

California Pepper Commission
Research Report 2024-2025

I. IDENTIFICATION

A. California Pepper Commission

B. Insect Pest Management on Peppers

C. Proposal for the period beginning March 2024 and ending February 2025.

D. Principal Investigator:

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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. 'Double Up'

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 eugeni* Cano

Serpentine Leafminer; *Liriomyza trifolii* (Burgess)

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

Stink bugs; *Pentatomidae* spp.

Tomato/Potato Psyllid; *Bactericera cockerelli* (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 22 May at the University of California Riverside's Agricultural Operations field #10E. Experimental plots were 3 rows wide (5-ft centers) by 48 ft long and separated by a 3-ft buffer. The pepper transplants were drip irrigated (water pH 7.2 - 7.5). Treatments were replicated 4 times in a randomized complete block design (Figure 1). 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 2024

Treatment #	Compound	Rate-Product	Application Dates	Company Sponsor
1	Non-treated	-	-	-
2	IPM Intrepid 2F Sequoia 2 SC Radiant SC Sivanto Prime Dyne-amic	10.0 oz 4.5 oz 7.0 oz 14 oz 0.125%	7/3, 7/18, 7/26, 8/1	-
3	Organic IPM Pyganic 5.0EC Trilogy EC Entrust SC	15.0 oz 64.0 oz 8.0 oz	7/3, 7/18, 7/26, 8/1	-
4	Organic PureCrop 1 oil	1%	7/3, 7/18, 7/26, 8/1	-
5	Organic Aza-direct Venerate Dipel DF Oroboost	32 oz 128 oz 1 lb 0.125%	7/3, 7/18, 7/26, 8/1	-
6	Chemical Standard Asana XL Dyne-amic	9 oz 0.125%	7/3, 7/18, 7/26, 8/1	-



Figure 1. The field trial was composed of ten treatments with 4 replicates each for a total of 24 plots. The field was located at UCR Agricultural Operations.

To determine the impact of insecticides, a mid-season field assessment of insects was done on 18 July 2024 by counting all insects on five plants per replicated plot. On 13 August 2024, 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).



Photos by Greg Kund



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 low to 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 ($P > 0.05$) (Figure 3). The total psyllid numbers showed that the psyllid population was developing. Psyllid egg, nymph, and adult counts were nine or fewer insects on average per treatment. Leafhopper counts were 1 insect or fewer per treatment. There were low field counts of lepidopterans, thrips, aphids, whiteflies, lygus, and mites. High heat due to temperature extremes may have contributed to lower pest pressure.

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 aphid damage ($p=0.049$) (Table 2). Spider mite infestation and damage on the fruit were high in treatments 1-3, sustaining over 15% damage, and treatments 4-6 sustained damage below 10% (Figure 4).

Damage to the calyx caused by beet armyworm and tomato fruitworm was moderate and not significantly different between treatments (Figure 5). Overall, lepidopteran pressure was moderate in this study, and there were no differences between treatments for total lepidopteran damage (Figure 6). The control sustained 4.5% damage, and the organic treatment 5 had the highest amount of damage at 9.5%. Significant differences were seen for aphid infestation levels. All treatments performed well with zero percent aphid damage except treatment 6 (Asana XL). Bagrada bug damage was low to moderate, with treatments 2 and 5 sustaining the higher levels of lesions at 4.5% (Figure 7). Bagrada bug damage is associated with star-shaped lesions under the fruit's skin, as shown in Figure 8.

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	-	0.00 b	2.25	2.25	1.50	2.00	2.75
2 IPM		0.00 b	3.00	3.00	2.25	3.00	3.50
Intrepid 2F	10.0 oz						
Sequoia 2 SC	4.5 oz						
Radiant SC	7.0 oz						
Sivanto Prime	14 oz						
Dyne-amic	0.125%						
3 Organic IPM		0.00 b	2.50	2.50	1.25	3.50	3.25
Pyganic 5.0EC	15.0 oz						
Trilogy EC	64.0 oz						
Entrust SC	8.0 oz						
4 Organic		0.00 b	2.25	2.25	1.25	4.25	2.25
PureCrop 1 oil	1%						
5 Organic		0.00 b	4.75	4.75	2.25	4.00	5.75
Aza-direct	32 oz						
Venerate	128 oz						
Dipel DF	1 lb						
Oroboost	0.125%						
6 Chemical		2.50 a	3.00	3.00	1.75	5.25	3.75
Standard							
Asana XL	9 oz						
Dyne-amic	0.125%						
ANOVA F value (by column)		2.778	0.895	0.895	0.197	0.550	0.857
ANOVA P value (by column)		0.049	0.505	0.505	0.959	0.736	0.528

^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.

