

PROJECT No. 2000-RC-00 SUMMARY REPORT

ANT MANAGEMENT IN ALMONDS, 2000:
SAN JOAQUIN VALLEY

Richard L Coviello, Farm Advisor

Mark Freeman, Farm Advisor

Walt Bentley, Area IPM Advisor

Benny Fouche, Farm Advisor

Lonnie Hendricks, Farm Advisor

Mario Viveros, Farm Advisor

University of California Cooperative Extension

Michael K. Rust, Prof. Of Entomology, UCR

INTRODUCTION AND OBJECTIVES

Southern fire ant, *Solenopsis xyloni* McCook, has become one of the major pests damaging almonds in the last two decades throughout the San Joaquin Valley (SJV). The pavement ant, *Tetramorium caespitum* (Linnaeus) is also damaging, but damage is limited to the northern SJV and Sacramento Valley. The major damage is from ants foraging on the nuts after the nuts are dropped on the ground during harvest, however, significant ant feeding can occur on nuts still hanging in the tree. Damage on the nuts can range from small nicks and holes, which downgrade the crop, to removal of the entire nutmeat, which reduces crop size. Downgrading of the crop, which reduces the premium paid to the grower, is the more important damage. Crop damage of over 25% has been reported from some orchards in 1998.

Until the summer of 1999, Lorsban® (chlorpyrifos) and Pounce® (permethrin) were the only registered insecticides for ant control in almonds. Data from previous trials have shown Pounce to be ineffective. Lorsban is one of many organophosphate pesticides, which are under scrutiny as part of the Food Quality Protection Act and may not be available to growers in a few years. Trials conducted by UC Farm Advisors in the last two years have shown two new materials to be effective alternatives to Lorsban for ant control. In 1999 one of the evaluated materials, abamectin, Clinch Ant Bait®, received registration in California. In 2000 the other material, pyriproxifen, Distance Ant Bait®, received a 24c Special Local Needs registration for California. The trials in 1999 examined the proper timing for using the bait materials prior to harvest in comparison to Lorsban. The results showed that Clinch should be applied from four to five weeks before harvest and Distance should be applied seven to eight weeks before harvest for best efficacy. The objectives in the 2000 trial were to refine and validate the timing data from last year and to evaluate the use of the materials in multiple applications and in combination with Lorsban.

METHODS AND MATERIALS

The project was established in four locations in the San Joaquin Valley: Kern County, Fresno County, Merced County and San Joaquin County. This was done in order to test the materials over a wide geographic region and also, in the case of San Joaquin Co., to test the materials against the pavement ant. Non-bearing orchards were used in the Kern and Merced locations. Bearing orchards were used in Fresno and San Joaquin Counties.

General Experimental Procedures

The individual experiments were laid out as a randomized complete blocks with multiple factors. The factors were the various insecticides and treatment timing. Individual plots were approximately 0.25 to 0.48 acres in size. Chemicals evaluated in the trial included chlorpyrifos (Lorsban®), pyriproxyfen (Esteem®, Distance®), abamectin (Clinch®), and boric acid mixed in sugar water. Table 1 A-D. show the treatments, rates, nominal application timing and dates for all locations. All spray treatments were applied at various application rates depending on the treatment and covered the entire orchard floor within each plot. The broadcast treatments of the granular materials were applied with a Herd electric powered spreader. The boric acid solutions were enclosed in various forms of liquid dispensers that allowed the ants to feed without drowning. These were left in the orchard continuously and the solutions replenished as needed.

The effects of the treatments were evaluated by measuring ant activity during the course of the experiment and measuring nut damage at harvest. Ant activity throughout the duration of the trials was measured by "hot-dogging" (see 1999 Project Report, Proceedings of Almond Research Conference, 1999). Except in the Fresno site, nut damage at harvest was measured by placing 10 shelled kernels each in PVC pipe bait stations and placed on the ground for from 24 to 96 hours depending on apparent ant activity. The stations were retrieved and the kernels examined for the number and amount of nuts damaged. In the bearing orchards samples were taken from the commercially harvested nuts just prior to picking up, cooled down to prevent further feeding and then the kernels cracked out and examined for ant damage.

