

Low Volume Sprays for control of Asian citrus psyllid

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Low volume spraying-broad use on the horizon

Problem:

- Psyllid management requires multiple seasonal treatments, which is expensive
- Psyllid movement requires coordinated treatments
- Low volume spray technology represents a potential cost effective alternative to conventional dilute sprays



Objective: Gather efficacy data on low volume sprays so that we can make this use pattern legal

- LABEL CHANGES ARE IN PROGRESS

Psyllid movement impacts effectiveness of control practices

- During spring and summer, when psyllid populations peak, foliar applications of insecticides against the psyllid are effective for only 2-3 weeks

• Why?

- Psyllids quickly re-colonize groves from surrounding habitats
- LV technology can help work against this psyllid movement because large areas can be treated rapidly and spot treatments are easier

How have we measured psyllid movement?

- We adopted a protein marking technique
- Psyllids are marked in various locations by spraying with egg, milk, or soy protein solutions
- Psyllids marked in the field are re-captured on traps
- Enzyme-linked Immunosorbant Assay (ELISA) is used to identify previously marked psyllids and determine where they came from and how far they moved



Egg
protein

Marking psyllids



Egg protein



Identifying marked
and re-captured
psyllids in the lab
by ELISA method

Impact of abandoned groves on managed groves

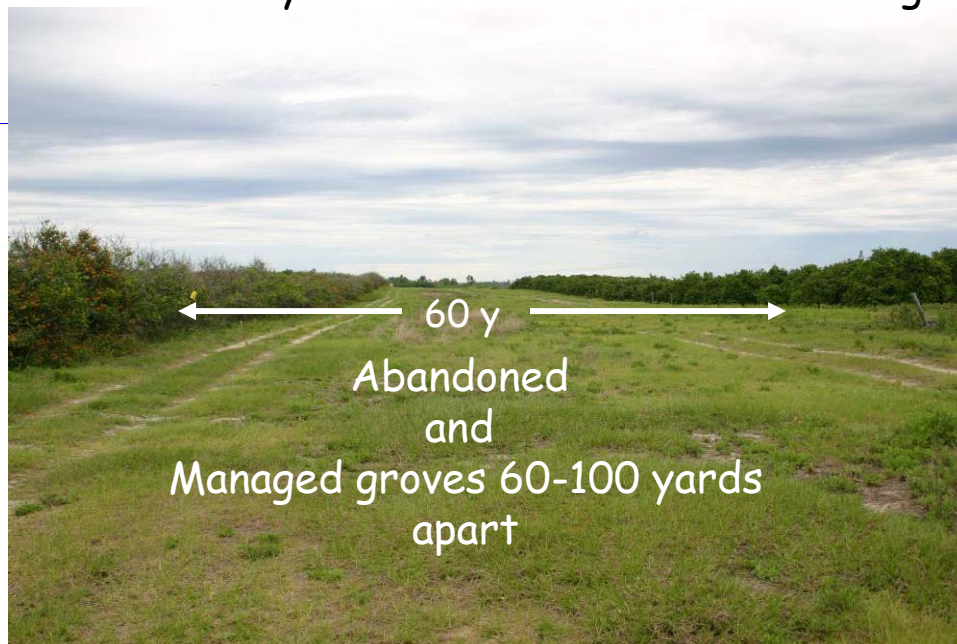
Abandoned Grove
marked with Protein 1

Managed Grove
marked with Protein 2

Abandoned



Psyllids recaptured on traps within each grove
are tested by ELISA to determine their origin



Managed



Results suggest that direction of psyllid movement
is from abandoned to nearby managed groves