Figure 3. Pepper field insect counts 7-18-2024.

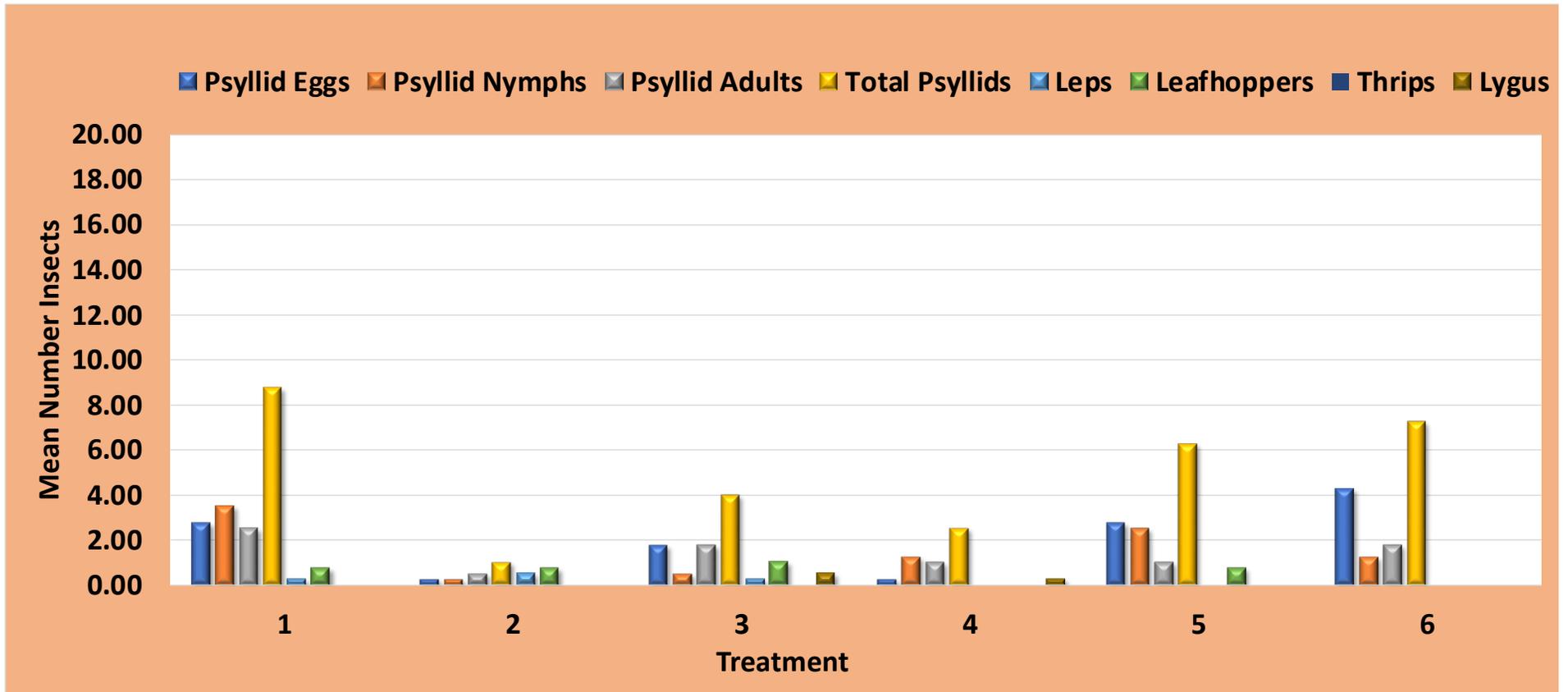


Figure 4. Spider mite infestation and damage on pepper fruit at harvest.

