California Pepper Commission
Research Report 2025-2026

I. IDENTIFICATION

A. California Pepper Commission
B. Insect Pest Management on Peppers
C. Proposal for the period beginning March 2025 and ending February 2026.
D. Principal Investigator:

Dr. Chow-Yang Lee
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University of California, Riverside

E. Cooperating Personnel:

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F. Locations of Work:
U.C. Riverside Agricultural Operations
Riverside, CA
Riverside County, CA

G. Plants:
BELL PEPPER: *Capsicum annuum* L. 'Huntington'

H. Insects:

Bagrada bug; *Bagrada hilaris* (Burmeister)

Beet armyworm; *Spodoptera exigua* (Hübner)

Beet Leafhopper; *Circulifer tenellus* (Baker)

Green peach aphid; *Myzus persicae* (Sulzer)

Lygus bugs; *Lygus hesperus* (Knight)

Pepper weevil; *Anthonomus eugenii* Cano

Serpentine Leafminer; *Liriomyza trifoilii* (Burgess)

Silverleaf Whitefly; *Bemisia argentifolii* (Bellows and Perring)

Stink bugs; *Pentatomidae* spp.

Tomato/Potato Psyllid; *Bactericera cockerell*i (Sulc)

Tomato Fruitworm; *Helicoverpa zea* (Boddie)

Twospotted Spider Mite; *Tetranychus urticae* (Koch)

Vegetable Leafminer; *Liriomyza sativae* (Blanchard)

II. Field Screening Trials for Identification of Effective Pesticides

Seedlings were transplanted in a sandy loam-type soil on 14 May at the University of California Riverside's Agricultural Operations field #10J. Experimental plots were 3 rows wide (5-ft centers) by 48 ft long and separated by a 3-ft buffer. Each bed had two rows of peppers. The pepper transplants were drip irrigated (water pH 7.2 - 7.5). Treatments were replicated 4 times in a randomized complete block design. Application dates and a treatment list are shown in Table 1. All applications were made during working hours when wind conditions were mild. A tractor-mounted boom sprayer with 6 nozzles per row incorporated D-3 orifice disks, #25 cores, and 50 mesh screens. The operating pressure was 100 psi, delivering 100 gpa. All treatments included an adjuvant except treatments #3 and #4.

Table 1: Pepper Chemical Trial List of Treatments 2025

Treatment #	Compound	Rate-Product	Application Dates	Company Sponsor
1	Non-treated	-	-	-
2	IPM Intrepid 2F Sivanto Prime Radiant SC Dyne-amic	 10.0 oz 14 oz 7.0 oz 0.125%	 6/20, 6/27, 7/3, 7/18, 7/25, 8/1	-
3	Organic IPM Pyganic 5.0EC Trilogy EC Entrust SC	 15.0 oz 64.0 oz 8.0 oz	6/20, 6/27, 7/3, 7/18, 7/25, 8/1	-
4	Organic PureCrop 1 oil	 1%	6/20, 6/27, 7/3, 7/18, 7/25, 8/1	-
5	Organic Pyganic 5.0EC Venerate Dipel DF Oroboost	 15 oz 128 oz 1 lb 0.125%	6/20, 6/27, 7/3, 7/18, 7/25, 8/1	-
6	Chemical Standard Asana XL Dyne-amic	 9 oz 0.125%	6/20, 6/27, 7/3, 7/18, 7/25, 8/1	-

Figure 1. Pepper field insect counts

To determine the impact of insecticides, a mid-season and a pre-harvest field assessment of insects was done on 18 June 2025, and 31 July by counting all insects on five plants per replicated plot (Figure 1). On 5 August 2025, 50 mature-green to ripe fruit were harvested from the center row of each plot (200 fruit per treatment) and examined for the presence of potato psyllids, aphids, spider mites, and for damage caused by beet armyworm, bagrada bug, and other stinkbugs (external feeding), as well as tomato fruitworm (internal feeding). We also searched the calyx for damage caused by beet armyworm and tomato fruitworm. Furthermore, we opened 50 fruit per plot and inspected them for pepper weevil larvae (Figure 2).

Figure 2. Fifty harvested pepper fruit were picked for each tray and were subsequently evaluated for pepper weevil damage by cracking open each fruit. Damage was recorded when either larval feeding or adults were present inside the fruit.

