Annual Report to
Almond Board of California
May 1, 2003

Project No.: 2002-FZ-o0 Insect and Mite Research
Correct Project Number: 02-FZ-00

Project Leader:
Frank G. Zalom
Department of Entomology
University of California
Davis, CA 95616
Tel: (530) 752-3687

Project Participants: UC Farm Advisors and Rich Coviello (UCCE Fresno Co.) and Toby Glik (UC Davis) for Objective 1; Walt Bentley (UC Kearney Agricultural Center), Mario Viveros (UCCE Kern Co.), Minnerva Gonzalez (UC KAC) and Peggy Schraeder (UC KAC) for Objective 2; Mike Oliver (UC Davis), Barry Wilson (UC Davis) and Herb Scher (UC Davis) for Objective 3; John Edstrom (UCCE Colusa Co.), Toby Glik and Beth Teviotdale (UC KAC) for Objective 4.

Objectives:

1. Purchase pheromone traps, navel orangeworm (NOW) bait traps, and lures for UC Cooperative Extension Farm Advisors as part of their ongoing monitoring and extension efforts. Determine distribution of NOW eggs on the almond tree canopy.

2. San Jose Scale - Complete study of monitoring of SJS by correlating male abundance in pheromone traps to scale crawlers and scales on almond spurs. Determine distance that SJS males can move to pheromone traps, and the effect of SJS density on male trap captures.

3. San Jose scale and peach twig borer control - Conduct field trials to test the efficacy of different dormant sprays and treatment timings for control of San Jose scale and peach twig borer.

4. Spider mite/ predator bioassays – Determine impact, if any, of fungicides and new miticides used in almonds on spider mites and mite predators.

Summary of Results:

Objective 1, Monitoring supplies and navel orangeworm spatial distribution. Each year through this project, trapping supplies are purchased for use by UC Cooperative Extension Farm Advisors to help them to monitor the phenological activity of specific insects in their counties. The advisors use the data gathered from these traps to update status of various almond insect pests for local growers and PCA's. Trapping records are solicited from the Advisors at the end of each season, and become part of a database for research and validation when needed. For the

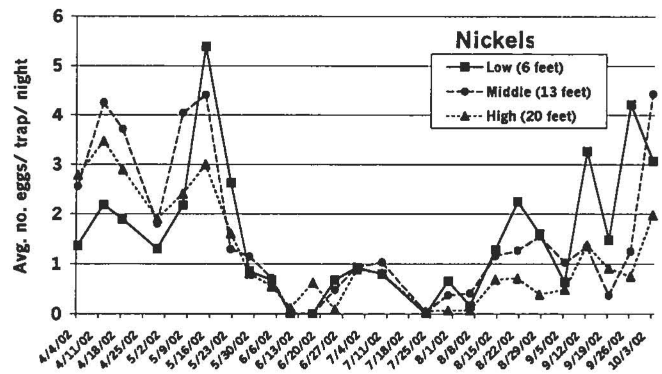
2002 season, supplies purchased included over 1800 traps and trap liners, 835 pheromone lures, and 17 lbs of navel orangeworm bait (see Table 1 for distribution in 2002). This was somewhat fewer than in previous years. Trapping data and weekly degree-day updates collected by Rich Coviello were distributed by email and on the UC Kearney Agricultural Center (http://www.uckac.edu/treefruitIPM/PMA/degreeday.htm) and Fresno County Cooperative Extension (http://cefresno.ucdavis.edu/Entomology/) world wide web sites during the spring and summer of 2002, for 5 peach twig borer locations (Fowler, Laton, Panoche, Coalinga and Parlier), 4 San Jose scale locations (Fowler, Laton, Coalinga and Parlier), 3 oriental fruit moth locations (Fowler, Laton and Parlier), and 3 navel orangeworm locations (Fowler, Panoche and Coalinga).

