Vector Management

Asian citrus psyllid and HLB

Michael E. Rogers

UF / IFAS / Citrus Research and Education Center, Lake Alfred

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Today's Presentation

- What to spray?
- When to spray?
- How to spray it?

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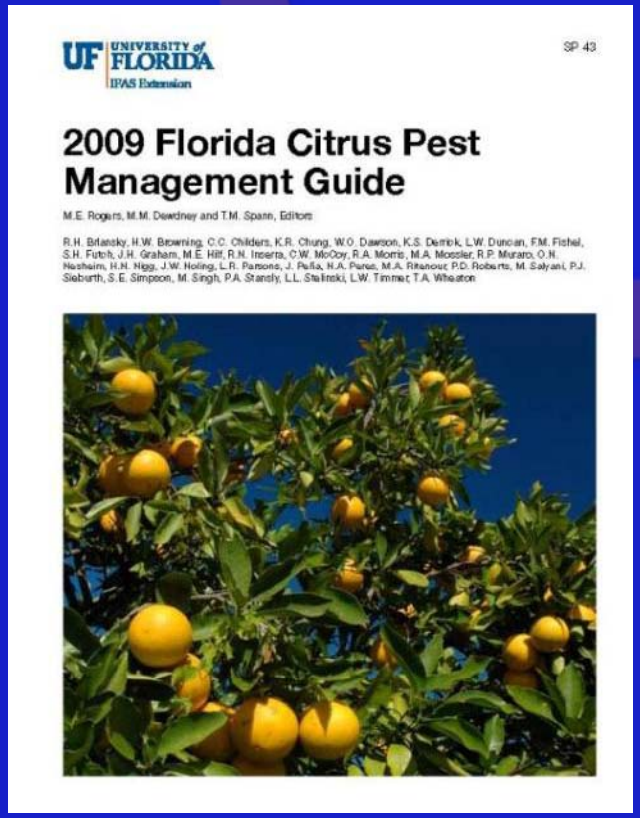
2009 Florida Citrus Pest Management Guide

CREC LINK: http://www.crec.ifas.ufl.edu/extension/pest/index.htm

EDIS LINK: http://edis.ifas.ufl.edu/topic_book_florida_citrus_pest_management_guide



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SP 43

2009 Florida Citrus Pest Management Guide

M.E. Rogers, M.M. Dewdney and T.M. Spann, Editors

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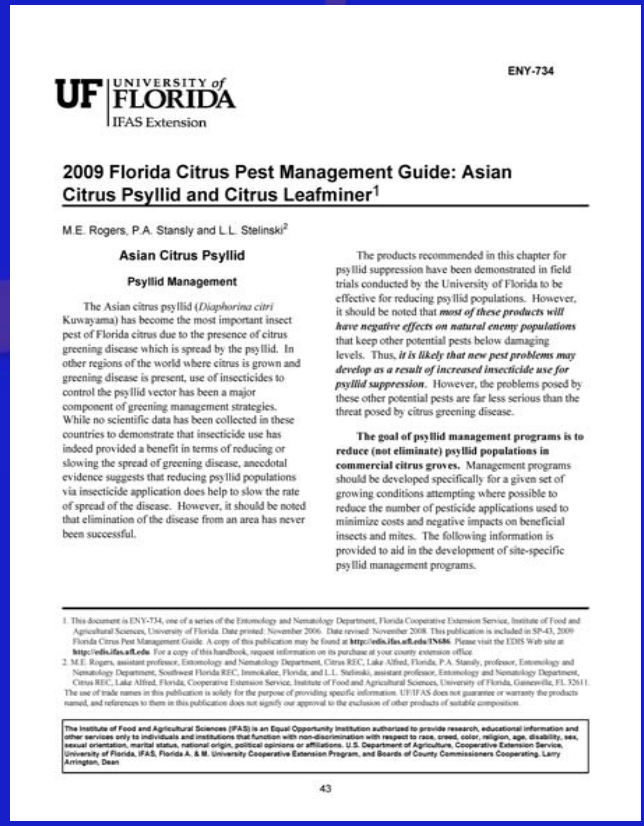

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ENY-734

2009 Florida Citrus Pest Management Guide: Asian Citrus Psyllid and Citrus Leafminer[1]

M.E. Rogers, P.A. Stansly and L.L. Stelinski[2]

Asian Citrus Psyllid

Psyllid Management

The Asian citrus psyllid (*Diaphorina citri* Kuwayama) has become the most important insect pest of Florida citrus due to the presence of citrus greening disease which is spread by the psyllid. In other regions of the world where citrus is grown and greening disease is present, use of insecticides to control the psyllid vector has been a major component of greening management strategies. While no scientific data has been collected in these countries to demonstrate that insecticide use has indeed provided a benefit in terms of reducing or slowing the spread of greening disease, anecdotal evidence suggests that reducing psyllid populations via insecticide application does help to slow the rate of spread of the disease. However, it should be noted that elimination of the disease from an area has never been successful.