Results

Field Sampling
Overall, the insect pressure was moderate this season, and there was variability within treatments. The insects of concern, except the pepper weevil, were present.

For the field counts, there were no significant differences ($P > 0.05$) (Figures 3&4). The total psyllid numbers showed that the psyllid population was developing in mid-season and pre-harvest counts. There were low field counts of leafhoppers, thrips, aphids, whiteflies, and lygus. Lepidopteran pressure was high in the early season count but dropped to low numbers in the pre-harvest count.

Harvest Evaluation
Our harvest assessment revealed low to moderate numbers of insects and damage in the various treatments, and there was no statistical separation except for the "Other" category of Lygus and stink bug damage ($p=0.020$) (Table 2). Spider mite infestation and stippling on the fruit were low with all treatments sustaining 1% or lower damage (Figure 5).

Damage to the calyx caused by beet armyworm and tomato fruitworm was moderate and not significantly different between treatments (Figure 6). Overall, lepidopteran pressure was moderate in this study, and there were no differences between treatments for total lepidopteran damage (Figure 7). The untreated control sustained 11% damage, and the other treatments had lepidopteran damage at levels of 7% or lower. Aphid infestation levels were low with less than 1% damage in the control and Asana XL treatments. Bagrada bug damage was moderate, with treatment 5 sustaining the highest levels of lesions at 10.5%. Treatment 6 had 0% bagrada bug damage, and treatments 2,3, and 4 sustained 4.5% or fewer lesions (Figure 8). Bagrada bug damage is associated with star-shaped lesions under the fruit's skin, as shown in Figure 9.

Internal damage by the pepper weevil was not present this year and could result from hot weather conditions and a lack of good host plants to sustain populations throughout the year. Some pepper weevils were seen in the field, but no damage was seen in the harvested fruit. Additionally, good control of weed host plants such as "nightshade" can eliminate a potential source for reproduction of pepper weevils. Nightshade berries can provide a food source for developing pepper weevil larvae. Therefore, controlling nightshade plants near commercial pepper field operations is recommended. Potato psyllids were present in the field, as seen in the field counts, but we noticed very few in our harvest assessment.

Table 2.		Mean Number of Fruit Damaged/Replicate [a]					
Treatment/ Formulation	Rate Amt/acre	Aphids	External	All Leps	Bagrada Bug	Calyx Damage	Other
1 Non-treated	-	0.25	5.50	5.50	5.00	2.00	0.25 b
2 IPM		0.00	2.50	2.50	0.50	2.00	0.75 b
Intrepid 2F	10.0 oz						
Sivanto Prime	14 oz						
Radiant SC	7.0 oz						
Dyne-amic	0.125%						
3 Organic IPM		0.00	3.50	3.50	2.00	1.75	0.25 b
Pyganic 5.0EC	15.0 oz						
Trilogy EC	64.0 oz						
Entrust SC	8.0 oz						
4 Organic		0.00	1.75	2.00	2.25	1.25	3.50 a
PureCrop 1 oil	1%						
5 Organic		0.00	2.50	3.00	5.25	2.25	1.00 b
Pyganic 5.0EC	15 oz						
Venerate	128 oz						
Dipel DF	1 lb						
Oroboost	0.125%						
6 Chemical		0.25	3.00	3.50	0.00	2.25	0.25 b
Standard	9 oz						
Asana XL	0.125%						
Dyne-amic							
ANOVA F value (by column)		0.800	2.312	1.703	2.610	0.276	3.600
ANOVA P value (by column)		0.564	0.087	0.185	0.061	0.921	0.020

[a] Means in columns followed by the same letter are not significantly different (P<0.05 level, Fisher's LSD Test). Internal damage due primarily to tomato fruitworm; external damage due primarily to beet armyworm. Calyx damage can be attributed to tomato fruitworm and beet armyworm. Other damage is related to Lygus and stink bugs.

Figure 3. Pepper field insect counts 6-18-2025.