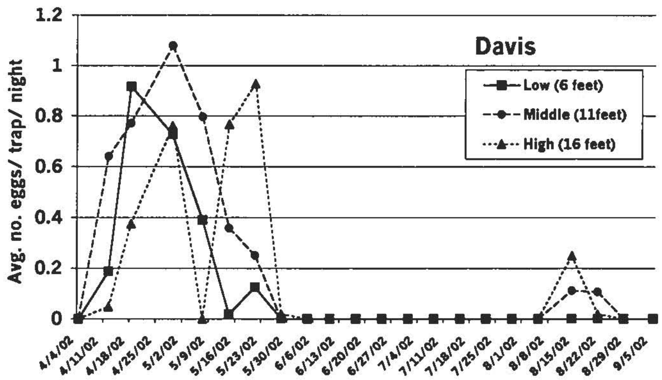
Determining the spatial location of nuts on which navel orangeworms prefer to oviposit is significant both in terms of where to place traps for monitoring but also to improve the potential for ovipositional disruption. To determine if there is a preferred height in an almond tree for oviposition, navel orangeworm egg traps were placed at 3 heights in two orchards on Fresno county's west side (Panoche and Coalinga) and in two orchards in the Sacramento Valley (UC Davis and Arbuckle). Each trap location within an orchard consisted of a 20 ft length of PVC pipe placed vertically within a tree to which were attached standard Trece black navel orangeworm bait vials baited with almond press cake at 6, 12 and 18 ft heights. Eight locations were monitored weekly within each orchard. The Panoche orchard and UC Davis orchard were mature orchards close-planted at 12 ft or less tree spacing and 24 ft row spacing. The Coalinga orchard was the youngest of the orchards, estimated at 8-10 years of age, while the Arbuckle orchard was mature. Both the Coalinga and Arbuckle orchards were planted at a density of approximately 22 ft tree spacing and 24 ft row spacing. Densities were highest in the Panoche orchard, moderate at Coalinga and Arbuckle, and low at Davis, with densities possibly due to the cultivars present at each site. Results from 2002 showed no consistent pattern of oviposition by height (Figure 1). The total number of eggs trapped in the Panoche orchard were significantly greater (P=0.0001) at the 6 ft level (2569) than at 12 (1022) or 18 (813) feet, but were lower (P=0.0083) at the 6 ft level (158) than at 12 (454) or 18 (512) feet in the Coalinga orchard. There was no significant difference (P>0.05) between location at the Arbuckle (6 ft.=288; 12ft.=292; 18 ft=220) or Davis sites (6 ft.=153; 12ft.=272; 18 ft=265).

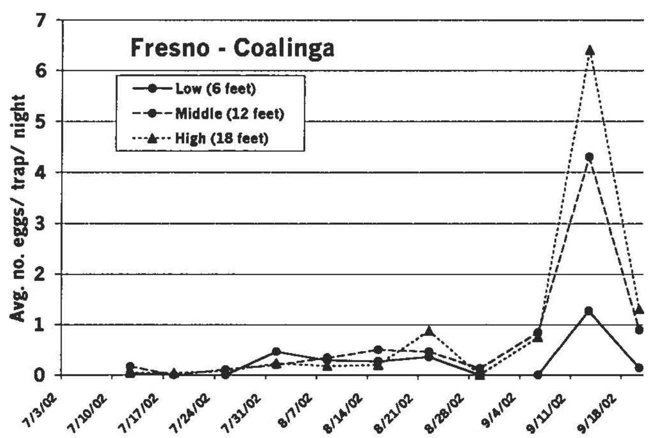
Table 1. Trapping supplies purchased for monitoring insect pests in almonds, 2002.

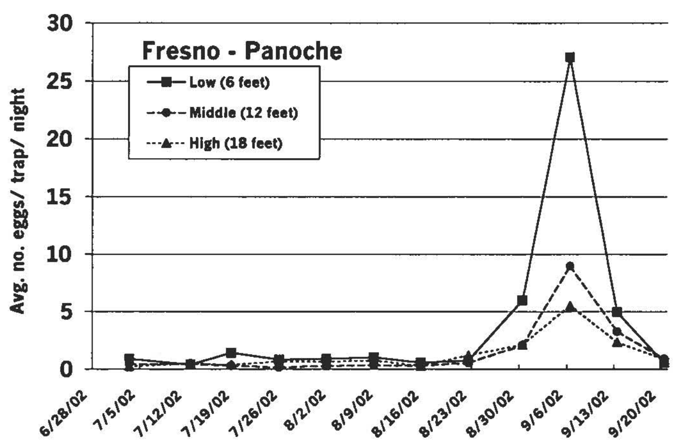
Name	Location	Wing Traps	Trap Liners	NOW Traps	SJS Traps	PTB Lures	OFM Lures	SJS Lures	NOW Bait (lb)
R. Coviello	Fresno Co.	225	450	100	350	25	25	275	8
W. Bentley	UC Kac				500			75	
J. Edstrom	Colusa Co.	8	30	4	8	15		8	2
R. Buchner	Tehama Co.	16	50	4	4	50	50	12	1
W. Reil	Yolo Co.		50			100			1
F. Zalom	UC Davis	100	100	50	100	100		100	5
Total	All Sites	350	680	158	962	290	75	470	17