RESULTS AND DISCUSSION

The results of the samples for ant activity are shown in Table 2, A-E for the four trial locations. Results of the damage evaluations for Merced and San Joaquin locations are shown in Table 3, A-B. The samples for damage evaluation in Fresno Co. and Kern Co. locations are still being processed and the results will be available in the final report.

Fresno County: None of the data have been statistically analyzed yet. All of the treatments showed numerically less ant activity at or near the time of harvest than the untreated check (Table 2-A). Results from the damage evaluation and statistical analyses will be available in the final report.

Kern County: Effects of the treatments on ant activity are shown in Table 2-C. The first reading of ant activity (5-30) did not show any significant difference among treatments, but it was significantly different from the untreated control. The second reading (6-13), four weeks after treatment, the two Lorsban® and

Clinch® treatment did significantly reduce the ant populations. By the third reading, or six weeks after treatment, the Distance® treatment significantly reduced the ant population. In fact, Distance® was as effective as Clinch® (May 16) and Lorsban® (8 pt/A). The fourth reading, eight weeks after treatment, Distance® significantly maintained a low ant population. It was equal to Clinch® (May 16) Clinch® (June 12) and Clinch® (May 16-July 6). At this reading, six weeks after treatment, the Lorsban® treatments were no longer effective in reducing the ant populations.

By harvest time, which in Kern County takes place around the first week in August, Distance® continued to hold the ant population down. At this time, it was as effective as Clinch® (May 16), Clinch® (June 12), Clinch® (May 16-July 6) and Lorsban (8 pt/A).

The boric acid was not effective in reducing ant populations at any of the readings. The fifth reading showed no significant differences among any of the materials. This may be due to the high temperatures at the sampling date.

Merced County: The “hotdog” vials were placed in the test plots before each treatment was made and at approximately weekly intervals after treatment until harvest, so the return of ants to a treated plot could be monitored. The mean number of ants per vial for each treatment are shown in Table 2-B. Clinch reduced ant activity substantially compared to check, and was especially effective when applied in mid-July. The mid-June application seemed to lose effectiveness as harvest approached. Lorsban at the 2 pint rate was effective, but reduced ant activity more slowly than had been our experience in 1999 with the 4 pint per acre rate. Distance effectively reduced ant activity in hotdog traps, and Distance was also especially effective when applied in mid-July. The June 13th application seemed less effective as harvest approached.

The measured number of kernels damaged from ant damage and the loss of kernel weight with 4 days exposure at harvest are shown in Table 3-A. This is a very important criterion, since damaged kernels will be rejected by the trade and will be a loss to the grower. Please note that this is a very rigorous test. This is a second-leaf orchard with no production, and the test nuts are the only almond kernels available to the ants. There were no significant differences in number of damaged kernels among any of the treatments from the untreated check except for the July 13 treatment of Distance. For percentage of weight loss, the June 13 and the July 13 Distance treatments significantly reduced damage below the check.

San Joaquin County Although ant populations normally increase in orchards during the summer months, the ant numbers and damage to samples decreased in this test during the time that the orchard was monitored. Although the grower treated the surrounding orchard with Clinch, we are confident that the grower did not treat the test plot. The decline in the test plot populations can not be explained at this time.

The best treatments in preventing damage to the 10-nut sample were the Clinch and the Distance followed by Lorsban and the boric acid solution. The baits plus the Lorsban treatments were better than either the

baits or the Lorsban alone. The boric acid solution has potential for use in organic orchards where growers are not allowed to use the baits.

SUMMARY

Both Clinch and Distance performed as well as the Lorsban standard as in previous years. Generally, the results were similar to the 1999 trial showing that both Clinch and Distance need to be applied from 4 to 7 weeks before harvest in order to reduce foraging ants sufficiently to adequately reduce damage. However, the Merced trial shows a definite limit to the time prior to harvest for best efficacy. Baits should not be applied longer than about 8 weeks prior to harvest to avoid the possibility that ant populations will rebound before all varieties are harvested. There does not appear to be any marked advantage to apply either material twice prior to harvest to reduce damage in that year. There does not appear to be a significant improvement in damage reduction when either of the baits are combined with Lorsban although in most cases ant activity was reduced more than in the bait alone treatments. The 2 quart/Acre rate of Lorsban appears to be generally as effective as the 4 quart rate, however the longevity of efficacy may not be as great. Activity samples are continuing in some studies to verify that. The results of the use of boric acid baits is ambiguous at best. It was not effective at all in the Kern and Merced County tests however it was one of the best materials in the San Joaquin test. This may be due to differences in the way that the bait was mixed or presented. It is known that Argentine ants are repelled when boric acid is mixed with sugar water at over about 0.5% solution. wt:wt The optimum mixture for southern fire ants remains to be adequately determined.

