PREDATOR & PARASITE IPM ON ALFALFA LEAFCUTTING BEE BROOD

Doug Walsh, Professor of Entomology
Washington State University

Objectives

- 1. Identify the predators and parasitoids captured in research ALCB binder boards.
- 2: Investigate alternatives to DDVP-based kill strips in the incubator.
- 3: Investigate how in-season insecticide/ pesticide use in individual grower fields impacts rates of parasitism and predation of ALCB in storage and incubation.

Objective 1

- In spring 2025 we collected bee 2nd year bee boards from 6 alfalfa seed growers. In total we received 7 bee boards.
- Four were battle scarred old wood boards.
- Three were Styrofoam boards that had been direct purchased the prior spring from Canada.
- Each board was cut in half in our wood shop by belt saw.
- Subsequently the boards were placed in isolation cages in the Stary Insect Rearing Room Facility located at WSU IAREC. Temperatures were held constant at 30° C (86° F). The isolation cages were monitored weekly for the next 6 weeks.

Objective 1

- A myriad of various arthropods emerged from the bee boards.
- At the end of 6 weeks we banged on the boards to see what was still left in the boards.
- Multiple types of beetles emerged.
- These included Cadelles and Tenebrionids.
- We expected to recover Cleridae and Trogoderma, but we did not.
- In two of the wooden boards we collected Indian meal moths.
- In two of the wooden boards we collected numerous Pteromalids.
- We did not attempt to identify them any further

Results:

- Objective 2. We were never able to complete this objective.

- Objective 3. There did not appear to be much difference among boards received from various growers.
- Overall, the Styrofoam boards had fewer pests and parasites then the wood boards.

LYGUS (AND SPIDER MITE) CONTROL STUDIES ON ALFALFA PRODUCED FOR SEED

Doug Walsh, Professor of Entomology

Washington State University

Pest and Pollinator Management Strategic Plan for Alfalfa Seed Production in the Western U.S.

Summary of a workshop held on
January 30-31, 2017
Las Vegas, NV
Issued March 31, 2017

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USDA

This project was funded in part by the USDA National Institute of Food and Agriculture, through the Western Integrated Pest Management Center.

Western IPM Center

Thirty nine alfalfa seed growers from across the Western US provided input and prioritized their research, education, and regulatory needs.

Washington State Managed Pollinator Plan for Alfalfa Seed Production

Doug Walsh, Erik Johansen, and Sally O'Neal

WASHINGTON STATE UNIVERSITY

WSDA

A Standard Spray Program in WA Alfalfa Seed Production

- **<u>Pre-Bloom,</u> 1. dimethoate, 2. chlorpyrifos, 3. chlorpyrifos and bifenthrin, 4. lambda-cyhalothrn, 5. sulfoxaflor.**
- **Unofficial cutoff is May 31**
- **<u>Bloom-</u> Historically naled. Now flonicamid and afidopyropen in WA. Sulfoxaflor late in bloom.**
- **<u>Late-Bloom-</u> Historically propargite for mite control. Recent increases in abamectin, bifenazate and fenpyroximate.**
- **<u>Post Bloom-</u> Typically lamda-cyhalothrin, bifenthrin, or acephate.**

Lygus hesperus
The true key pest

- "Native" hemipteran
- 5 nymphal instars
- Direct pest
- Documented history of insecticide tolerance

1.5 Alfalfa seed damaged by lygus bug photographed 2 weeks after the lygus fed.

1.1 The alfalfa stem at the left is a normal growing one. The stem at the right is damaged by lygus bug.

In 2025 we conducted 2 Lygus insecticide efficacy studies

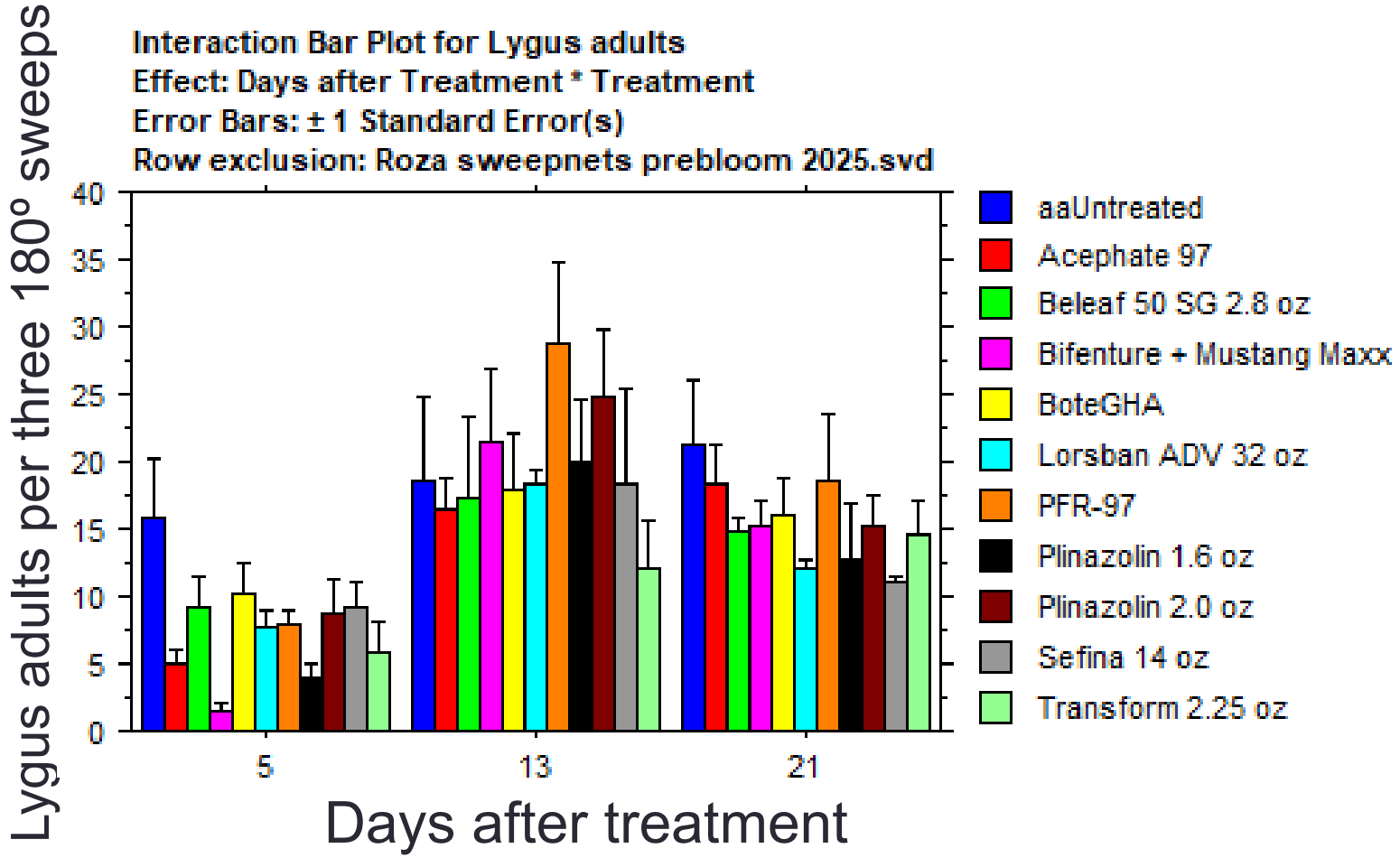
- Complete Random Block Design
- 4 Replicates
- 15 Gallons per acre
- $C0_2$ Backpack Sprayer
- 18x36 ft. plots