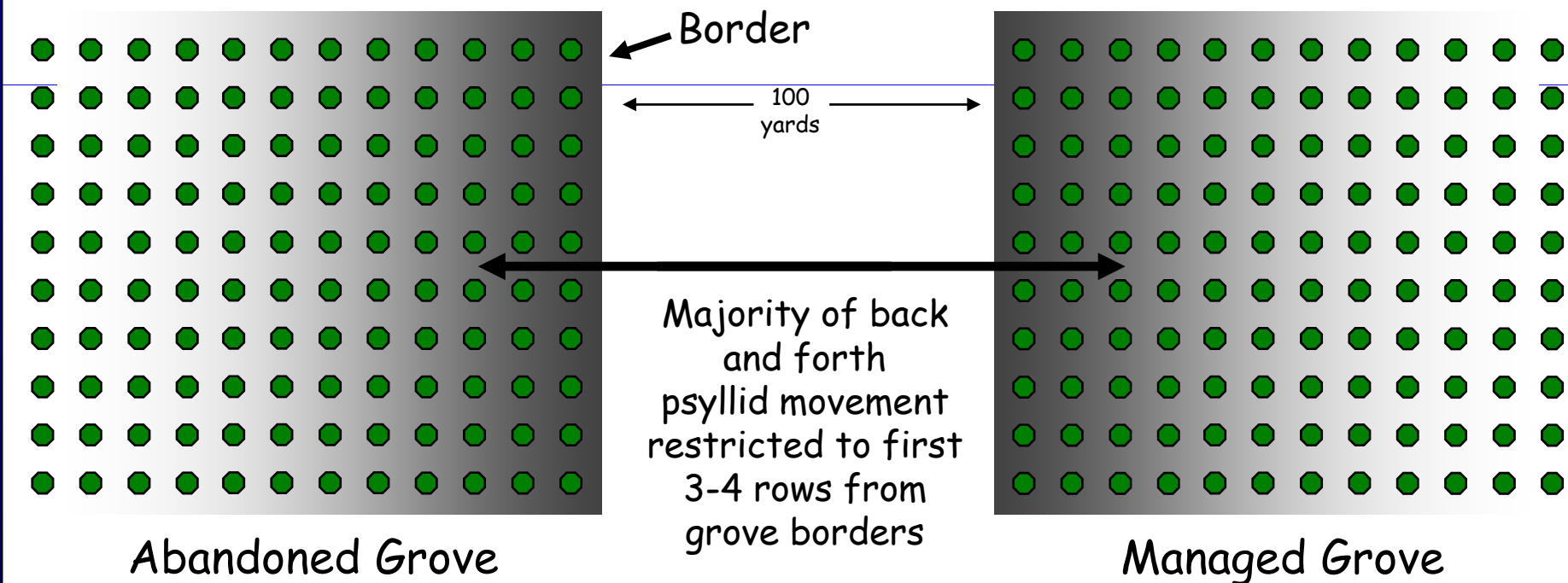
The Border Effect

Average number of psyllids / sticky trap per week



0-5/
trap 5/
trap 15/
trap 30/
trap

30/
trap 15/
trap 1/
trap 0/
trap



Psyllid movement impacts our ability to manage

- Movement is biased in the direction from abandoned into managed groves
- Psyllids are capable of moving back and forth between 2 groves separated by 100 yards within 2 days
- Psyllids move even when there is abundant flush (food/egg laying sites) available
- Most psyllids moving between groves are found in the first 3-4 rows of trees from the plot borders
- Low volume technology is fast and agile and can help with supplemental border sprays and large scale coordinated treatments

Laboratory investigations of LV technology for psyllid control

Objective:

- Determine the effects of spray droplet size and deposit distribution patterns on the efficacy of psyllid control.
- Determine effects of spray wind speed on psyllid behavior

Practical application of this research:

Optimize spray droplet size for best psyllid control



Collaboration
with M. Salyani,
UF-CREC

Laboratory droplet generator and wind tunnel which mimic field applications of various droplet sizes to psyllid-infested citrus