Figure 1. Seasonal navel orangeworm trap captures at 3 heights in 4 locations, 2002.


Nickels
Low (6 feet)
Middle (13 feet)
High (20 feet)
Avg. no. eggs/ trap/ night


Davis
Low (6 feet)
Middle (11feet)
High (16 feet)
Avg. no. eggs/ trap/ night


Fresno - Coalinga
Low (6 feet)
Middle (12 feet)
High (18 feet)
Avg. no. eggs/ trap/ night

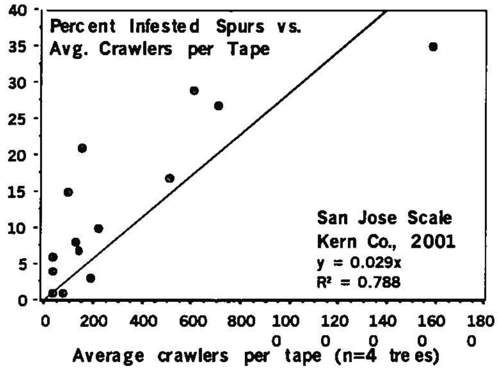

Fresno - Panoche
Low (6 feet)
Middle (12 feet)
High (18 feet)
Avg. no. eggs/ trap/ night

Objective 2, San Jose scale. Sampling decision rules for San Jose scale are not established. Because wood infestation is often difficult to detect, many farmers annually apply dormant sprays as a prophylactic treatment. Goals of this study are to determine acceptable monitoring methods for San Jose scale, and to identify levels of San Jose scale in almonds that require insecticide application. Last year we reported a statistically significant, but rather variable relationship of number of male scales in pheromone traps to number of crawlers on sticky tape bands. In order to use these sampling methods, they must be related to infested spurs and spur death due to scale infestation. Five San Jose scale infested almond orchards in Kern County were selected for monitoring in 2001, ranging in size from 37 to 66 acres. Nonpareil was the predominant cultivar in 4 of the orchards, comprising 50% of the plantings, while Butte comprised 50% of the planting in the fifth orchard.

Crawlers were monitored on four trees around each of the pheromone trap locations. The tree located at each of the four compass points around the tree that held the pheromone trap was monitored for SJS crawlers. A single double-sided sticky tape was placed on one of the scaffolds. The scaffold chosen ranged from 3 to 8 inches in circumference. Tapes were placed prior to crawler emergence in spring, 2001 (April 1), and were changed after each crawler generation (a total of five changes made at approximately 6 week intervals). Crawlers on the tapes were counted, and the number of crawlers per tape totaled for the year. Data presented are the number of crawlers per tape per trapping location for the entire season. During December, 25 live spurs were collected from each of the trees where the sticky tapes were deployed. A total of 100 spurs were collected from the four trees surrounding the SJS pheromone traps, and the base to a distance of 3 inches along the spur examined for live scales. Data obtained include the number of live scale per spur, and the number of infested spurs. Linear regression analysis (Stat View 5.1) was performed to determine the relationship of number of crawlers per tape per year as the independent variable and the number of infested spurs per 100 (same as percent of spurs infested) as the dependent variable. Regression analysis was also performed to determine the relationship between the number of male SJS per pheromone trap as the independent variable and the number of infested spurs. Regressions were performed for each orchard independently and by pooling the five orchards.