Prebloom sprays 2025

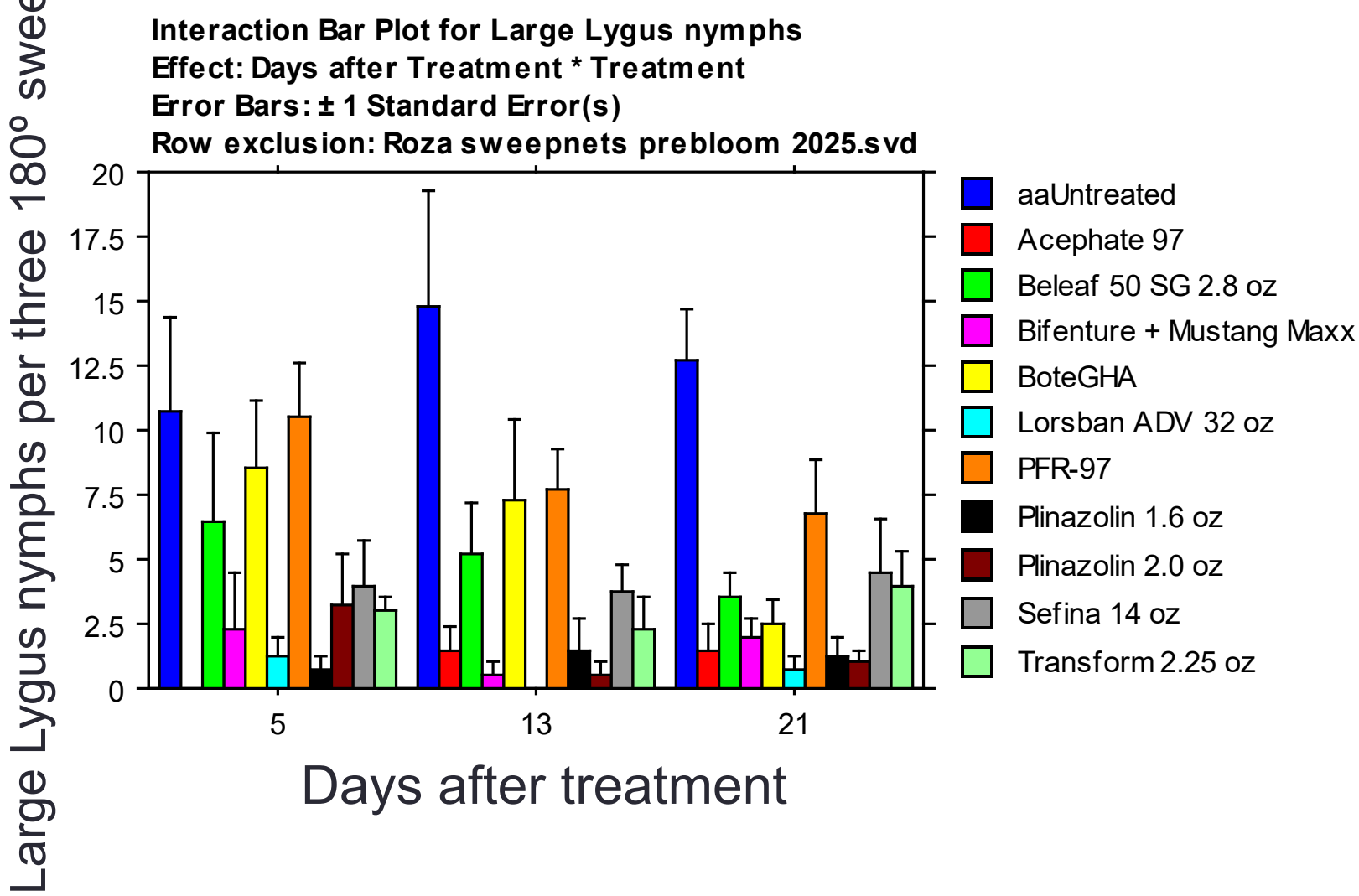
Table 1 The trade name, active ingredient, rate per acre, and plot numbers of plots treated with insecticides on 5/28/2025

#	Trade name	active Ingredient	rate		plot #s
1	Untreated Control				103, 211, 301, 406
2	Beleaf 50 SG	flonicamid	2.8	oz/acre	111, 202, 305, 405
3	Transform	sulfoxaflor	2.25	oz/acre	110, 205, 304, 402
4	BoteGHA	Beauveria bassiana	3	qt/acre	106, 203, 307, 404
5	Sefina	afidopyropen	14	Fl oz/acre	102, 206, 311, 410
6.	Bifenture +	bifenthrin	8.5	Fl oz/acre	105, 210, 308, 407
	Mustang Maxx	zeta-cypermethrin	8.0	Fl oz/acre	
7.	Plinazolin	isocycloseram	1.6	FL oz/acre	107, 201, 310, 403
8.	Plinazolin	isocycloseram	2.0	Fl oz/ acre	101, 209, 302, 409
9.	PFR-97 20% WDG	Beauveria bassiana	2	lbs /acre	109, 204, 306, 411
10.	Lorsban Advanced	Chlorpyrifos	32	Fl oz /acre	108, 207, 303, 408
11.	Acephate 97	acephate	1	lb /acre	104, 208, 309, 401