Piezo-electric sprayer

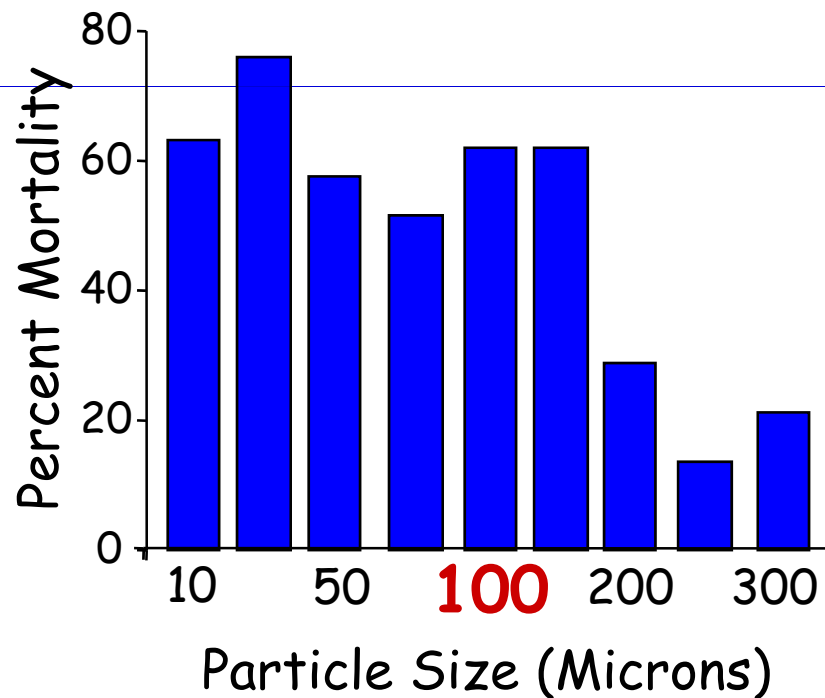
Target plant on moving
conveyer belt

Wind tunnel

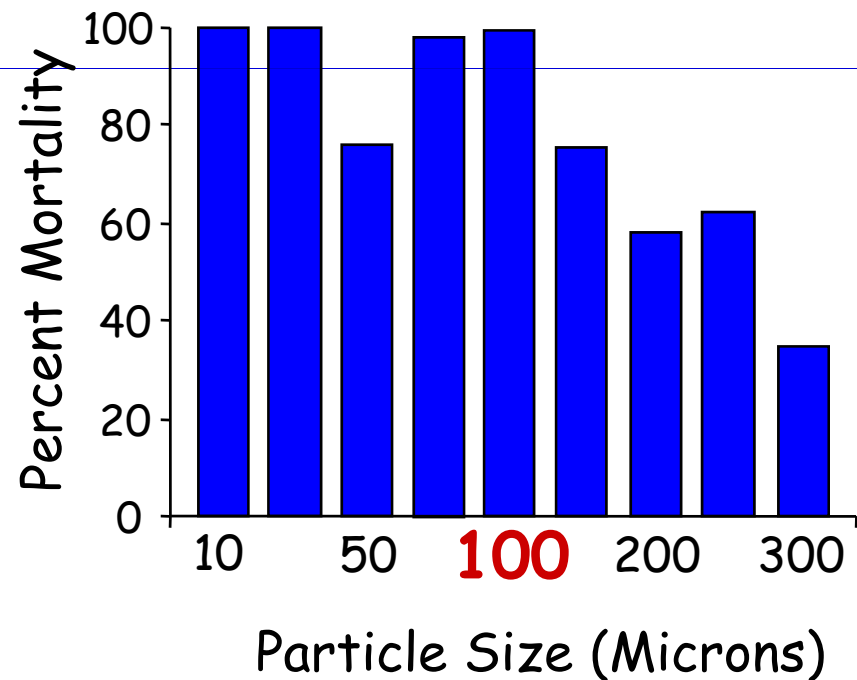


Higher psyllid mortality is obtained with smaller spray droplet size using pyrethroid and OP insecticides in laboratory experiments

Spray droplet size ↓ Psyllid mortality ↑

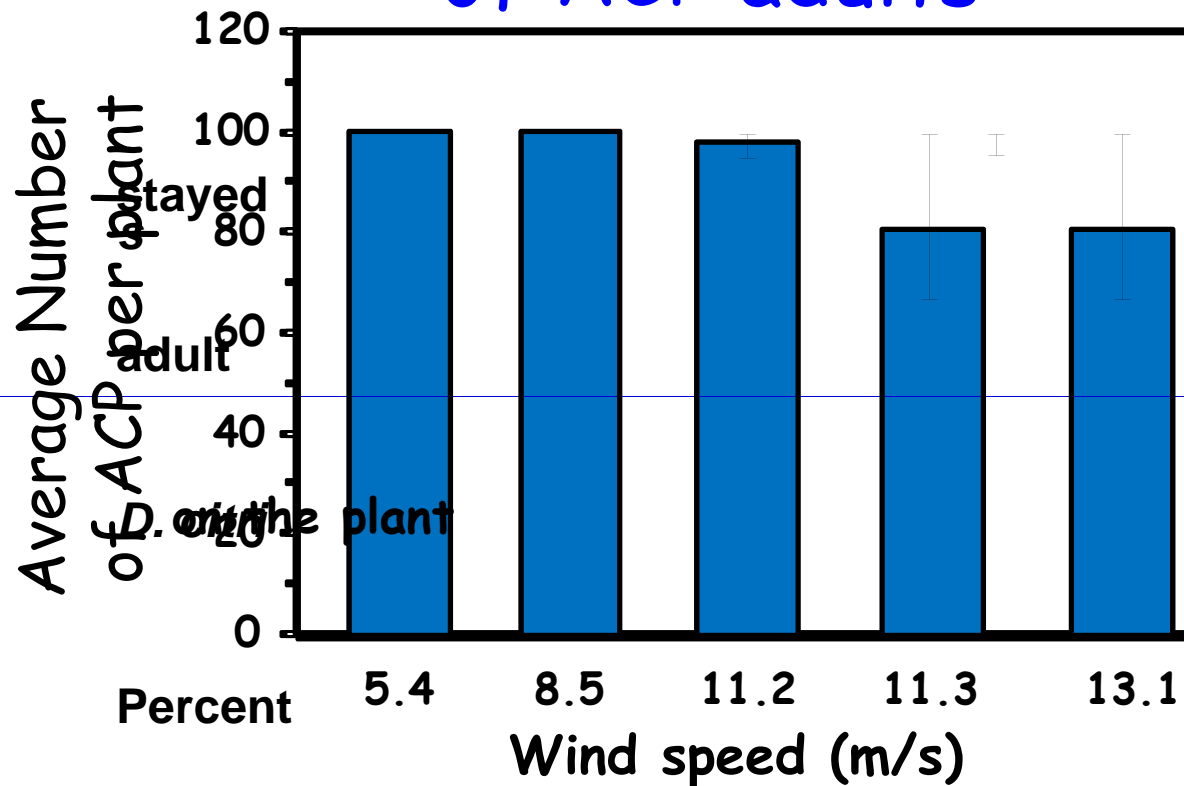


3 Days after spray



7 Days after spray

Effect of wind speed on the flight activity of ACP adults



Low Volume

Airblast/
speed sprayer

Slightly fewer psyllids fly away at lower wind application velocities

Which technology works best?

