
Efficacy Trials of Registered and Developmental Insecticides Against Navel Orangeworm

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Project Leaders: David Haviland
Entomology Farm Advisor
University of California Cooperative Extension - Kern County
1031 S. Mount Vernon
Bakersfield, CA, 93307
(661) 868-6215
dhaviland@ucdavis.edu

Brent Holtz
Pomology Farm Advisor
University of California Cooperative Extension - Madera
County
328 Madera Avenue
Madera, CA 93637
(559) 675-7879 ext. 205
baholtz@ucdavis.edu

Project Cooperators: Brad Higbee, Paramount Farming Company
Vernon Martinazzi, Martinazzi Farms
South Valley Farms
S&J Ranch

Interpretive Summary:

Effective navel orangeworm management in almonds requires a combination of cultural practices, such as winter orchard sanitation, in combination with in-season insecticide applications. This research project was conducted to evaluate nineteen existing and nonregistered insecticides for their usefulness at hull split in a navel orangeworm management program. These insecticides were evaluated at three field research sites in Kern Co. (Nonpareils), Madera Co. (Fritz) and in Kern Co. (Monterey). However, damage in all three trials was extremely low in 2007 such that no significant differences among the treatments could be discovered.

Objectives:

1. Develop efficacy data for newly-registered and experimental insecticides against navel orangeworm in almonds.

Intrepretive Summary:

Navel orangeworm continues to be a major pest of harvestable almond nut meats throughout the San Joaquin and Sacramento Valleys of California. In some cases multiple insecticide sprays are applied in addition to sanitation programs to remove overwintering inoculum sources.

During the past few years there have been several new insecticides that target worms that have become registered for almonds in California, with several more coming down the pipe. One group of products includes newer generation pyrethroids such as Brigade, Battalion, Baythroid, Danitol, Renounce and Warrior. Additionally there are a wide range of new reduced-risk insecticides that offer a wide range of existing and new modes of action such as Altacor, Alverde, Assail, Belt, Delegate, Dimilin, Rimon and Proclaim.

Currently there is a large gap in our understanding of the efficacy of these products. Many of these products have undergone substantial testing and have been proven effective against codling moth in apples, pears and walnuts; however, to date there is very little information on how they perform on navel orangeworm on almonds. Considering the economic scale of the significance of navel orangeworm as a pest of almonds in California, including both the effects on percentage offgrades and aflatoxins, it is essential that we learn more about how each of these new insecticides works and might contribute to improved control in the field.

Materials and Methods:

During 2007 a total of three insecticide trials were conducted in Kern and Madera counties to evaluate the effects of 19 registered and non-registered insecticides. The first two trials were conducted in a third-leaf almond block near Blackwell's corner, Kern County, with one trial done in the Nonpareil trees and the second completed later in the year in the Montereys. The third trial was conducted in a mature Fritz orchard in Madera County. With only a few exceptions, all three trials evaluated the same 19 insecticides, and at the same per-acre rates.

To date we have completed all three 2007 trials and will be spending the winter cracking out the nuts required for efficacy evaluations. Data from these trials will be available during the second half of this 2007-8 research project during the spring of 2008.

All three trials were organized into a randomized complete block design with six replications of single trees. Applications were made at 200 gallons per acre using handgun sprayers at 150-200 psi. Applications were made on July 3-5 (Kern Nonpareil

trial), August 22 (Madera Fritz trial), and August 26-27 (Kern Monterey trial). Trees were shaken approximately one month after applications were made on August 8, September 15, and September 23, respectively. Once nuts were on the ground, samples were collected and returned to the laboratory for evaluation. An average of 994, 400, and 343 nuts per tree were collected and evaluated from each trial, respectively. Results are reported as percentage of the almond kernels with damage from navel orangeworm, and were evaluated by ANOVA, with means separated by Fisher's protected LSD.

Results and Discussion:

Navel orangeworm damage in all three trials was extremely low in 2007, such that there were no significant differences among treatments in any of the three trials (Table 1). Damage in each of the three sets of untreated checks in each of the three trials ranged from 0.53-1.17% (Kern, Nonpareil), 0.29-0.79% (Madera, Fritz), and 0.09-0.27% (Kern, Monterey). This is in comparison to 0.09-0.87%, 0.08-0.75% and 0.00-0.55% damage for plots being treated with one of the 19 treatments being evaluated.

Due to the overall low pest pressure, and lack of significant differences in the data, we are not able to make any statements regarding the several new insecticides that will shortly be on the market for almond and other nut crops in California in the next few years.

Table 1. Effects of insecticide treatments on navel orangeworm populations in three field trials, 2008:

Treatment	Rate Product per Acre	Surfactants ¹	Percentage kernels with NOW		
			Kern Co. Nonpareil	Madera Co. Fritz	Kern Co. Monterey
Altacor 35WG	4 oz	R,I,I	0.09	0.58	0.07
Alverde 2L	16 fl oz	P,P,P	0.33	0.50	0.00
Assail 30SG	6 oz	S,D,S	0.35	0.46	0.11
Battalion 0.2EC	14 fl oz	R,I,I	0.87	0.46	0.22
Baythroid XL	2.4 oz	R,I,I	0.33	0.38	0.04
Belt 480SC	4.0 fl oz	R,I,I	0.22	0.17	0.08
Brigade	2 lb	R,I,I	0.57	0.33	0.04
Danitol 2.4EC	21.3 fl oz	R,I,I	0.15	0.58	0.00
Delegate 25WG	6.4 oz	R,I,I	0.36	0.38	0.05
Dimilin 2L	16 fl oz	D,D,D	0.36	0.75	0.00
Dipel DF	16 oz	R,I,I	0.33	0.42	0.18
Gowan 1998	9 oz	D,I,D	0.32	0.50	0.55
Guthion	4 lb	R,-,-	0.12	0.08	-
Imidan 50WP	5 lb	R,I,I	0.75	0.29	0.32
Intrepid 2SC	16 fl oz	R,I,I	0.43	0.63	0.31
Lorsban 4E	4 pt	R,I,I	0.21	0.21	0.07
Novaluron 10EC	16 fl oz	D,D,D	0.70	0.46	0.71
Proclaim	3.2 oz	R,D,I	0.33	0.50	0.25
Warrior	3.2 fl oz	R,-,I	0.41	-	0.04
Untreated 1			0.69	0.29	0.09
Untreated 2			1.17	0.38	0.27
Untreated 3			0.53	0.79	0.17
<i>P</i>			NS	NS	NS

Letters indicate surfactants used in the Kern Nonpareil, Madera Fritz, and Kern Monterey trials, respectively. R = R-11 at 0.125%; I = Induce at 0.125%, P = Penetrator plus at 0.25%, S = Sylgard at 4 fl oz/100 gal, D = Dyne-amic at 0.25%.