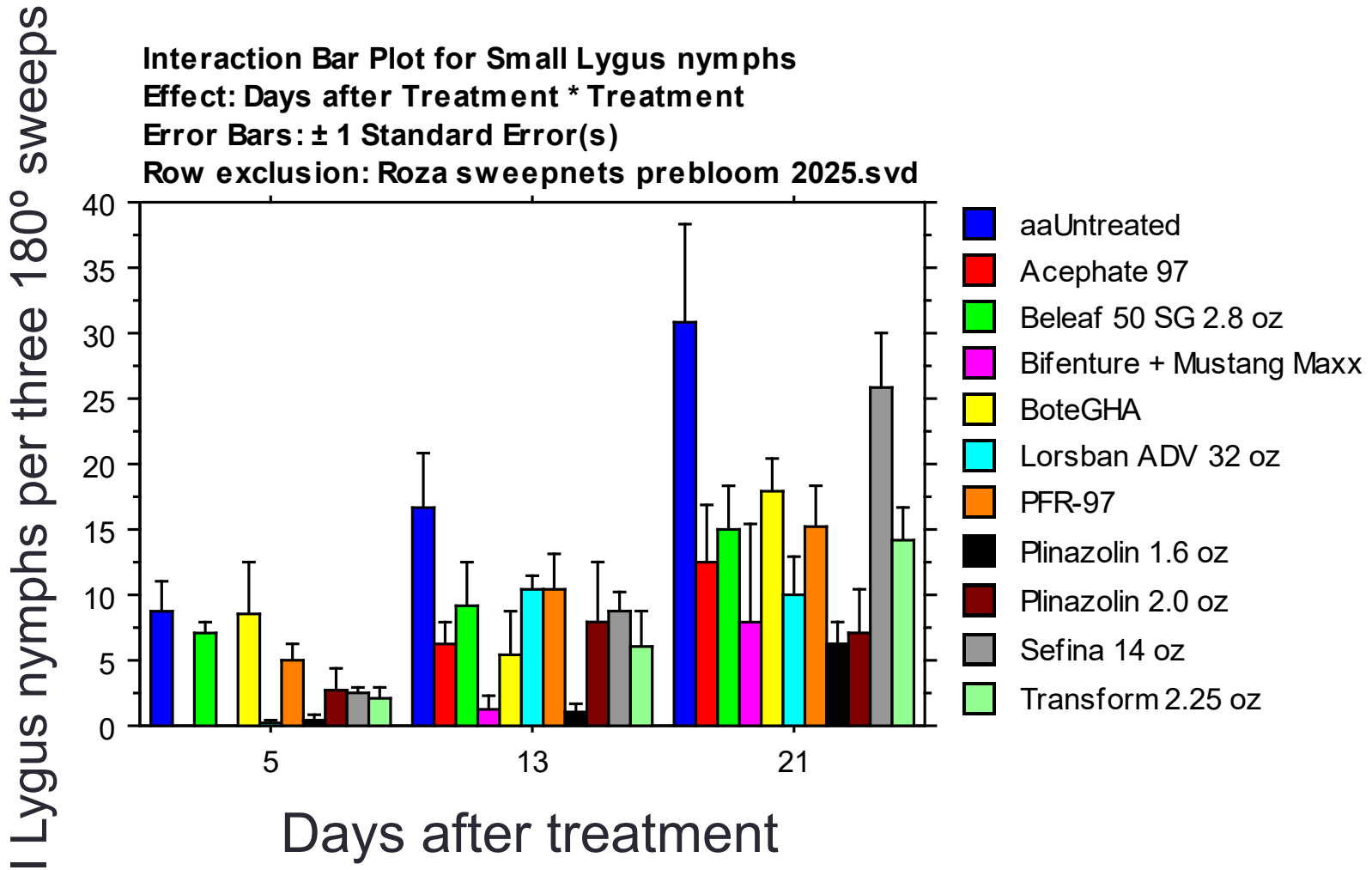
Prebloom sprays 2025



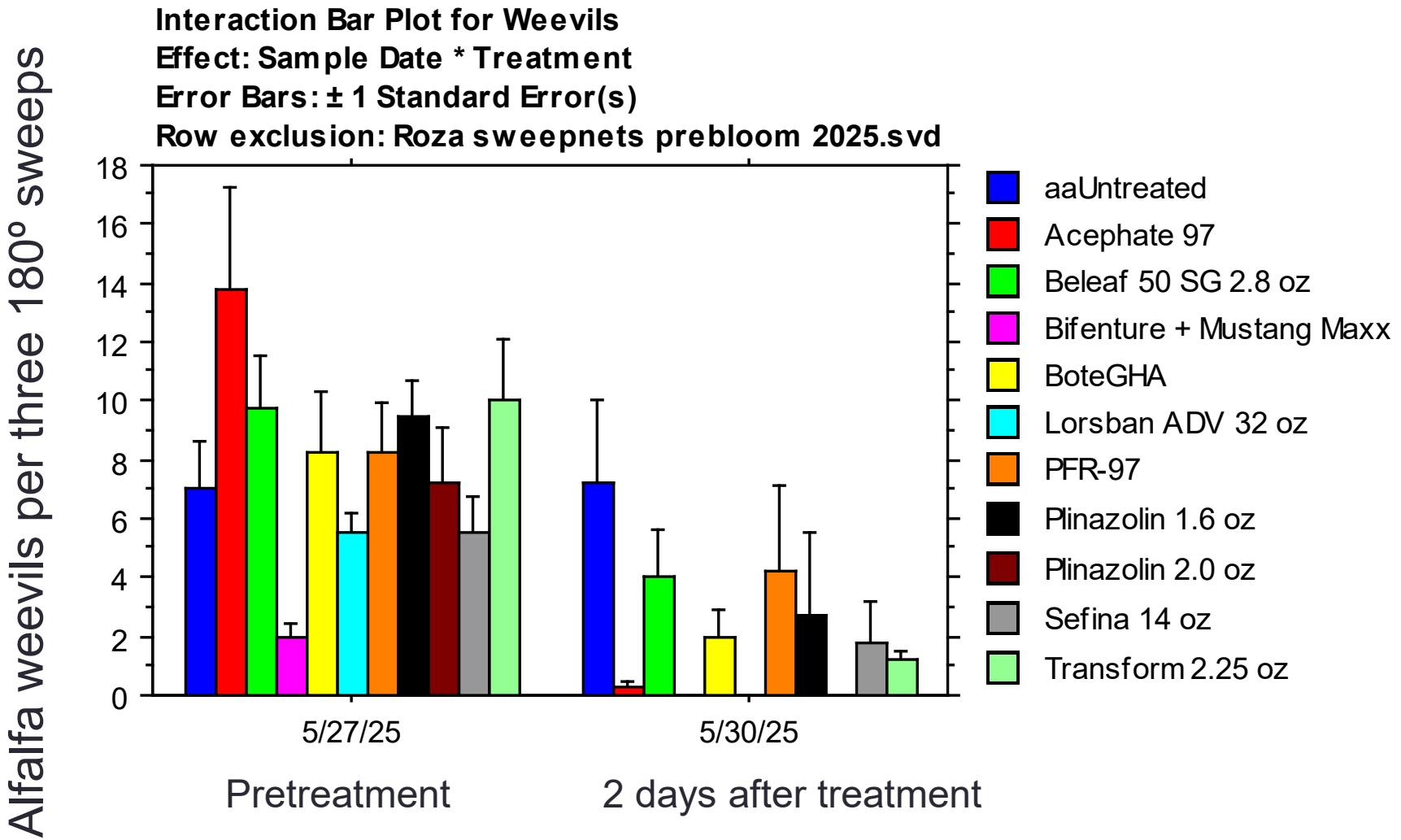
Prebloom sprays 2025



Prebloom sprays 2025



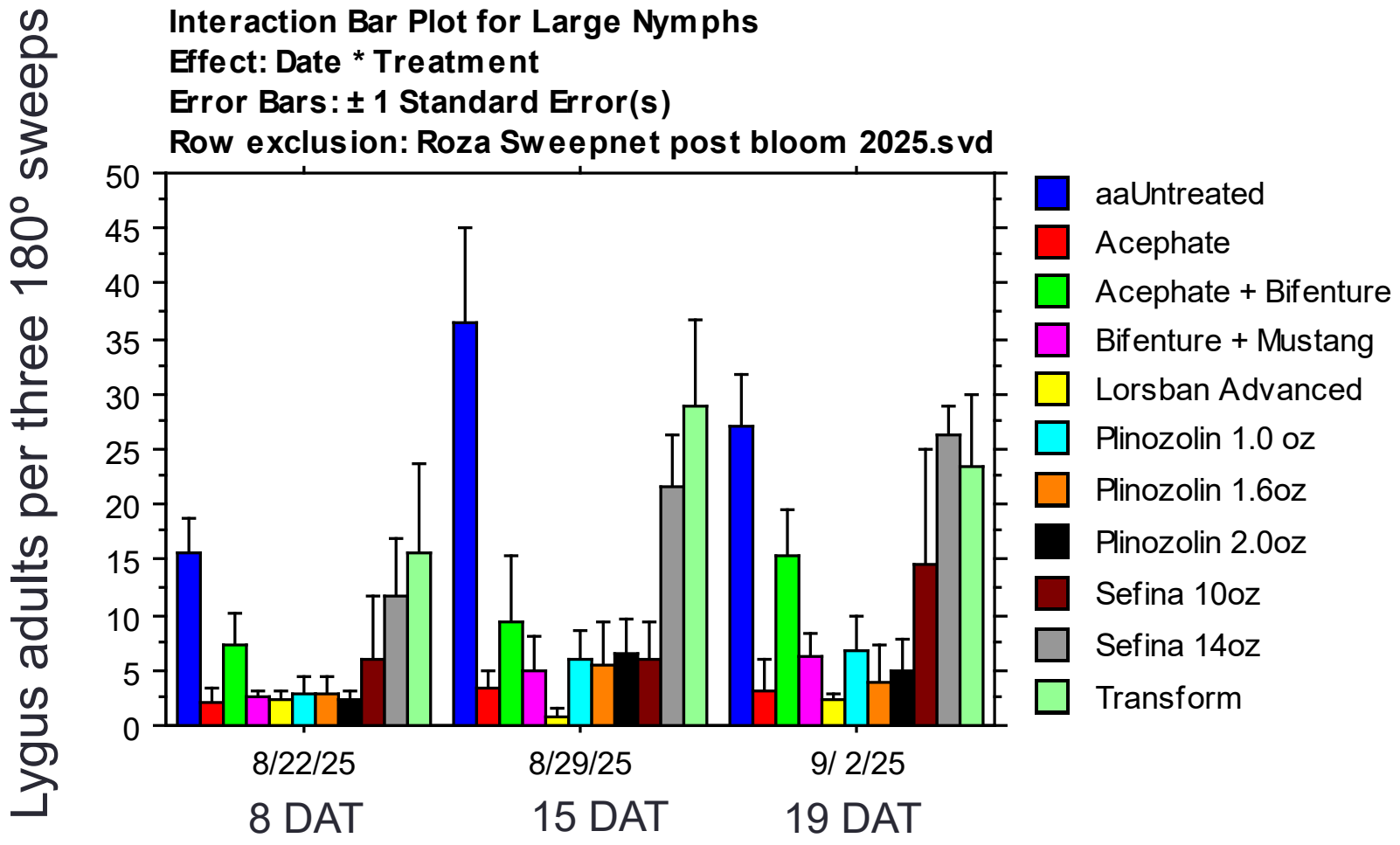
Prebloom sprays 2025