The products recommended in this chapter for psyllid suppression have been demonstrated in field trials conducted by the University of Florida to be effective for reducing psyllid populations. However, it should be noted that ***most of these products will have negative effects on natural enemy populations*** that keep other potential pests below damaging levels. Thus, ***it is likely that new pest problems may develop as a result of increased insecticide use for psyllid suppression***. However, the problems posed by these other potential pests are far less serious than the threat posed by citrus greening disease.

The goal of psyllid management programs is to reduce (not eliminate) psyllid populations in commercial citrus groves. Management programs should be developed specifically for a given set of growing conditions attempting where possible to reduce the number of pesticide applications used to minimize costs and negative impacts on beneficial insects and mites. The following information is provided to aid in the development of site-specific psyllid management programs.

1. This document is ENY-734, one of a series of the Entomology and Nematology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Date printed: November 2006. Date revised: November 2008. This publication is included in SP-43, 2009 Florida Citrus Pest Management Guide. A copy of this publication may be found at **http://edis.ifas.ufl.edu/IN686**. Please visit the EDIS Web site at **http://edis.ifas.ufl.edu**. For a copy of this handbook, request information on its purchase at your county extension office.
2. M.E. Rogers, assistant professor, Entomology and Nematology Department, Citrus REC, Lake Alfred, Florida; P.A. Stansly, professor, Entomology and Nematology Department, Southwest Florida REC, Immokalee, Florida; and L.L. Stelinski, assistant professor, Entomology and Nematology Department, Citrus REC, Lake Alfred, Florida; Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611. The use of trade names in this publication is solely for the purpose of providing specific information. UF/IFAS does not guarantee or warranty the products named, and references to them in this publication does not signify our approval to the exclusion of other products of suitable composition.

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Table 1. Recommended Chemical Controls for the Asian Citrus Psyllid

Pesticide / Trade name[1,4]	IRAC MOA[2]	Rate / Acre	Evaluated for Asian citrus psyllid[3]	Comments	Other pests controlled
Aldicarb					
Temik 15G	1A	33 lbs	+	Restricted use pesticide. Notification of intent is required. Application permitted only between Nov. 15 and Apr. 30. See label for application restrictions. When psyllid control is required on mature trees, apply at least 30 days prior to anticipated flush.	Aphids, citrus rust mites, citrus nematodes
Carbaryl					
Sevin XLR Plus	1A	1.5 qts	+	Highly toxic to bees. Sevin XLR Plus has a 2(ee) label for control of Asian citrus psyllid; other formulations of carbaryl not currently labeled for psyllid control.	Adult root weevils, scale insets, grasshoppers, crickets, katydids
Chlorpyrifos					
Lorsban 4E	1B	5 pts	+	Restricted Use Pesticide. Highly toxic to bees. May increase spider mite populations. Lorsban 4E has a 2(ee) label for control of Asian citrus psyllid; other formulations of chlorpyrifos are not currently labeled for psyllid control.	Mealybug, orangedog, katydids, grasshoppers, aphids, thrips
Dimethoate					
Dimethoate 4 E	1B	1 pt	+	Highly toxic to bees, do not apply during bloom. Do not make more than 2 applications per crop season. Consult label for buffering instructions when water pH is greater than 7.	Aphids, scales except snow scale and black scale, flower thrips
Fenpropathrin					
Danitol 2.4EC	3	1 pt	+	Restricted use pesticide. Highly toxic to bees. May result in increased rust mite populations. May have significant negative effects on beneficial insect populations.	Flower and orchid thrips, adult root weevils
Imidacloprid (foliar application)				Limit of 0.5 lbs / AI per acre per growing season regardless of application type (soil and/or foliar) and trade name of imidacloprid product used. Do not apply during bloom or within 10 days of bloom or when bees are actively foraging.	Aphids
Couraze 1.6F	4	10 to 20 fl oz	ID (+)		
Nuprid 1.6F			ID (+)		
Pasada 1.6F			ID (+)		
Provado 1.6F			+		