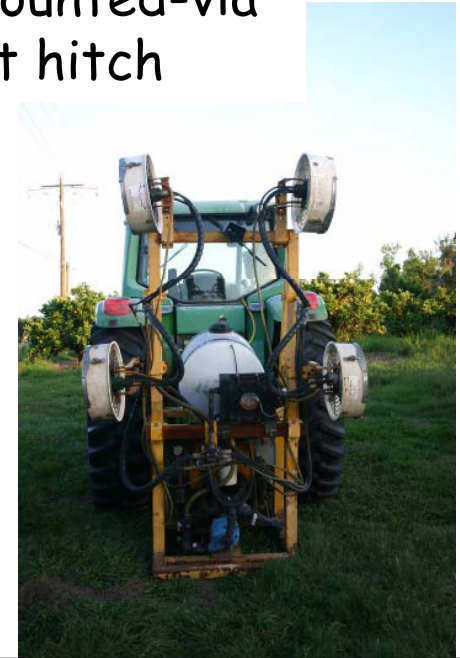
1. Truck-mounted devices



2. Mist-blower— Standard tractor mount



3. Proptec sprayer— Tractor mounted-via 3-point hitch



What happens with a low volume dormant spray?

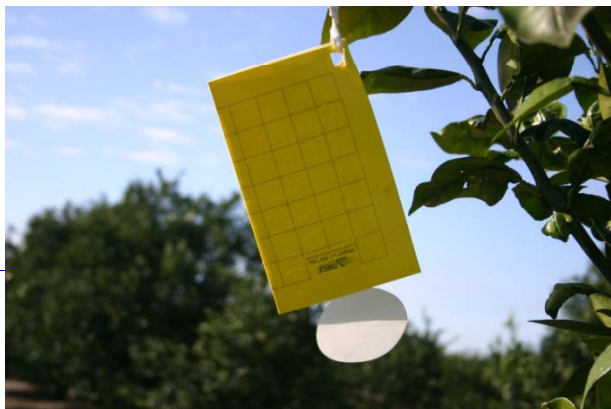


Treatments compared:

- 1) LV at 1 pt / acre (no carrier)
- 2) LV at at 2 gallons water / acre
- 3) Mist blower with Micronait nozzles at 2 GPA
- 4) Standard airblast at 100 GPA
- 5) Untreated control

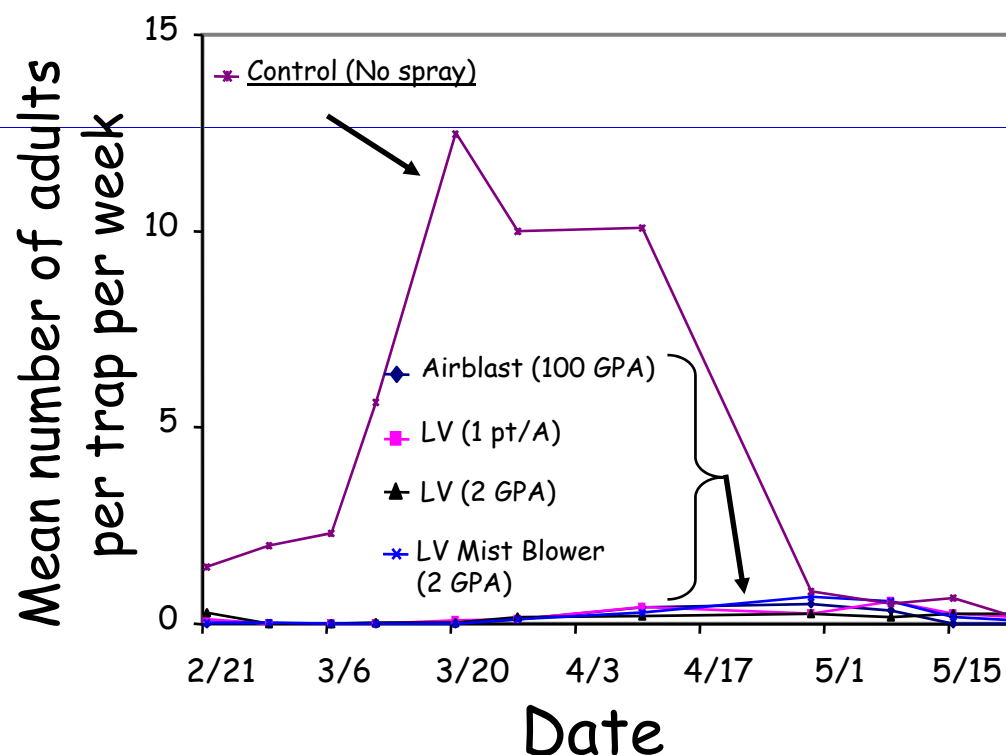
Pyrethroid insecticide was applied

Efficacy of various application technologies using pyrethroid insecticide: Application made during dormant period on February 15-16th