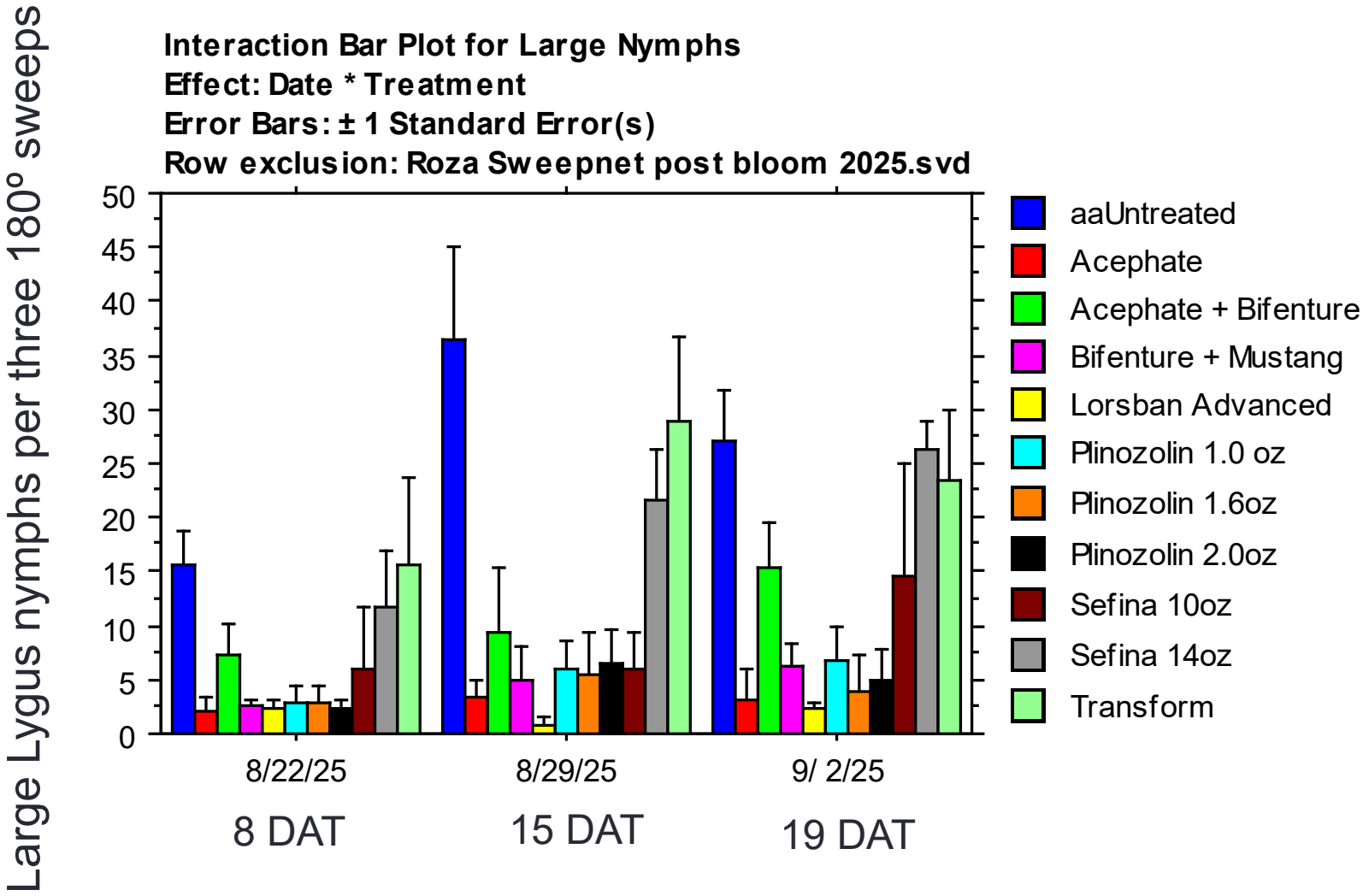


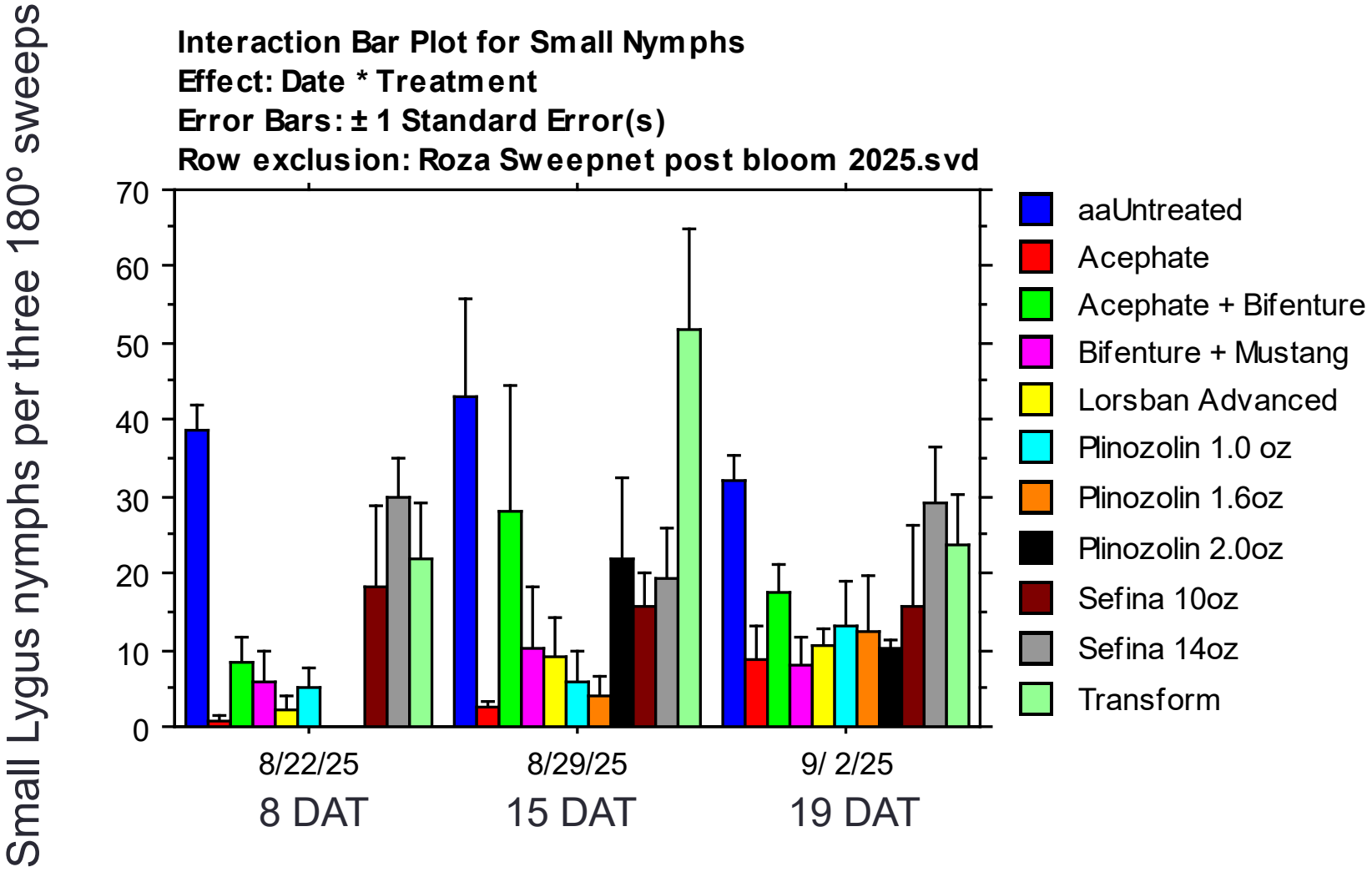
Post Bloom sprays 2025

Table 6. The Trade name, active ingredient, rate per acre, and plot numbers of alfalfa plots treated with insecticides on 8/14/2025