There appears to be a definite carryover effect into the following year from the bait treatments, particularly with Distance (data not shown in this summary). Post-harvest treatments applied in September or October, 2000 in all locations will be evaluated in the spring and summer of 2001 for reduction in ant activity.

ACKNOWLEDGEMENTS

We would like to thank the following growers for their kind generosity and assistance in conducting this project: Doug Blair, Asst. Manager, Paramount Farming Co. Shafter, CA; Bill and James McFarland of McFarland Ranch, Clovis, CA; Stan Morimoto and Danny Wade of Morimoto Farms, Livingston, CA; and John Boggs, Manager of Phippin Brothers, Manteca, CA. The project could not have been completed without the capable assistance of Peggy Shraeder, Marjie Bartels, Steve Bowman, Jose Cantu, Kerry Hedberg, and Dawn Brunmeier. We thank them very much. The advice and expertise of Chris Ishida and Randle Wittie of Novartis, Inc and Michael Ansolabehere and Tom DeWitt of Valent Corp. is much appreciated.

Table 1. Chemicals, rates, nominal timing of applications and application dates at the four trial locations in the San Joaquin Valley.

A. Fresno Treatments

<u>Chemical</u>	<u>Rate Prdct/A</u>	<u>Timing</u>	<u>Appl. Date</u>
Clinch 1.1G	1 lb	5 wks PHI	July 20
Clinch + Lorsban	1 lb + 1 qt	5 wks + 5 days	July 20+ July 25
Clinch 1.1G	1 lb + 1 lb	5 wks +1 day	July 20+ July 21
Distance	2 lb	7 weeks PHI	July 5
Distance + Lorsban	2 lb + 1 qt	7 wks + 7 days	July 5+ July 12
Clinch + Spurge	1 lb	5 wks PHI	July 20
Clinch + Lorsban	1 lb	5 wks +2 wk PHI	July 20
Distance	2 lb	Fall	Oct. 6
Distance	2 lb	Fall + Spring '01	Oct. 6
Clinch	1 lb	Fall + Spring '01	Oct. 6
Lorsban 4E	2 qts/50 GPA	2 wk PHI	July 29
Lorsban 4E	4 qts/100 GPA	2 wk PHI	July 28
Untreated			

B. San Joaquin Treatments

<u>Chemical</u>	<u>Rate Prdct/A</u>	<u>Timing</u>	<u>Appl. Date</u>
Clinch	1 lb.	12 wk PHI	June 27
Distance	2 lb.	12 wk PHI	June 27
Clinch + Clinch	1 lb + 1 lb	12 wk + 5 wk PHI	June 27 + Aug 1
Clinch	1 lb.	5 wk PHI	Aug 1
Distance	2 lb.	9 wk PHI	July 17
Distance	2 lb.	5 PHI	Aug 1
Clinch + Lorsban	1 lb + 2 qt	4 wk + 3 wk PHI	Aug 7 + Aug 15
Distance + Lorsban	2 lb + 2 qt	4 wk + 3 wk PHI	Aug 7 + Aug 15
Boric acid/sugar water	64 oz (0.25% solution)	9 wk PHI, continuous	Aug 1
Lorsban Low Rate	1 qt	3 wk PHI	Aug 15
Lorsban High Rate	2 qt	3 wk PHI	Aug 15
Untreated Control			

C. Kern Co. Treatments

<u>Chemical</u>	<u>Rate Prdct/A</u>	<u>Timing</u>	<u>Appl. Date</u>
Distance	2 lb	Spring	May 16
Distance	2 lb	Post harvest	Sept. 21
Clinch	1 lb	Spring	May 16
Clinch	1 lb	7 wk PHI	June 12
Clinch	1 lb	5 wk PHI	July 6
Clinch	1 lb	Spring + 5 wk	May 16 + July 6
Lorsban 4E	4 pt @ 100 GPA	Spring	May 15
Lorsban 4E	8 pt @ 200 GPA	Spring	May 15
Lorsban 4E	4 pt @ 100 GPA	2 wk PHI	July 28
Lorsban 4E	8 pt @ 200 GPA	2 wk PHI	July 28
Boric acid/sugar water	9 gm + 215 gm		June 14
Untreated Control			

Table 1. Continued.