When the number of crawlers per tape per season at each trapping location in each orchard was pooled and regressed against the percent of infested spurs (n=100 per tree), a highly significant (R^2=0.788; P<0.0001; StatView 5.1, no intercept model) relationship was indicated. The regression equation was y=0.029x (n=18) (Figure 2). When averaging the number of crawlers per tape per orchard for the season and regressing these data against the total number of infested spurs collected from each orchard (n=5 orchards), a highly significant (R^2=0.982; P<0.001; StatView 5.1, no intercept model) regression was indicated. The regression equation was y=-3.317+0.131x. Similarly, when the number of male scales per trap per season for each orchard was regressed against the number of SJS infested spurs, a significant (R^2=0.772; P<0.0212; StatView 5.1, no intercept model) regression was indicated (StatView 5.1, no intercept model). The regression equation was y=2.973x.

Figure 2. Relationship between mean number of San Jose scale crawlers per tape per season (n=4 trees per site) and percent spur infestation (n=100 spurs per site) for all locations combined in the 5 orchards (n=18 locations) in December, 2001.



These results indicate that there is a relationship between total San Jose scale crawlers trapped per tape per season and the amount of almond spurs infested. This is an excellent follow up to our previous work that indicated that there is a significant but rather variable relationship of number of male scales in pheromone traps to number of crawlers on sticky tape bands. This prompted us to try to determine if one of these measures of San Jose scale infestation can be used to predict amount of wood death, thus resulting in a treatment threshold for San Jose scale.

The hypothesis that some measure of scale infestation can be used to predict San Jose scale damage was tested in the same orchard used in the almond PMA project in both 2001 and 2002. This was possible because of the different treatments that were being applied to individual plots which created a series of scale densities. The orchard is a 160 acre planting located near Delano in Kern County. The orchard consists of two 40 acre blocks of "hard" shell varieties (Butte, Mission and Padre) and two 40 acre blocks of "soft" shell varieties (Nonpareil, Sonora and Fritz). Each 40 acre block was divided in half in 1999 at the beginning of the project. One half has been managed with non-disruptive insecticides (termed 'Reduced Input') and the other with traditional organophosphate insecticides (termed 'Conventional'). In 2001, each half was again split equally with one portion receiving no dormant spray (termed 'Reduced Input - No Dormant Spray' or 'Conventional - No Dormant Spray').

In January, 2001, and February, 2002, the 'Reduced Input' treatment (10 acres of the original 20 acre plot) was sprayed with 6 gallons of Volck® Supreme oil in 200 gallons of water per acre. The remaining 10 acres were left untreated in both 2001 and 2002. On the same dates, the 'Conventional' treatment was sprayed with 4 pints of diazinon and 6 gallons of Volck® Supreme Oil in 200 gallons of water per acre. This treatment was also applied to only 10 acres of each replicate, the remaining 10 acres being left untreated.

San Jose scales were monitored with San Jose scale pheromone traps (Trece®) and double-sided sticky tapes during the growing season, and spur sampling during the dormant season. Two San Jose scale traps were placed in each of the two primary treatments ('Reduced input' and "Conventional'). One trap was placed in the treated area, and the second trap in the unsprayed area. The traps were deployed on February 20 in both years. Male scale and parasitoid (*Encarsia* *perniciosi* and *Aphytis* spp.) were recorded each week. Double-sided sticky tape was placed on the tertiary scaffold of the tree on which the San Jose scale pheromone trap was located. Double-sided sticky tape was deployed around a single tertiary scaffold of the first adjacent tree at each of the four major compass points around the tree holding the pheromone trap. This resulted in five sticky tapes for each trap. Tapes were changed every week. In October, 2002, each of the trees with a sticky tape were rated for scale infestation on a 0 to 3 basis, and examined for the presence of scale on wood. A 0 rating indicated no evidence of scale damage, and no scales were found in a 2 minute search of the wood. A rating of 1 was assigned if any leaves attached to spurs were wilting or dying, and any scales were found in a 2 minute timed search. A rating of 2 was assigned if larger branches showed symptoms of scale infestation such as dead leaves and wood, and scales were common on the branches. A rating of 3 was assigned if larger limbs and leaves were dying, and numerous scales were present on the scaffolds. One hundred spurs were collected from each of the trap locations (20 spurs from each of the trees with a crawler tape), and scales counted. Regression analysis was employed to examine the number of infested spurs found in December to the severity rating of infestation assigned the previous October.