1. Untreated Control				106, 211, 301, 410
2. Acephate 97	acephate	1	lb/acre	110, 204, 310, 409
+ Bifenture	bifenthrin	8.5	fl oz/ acre	
3. Transform	sulfoxaflor	2.25	oz/acre	104, 202, 305, 406
4. Sefina	afidopyropen	10	Fl oz/acre	102, 203, 306, 408
5. Sefina	afidopyropen	14	Fl oz/acre	109, 210, 303, 405
6. Bifenture +	bifenthrin	8.5	Fl oz/acre	103, 206, 302, 411
Mustang Maxx	zeta-cypermethrin	8.0	Fl oz/acre	
7. Plinozolin	isocycloseram	1.0	FL oz/acre	101, 207, 311, 404
8. Plinozolin	isocycloseram	1.6	Fl oz/ acre	111, 208, 308, 403
9. Plinolzolin	Isocycloserum	2.0	Fl o//acre	108, 209, 307, 401
10. Lorsban Advanced	Chlorpyrifos	32	Fl oz /acre	107, 201, 309, 407
11. Acephate 97	acephate			


Interaction Bar Plot for Large Nymphs
Effect: Date * Treatment
Error Bars: ± 1 Standard Error(s)
Row exclusion: Roza Sweepnet post bloom 2025.svd
Lygus adults per three 180º sweeps
50
45
40
35
30
25
20
15
10
5
0
8/22/25
8/29/25
9/ 2/25
8 DAT
15 DAT
19 DAT
aaUntreated
Acephate
Acephate + Bifenture
Bifenture + Mustang
Lorsban Advanced
Plinozolin 1.0 oz
Plinozolin 1.6oz
Plinozolin 2.0oz
Sefina 10oz
Sefina 14oz
Transform


Interaction Bar Plot for Large Nymphs
Effect: Date * Treatment
Error Bars: ± 1 Standard Error(s)
Row exclusion: Roza Sweepnet post bloom 2025.svd
Large Lygus nymphs per three 180º sweeps
50
45
40
35
30
25
20
15
10
5
0
8/22/25
8/29/25
9/ 2/25
8 DAT
15 DAT
19 DAT
aaUntreated
Acephate
Acephate + Bifenture
Bifenture + Mustang
Lorsban Advanced
Plinozolin 1.0 oz
Plinozolin 1.6oz
Plinozolin 2.0oz
Sefina 10oz
Sefina 14oz
Transform


Interaction Bar Plot for Small Nymphs
Effect: Date * Treatment
Error Bars: ± 1 Standard Error(s)
Row exclusion: Roza Sweepnet post bloom 2025.svd
Small Lygus nymphs per three 180° sweeps
70
60
50
40
30
20
10
0
8/22/25
8 DAT
8/29/25
15 DAT
9/ 2/25
19 DAT
aaUntreated
Acephate
Acephate + Bifenture
Bifenture + Mustang
Lorsban Advanced
Plinozolin 1.0 oz
Plinozolin 1.6oz
Plinozolin 2.0oz
Sefina 10oz
Sefina 14oz
Transform

Baseline Data for Plinazolin- 2025

- Lygus bugs were collected with a canvas, heavy duty sweep net from a diversity of host plants including forage alfalfa, seed alfalfa, mustards and pigweed.
- The Lygus were then separated from the sweep net collection placed in a portable insect cage) with each cage holding only a single collected population from distinct fields.

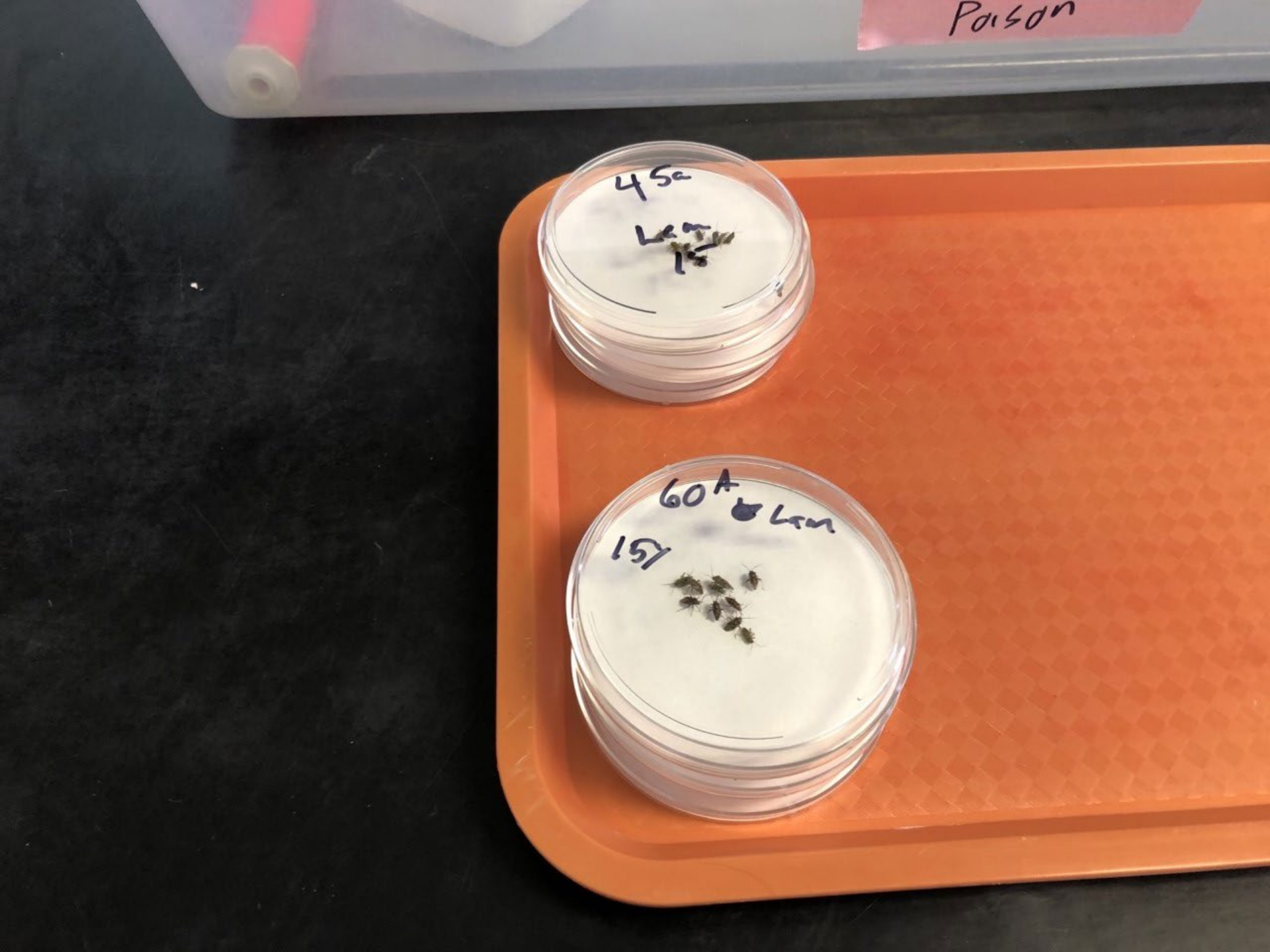
Doug Walsh, Washington State University, sweep-netting for Lygus bugs.