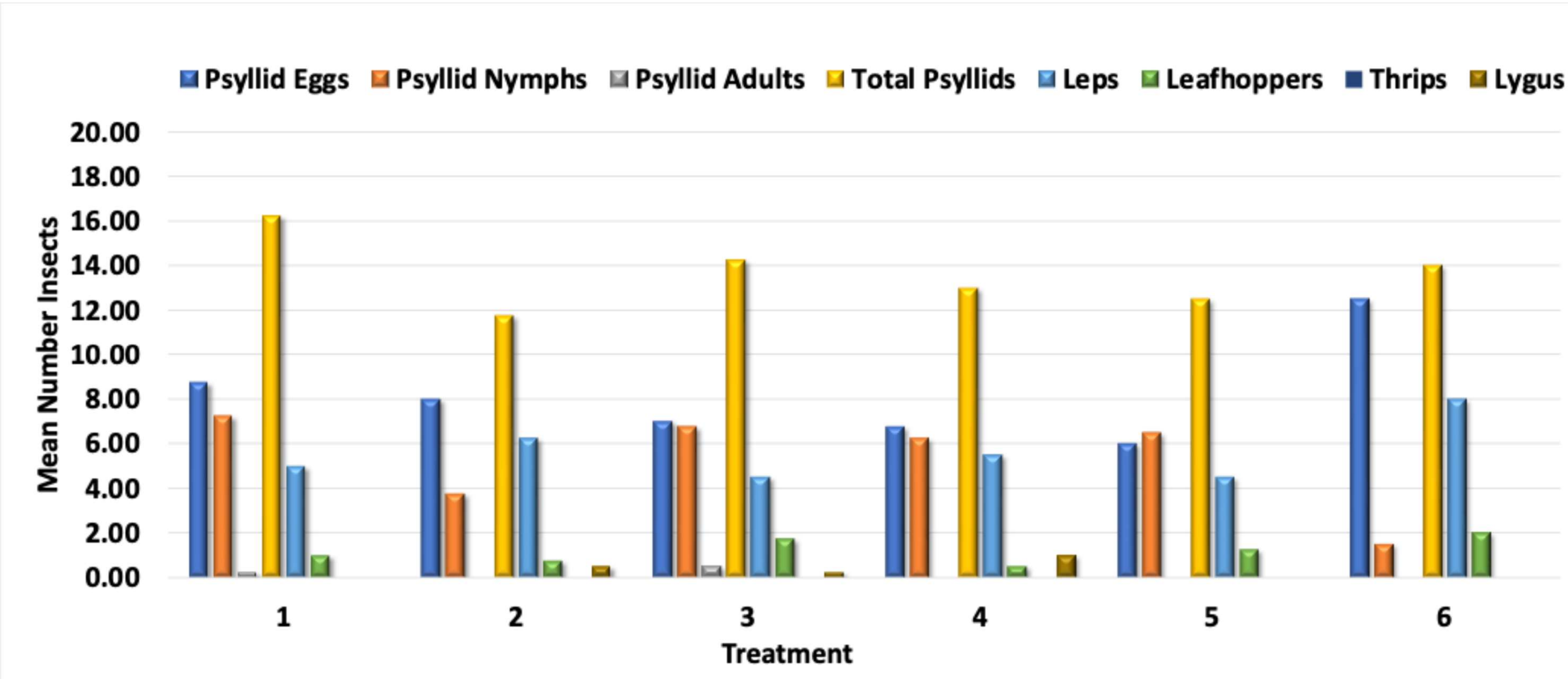

Figure 4. Pepper field insect counts 7-31-2025.