With dormant spray can get many weeks of effective control into the spring flush

← Captures on sticky traps

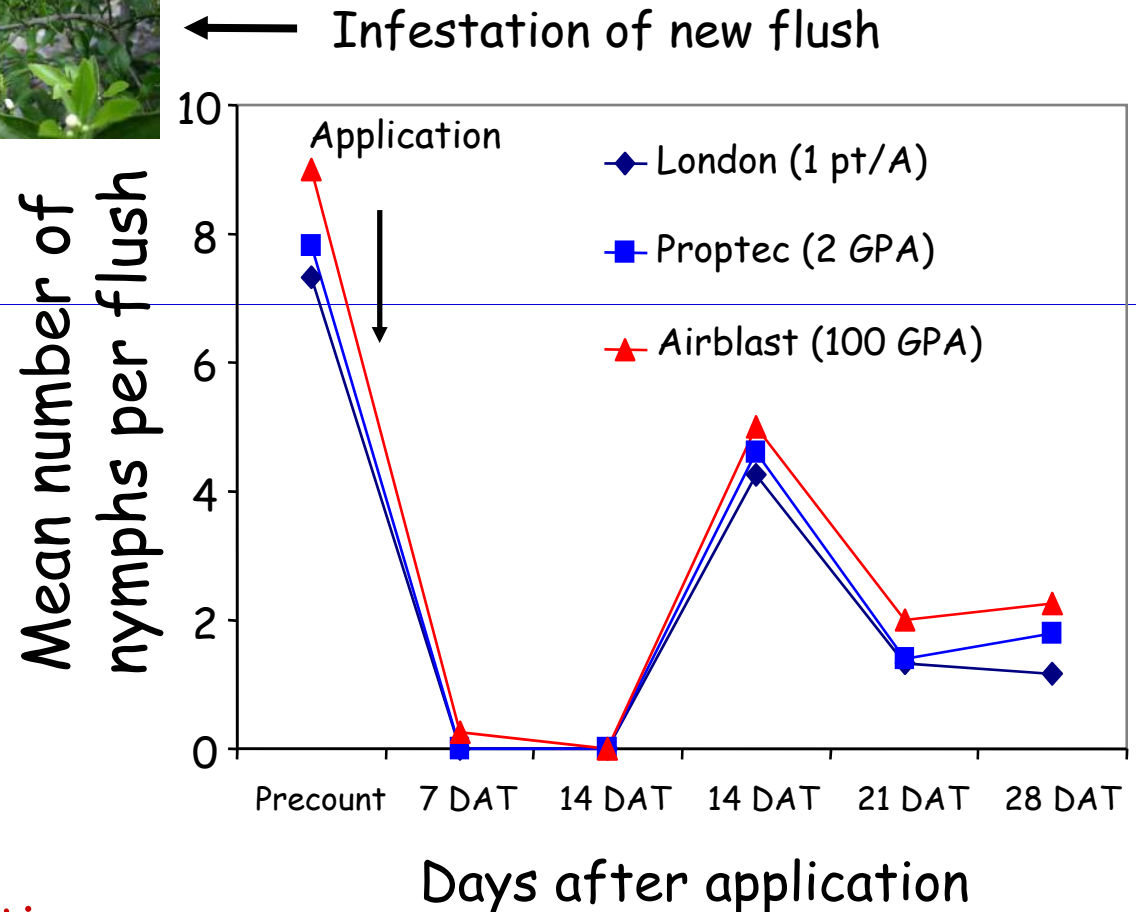


Bottom Line—All current machines available work

But, you only get two weeks of efficacy if the application is made after main spring flush (April)



- Populations may build up too high if large area is not treated effectively before major flush
- Coordinated large scale treatment is best option no matter what technology is used
- Psyllid movement leads to rapid re-colonization of unprotected new flush if nearby psyllid populations exist



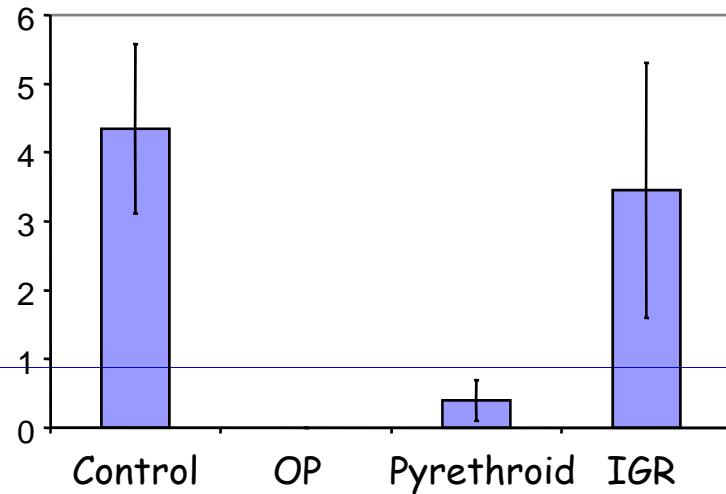
Effect of insecticide mode of action on control efficacy using Low volume applicator

Treatments compared:

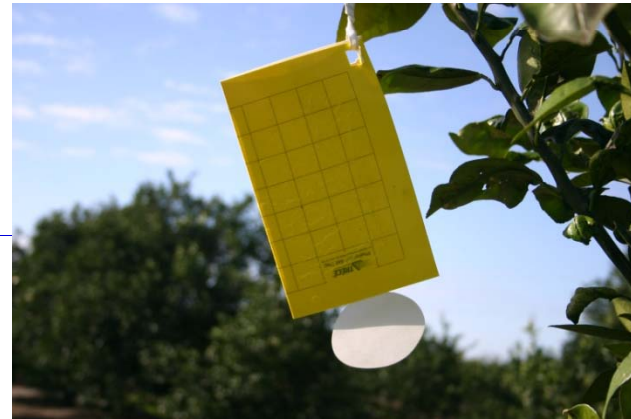
- 1) Pyrethroid, (Danitol, Mustang)
- 2) Organophosphate (Dimethoate, Malathion),
- 3) Insect growth regulator (Micromite),
- 4) Untreated control