The next morning Lygus were sorted by population into cohorts of 10 individuals

Insecticide bioassays

- Adults of *L. hesperus* from each field location were exposed to extremely low concentrations of isocycloserum.
- The bioassays were completed using a Potter Precision Laboratory Spray Tower.
- 80 ul per 100 ml as our stock solution was equivalent to 2.0 oz per acre in 20 gallons of water

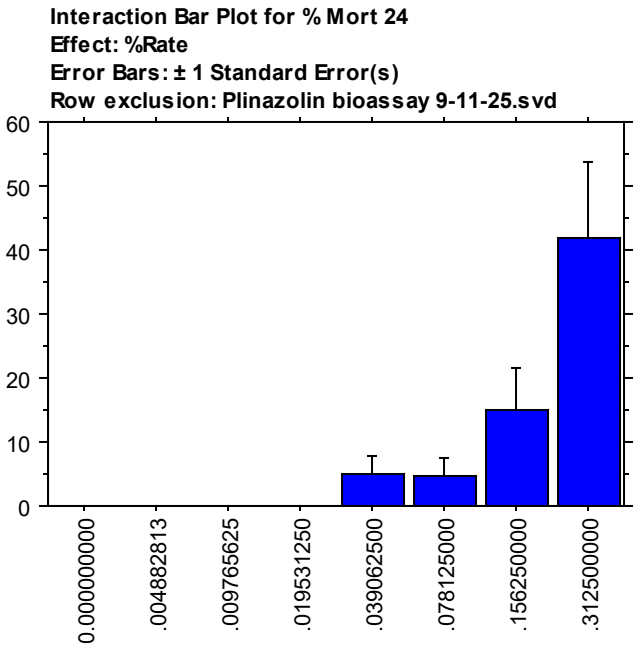

Safety gl ses
ailable in main
lab drawer #65.

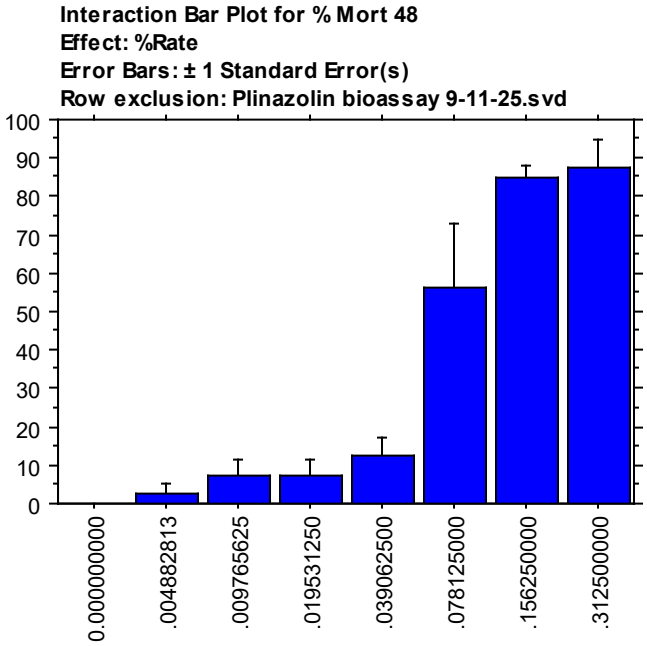

Poison
45a
60A
151

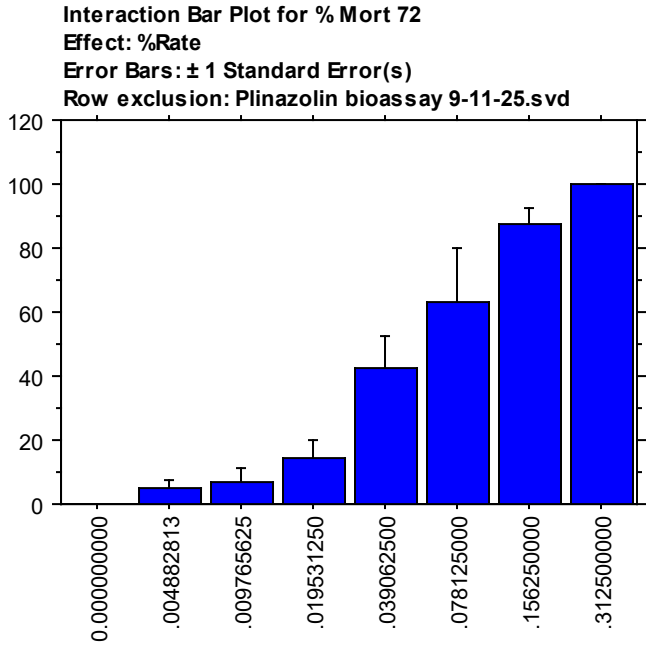
Methods

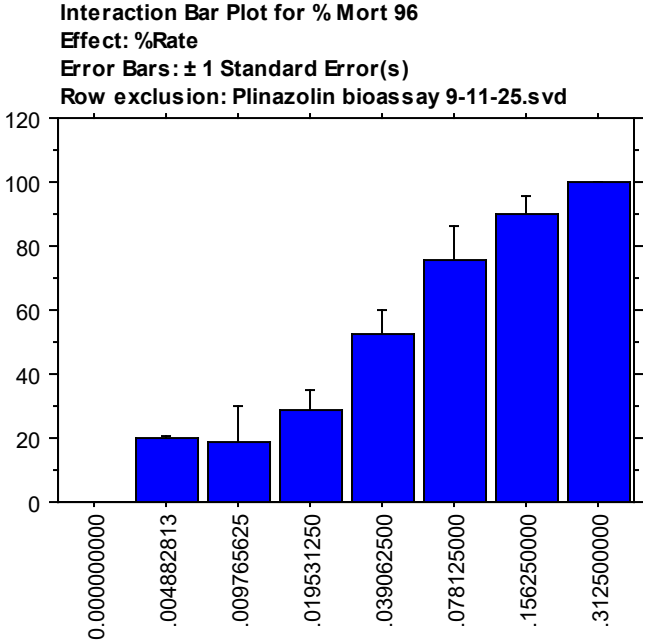
- Mortality was determined at 24, 48, 72, and 96 hours after treatment.
- Adults were considered dead if they were unable to move or there was no movement when prodded with a fine camel-hair brush.

- Polo Plus was used to calculate dose response curves, and LC50 & LC90 concentrations.









100% mortality at 0.3125% of the 2.0 fl oz per acre rate in 20 gpa at 72 hours after treatment.

That's 0.177 grams per acre

Outrageous

Three Field Populations Tested 2025

- On 24 June we collected 3 populations and treated them on 25 June.
- One of the populations were from a pigweed patch between Gardena and Lowden
- One of the populations were from an alfalfa seed field near Lowden
- One of the populations were from an alfalfa seed field near Gardena
- The dilutions tested on these populations were at 1%, 0.25%, 0.125%, 0.0625% and 0% water control, based on the initial 100% dilution of 80*ul* of Plinzolin in 100ml of water carrier. Finally, some decent mortality dose-response results were observed. See table 10.

Plinazolin efficacy against Lygus bugs in controlled laboratory bioassays

Lygus Population	Plinazolin % Field Rate	% Mortility at 24 hr ± SE	% Mortality at 48 hr ± SE
AS-W	0%	0.97± 0.74	10.98±4.17
AS-W	0.0625%	5.56± 5.56	25.10±5.34
AS-W	0.125%	30.00±10.80	38.86±8.78
AS-W	0.25%	12.27± 4.83	80.91±5.54
AS-W	1%	88.18± 4.61	100
AS-B	0%	0	5.00± 5.00
AS-B	0.0625%	7.27±2.43	21.36± 6.57
AS-B	0.125%	0	52.50± 4.79
AS-B	0.25%	3.33±3.33	80.00±11.55
AS-B	1%	96.67±3.33	100
Pigweed	0%	10.00± 5.77	33.64±6.63
Pigweed	0.0625%	12.05± 7.36	56.14±6.26
Pigweed	0.125%	11.46± 4.55	58.86±5.05
Pigweed	0.25%	32.28±10.19	95.00±5.00
Pigweed	1%	100	100

