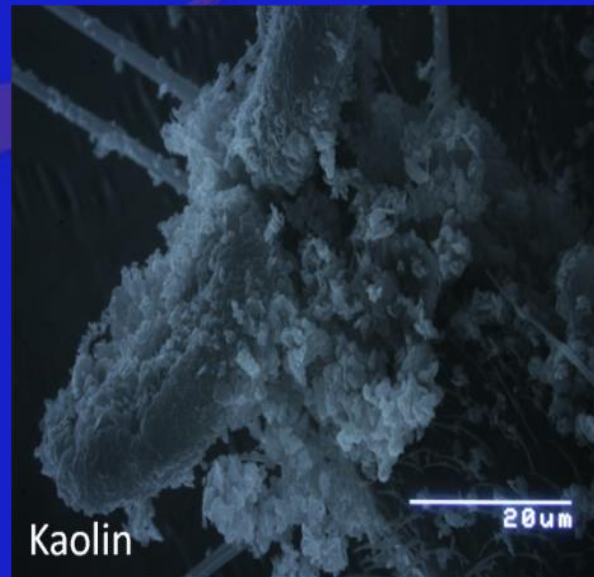
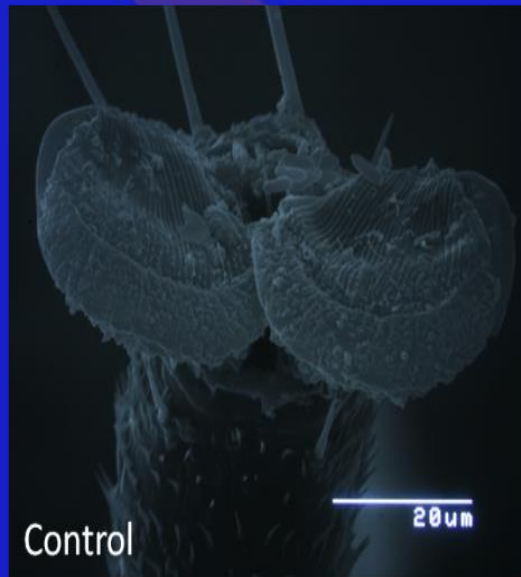
Previous Kaolin Studies

- **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.)

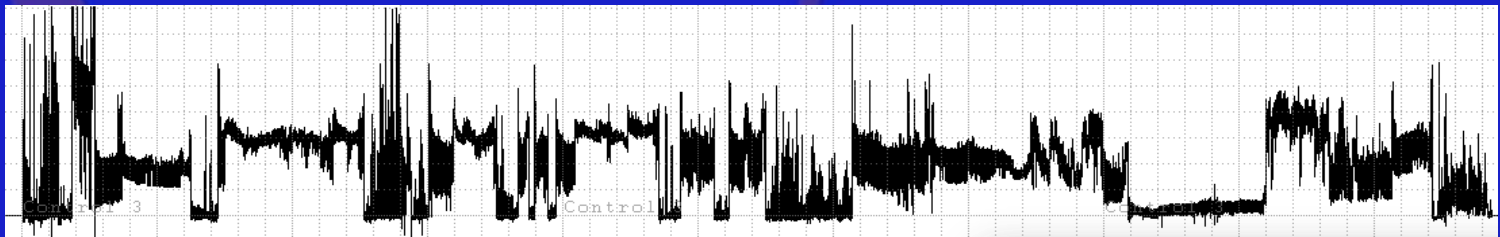
Current Kaolin Studies

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

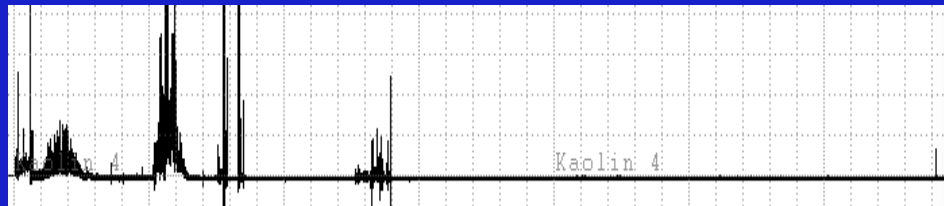


Current Kaolin Studies

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



Untreated leaf surface



Kaolin-treated leaf surface



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
- **Shading effects on coated leaves?**
 - Interior leaves of mature trees
 - Not likely a problem for young trees