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Pesticide / Trade name[1,4]	IRAC MOA[2]	Rate / Acre	Evaluated for Asian citrus psyllid[3]	Comments	Other pests controlled
Imidacloprid (soil-drench)	4			Limit of 0.5 lbs / AI per acre per growing season regardless of application type (soil and/or foliar) and trade name of imidacloprid product used. Recommended application is a soil drench made to base of trees up to 6 feet tall.	Aphids, citrus leafminer
Admire Pro 4.6F	4	7 to 14 fl oz	+		
Admire 2F	4	16 to 32 fl oz	+		
Alias 2F			ID (+)		
Couraze 2F			ID (+)		
Nuprid 2F			ID (+)		
Phosmet				Highly toxic to bees, do not apply during bloom. Consult label for buffering instructions when water pH is greater than 7. Do not make more than 2 applications per season. EPA SLN No. 10163-169, FIFRA 2(ee).	Citrus root weevils
Imidan 70 W	1B	1.5 lb	+		
Spinetoram				Highly toxic to bees, do not apply during bloom. Do not apply more than 12 oz of product (0.188 lb ai) per acre per season. Do not make more than 3 applications per calendar year.	Citrus leafminer
Delegate WG + Petroleum Oil 97+% (FC 435-66, FC 455-88, or 470 oil)	5	4 oz + 2% V/V	+		
Spirotetramat				Limit of 20 oz of product (0.32 lb ai) per acre per season. Do not apply within 10 days prior to bloom, during bloom, or until petal fall is complete.	Citrus rust mites, some scale insects
Movento 240 SC + Petroleum Oil 97+% (FC 435-66, FC 455-88 or 470 oil)	23	10 oz + 3% V/V	+		

Table 1. Recommended Chemical Controls for the Asian Citrus Psyllid

Pesticide / Trade name[1,4]	IRAC MOA[2]	Rate / Acre	Evaluated for Asian citrus psyllid[3]	Comments	Other pests controlled
Zeta-cypermethrin					
Mustang Insecticide	3	4.3 oz	+	Restricted use pesticide. Highly toxic to bees, do not apply during bloom. Do not make more than 4 applications (0.20 lb ai) per acre per season.	Citrus root weevils
Mustang Max EW	3	4.0 oz	+	Restricted use pesticide. Highly toxic to bees, do not apply during bloom. Do not make more than 4 applications (0.10 lb ai) per acre per season.	

[1] Trade names provided are all products for a given active ingredient that have been tested and are currently labeled for psyllid control.
[2] Mode of action class for citrus pesticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification V4.2.1 (2005). Refer to ENY-624, Pesticide Resistance and Resistance Management, in the 2009 Florida Citrus Pest Management Guide for more details.
[3] + = products have been tested in multiple trials and have provided adequate control of the Asian citrus psyllid; ID(+) = incomplete data with only one trial conducted to date demonstrating efficacy.
[4] Additional trade names of products with the same active ingredient that have not been tested to determine efficacy are listed in chapter ENY-601 Pesticides Registered for Use on Florida Citrus.

ENY-854

Quick Reference Guide to Citrus Insecticides and Miticides

M.E. Rogers, P. A. Stansly, L. L. Stelinski and J. D. Yates

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Products recommended in the Florida Citrus Pest Management Guide and their effects on selected pests and their natural enemies.

Pesticide active ingredient	Target pest								Effects on natural enemies
	Mode of Action[1]	Psyllid	Leafminer	Rust Mites	Spider Mites	Root Weevil Adults	Scale Insects	Mealybugs	
Abamectin + oil	6	++	+++,R	+++,R	+	+ (oil)	+(oil)	+ (oil)	medium
Acetamiprid	4	-	+++,R	-	-	?	+	++	medium
Aldicarb	1A	+++,R	-	+++,R	+++	-	-	-	low
Carbaryl	1A	+++,R	-	+	-	+++,R	+++,R	+	high
Chlorpyrifos	1B	+++,R	+	+	-	+	+++,R	+++,R	high
Diflubenzuron	15	++	+++,R	+++,R	-	+++,R	-	-	low
Dimethoate	1B	+++	-	-	-	?	+++,R	+	high
Fenbutatin oxide	12	-	-	+++,R	+++,R	-	-	-	low
Fenpropathrin	3	+++,R	-	+	+	+++,R	-	+	high
Imidacloprid (soil application, nonbearing)	4	+++,R	+++,R	-	-	+	++	+	low
Imidacloprid (foliar application)	4	+++,R	+	-	-	-	++	+	medium
Petroleum oil	NR	+	++,R	++,R	++	+(eggs)	++,R	+	low
Phosmet	1B	+++, R	-	+	?	+++,R	?	?	medium/high
Pyridaben	21	-	?	+++,R	+++,R	-	-	-	high
Spinosad	5	-	+++,R	-	-	-	-	-	low
Spinetoram	5	+++,R	+++,R	-	?	?	?	?	low
Spirodiclofen	23	-	-	+++,R	+++,R	?	-	-	low
Spirotetramat	23	+++,R		+++,R	?	?	++	?	low
Sulfur	NR	-	-	+++,R	+++	-	?	?	high (short term)
Zeta-cypermethrin	3	+++,R	-	-	?	+++	?	?	high

