Grape Mealybug Control Trial using OMRI-Approved Materials, 2008

Principal Investigators: L. G. Varela and R. J. Smith
Cooperative Extension
133 Aviation Boulevard, Suite 109
Santa Rosa, CA 95403-2894

Cooperators: Hector Bedolla
Brian Malone
Kendall Jackson

Test Location: Kendall Jackson Fulton Road Ranch

Test Crop: Grapes: *Vitis vinifera* L. Chardonnay clone 4, AXR rootstock, planted in 1980 at 8 ft vine X 12 ft row spacing (454 vines per acre)

Species targeted: Grape mealybug, *Pseudococcus maritimus*

Summary: Insecticide applications of three organic products were applied over two generations of a grape mealybug population. Application timing was scheduled to target first instar nymphs (crawlers). Top label product rates were applied every seven to ten days when crawlers were present. Leaves collected 7 days after the first and second application respectively did not contain a significantly different number of first generation crawlers as compared to the control. The number of egg masses, either hatched or unhatched, counted in a two minute period per vine at the start of the first generation was not significantly different between treatments. The average number of mealybugs per cluster at harvest was not significantly different between treatments.

Experimental Design: Four treatments were replicated ten times in a randomized complete block design. Each replicate (plot) encompassed three treated vines; one data vine in the center of the plot and one buffer vine on either side.

Treatments and Rates:

Table 1. Treatment rate and application timing

Date	Backpack Sprayer	Gallonage	EcoTrol EC ®1	Neemix®	Pyganic®2	Control
			-------------------rate-------------------			
		gal ac^{-1}	------------------oz ac^{-1}-----------------			
4/25/2008	Pump	50	24	16	64	-
5/6/2008	Pump	50	24	16	64	-
5/16/2008	Powered	50	24	16	64	-
6/29/2008	Powered	100	96	-	-	-
7/2/2008	Powered	100	-	16	64	-
7/9/2008	Powered	100	96	16	64	-
7/16/2008	Powered	100	96	16	64	-

[1]Ecotrol EC® was applied with 8 oz ac^{-1} NaturalWet® CA wetting agent on first three applications dates and 16 oz ac^{-1} on last three dates.

[2]The pH of the mixed Pyganic® solution was 6.4 for all applications

Application Equipment:

Foliar sprays were applied with backpack pump sprayers on April 25 and May 6. To maximize coverage, gasoline-powered backpack sprayers were used to apply foliar sprays on May 16, June 29, July 2, 9 and 16. Special attention was given to ensure saturation of the cordon and fruiting zone. EcoTrol EC® was the only product sprayed on June 29 and was not sprayed on July 2.

Evaluation Procedures

To select 3-vine plots in which all vines contained grape mealybugs, a pre-count was made on each of 50 vines in four rows on April 11, 12, 16 and 18. Spurs on five arms on each vine were examined for presence - absence of the overwintering generation of grape mealybug. Contiguous three-vine sets with mealybugs present on spurs were selected into a pool of possible plots. Treatments were assigned to plots in a randomized complete block design. For most evaluations, the center vine of each plot was considered the data vine, and the two outer vines served as buffers between plots.

On May 2, one week after the first product application, five basal leaves in direct contact with the cordon were sampled from the data vine of each plot and crawlers were counted on each leaf utilizing a dissecting microscope (Table 2). Leaves were sampled and examined in the same manner on May 13, one week after the second product application.

Table 2. Average number of grape mealybug crawlers per leaf

Date	EcoTrol EC®	Neemix®	Pyganic®	Control
5/2/2008	0.04	0.08	0.08	0.10
5/13/2008	0.06	0.02	0.02	0.08

To determine application timing targeting first generation crawlers, two minute timed counts focused on wood beneath the bark occurred June 27 on each of the two buffer vines in each plot. Egg masses were counted and observed as to whether egg hatch had occurred (Table 3). At this time, crawlers had emerged from approximately 60% of the egg masses which indicated optimal timing for applications targeting this generation. Three applications of each product were made subsequent to this examination. Ecotrol was sprayed June 29 then re-applied twice at 10 and 7 day intervals; Neemix® and Pyganic® were sprayed July 2 and re-applied twice at 7 day intervals (Table 1).

Table 3. Average number of grape mealybug females with egg masses per vine found in 2 minute counts 6/27/2008

Status of eggs	EcoTrol EC®	Neemix®	Pyganic®	Control
Females with unhatched eggs	0.10	0.05	0.10	0.25
Females with hatched eggs	0.05	0.30	0.30	0.10

Vines were examined once more on July 30 for crawlers. Leaves on each data vine were observed for two minutes during which crawlers were counted in the field (Table 4).

Table 4. Average number of grape mealybug crawlers per vine found in 2 minute counts 7/30/2008

	EcoTrol EC®	Neemix®	Pyganic®	Control
Crawlers / Vine	0.1	0.4	0.8	0.2

Grape mealybugs were counted in clusters September 2-8, the week prior to commercial harvest. Ten clusters were removed from each data vine, placed in labeled paper bags and transported to the laboratory in coolers. Selection priority was given to clusters touching the cordons. In the event that no clusters touched the cordons, the most basal clusters were selected. As the cluster sampling process occurred over the course of one week, treatments were harvested and mealybugs counted by replication.