Kaolin effects on photosynthesis

- Reduced leaf temperature allowing trees to continue to grow during excessive heat (young trees)

J. AMER. SOC. HORT. SCI. 128(1):107-112. 2003.

Kaolin Particle Film Applications Can Increase Photosynthesis and Water Use Efficiency of 'Ruby Red' Grapefruit Leaves

John L. Jifon¹

Texas A&M University, 2415 East Highway 83, Weslaco TX 78596

James P. Syvertsen

Citrus Research and Education Center, University of Florida, IFAS, 700 Experiment Station Road, Lake Alfred, FL 33850

ADDITIONAL INDEX WORDS. Surround WP, leaf temperature, vapor pressure deficit, stomatal conductance, chlorophyll fluorescence

ABSTRACT. Effects of foliar sprays of a kaolin clay particle film (Surround WP) on leaf temperature (T_L), net gas exchange, chlorophyll fluorescence and water relations of sun-exposed leaves on field-grown grapefruit trees (*Citrus paradisi* L.) were studied during Summer and Fall 2001. Trees were sprayed twice a week for 3 weeks with aqueous suspensions of kaolin (Surround) at 60 g·L⁻¹. Physiological effects of kaolin application were most prominent around midday on warm sunny days than in mornings, evenings or cloudy days. Kaolin sprays increased leaf whiteness (62%), reduced midday leaf temperature (T_{L0} ; $\approx 3^\circ\text{C}$) and leaf to air vapor pressure differences (VPD; $\approx 20\%$) compared to water-sprayed control leaves. Midday reductions in T_L and VPD were accompanied by increased stomatal conductance (g_s) and net CO₂ assimilation rates (A_{CO_2}) of kaolin sprayed leaves, suggesting that g_s might have limited A_{CO_2} in water-sprayed control leaves. Midday photoinhibition of photosynthesis was 30% lower in kaolin-sprayed leaves than in control leaves. Midday water use efficiency (WUE) of kaolin-sprayed leaves was 25% higher than that of control leaves. However, leaf transpiration and whole-tree water use were not affected by kaolin film sprays. Increased WUE was therefore, due to higher A_{CO_2} . Leaf intercellular CO₂ partial pressures (C_i) were similar in control and kaolin-sprayed leaves indicating that stomatal conductance was not the major cause of reduced A_{CO_2} . These results demonstrate that kaolin sprays could potentially increase grapefruit leaf carbon uptake efficiency under high radiation and temperature stress.

