Establishment of Almond Research Orchards in the San Joaquin Valley and Evaluation of Metaflumizone as a Potential Ant Bait for Use Near Harvest in Almond

Project No.: **10-ENTO13-Haviland**

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Objectives:

1) Establish almond orchards that can be used for pest management research in Kern and Fresno Counties
2) Leverage experimental advantages of these orchards (e.g., ability to maintain untreated plots as standards and evaluating unregistered pesticides requiring crop destruct). An example trial is included in this report: Evaluation of metaflumizone as a potential ant bait for use near almond harvest

Interpretive Summary:

Trials that evaluate the effectiveness of new insecticides, herbicides and fungicides are a high priority for the almond industry. Every year there are new pesticides that have the potential to allow for improvements in almond production. However, use of new pesticides is often tricky due to many uncertainties about their effectiveness, specificity toward target pests, impacts on beneficial organisms, rates, and appropriate timing. In order to address the needs related to new pesticides we have made efforts to establish two research orchards. The first is a 7-acre orchard located in Kern County that was planted in 2009. The other is a 5-acre orchard located in Fresno County that was planted in 2008 and that was harvested for the first time during 2010. Both orchards are located on property that is either owned or leased by the University of California with production practices dictated by researchers. These orchards will provide great flexibility regarding research, particularly in the ability to maintain untreated plots as standards and for projects using unregistered pesticides. This has and will continue to allow for maximum flexibility in the manner in which research trials are conducted such that they can have maximum benefit to the California almond industry.

Results and Discussion:

<u>Orchard establishment</u>

To date we have been successful in establishing two orchards in the San Joaquin Valley for use in pest management research. The first site is a 7-acre orchard in Shafter in Kern County on land that used to be part of the UC Shafter Research and Extension Center. The orchard is planted on a 20' by 22' spacing with alternating rows of Nonpareil and Monterey. These varieties were chosen due to their compatibility within an orchard and for the ability to conduct navel orangeworm trials in the Nonpareils (timed at the second flight when hull split occurs) and then again in the Montereys (timed at the third flight when they begin to split). Irrigation is set up using microsprinklers with the capability to turn water on and off on each individual row. The orchard has a total of 700 trees, and as of the summer of 2011 all trees are alive and growing and will be harvested for the first time.

The second orchard is approximately 5 acres in size and is located at the UC Westside Research and Extension Center in Five Points in Fresno County. The orchard is planted on a 22' x 15' spacing with a three-tree alternating pattern down each row of Nonpareil, Carmel and NePlus Ultra. The orchard was designed and planted under the direction of Dr. Brent Holtz in 2008 to conduct research on almond diseases. It will now be managed for use in a variety of pesticide research trials.

<u>Research trials</u>

During 2010 there were a total of seven research trials completed within these two orchards. These trials are as follows: 1) Miticide trial by David Haviland in Shafter, 2) Miticide trial by Syngenta CropScience in Shafter, 3) Miticide trial by Nichino America in Shafter, 4) Ant bait trial by David Haviland in Shafter, 5) Navel orangeworm trial by David Haviland in Five Points, 6) Miticide trial by Syngenta in Five Points, and 7) a herbicide trial by Kurt Hembree at Five Points.

Results from each individual project are being reported independently by the researchers that are responsible for them. Results of the three projects by David Haviland are available within reports that were submitted to the Almond Board of California for the 2010-2011 research cycle. Trials by Syngenta and Nichino were considered internal preliminary trials for those companies and are not available publicly. However, the results were used by these companies and David Haviland to determine treatments and rates for products from those trials that are being tested in UC miticide trials by David Haviland during the summer of 2011. Results of the herbicide trial are available through Kurt Hembree.

<u>Conclusions</u>

Despite being only two and three years old, both research orchards have already begun to show their value in being able to host trials that can be of benefit to the California almond industry. In 2010 a total of 7 trials were conducted within these orchards that provided information on the management of mites, navel orangeworm, ants and weeds. In 2011 for the next research cycle there are currently plans for at least 9 trials related to pest management plus one related to nutrition. These orchards and the research being conducted in them would not be possible without the contributions provided by the Almond Board of California.

Evaluation of Metaflumizone as a Potential Ant Bait for Use Near Almond Harvest

Objectives:

Evaluate the effects of Altrevin, new ant bait from BASF containing metaflumizone, for its effects on southern fire ant near harvest

Interpretive Summary:

Southern fire ant is an important pest of almonds due to its ability to cause significant amounts of damage in a very short period of time to almond kernels while they are on the ground. Currently, the standard management practice for infested orchards is to make one or two applications of ant baits between April and June. Advantages to this program are that baits are considered relatively inexpensive compared to other pesticides, application is fast and easy, and baits have minimal risk to fieldworkers or the environment. However, the key disadvantage is that baits take a long time to work such that applications are often made preventatively on a calendar basis to fields that may or may not actually need a treatment.

The alternative to early-season applications of baits is to apply a quick-acting insecticide for ants near harvest. Traditionally this has been done with the organophosphate chlorpyrifos, though this practice is no longer common due to inherent risks related to pesticide residues, worker safety, and environmental risk. However, the recent development of a new ant bait containing metaflumizone (Altrevin, BASF Corp) provides an interesting new opportunity to reevaluate the practicality of threshold-based applications near harvest.