Plinazolin efficacy against Lygus bugs in controlled laboratory bioassays

- Mixed Alfalfa Timothy Hay plots at WSU IAREC

Lygus	Plinazolin	24 hour % Mortility	48 hour % Mortality
WSU IAREC	0%	8.90±3.72	22.16±6.12
WSU IAREC	0.03125%	11.52±5.14	19.27±1.20
WSU IAREC	0.0625%	5.00±2.89	25.36±2.70
WSU IAREC	0.125%	10.06±1.86	36.66±6.96
WSU IAREC	0.25%	10.10±5.89	43.57±8.35
WSU IAREC	0.5%	44.23±7.11	95.83±4.17
WSU IAREC	1.0%	88.64±8.60	100

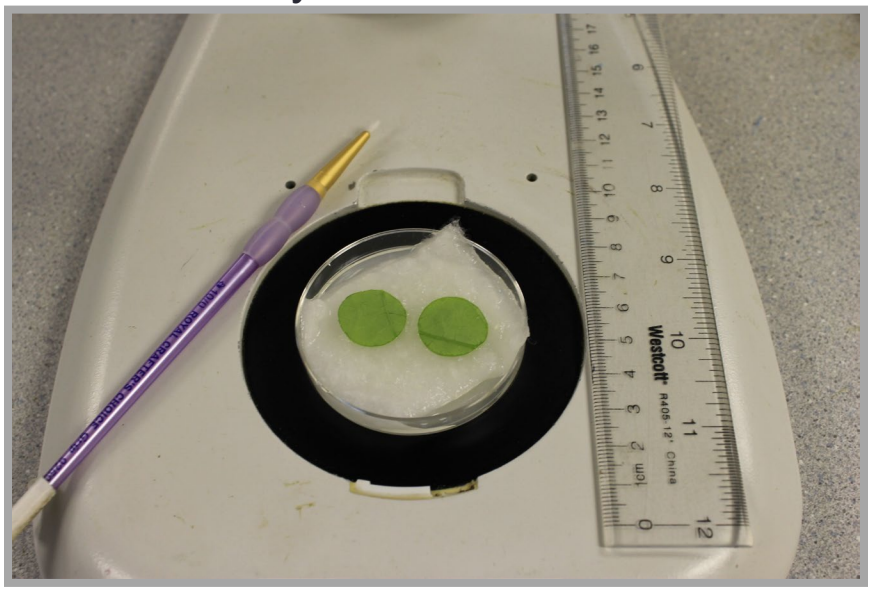
Finally we had a rate range at which were getting a dose response!

We completed probit analysis with PoloPlus

Population	LC_{50} (95% CI) ppb	LC_{90} (95% CI) ppb	Slope	X^2 (*df*)
Touchet Pigweed	198 (108-271)	746 (510-1820)	2.223±0.469	15.92 (14)
Lowden B Seed	405 (300-544)	1083 (741-2619)	2.995±0.503	18.27 (12)
Touchet W Seed	422 (423-496)	972 (745-1607)	3.54±0.649	11.80 (14)
Prosser Forage	641 (320-1020)	2379 (1489-7146)	2.25±0.342	73.33 (22)

- These results are detailed in parts per billion!
- Our stuck solution 80ul per 100 ml is equivalent to 2.0 fluid oz of Plinazolin per acre in 20 gallons of water.
- The proposed field rate of Plinazolin (isocycloseram) is 1.6 Fluid oz per acres.
- In 20 gallons of water per acre this is 2,784,000 ppb.
- Plinazolin is a very potent acaricide.
- This is outrageous!

Leaf Disc Bioassays with Plinazolin Fall 2025



Transferred ten adult female mites to leaf discs placed on top of soaked cotton

Exposed to 2 mL of varying concentration of Plinazolin.

Mites were held at 24C for 48 hrs, and evaluated for mortality

We learned we had to go to very low rates to get a dose response

Bioassays with Plinazolin on Spider Mites Fall 2025

Dose responses of adult female spider mites in parts per billion to exposure to Plinazolin 48 hours after treatment

Population	LC_{50} (95% CI) ppb	LC_{90} (95% CI) ppb	Slope	X^2 (*df*)
Lab Susceptible	120 (81-186)	690 (389-1805)	1.688±0.153	77.78 (10)
Lab Susceptible 2	660 (534-815)	1571 (1224-2300)	3.452±0.49	21.24 (10)
Hops Roy GH019	840 (644-1121)	2715 (1855-5206)	2.515±0.281	31.28 (10)
Hops (Blackstar)	488 (313-696)	2200 (1413-4741)	1.91±0.28	30.05 (10)
Mint Toppenish	322 (252-392)	885 (694-1293)	2.92±0.43	10.87 (10)
Mint Satus Longhouse	431 (340-545)	1654 (1231-2594)	2.22±0.29	13.65 (10)
Mint Hwy 22	414 (302-533)	1230 (905-2048)	2.71±0.38	22.54 (10)

The proposed field rate of Plinazolin (isocycloseram) is 1.6 Fluid oz per acres. In 20 gallons of water per acre this is 2,784,000 ppb. Plinazolin is a very potent acaricide.

Dose responses of spider mite eggs in parts per billion to exposure to Plinazolin

Population	LC_{50} (95% CI) ppb	LC_{90} (95% CI) ppb	Slope	X^2 (*df*)
Lab Susceptible	284 (226-345)	469 (375-871)	5.88±0.83	110.48 (22)

The proposed field rate of Plinazolin (isocycloserum) is 1.6 Fluid oz per acres. In 20 gallons of water per acre this is 278,400 ppb.

Plinazolin is a very potent acaricide.

Dose response of adult female mites placed on 5-day old residues of isocycloserum (Plinazolin) on leaf disks 48-hours after placement on the disks.

Population	LC_{50} (95% CI) ppb	LC_{90} (95% CI) ppb	Slope	X^2 (*df*)
Lab Susceptible	529 (403-674)	1476 (1092-2,407)	2.879±0.359	25.26

The proposed field rate of Plinazolin (isocycloseram) is 1.6 Fluid oz per acres. In 20 gallons of water per acre this is 2,784,000 ppb.

Mites sprayed directly

Dose responses of spider mite eggs in parts per billion to exposure to Plinazolin

Population	LC_{50} (95% CI) ppb	LC_{90} (95% CI) ppb	Slope	X^2 (*df*)
Lab Susceptible	284 (226-345)	469 (375-871)	5.88±0.83	110.48 (22)

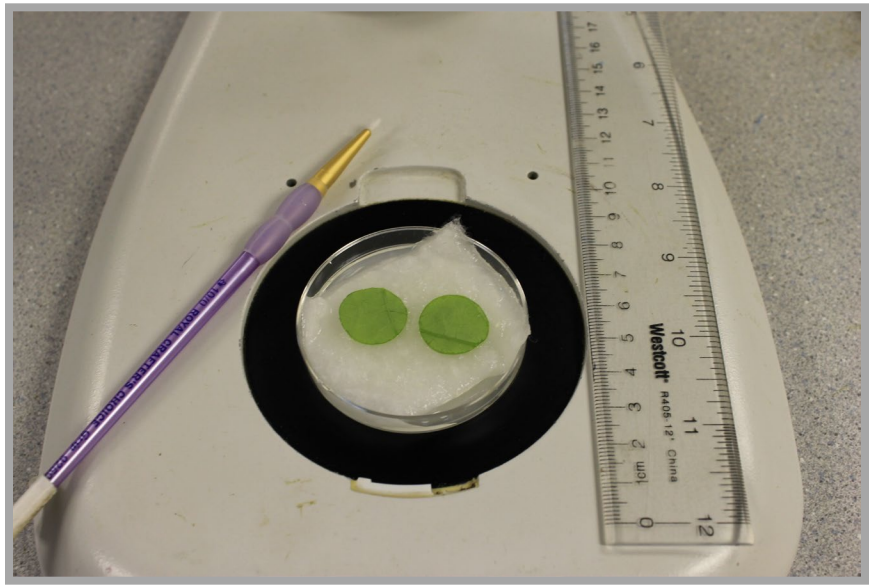
Mites placed on 5-day old residues

Dose response of adult female mites placed on 5-day old residues of isocycloserum (Plinazolin) on leaf disks 48-hours after placement on the disks.