[1]Mode of action class for citrus pesticides from the Insecticide Resistance Action Committee; NR = no resistance potential

(R) = product recommended for control of pest in Florida Citrus Pest Management Guide

(+++) = good control of pest

(++) = short-term control of pest

(+) = low levels of pest suppression

(-) = no observed control of pest

(?) = insufficient data available

Revised December 2008





Imidacloprid soil drench rates for solid plantings of nonbearing citrus

Tree Height	Rate Product/A*	Applications per season	Ounces per tree	Trees per ounce
Imidacloprid 2F (Admire and various generic products)				
2 ft – 4 ft	8 fl oz	4	0.057 fl oz	17.5 trees
4 ft – 6 ft	16 fl oz	2	0.114 fl oz	8.77 trees
Imidacloprid 4.6F (Admire PRO)				
2 ft – 4 ft	3.5 fl oz	4	0.025 fl oz	40 trees
4 ft – 6 ft	7 fl oz	2	0.05 fl oz	20 trees
**Rates based on 140 trees per acre*				

Restricted Entry Interval (REI) and Pre-Harvest Interval (PHI) for products listed on front page

Active Ingredient	Product brand names*	Restricted entry interval (REI)	Pre-harvest interval (PHI)
Abamectin	Agri-mek 0.15EC	12 hours	7 days
Acetamiprid	Assail 70 WP	12 hours	7 days
Aldicarb	Temik 15G	48 hours	0; 30 days lemons
Carbaryl	Sevin XLR Plus	12 hours	5 days
Chlorpyrifos	Lorsban 4 E	5 days	21 days
Diflubenzuron	Micromite 80 WGS	12 hours	21 days
Dimethoate	Dimethoate 4 E	48 hours	15 days
Fenbutatin oxide	Vendex 50 WP	48 hours	7 days
Fenpropathrin	Danitol 2.4 EC	24 hours	1 day
Imidacloprid	Admire Pro 4.6 F, Provado 1.6 F	12 hours	0
Phosmet	Imidan 70 W	24 hours	7 days
Pyridaben	Nexter miticide	12 hours	7 days
Spinosad	Spintor 2 SC	4 hours	1 day
Spinetoram	Delegate WG	4 hours	1 day
Spirodiclofen	Envidor 2 SC	12 hours	7 days
Spirotetramat	Movento 240 SC	24 hours	1 day
Sulfur	various	12 hours	0
Zeta-cypermethrin	Mustang Insecticide, Mustang Max EW	12 hours	1 day
**Additional generic brand names may be available for a given active ingredient. Use pesticides safely. Read and follow directions on the manufacturer's label.*			

Additional citrus pest management information can be found in the Florida Citrus Pest Management Guide available online at http://www.crec.ifas.ufl.edu/extension/pest/index.htm

When to Spray?

- **Winter "dormant" spray**
  - initial spray of the year
  - Jan-Feb; prior to the spring flush
- **Post-bloom "clean-up"**
  - Control psyllid populations that developed on flush associated with bloom
  - May not be needed in all cases
- **Applications prior to major flushing events**
  - Summer flush, fall flush
- **Post-fall flush "clean-up"**
  - Psyllid movement post fall flush

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How many sprays are really needed?

Psyllid acquisition and transmission of the greening pathogen

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Seasonal Psyllid Infection Rates

- **Monthly collections from natural psyllid populations – are there times of the year when it is more important to control psyllids to reduce HLB spread?**
- **DNA extraction / PCR of psyllids to detect presence of HLB pathogen**
- **5 grove sites in 4 Florida counties including:**
  - DeSoto, Highlands, Okeechobee, and Polk counties
  - 2009, added grove in Miami-Dade area 100% HLB+