D. Merced Treatments

<u>Chemical</u>	<u>Rate Prdct/A</u>	<u>Timing</u>	<u>Appl. Date</u>
CHECK			
Clinch	1 lb	13 wks	June13
Clinch	1 lb	13 + 9 wks	June13 + July 13
Clinch	1 lb	9 wks	July 13
Distance	2 lb	13 wks	June13
Distance	2 lb	13 + 9 wks	June13 + July 13
Distance	2 lb	9 wks	July 13
Lorsban 4E	2 pt	6 wks	Aug 4
Boric acid/sugar water	1% solution	8 wks, continuous	July 17, continuous
Clinch	1 lb	Post Harvest	Sept 13
Distance	2 lb	Post Harvest	Sept 13

Table 2. Effects of treatments on ant activity as measured by ant counts in hot-dog vials.

A. Fresno Co. trial.

Treatment	No. of Southern Fire Ants per Vial (n= 40)								
	28-Jun	11-Jul	18-Jul	1-Aug	8-Aug	15-Aug	23-Aug	31-Aug	13-Sep
Clinch-5 wks phi	36.1			105.8	94.9	37.2	32.8	30.6	23.0
Clinch-5 wks+1 day	43.5			91.5	58.8	44.5	23.0	11.9	7.1
Clinch +Lrsbn-5 wks+5 days	64.3			150.4	111.5	72.4	41.3	9.6	21.8
Clinch +Lrsbn-5 wks+14 days phi	85.1			72.9	55.8	23.3	15.3	4.3	5.6
Distance-7 wks phi	85.5	100.3	120.9	67.8	73.7	24.0	24.1	5.5	32.0
Distance +Lrsbn-7 wks+7 days	111.5	182.1	10.1	35.6	25.6	16.5	6.2	8.8	0.6
Lorsban-2 qt/50 GPA, 14 days phi	89.4				46.8	21.8	36.9	26.6	42.8
Lorsban-4 qt/100 GPA, 14 days	109.0			35.7	22.5	40.3	31.8	27.1	23.3
Untreated	86.7	211.4	219.2	191.4	197.9	99.8	147.1	78.6	154.7

B. Merced Co. trial.

Treatment	No. of Southern Fire Ants per Vial (n= 25)							
	8-Jun	27-Jun	10-Jul	25-Jul	3-Aug	18-Aug	23-Aug	30-Aug
Untreated	32.7	20.8	47.4	60.0	68.4	178.8	187.0	55.6
Clinch 6/13	35.8	35.6	35.4	26.6	3.0	67.8	50.0	75.7
Clinch 6/13+7/13	15.8	24.1	20.0	27.4	22.4	24.6	16.4	29.0
Clinch 7/13	24.8	52.8	43	81.6	69.9	31.6	23.8	27.4
Distance 6/13	14.9	30.0	29.1	49.3	16.1	125.2	95.0	48.7
Distance 6/13+7/13	40.2	8.8	13.0	41.3	15.6	21.1	20.2	4.3
Distance 7/13	48.3	129.4	78.4	85.4	74.4	26.7	23.0	9.8
Lorsban 4E 8/3	24.6	19.8	13.3	109.0	102.8	52.0	38.6	6.3
Boric acid	30.6	27.9	39.0	71.1	139.3	98.0	81.2	70.4