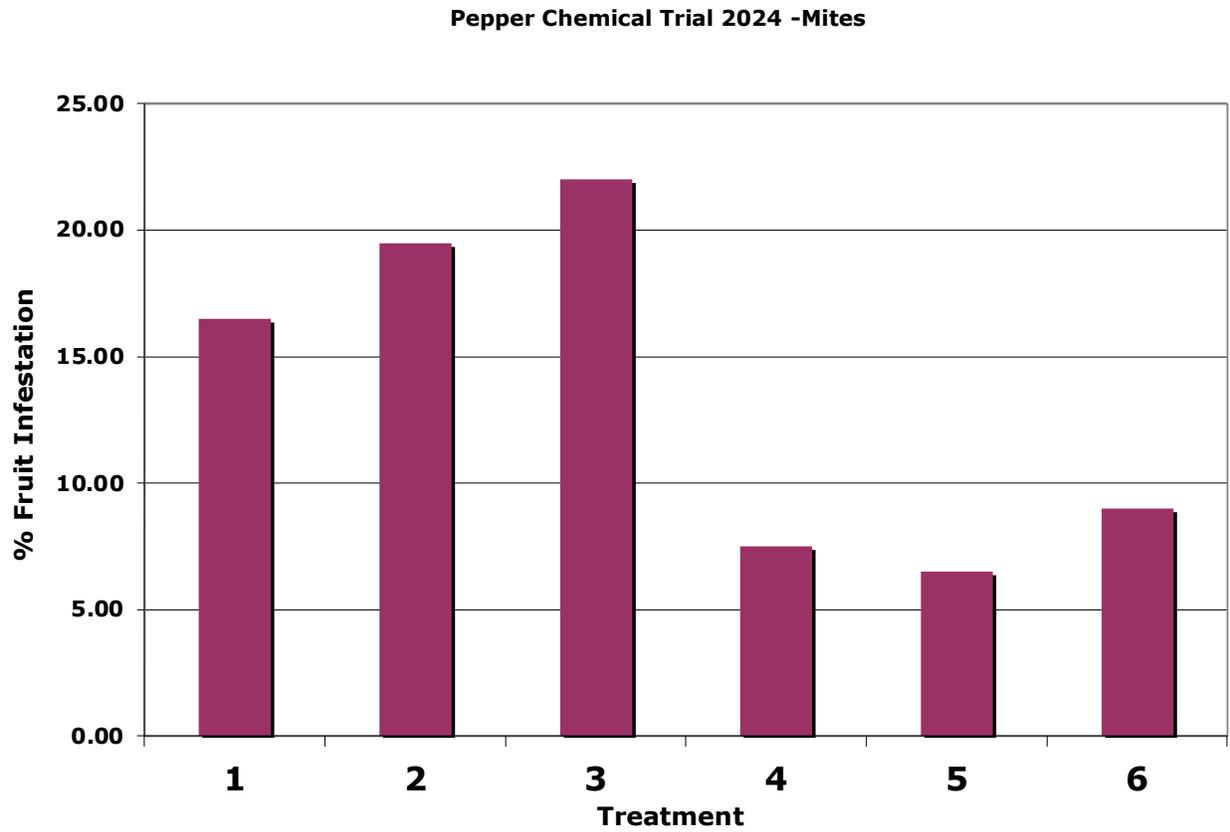


Figure 5. Calyx feeding damage

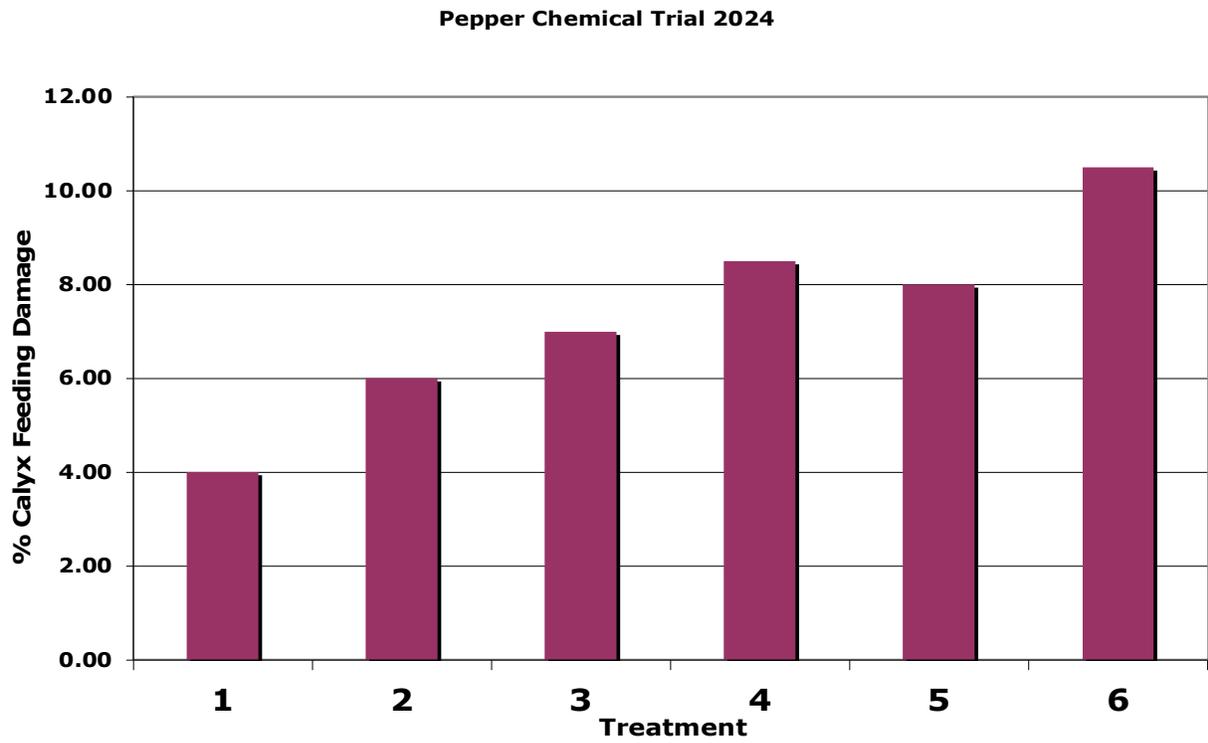


Figure 6. All Lepidopteran damage combined

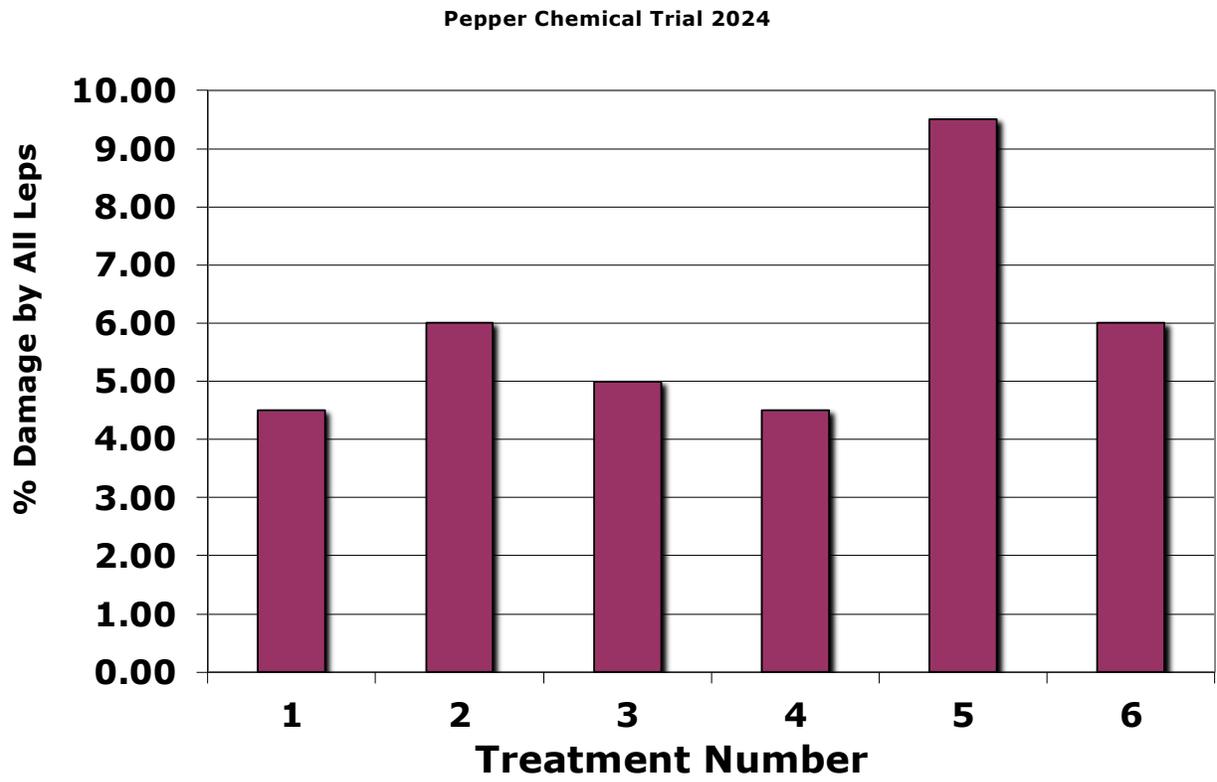


Figure 7. Damage by bagrada bug