Kaolin effects on photosynthesis

S. LaPointe (USDA-ARS-USHRL)

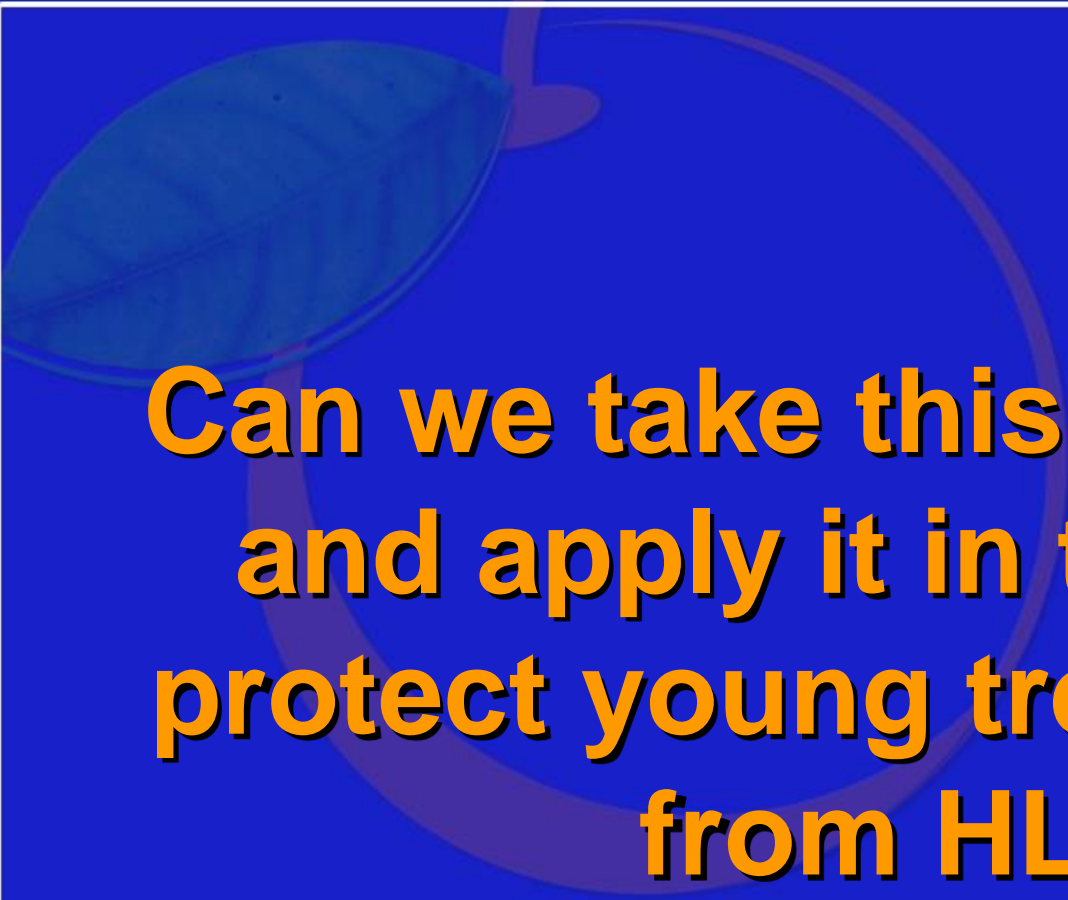


Use of Kaolin for psyllid control

- **Current studies have shown kaolin effective in reducing psyllid infestation**
 - Deter psyllids from feeding on treated trees
- **Application rates being tested in field**
 - Initial 50lbs/100 gal water
 - “initial primer” or base coating
 - Follow-up sprays using 10-20 lbs / 100 gal water to maintain complete leaf coverage

Use of Kaolin for psyllid control

- **The residual effects are LONGER than conventional foliar insecticides...except...**
 - Loss of residues due to rainfall
 - New leaf growth not protected so must be reapplied periodically
- **Current work**
 - Develop a rainfall-based model for kaolin applications similar to “the copper model”