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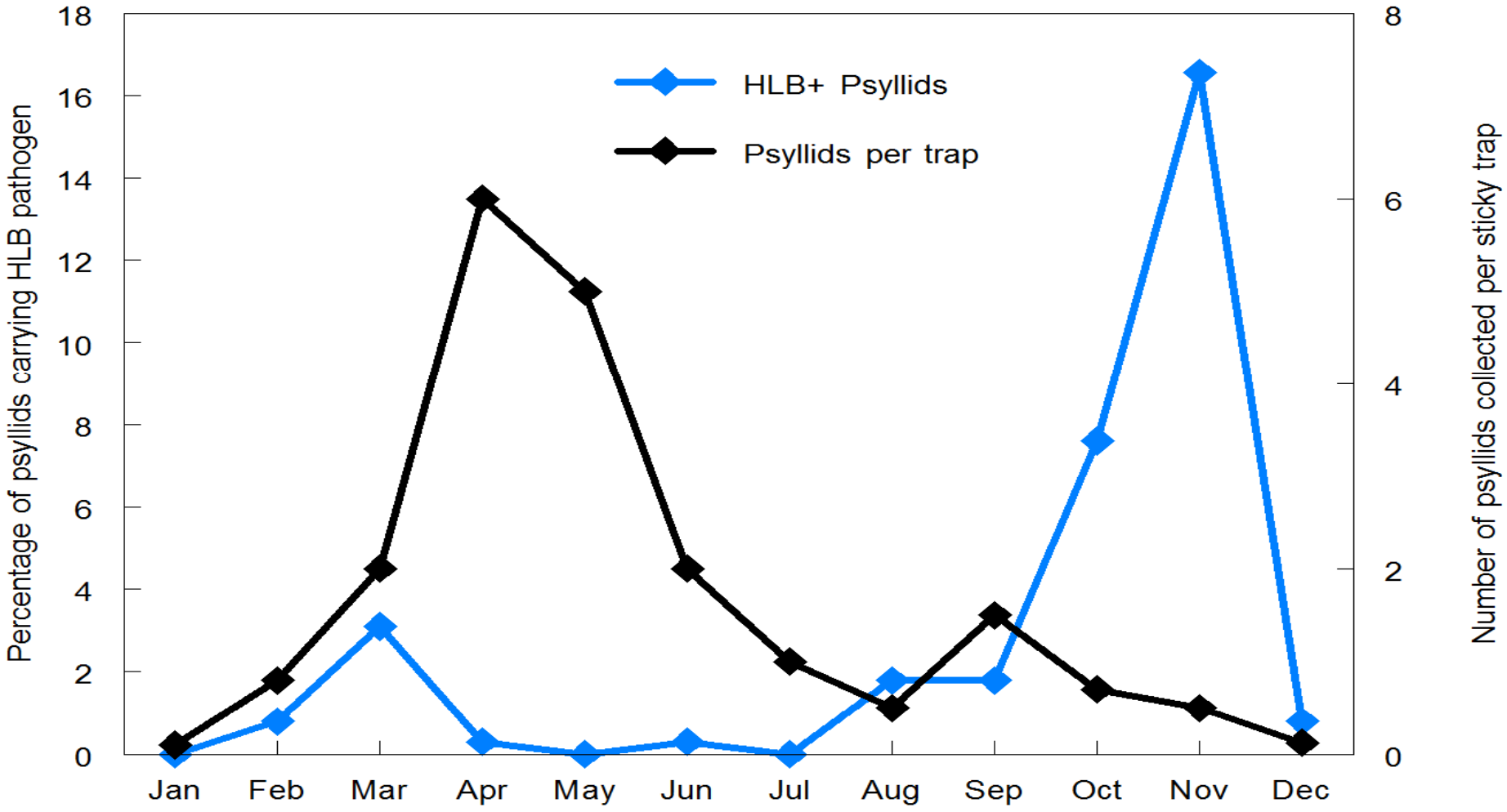
Example of Psyllid / HLB Seasonal Trends



Data based on only 1 year of sampling from groves <30% HLB+ (showing symptoms) – being repeated in 2009

How to spray it?

- **Coordinated grove sprays**
  - Area-wide reduction of psyllid populations
  - Goal: quick and cheap!
- **Equipment**
  - Traditional ground rigs (slowest option)
  - Aerial applications
  - Low volume ground sprays (Stelinski, next talk)

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Aerial applications

- **Typically apply 5-10 gpa**
  - Faster and cheaper than ground rig
  - Can we make aerial applications more cost effective by reducing spray volume?
    - Must stay within label use requirements

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Aerial Trials 2009

- **Trial 1**
  - Malathion 2pts + 1 gal water
  - Agrisolutions Malathion 5 (EPA 9779-5)
  - 300 micron droplet size
  - 3 sites ~ 200 acres each in the Ft. Pierce vicinity
  - 100 acres treated / 100 acres untreated
  - Applications made March 6, 2009