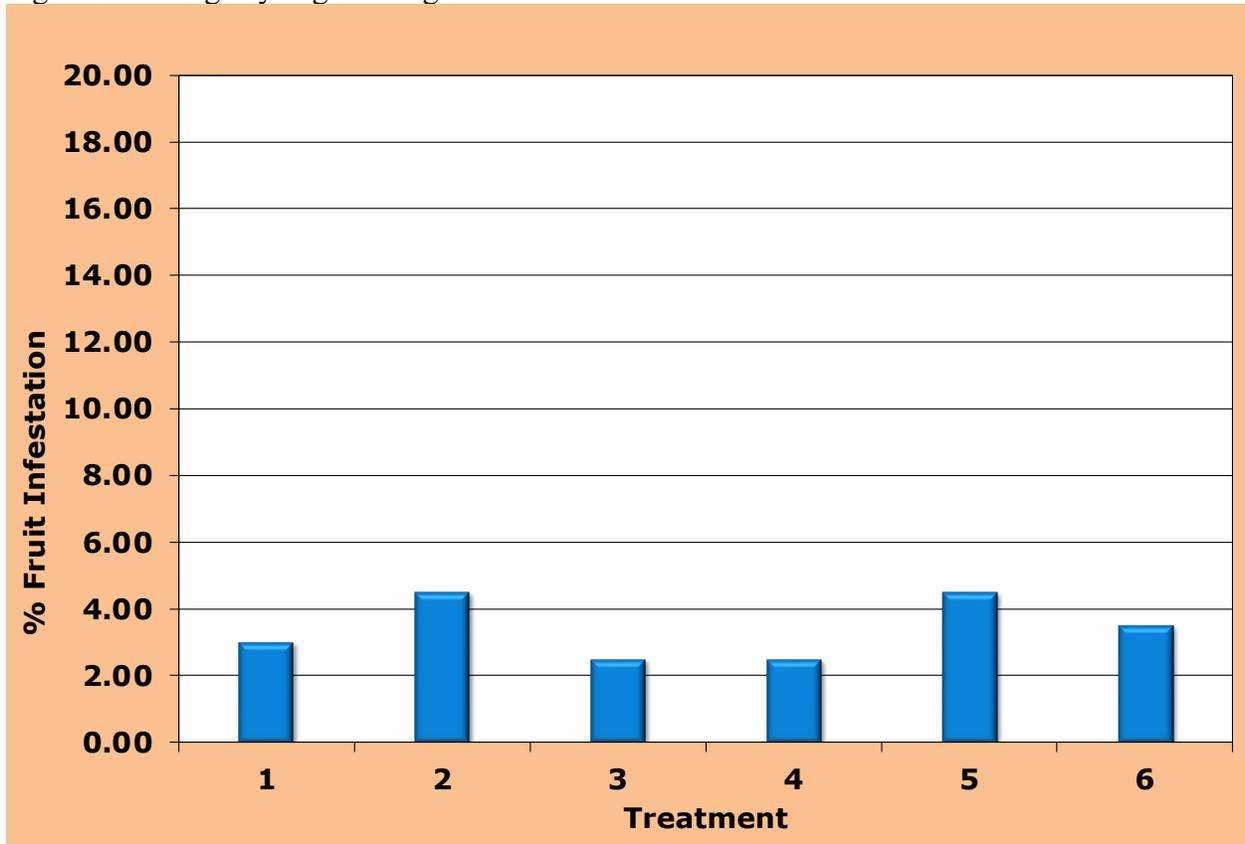


Figure 8. Bagrada bugs cause damage by feeding with their needle-like mouthparts. Multiple insertions of their mouthparts at each feeding site causes cell wall damage to the pepper fruit resulting in the visible star shaped patterns.



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. We are continuing to study pepper weevil control and are testing some alternative products that would comply with the Food Quality Protection Act.