Comparison of various modes of action applied by low volume

Mean number of adults per trap per 2 weeks



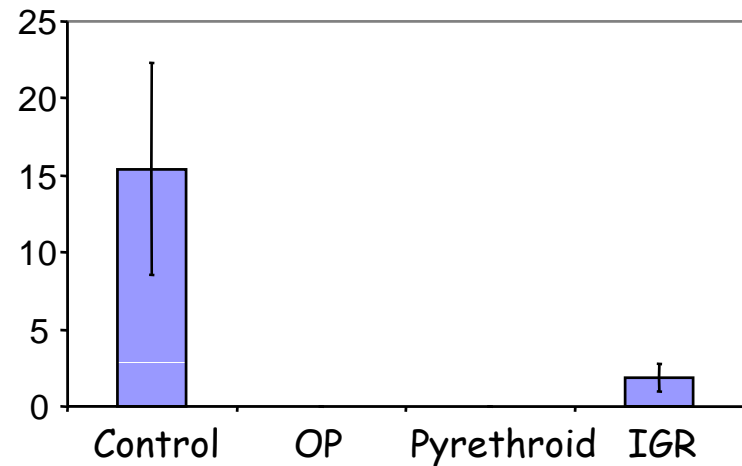
← Captures on sticky traps



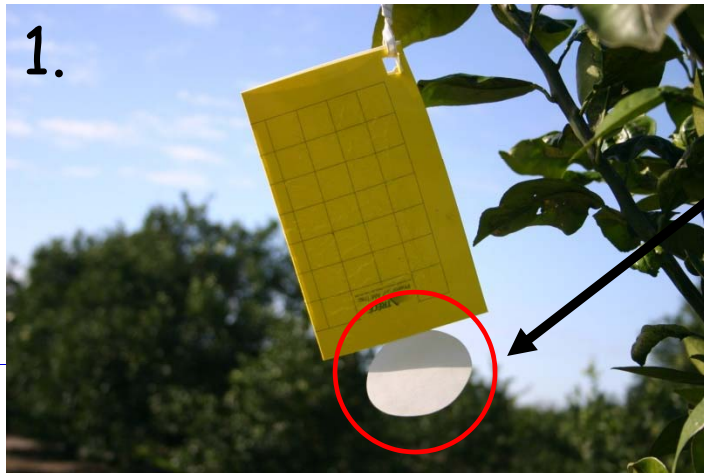
Infestation of new flush →



Mean number of nymphs per flush



How do pesticide residues compare between standard airblast and low volume applications?