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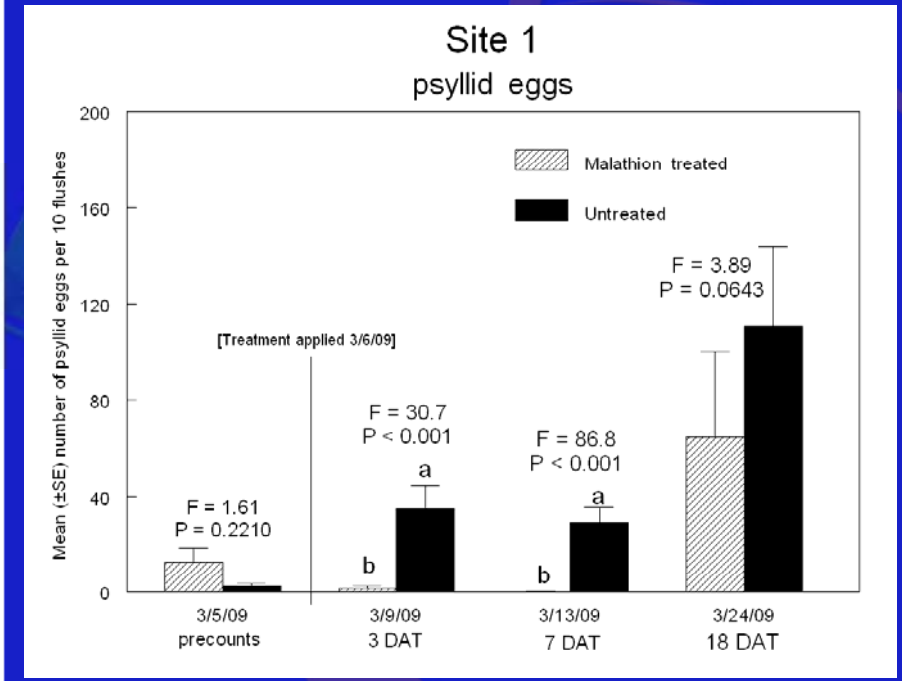