Population	LC_{50} (95% CI) ppb	LC_{90} (95% CI) ppb	Slope	X^2 (*df*)
Lab Susceptible	529 (403-674)	1476 (1092-2,407)	2.879±0.359	25.26

The field rate will be 278,400 ppb.

Leaf Disc Bioassay with Plinazolin Fall 2025 with spider mite eggs



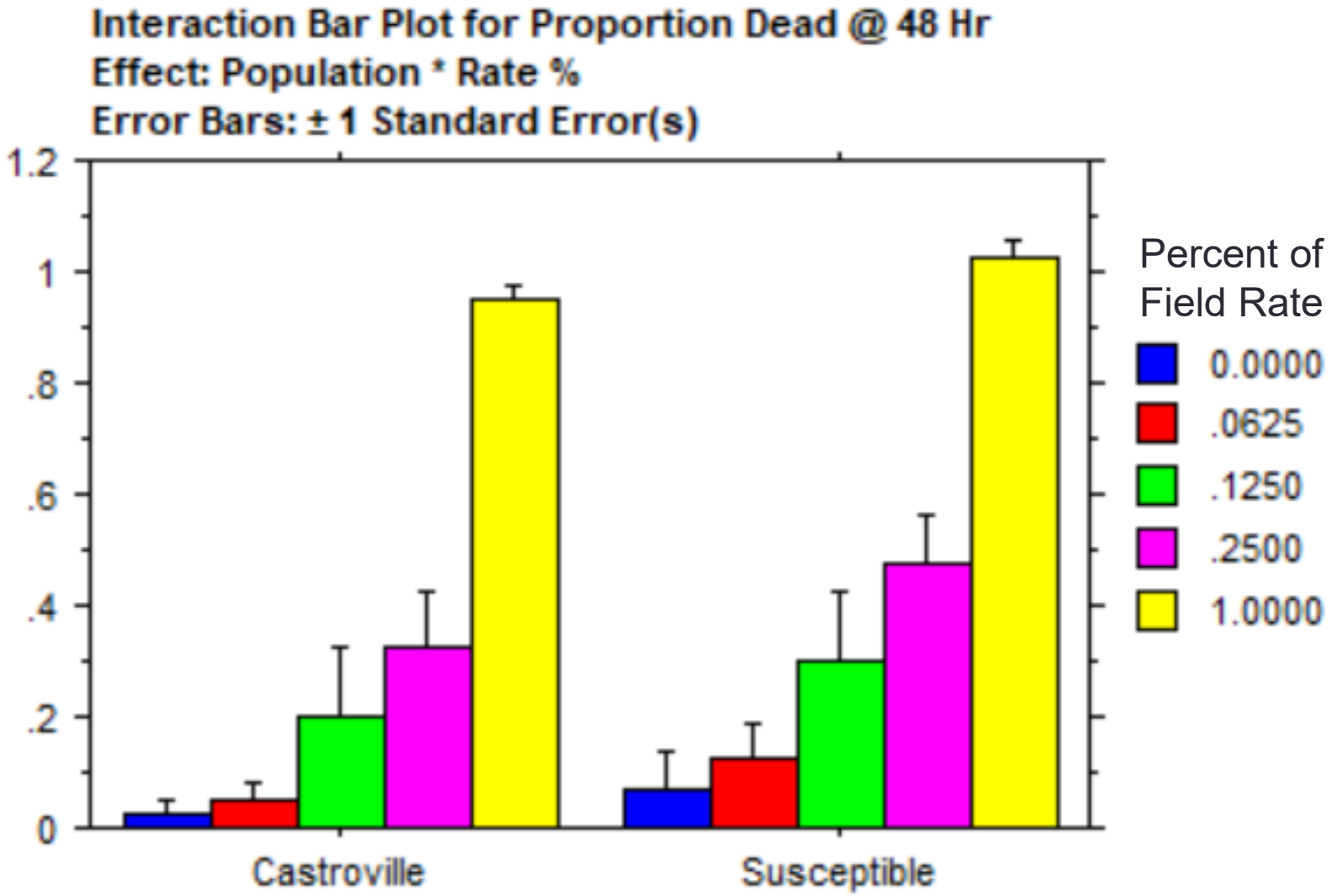
- Transferred ten adult female mites to leaf discs placed on top of soaked cotton.
- Removed females after 24 hours
- Exposed to 2 mL of varying concentration of Plinazolin at 24, 48, 72, and 96 hours.
- Eggs were between 1 day and 5 days “old” when they were sprayed
- Hatch was evaluated at 9 days

Dose responses of spider mite eggs in parts per billion to exposure to Plinazolin on eggs 1 day old and 3 days old at treatment laid by lab susceptible mites 9 days after arenas were established.

Egg age at Treatment	LC_{50} (95% CI) ppb	LC_{90} (95% CI) ppb	Slope	X^2 (*df*)
1 day old	87.35 (50-114)	221.55 (169-379)	3.170±0.284	115.64 (18)
3 days old	83.80 (21-126)	249.76 (164-1189)	2.702±0.305	158..21 (18)

- The field rate will be 2,784,000 ppb.
- Egg age does not appear to impact egg mortality

- Our preliminary lab results in fall 2025 with Plinazolin were outstanding.
- Plinazolin kills all life stages of spider mites at extremely low concentrations.
- When registered for use on hops Plinazolin will prove to be a powerful tool in mite management.



It appears that there's no cross resistance to isocycloseram with other acaracides. This was with adult female spider mites 48 hrs after treatment.

	Original 13 beds	Plus 3 new beds
2010	8,437,000	
2011	5,335,000	
2012	9,428,000	
2013	6,917,000	
2014	4,005,000	
2015	6,177,000	
2016	8,211,000	
2017	7,053,000	
2018	7,354,000	10,294,000
2019	4,063,000	6,550,000
2020	3,590,000	4,076,046
2021	1,601,921	2,505,126
2022	2,279,528	3,272,243
2023	1,919,444	2,932,364
2024	4,460,194	6,717,205
2025	5,136,745	7,565,578

- Estimated population abundance of alkali bees from 13 managed bee beds from 2010 through 2017 and 16 (now 15) managed bee beds from 2018 through 2024 in the Touchet Valley of Walla Walla County, WA.
- We observed a remarkable recovery in the estimated bee populations in 2024 and 2025.

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Article

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A new species of planthopper in the genus *Haplaxius* (Hemiptera: Auchenorrhyncha: Fulgoroidea: Cixiidae) on palms in Costa Rica and a new country record for *Haplaxius skarphion*

Abstract

The genus *Haplaxius* is a large taxon of cixiid planthoppers that is of economic importance due to the ability of *Haplaxius crudus* to transmit lethal yellowing in coconut palms. Haplaxius *dougwalshi* **sp. n.** is established as a new taxon of Cixiidae in the tribe Oecleini collected from native palms in lowland tropical rainforest in Costa Rica. Placement in the genus *Haplaxius* is supported both by molecular evidence based on the COI and 18S genes as well as by morphological characters. This novel taxon was discovered during survey work in Costa Rica to look for phytoplasmas and document planthopper diversity on palms. Furthermore, *Haplaxius skarphion* was also collected from coconut palms during survey work and is reported for the first time in Costa Rica.

Key words: Cixiidae, taxonomy, DNA barcoding, planthopper, palm, Costa Rica

FIGURE 2. Adult *habitus Haplaxius dougwalshi* **sp. n.**; (A) body dorsal view male (B) body lateral male, scale = 1 mm.

FIGURE 3. Adult *Haplaxius dougwalshi* **sp. n.**; (A) male head frontal view, (B) male head, pronotum, and mesonotum dorsal view (C) male head, pronotum, and mesonotum lateral view, scale = 1 mm.

Etymology. The specific name given is an honorarium in reference to the lead authors professor and chair during graduate school (Ph.D.), Dr. **Doug Walsh** at Washington State University, who's signature mustache resembles the color pattern observed on the frons of the novel taxon.

Questions and/or Comments?

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