Pesticide residue targets placed in the field prior to application of treatments

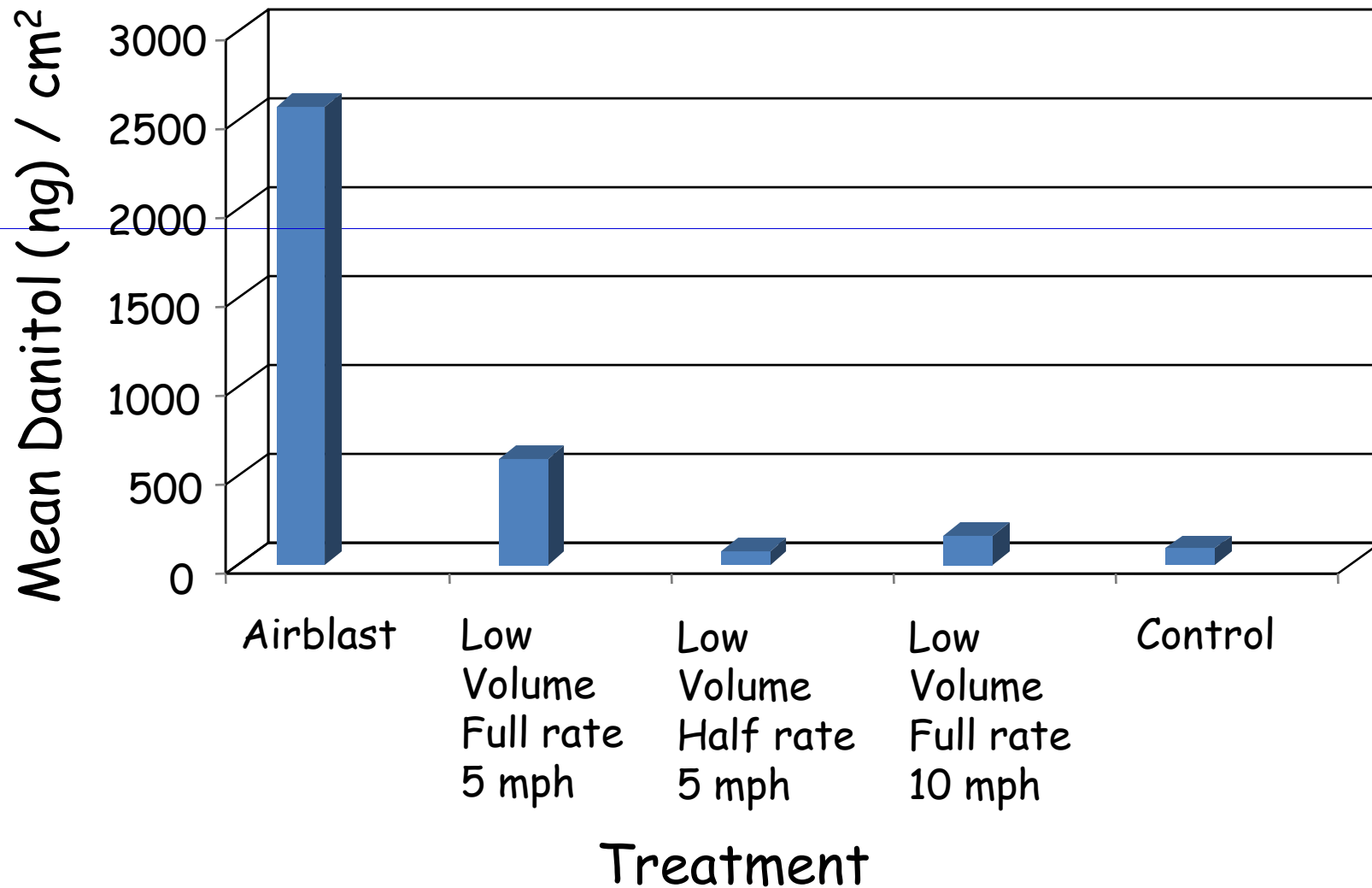


Residue cards collected
12-24 h after application



Pesticide residue analysis
conducted using Box tax funded
Gas Chromatograph

Residue analyses following airblast versus low volume sprays

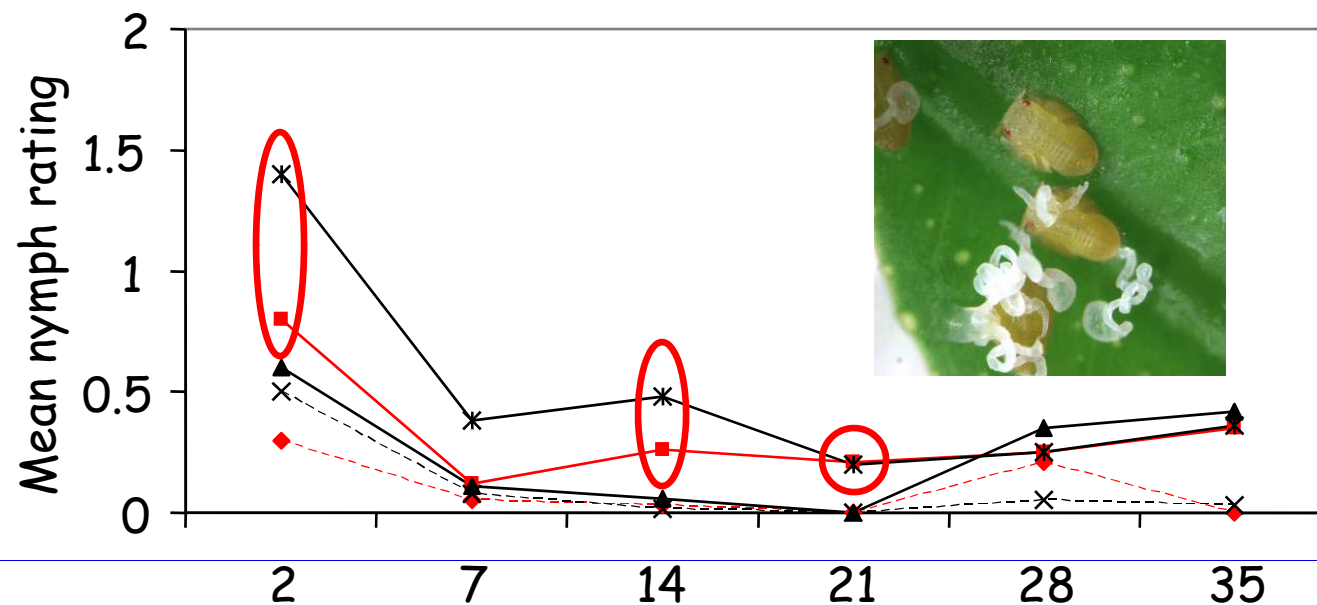


Can you spray every other row and still maintain efficacy with Low Volume sprays?