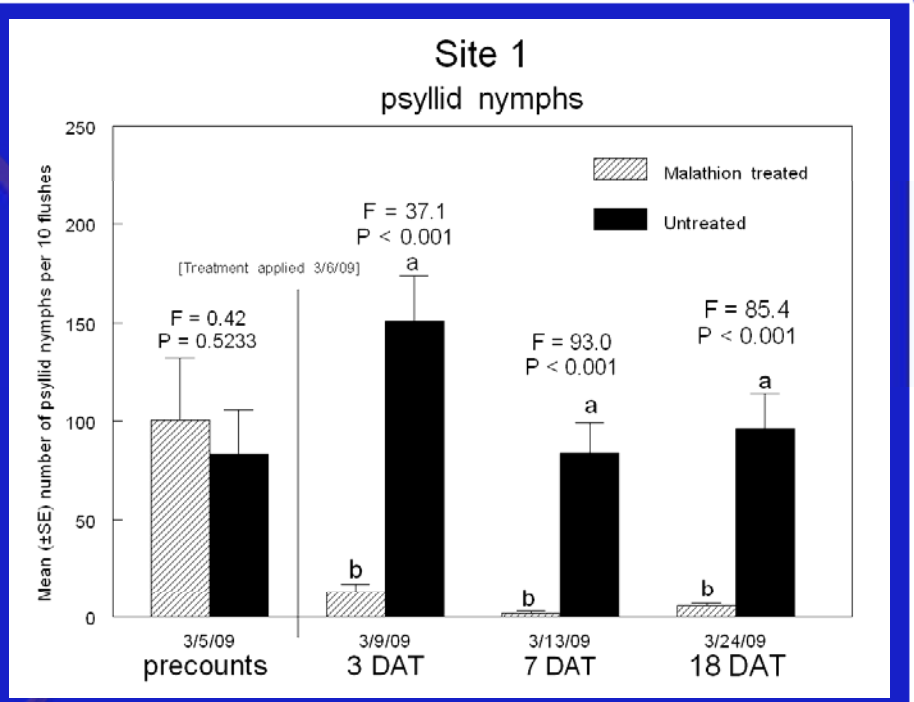

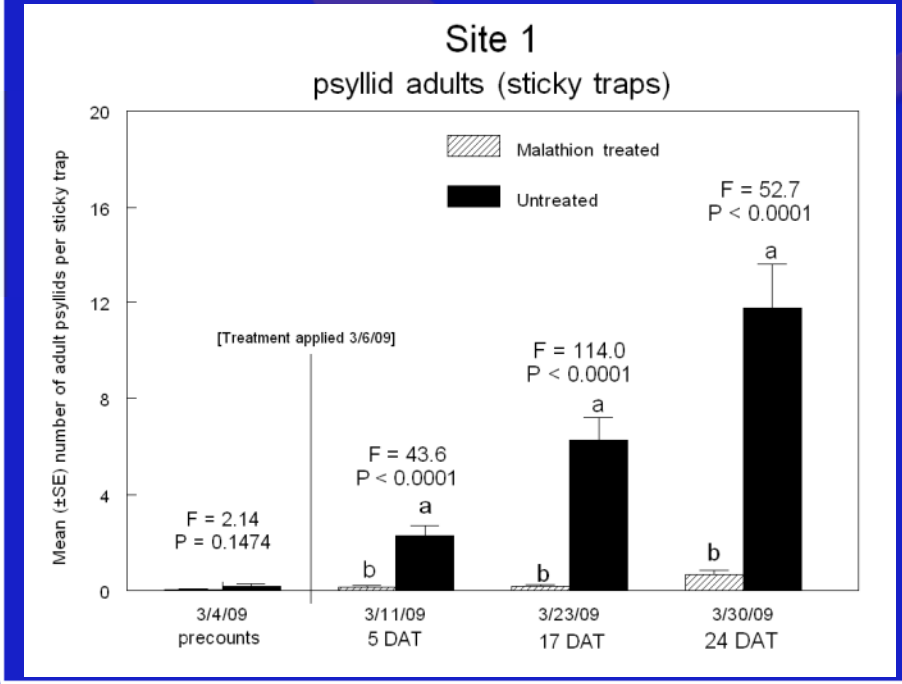

Sites 2 and 3…psyllid populations too low for data collection

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The effect of droplet size on coverage

microns	Type of droplet	Droplets per square inch	Coverage (relative to a 1,000 micron drop)
5	Dry fog	9,220,000	200
10	Dry fog	1,150,000	100
20	Wet fog	144,000	50
50	Wet fog	9,222	20
100	Misty rain	1,150	10
150	Misty rain	342	7
200	Light rain	144	5
500	Light rain	9	2
1,000	Heavy rain	1	1

Aerial Trials 2009

- **Trial 2**
  - Malathion 2pts + (0.25%) organosilicone surfactant + 1 gal oil
  - 150 micron droplet size
  - 2 sites ~ 200 acres each in the Ft. Pierce vicinity
  - 100 acres treated / 100 acres untreated
  - Applications made March 17, 2009

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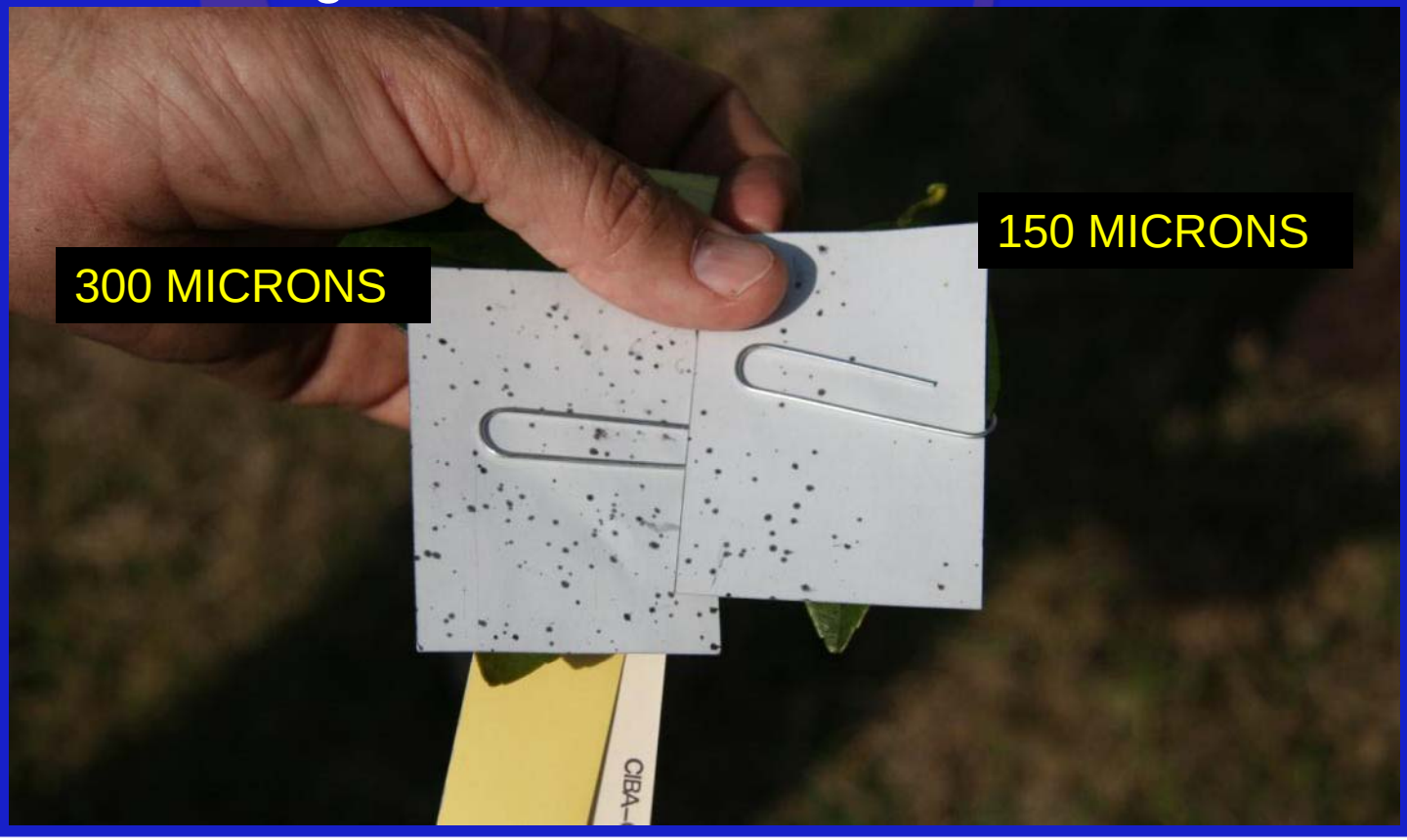
Spray oil only test run