**Can we take this information
and apply it in the field to
protect young tree plantings
from HLB?**

Multi-year field trial

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



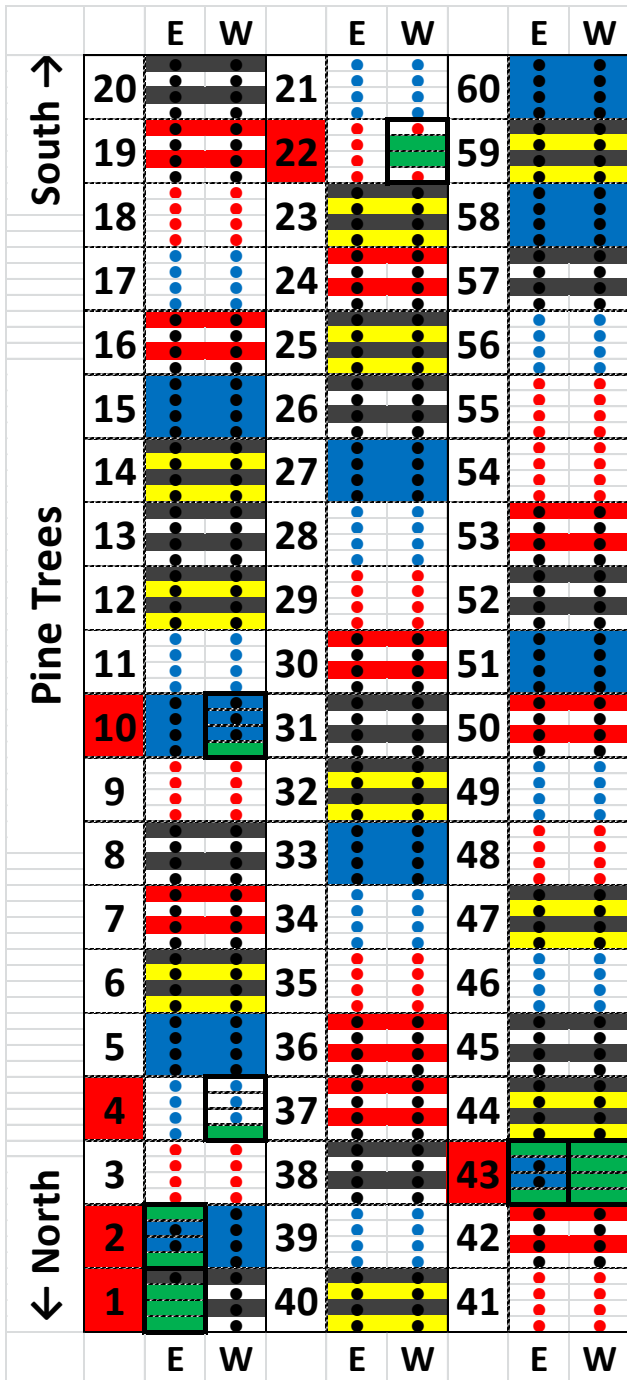
15 months after planting

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

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



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

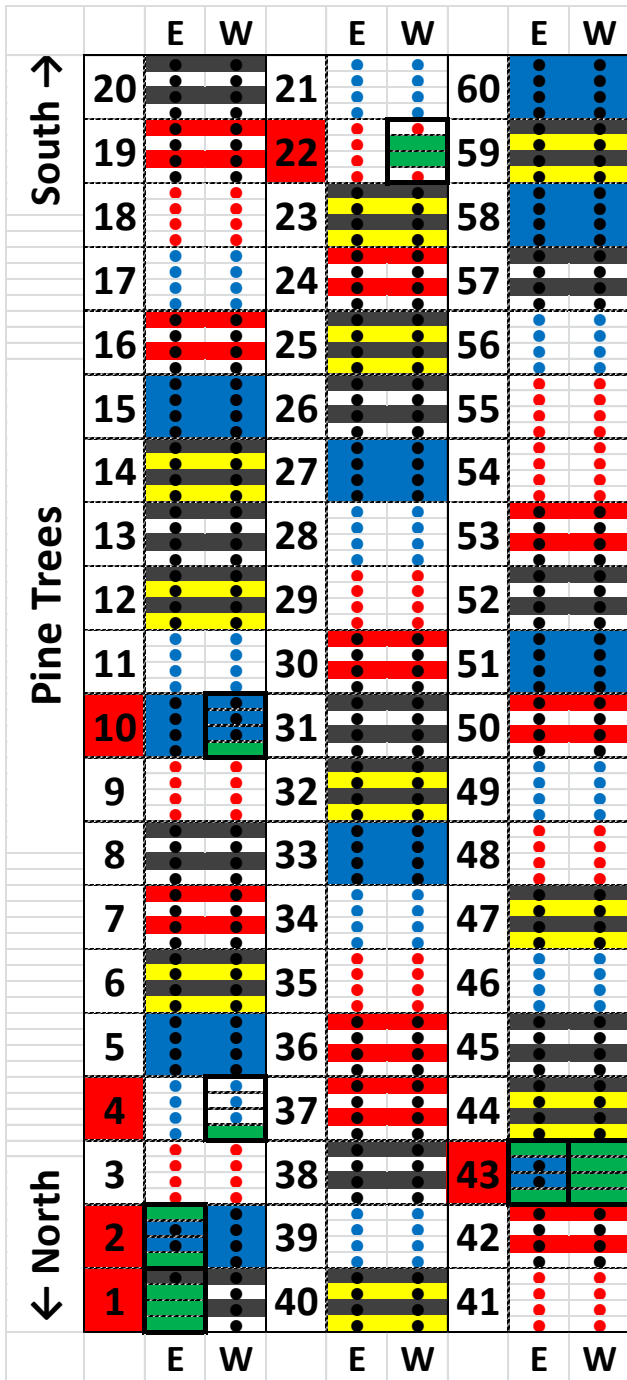
Season-long ACP control

(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.