In the laboratory, clusters were clipped apart with small scissors. Dissecting microscopes and mechanical counters were utilized to count all life stages. Most mealybugs were females and nymphs however only the total number per cluster was recorded (Table 5).

Table 5. Average number of grape mealybugs per clusters at harvest

	EcoTrol EC®	Neemix®	Pyganic®	Control
Grape Mealybugs / Cluster	2.61	3.42	3.59	2.11

Statistical Analysis:
Treatment effects on all mealybug counts were analyzed independently using ANOVA. Tukey's HSD procedure was used to detect treatment differences. Chi-squared tests for cross tabulation were also performed, as the dataset was not normally distributed and had many zero values.

Results and Discussion:
No significant differences existed between mealybug counts in the treatments or the control at any of the sampling dates at $\alpha=0.05$.

Both Neemix® and Pyganic® applications made on May 6 appeared to reduce crawler populations on the May 13 evaluation date (Figure 1). Differences, however, in crawler counts among all treatments were not significant at α=0.05 after spraying (p=0.5494).

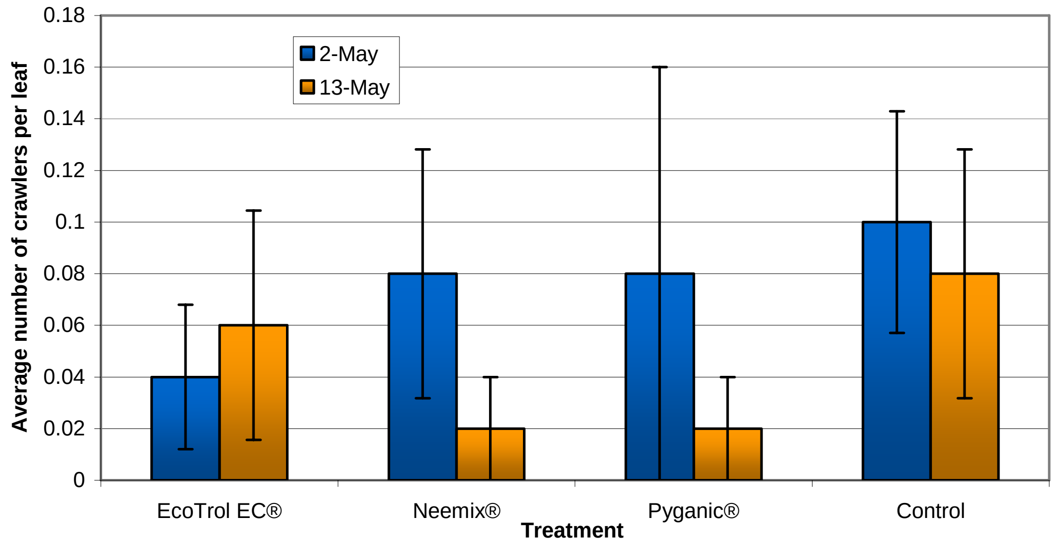

Figure 1. Grape mealybug crawler populations on leaves before and after May 6 product application

Approximately 60% of egg masses located in timed counts had hatched and crawlers were present on June 27 (Figure 2). Three pesticide applications were subsequently scheduled during the next three weeks to target the first generation.

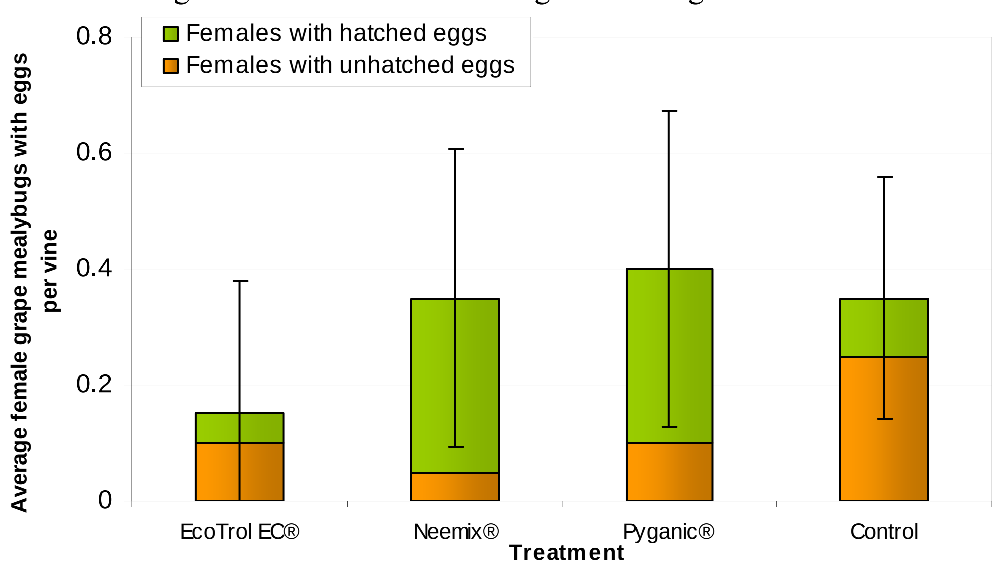

Figure 2. Grape mealybug females with egg masses found in two-minute counts per vine, June 27 2008
Error bars indicate standard error of total female grape mealybugs with egg masses per vine

Crawler populations on leaves were counted in the field on July 30, two weeks after the final product application (Figure 3). Crawlers were present in all treatments at levels that were not significantly different from those found in the untreated control α=0.05 (p=0.3541).