C. Kern Co. trial.

Material. Application Date. Rate	Sample date						
	5/30	6/13	6/29	7/17	7/31	8/11	
Distance, May 16, 2 lb/A	36.0a	23.8a	24.2a	4.4a	4.0a	15.8a	
Distance, September 21, 2 lb/A							
Clinch, May 16, 1 lb/A	60.0a	1.4a	77.8a	34.3abc	1.6	27.0a	
Clinch, June 12, 1 lb/A			226.2bc	87.0abcd	14.8a	33.6a	
Clinch, July 6, 1 lb/A				132.4de	31.8a	60.8ab	
Clinch, May 16-July 6, 1 lb/A	70.6a	14.8ab	56.6a	19.3ab	1.0a	11.4a	
Lorsban 4E, May 15, 4 pints/A, 100 GPA	41.0a	0.4a	244.8c	116.6cde	24.6a	67.0ab	
Lorsban 4E, May 15, 8 pints/A, 200 GPA	11.0a	1.4a	93.8ab	102.0bcde	7.6a	120.4bc	
Lorsban 4E, July 28, 4 pints/A, 100 GPA						64.6ab	
Lorsban 4E, July 28, 8 pints/A, 200 GPA						11.6a	
Boric acid, June 14, 1 % solution			266.6c	178.2e	31.2a	106.4bc	
Untreated	224.8b	36.6b	322.2c	165.0de	25.8a	150.4c	

Means within a column followed by the same letter(s) are not significantly different (P=0.05)

Table 2. Continued.

D. San Joaquin Co. Mean Number of **southern fire ants** per vial and subjective bait damage rating by all ants.

Treatment- Timing	Sample Date							
	6/21 ¹		7/12		7/26		8/8	
	SFA ²	Dmg	SFA	Dmg	SFA	Dmg	SFA	Dmg
Clinch- 12 wk PHI	30.9 ab	0.8 ab	16.8 a	0.5 abc	13.8 a	0.4 a	7.0abc	0.4ab
Knack- 12 wk PHI	53.4 abcd	1.1 abc	10.3 a	0.5 abc	20.9 ab	0.7 abcd	0.7a	0.4ab
Clinch+Clinch- 12 wk+6 wk PHI	72.7 d	1.5 cde	16.3 a	0.4 abc	22.4 ab	0.7 abcd	5.0abc	0.2a
Clinch- 6 wk PHI	27.9 a	0.9 ab	14.6 a	0.6 abc	40.0 bc	1.1 cd	9.0bc	0.3a
Knack- 9 wk PHI	34.9 abc	1.0 abc	10.8 a	0.4 abc	13.3 a	0.8 abcd	2.0ab	0.4ab
Knack- 6 wk PHI	27.8 a	1.0 abc	21.4 a	0.7 abc	17.7ab	1.0 bcd	3.0abc	0.4ab
Clinch+Lorsban- 5 wk+4 wk PHI	27.9 a	0.8 ab	5.3 a	0.3 a	8.6 a	0.8 abcd	1.0ab	0.2a
Knack+Lorsban-5 wk+4 wk PHI	20.8 a	1.3 bcd	14.4 a	0.8 bc	27.6 abc	0.6 abc	6.0abc	0.4ab
Boric Acid Bait- 4 wk PHI	36.6 abc	0.6 a	13.6 a	0.4 ab	18.2ab	1.0 bcd	0.3a	0.3a
Lorsban Low Rate- 4 wk PHI	63.6 bcd	1.8 de	14.6 a	0.5 abc	45.4 c	1.2 d	7.0abc	0.7bc
Lorsban High Rate- 4 wk PHI	66.6 cd	2.0 e	60.8 b	0.9 c	29.6 abc	1.0 bcd	11.0c	0.8c
Untreated Control	31.4 ab	0.8 ab	23.4 a	0.6 abc	23.2 ab	0.6 ab	5.0abc	0.4ab

Means within a column followed by the same letter(s) are not significantly different (DMRT, P=0.05).

¹Pretreatment counts²SFA=Fire Ant, Dmg=Damage: 0=no chewing, 1=0-10%, 2=10-25%, 3=25-50%, 4=50-75%, 5=100%E. San Joaquin Co. Mean Number of **pavement ants** per vial and subjective bait damage rating by all ants.