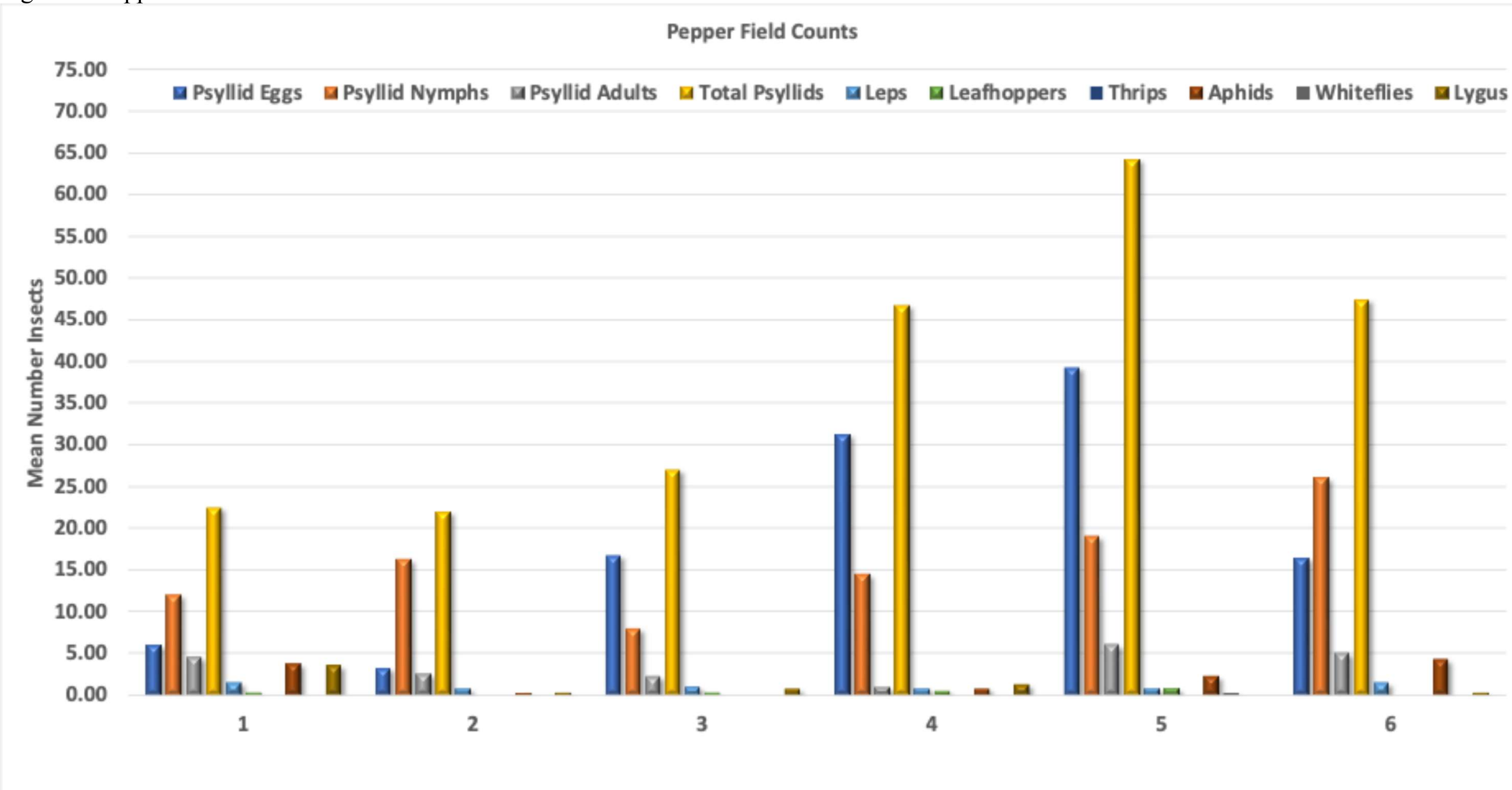

Figure 5. Spider mite infestation and damage on pepper fruit at harvest.