During 2010 we conducted a trial in Shafter to compare the effects of Altrevin and Lorsban Advanced compared to an untreated check. Over a period of eleven weeks both insecticides resulted in a reduction in the number of ant mounds as well as in the number of foraging ants. However, with both insecticides ant mounds did not disappear, nor did ant foraging cease. These results suggest that Altrevin has the potential to be used in almonds close to harvest, but that more work is needed to determine if the results are effective enough and predictable enough for it to be recommended to growers.

Materials and Methods:

During 2010 we conducted a trial in Shafter, CA to evaluate the effects of two insecticides on the density of Southern fire ants in almonds. The trial was located in a 7.2 acre portion of a second-leaf orchard that contains alternating rows of the varieties Nonpareil and Monterey. Each plot was six rows wide and ten trees long on a 20 ft by 22 ft spacing (0.6 ac). The plots were organized into a randomized complete block design (RCBD) with 4 blocks of 2 treatments and an untreated check. The Lorsban treatment was applied to the floor of the orchard by ground rig at the rate of 4 pints in 40 gal water/acre on 6 Aug. Altrevin bait was applied by using a hand spreader at the rate of 1.5 lbs/acre on 5 Aug.

Southern fire ant densities were evaluated in each plot prior to treatment on 29 Jul and then weekly through 11 weeks after treatment (WAT). On each sample date mounds were counted in a 44 ft x 180ft area in the center of each plot. Additionally, on each sample date except 22 Oct, six plastic vials baited with 0.5 inch slices of hot dog were placed next to the irrigation hose in rows 2 and 5 at trees 3, 5, and 8 of each 6-row by 10-tree plot. After 1.5 hrs to 3 hrs, depending on environmental conditions on the date of evaluation, hot dog vials were picked up and placed in a freezer. The number of southern fire ants was then counted per vial for each plot. Average number of mound counts and ants per vial were analyzed by ANOVA using transformed data (square root (x + 0.5)) with means separated by LSD (P = 0.05).

Results and Discussion:

Lorsban Advanced and Altrevin both resulted in numerical reductions in mound counts on all evaluation dates (**Table 1**). On all but two evaluation dates there were reductions in the number of foraging ants (**Table 2**). These reductions were only significant on two (mound counts) or three (ant counts) individual evaluation dates due to a high amount of experimental error (due to design) among plots. This error is likely due to the size of the plots making it possible that ants from an untreated check can forage into treated plots and become exposed to Lorsban Advanced or access the Altrevin bait. However, despite the large amount of experimental error in the trial, when cumulative averages of mound or ant counts were analyzed through 11 WAT, both products provided significant reductions in cumulative average mound counts compared to the untreated check (**Table 1**). Lorsban Advanced provided significant reductions in cumulative average ant counts compared to the untreated check while Altrevin produced only numerical reductions (**Table 2**). Mound and ant counts for Lorsban Advanced and Altrevin were statistically equivalent for all individual evaluation dates and during the analysis of cumulative data.

Data from this first study on Altrevin in almonds suggest that Altrevin is moderately effective against southern fire ant and that its effects can begin within two weeks after application. While the data were not compelling enough to recommend that Altrevin be immediately adopted by almond growers, they did show adequate efficacy to suggest that more work on this product is justified. Future work will need to be done to focus on how to maximum efficacy. It is also likely that trials conducted on a larger scale will allow for increased statistical differences and efficacy by minimizing the experimental error caused by ants that forage back and forth between 0.5-acre plots.

Table 1.

Treatment/ formulation	Rate amt form/acre	Average number of mounds												
		Pre-counts	6 DAT*	13 DAT	21 DAT	26 DAT	34 DAT	40 DAT	48 DAT	55 DAT	63 DAT	69 DAT	77 DAT	Cumulative to 11 WAT^
Lorsban Adv.	4 pts	16.33a	1.8a	2.0a	1.0a	0.25a	1.3a	0.8a	1.5a	1.0a	2.5a	3.3a	2.0a	1.6a
Altrevin	1.5 lbs	17.3a	2.0a	2.8a	3.0a	2.3ab	2.5a	1.0a	1.5a	1.8a	2.3a	3.3a	1.8a	2.2a
Untreated Check	--	17.8a	3.3a	5.5a	4.25a	3.5b	3.3a	2.8a	4.0a	4.5b	3.8a	2.8a	2.5a	3.7b

Means in a column followed by the same letter are not significantly different (*P* > 0.1, Fisher's protected LSD). Data are presented as original means followed by means separation of transformed (square root (x + 0.5)) data.

Table 2.

Treatment/ formulation	Rate amt form/acre	Average number of ants trapped per vial											
		Pre-counts	6 DAT*	13 DAT	21 DAT	26 DAT	34 DAT	40 DAT	48 DAT	55 DAT	63 DAT	69 DAT	Cumulative to 10 WAT^
Lorsban Advanced	4 pts	170.3a	0.0a	42.8a	52.5a	42.0a	1.1a	12.75a	22.7a	25.9a	35.7a	2.63a	23.8a
Altrevin	1.5 lbs	159.1a	57.3a	46.1ab	41.1a	58.0a	43.2a	97.1a	102.4a	27.6a	16.6a	39.8a	52.9ab
Untreated Check	--	186.8a	158.2b	122.5b	120.7a	83.4a	55.2a	97.2a	66.0a	99.2b	43.2a	36.3a	93.2b

Means in a column followed by the same letter are not significantly different (*P* > 0.1, Fisher's protected LSD). Data are presented as original means followed by means separation of transformed (square root (x + 0.5)) data.

* DAT = Days after treatment
^WAT = Weeks after treatment