Treatment- Timing	Sample Date							
	6/21 ¹		7/12		7/26		8/8	
	PA ²	Dmg	PA	Dmg	PA	Dmg	PA	Dmg
Clinch- 12 wk PHI	1.9 a	0.8 ab	0.0 a	0.5 abc	0.1 a	0.4 a	0.0a	0.4ab
Knack- 12 wk PHI	4.0 a	1.1 abc	2.6 a	0.5 abc	2.6 a	0.7 abcd	0.0a	0.4ab
Clinch+Clinch- 12 wk+6 wk PHI	0.5 a	1.5 cde	2.9 a	0.4 abc	4.8 a	0.7 abcd	0.0a	0.2a
Clinch- 6 wk PHI	5.1 a	0.9 ab	18.8 b	0.6 abc	24.3 ab	1.1 cd	0.0a	0.3a
Knack- 9 wk PHI	0.2 a	1.0 abc	0.0 a	0.4 abc	28.6 ab	0.8 abcd	1.0a	0.4ab
Knack- 6 wk PHI	26.8 b	1.0 abc	8.9 ab	0.7 abc	37.0 bc	1.0 bcd	1.0a	0.4ab
Clinch+Lorsban- 5 wk+4 wk PHI	5.5 a	0.8 ab	7.8 ab	0.3 a	18.2 ab	0.8 abcd	0.0a	0.2a
Knack+Lorsban-5 wk+4 wk PHI	48.7 c	1.3 bcd	0.0 a	0.8 bc	0.0 a	0.6 abc	0.7a	0.4ab
Boric Acid Bait- 4 wk PHI	0.0 a	0.6 a	13.7 ab	0.4 ab	60.0 c	1.0 bcd	3.0a	0.3a
Lorsban Low Rate- 4 wk PHI	14.8 ab	1.8 de	2.5 a	0.5 abc	3.7 a	1.2 d	8.0a	0.7bc
Lorsban High Rate- 4 wk PHI	10.1 ab	2.0 e	3.3 a	0.9 c	14.3 ab	1.0 bcd	0.3a	0.8c
Untreated Control	0.2 a	0.8 ab	0.0 a	0.6 abc	12.1 ab	0.6 ab	2.0a	0.4ab

Means within a column followed by the same letter(s) are not significantly different (DMRT, P=0.05).

¹Pretreatment counts²PA=Pavement Ant, Dmg=Damage: 0=no chewing, 1=0-10%, 2=10-25%, 3=25-50%, 4=50-75%, 5=100%

Table 3. Average number of almond kernels in PVC bait station damaged by ants in four day test period,

A. Merced Co.

<u>Treatment</u>	<u># Nuts Damaged</u>	<u>% Weight Loss</u>
Boric acid	7.72a	51 c
Lorsban 8/4	6.00ab	38 bc
Check	5.08abc	38 bc
Clinch 6/13 & 7/13	3.04abc	17ab
Clinch 7/13	3.00abc	18ab
Clinch 6/13	2.72 bc	15ab
Distance 6/13	1.88 bc	5a
Distance 6/13 & 7/13	1.48 bc	7ab
<u>Distance 7/13</u>	<u>0.84 c</u>	<u>2a</u>

Means followed by the same letter(s) are not significantly different (DMRT, p= 0.01).

B. San Joaquin Co.

<u>Treatment</u>	<u>Damage Rating¹</u>	<u>% Consumed²</u>
Clinch- 12 wk PHI	0.6ab	13.2ab
Distance- 12 wk PHI	0.7ab	16.7 b
Clinch+Clinch- 12 wk+5 wk PHI	0.9abc	17.9 b
Clinch- 6 wk PHI	2.2 bc	22.9 b
Distance- 9 wk PHI	1.1abc	22.9 b
Distance- 6 wk PHI	1.0abc	17.9 b
Clinch+Lorsban- 4 wk+3 wk PHI	0.1a	2.5a
Distance+Lorsban-4 wk+3 wk PHI	0.1a	3.3a
Boric Acid Bait- 9 wk PHI	0.3a	4.6a
Lorsban Low Rate- 3 wk PHI	2.6 c	13.8ab
Lorsban High Rate- 3 wk PHI	1.9abc	13.3ab
<u>Untreated Control</u>	<u>0.7ab</u>	<u>16.7 b</u>

Means followed by the same letter(s) are not significantly different (DMRT, p= 0.05).

¹Damage rating is: 0= no chewing, 1= >0-10%, 2= >10-25%, 3= >25-50%, 4= >50-75%, 5= >75-100%.

²Mean percentage of nuts damaged.