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



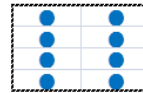
Treatments

HLB infected



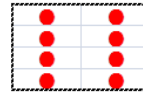
Control

3.8%



Kaolin Only

1.3%



Foliar spray Only

2.5%



Soil drench Only

11.3%



Soil + Kaolin

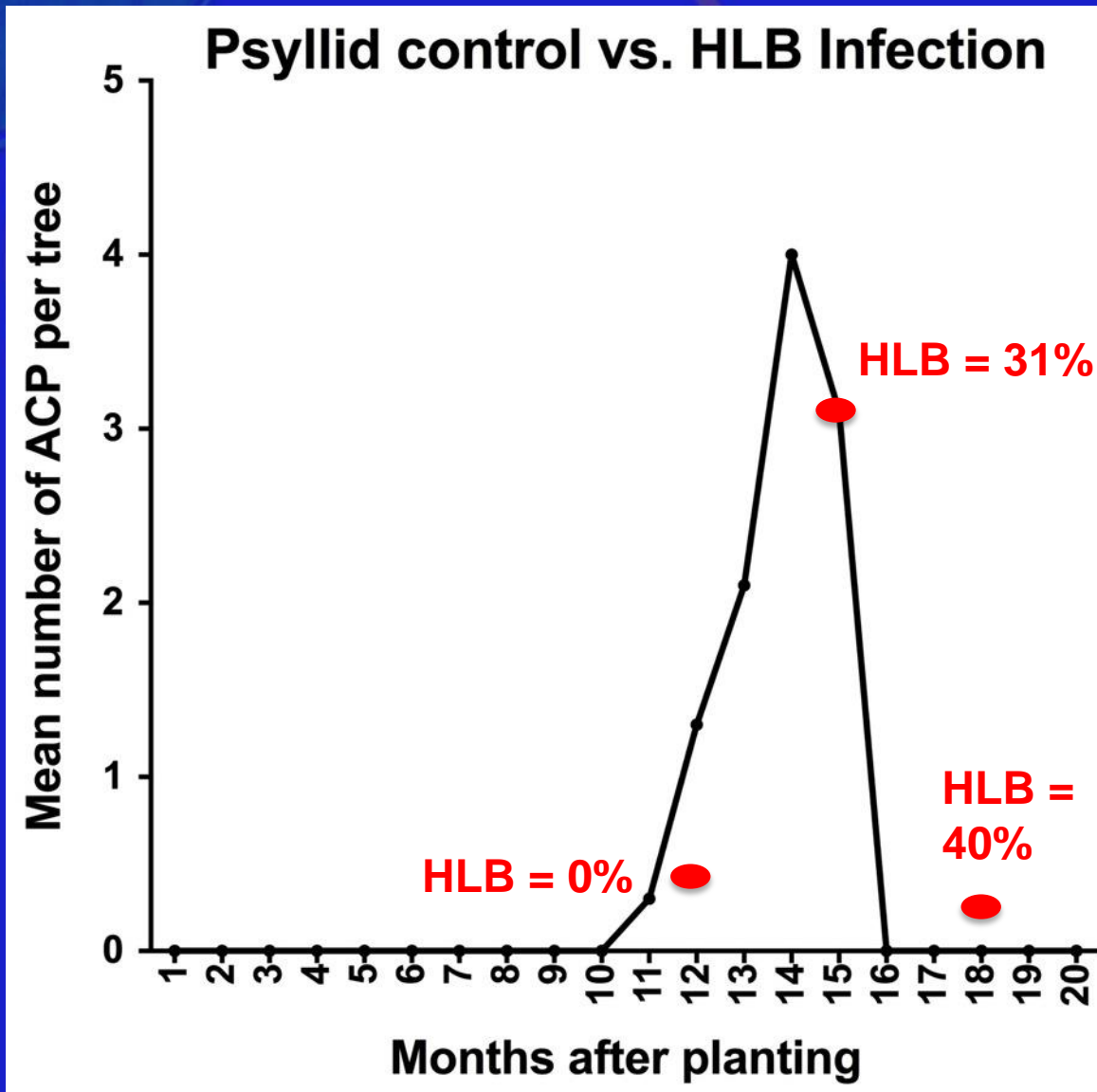
0%



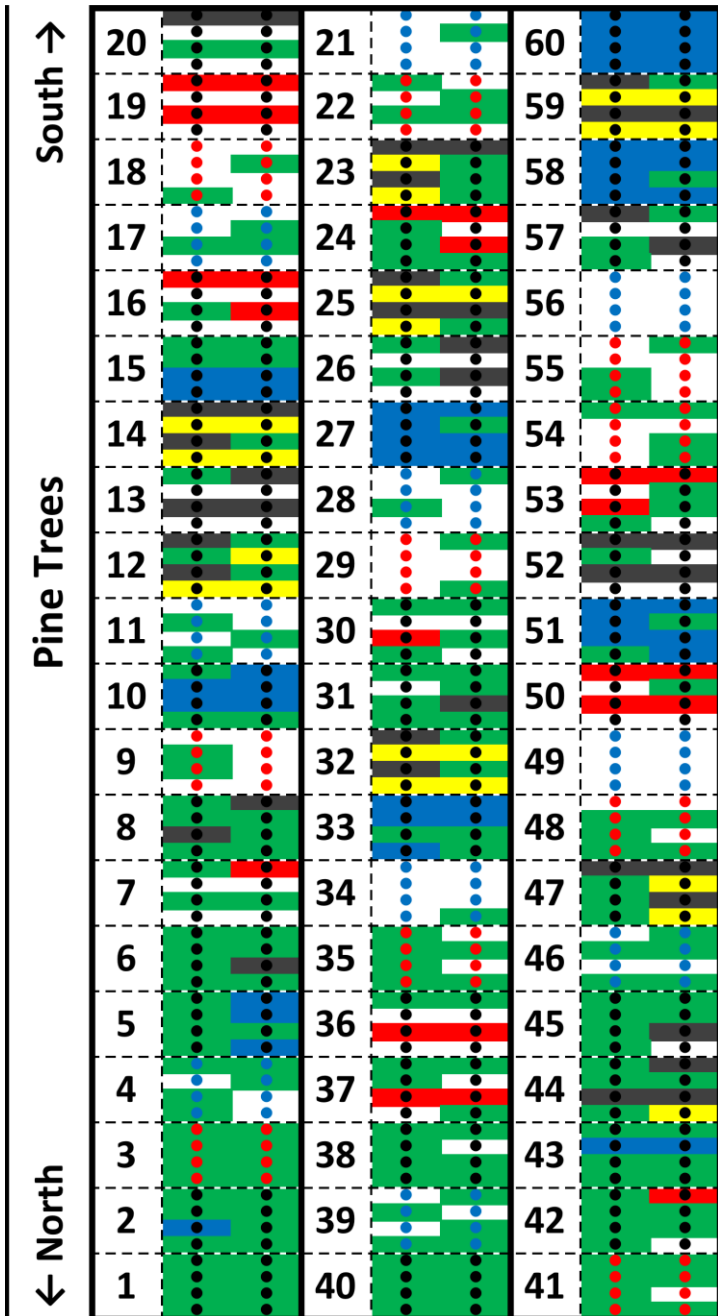
Soil + Foliar

0%







Gaps in ACP Control = HLB Spread



HLB Infection Status



PCR Analysis of trees for HLB (November 2012 – 18 months after planting)

<u>Treatments</u>	<u>HLB infected</u>
 Control	52%
 Kaolin Only	31%
 Foliar spray Only	53%
 Soil drench Only	40%
 Soil + Kaolin	35%
 Soil + Foliar	43%

Multi-year trial

(Results after 18 months)

- **Rotation of soil-applied neonics + foliar applications of insecticides (or kaolin) can greatly reduce HLB infection rates**
- **However, this study shows that a control failure can result in significant HLB spread in a young tree block**
- **Protecting young trees from HLB is possible...but you must be proactive!**

Season-long ACP control

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

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Reset (<3')	P	A	A	B	B	A	A	P				
1-2 yr (3-5')	P	A	B	B	B	B	B	A	P			
3-5 yr (5-9') bearing			P	A				A				

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