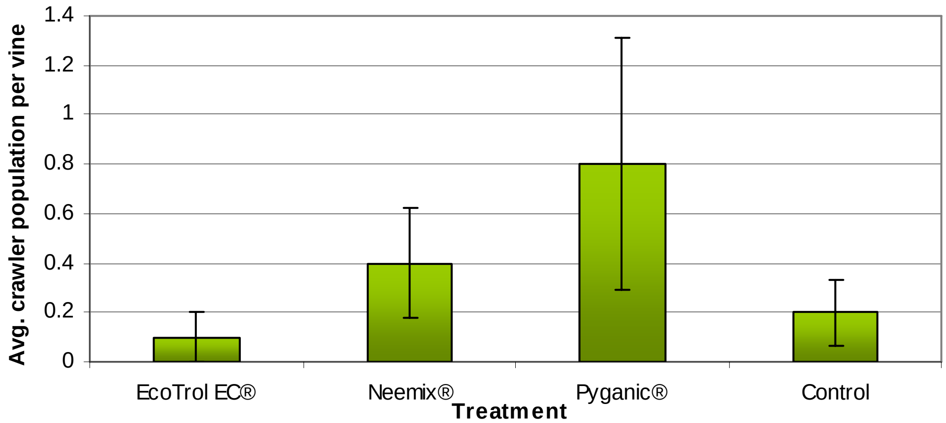

Figure 3. Average crawler population per vine found in two-minute counts on leaves, July 30, 2008

At harvest, clusters were evaluated for total grape mealybug populations (Figure 4). All treatments had mealybugs present. No significant differences existed between mealybug populations for the different treatments $\alpha=0.05$ ($p=0.0896$).

The control had the lowest mean number of mealybugs per cluster of all the treatments, although this difference was not significant. Evidence of parasitism as well as predators (mealybug destroyers) were observed during cluster dissection yet not recorded.

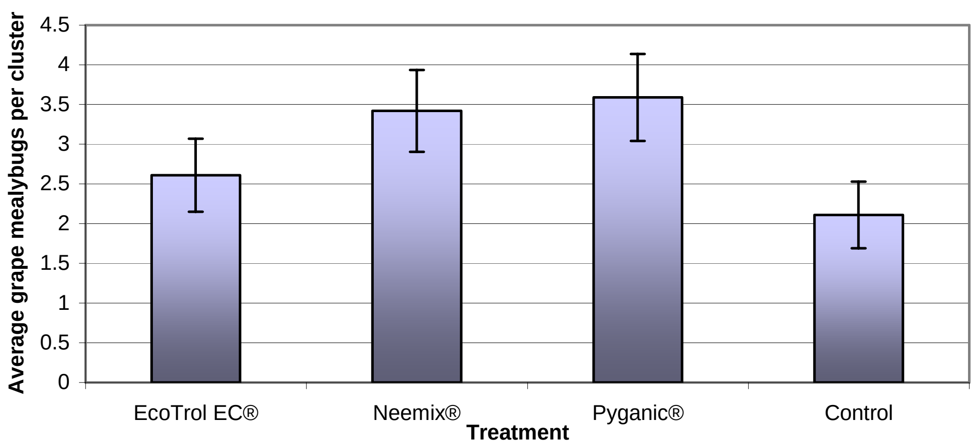

Figure 4. Average number of grape mealybugs per cluster at harvest

Conclusion:
None of the products evaluated proved effective at reducing grape mealybug populations. Integrated pest management concepts were applied to target the pest at its most vulnerable life stage, first instar nymphs. Products were applied frequently and at the highest labeled rates. Treated plots had on average more mealybugs per cluster than the control, although this difference was not significant at $\alpha=0.05$.

A few possible explanations exist for the inefficacy of the products tested. All three products control mealybugs through direct contact, not systemic action. Mealybugs are frequently found beneath outer bark layers on grapevines, thus shielded from direct contact with foliar applied materials. During applications, efforts were taken to direct sprays to the cordons and fruit zones. Spray material additives that are only utilized to enhance penetration of pesticides, were not utilized in this trial thus the products that were evaluated most likely did not come into contact with mealybugs on the wood and subsequently did not reduce mealybug populations. Grape mealybug populations were below crop damage threshold levels in the trial location, and the low populations may have masked treatment differences.