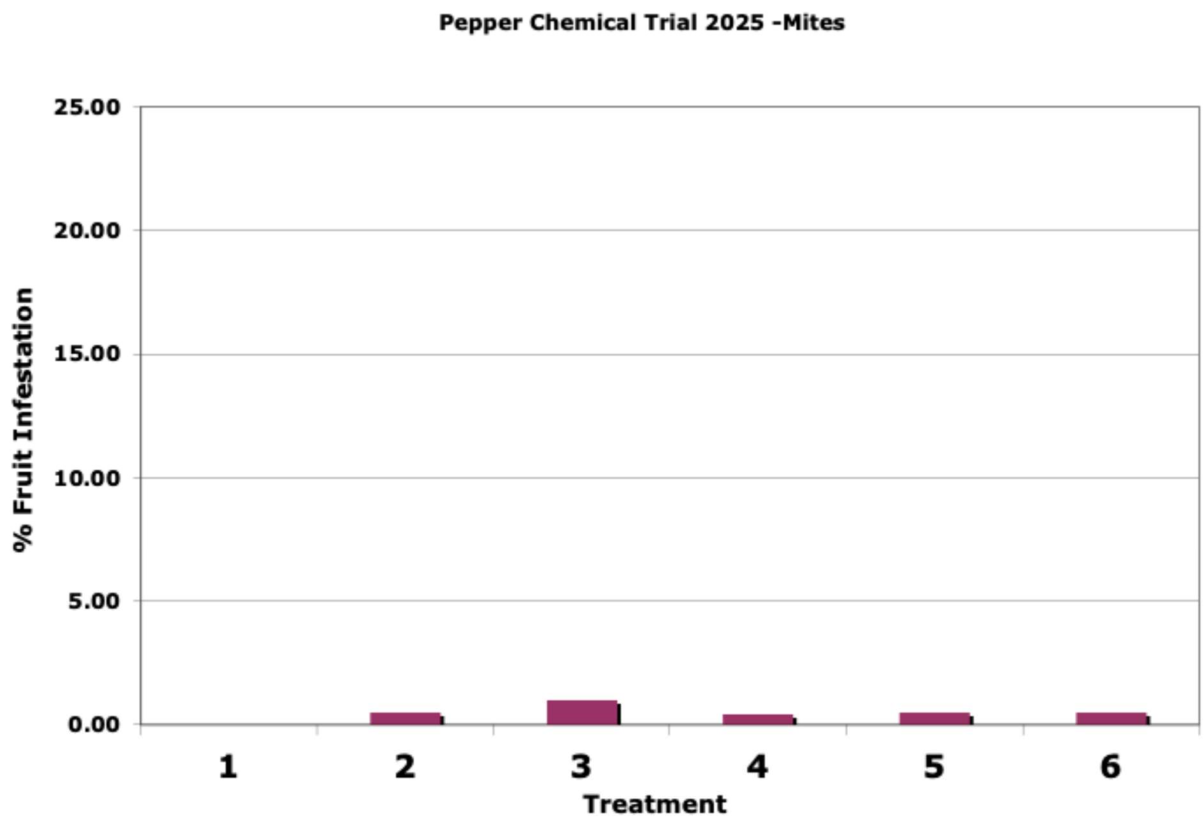

Figure 6. Calyx feeding damage

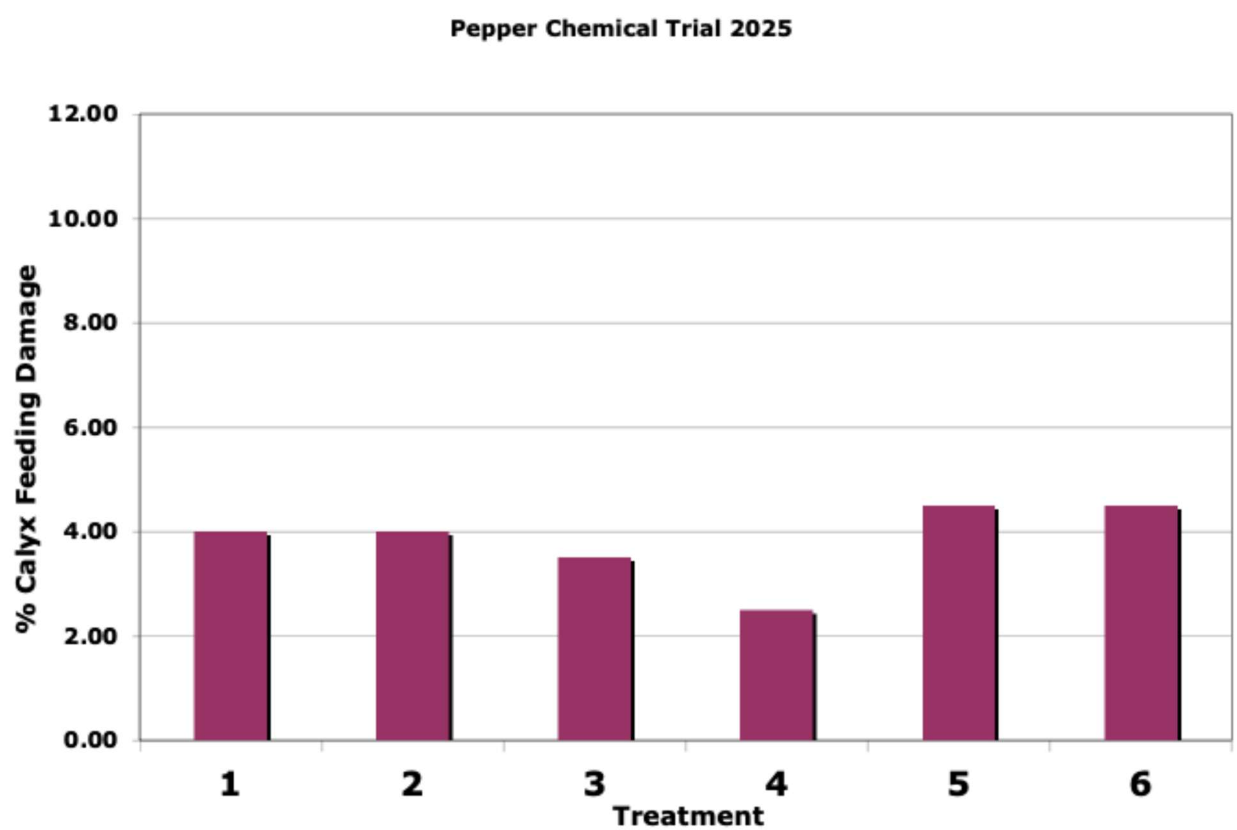

Figure 7. All Lepidopteran damage combined

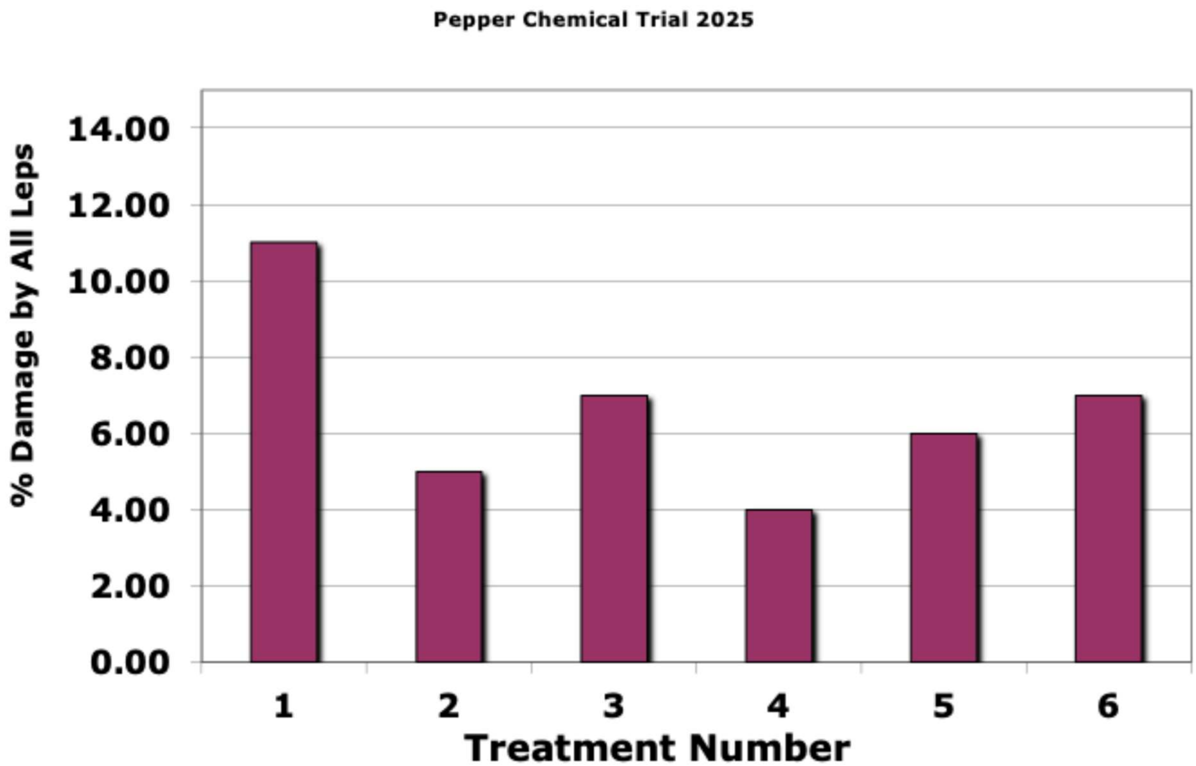

Figure 8. Damage by bagrada bug

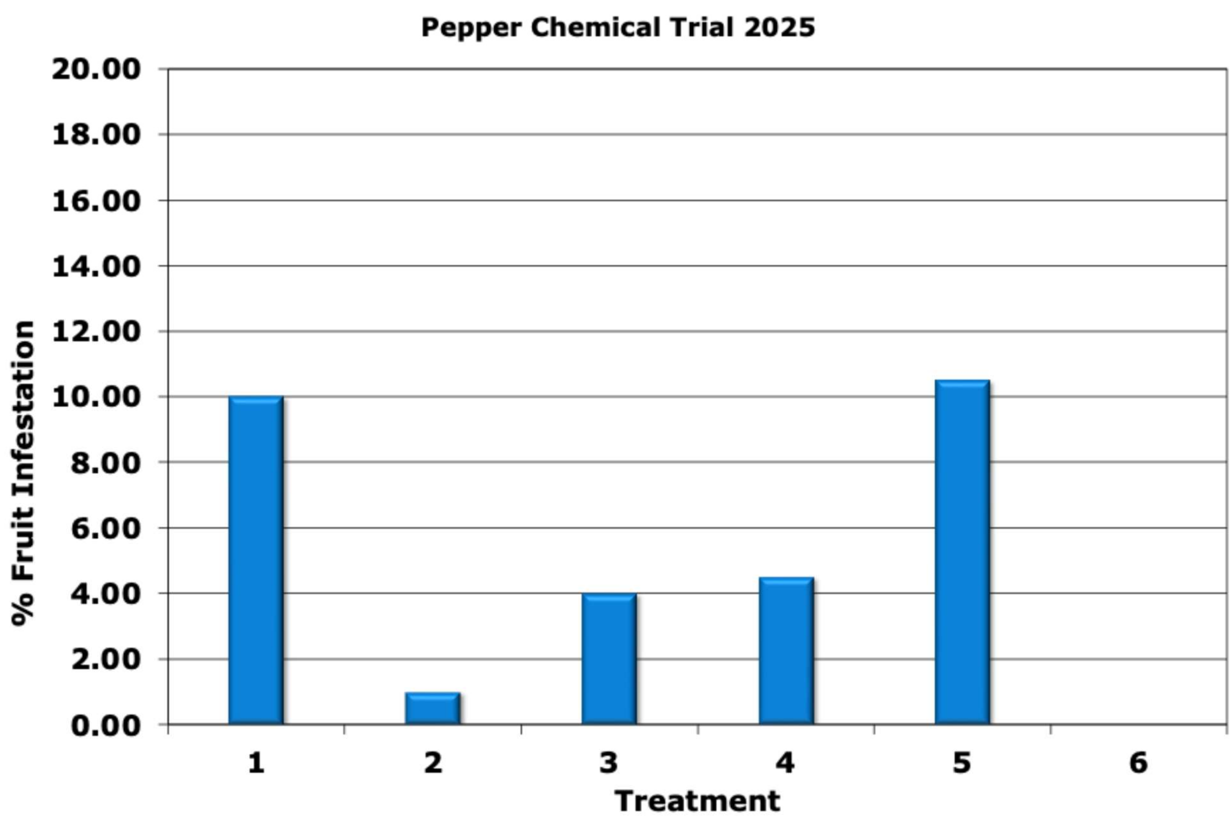

Figure 9. Bagrada bugs cause damage by feeding with their needle-like mouthparts. Multiple insertions of their mouthparts at each feeding site causes cell wall damage to the pepper fruit resulting in the visible star shaped patterns.

IV. Additional Research

We continue to test strategies and chemicals for psyllid and leafhopper control that disrupt insect behavior and cause mortality. Successful repellents and insecticides will be incorporated into an IPM program. We have been testing several novel compounds that have shown promising results for insect control, and we are hopeful that some of these products will eventually be available to pepper growers. Plinazolin is going through registration with the EPA and is a promising broad-spectrum product. The product name is Incipio and has shown good results for pepper weevil control. We will continue to study pepper weevil control options and are testing some alternative products that would comply with the Food Quality Protection Act.