- 4PM Ft. Pierce vicinity (Breezy)
  (not the typical time for an aerial application to be made)
- Applications with small droplet size are prone to drift reducing coverage…should be applied early in the morning



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- 1.25 GPA aerial application
- 150 micron droplet size
- applied 7:45 AM

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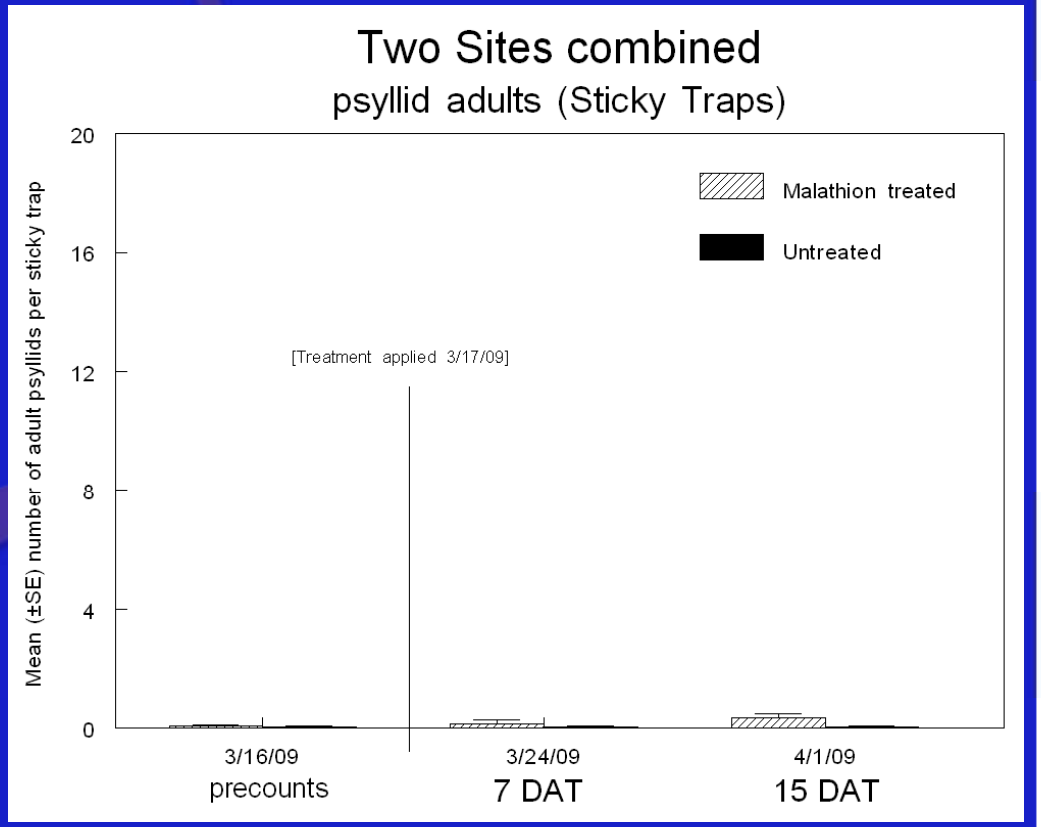
Results

- Applications made after flush, no egg nymph data available
- At both sites, overall adult psyllid populations low…continuing to monitor results



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Conclusions to date

- Preliminary work suggests reducing spray volume and droplet size may be a more cost-effective method for aerial applications
- More work is still needed and planned in the coming months
- Caution – most pesticide labels prohibit use of low volume aerial applications – ALWAYS READ AND FOLLOW LABEL INSTRUCTIONS

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