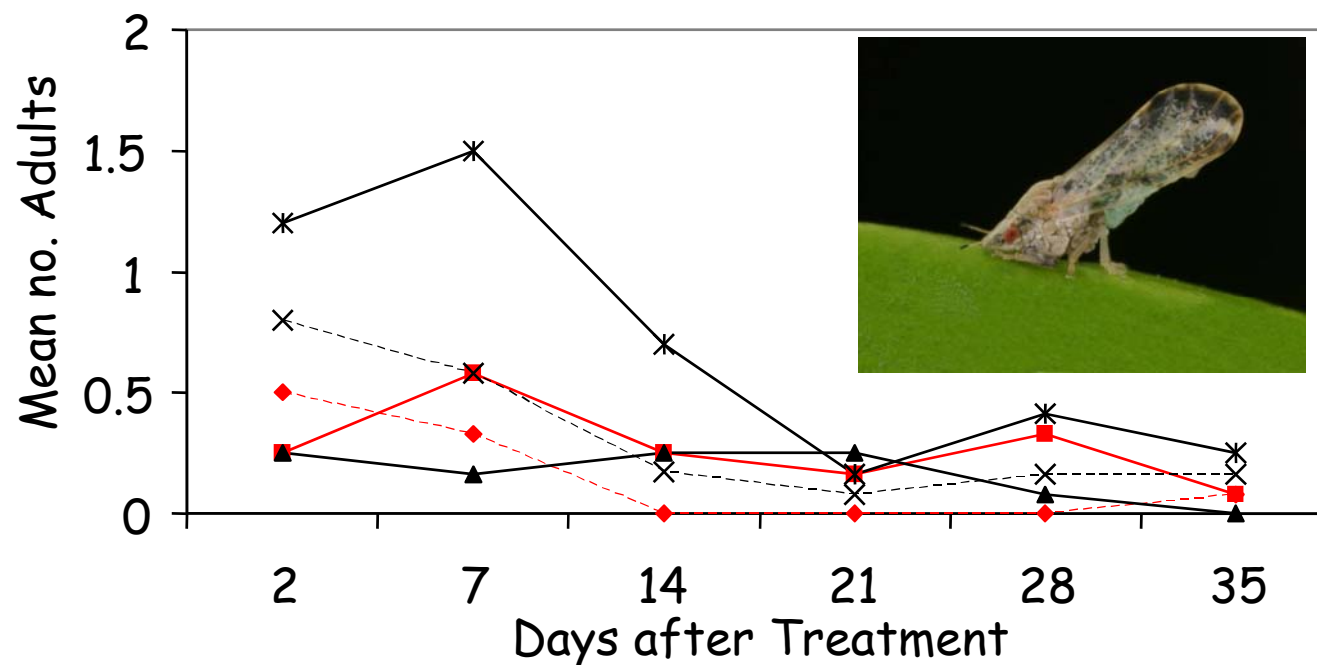
Treatments compared:

- 1) Low volume at 2 gal/acre every other row
- 2) Low volume at 2 gal/acre every row
- 3) Mist blower with Micronair nozzles at 2 GPA every row
- 4) Standard airblast at 100 gal/acre
- 5) Untreated control

Neonicotinoid insecticide was applied
--to mature trees



- ◆ Airblast 100 gal
- Low volume 2 gal, every other row
- ▲ Low volume 2 gal, every row
- ✖ Mist Blower 2 gal, every row



✖ Control

Efficacy was lower when spraying every other row- needs more testing

Products Found to Be Effective with LV Technology so far:

- Dibrom Micromite *(nymph activity only)
 - Malathion Portal *(nymph activity only)
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- Dimethoate
 - Provado 1.6 F
 - Mustang
 - Danitol
 - Delegate



What's legal Right Now?

- Dimethoate
 - Sevin XLR Plus
-
- Malathion 5 (at least 3 gallons/acre)
 - Agri-Mek (Potentially, but waiting on formal confirmation from EPA)

What's becoming available?

- Danitol-Label has been technically approved
- Dibrom-registrant led, in process
- Mustang-Has been reviewed, small issue still remains, which should be resolved shortly
- Delegate-IR-4 led
- Micromite-IR-4 led

Where are we going next?

- We continue to test new products
- Optimizing use of existing products
- Investigating effects on other pests—mites, CLM
- Effect of oil-only sprays
- Going to develop a weather-based model tool so that you can spray at optimal conditions to minimize drift



What should we be calling this technology?

We need to develop appropriate terminology because the term "fogging" is a four-letter word with respect to drift in the eyes of regulatory agencies

Fog = 10-50 micron = Substantial
particle size drift

Low volume = 100 micron = Less
psyllid average drift
sprays particle size

Advantages and Disadvantages

Advantages:

- It's agile
- It's fast—250 acres per night with one unit
- It can reduce cost per acre

Disadvantages:

- Wind a problem-night time spraying
- Regulations regarding drift will likely require large buffers

Conclusions on Low Volume Applications:

Controlling psyllids on a larger area combined with making a pre-flush dormant pesticide treatment is much more effective than treating a smaller area after flushing begins, irrespective of the ground spray technology used—Low volume same as high volume

Aerial low volume sprays are under investigation



Conclusions on Low Volume Applications:

- LV technology will be an important additional tool for psyllid management given the cost savings and the possibility of quickly and efficiently spot treating problem areas such as grove borders
- Effective psyllid management must take psyllid movement into consideration
- Abandoned groves serve as a source of psyllid re-infestation, so LV technology could be useful in groves bordering abandoned plots

Conclusions on Low Volume Applications:

- Low volume applications for psyllid control are as effective as standard airblast
 - Several insecticides are currently available for this use pattern and several more will be available soon
-
- Must follow label guidelines
 - No differences found between available low volume machines to date
 - Pesticide residues lower with LV application than airblast
 - Applying every other row with LV may be less effective than every row application-coverage issue

Acknowledgements:

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2008



2009