Figure 3 presents the seasonal flight activity of male San Jose scales in each of the four replicate treatments. Each of four flight periods are easily discernible. The number of males trapped per season does not reflect whether or not a dormant spray was used. This is especially true of the 'Reduced Input - No Dormant Spray' treatment where 4329 males were captured per season, the lowest abundance of any treatment. The 'Reduced Input' treatment where a dormant was applied had 6,631 males per season, the highest abundance of any treatment. Although these captures were based on the average of four replications, we believe that more traps per block would be needed to accurately reflect abundance. The high population of female San Jose scale appeared to inhibit trap catch.

Figure 3. Seasonal flight activity of male San Jose scale in each of four treated areas, Kern County almonds, 2002.

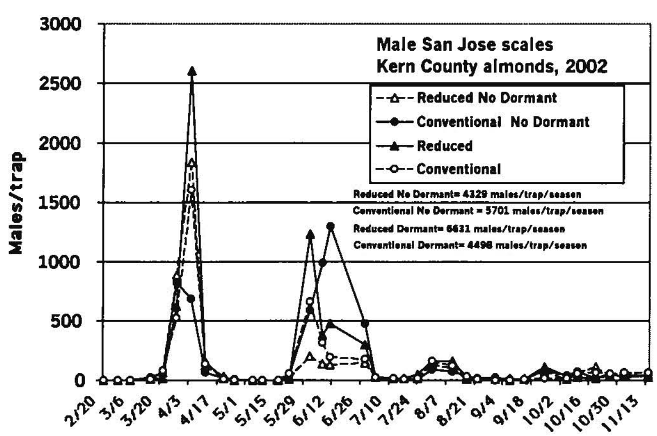
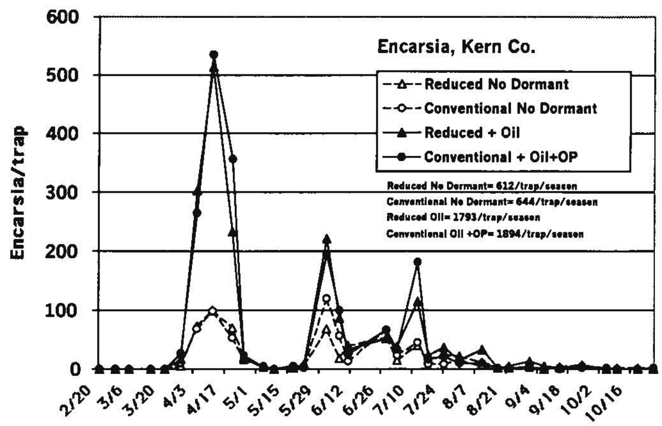


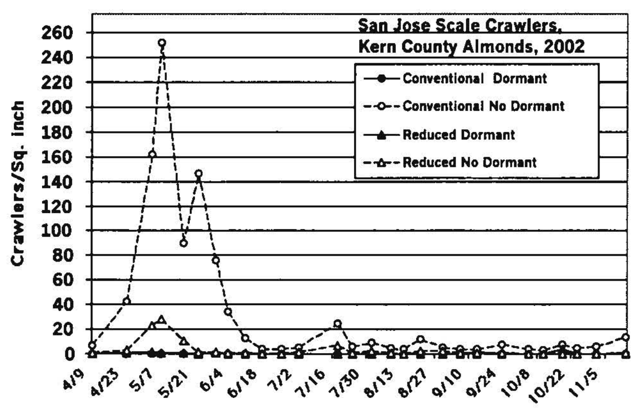
Figure 4 presents the seasonal abundance of *Encarsia perniciosi*. The population dynamics of *Encarsia* follow that of male San Jose scale emergence in the spring, early summer and summer. The abundance of *Encarsia* was greater in the treated plots than in the untreated plots. There may be a greater attraction to resident female San Jose scales than to the traps placed in the untreated plots.

Figure 4. Seasonal flight activity of *Encarsia* captured on San Jose scale traps in each of four treated areas, Kern County almonds, 2002.



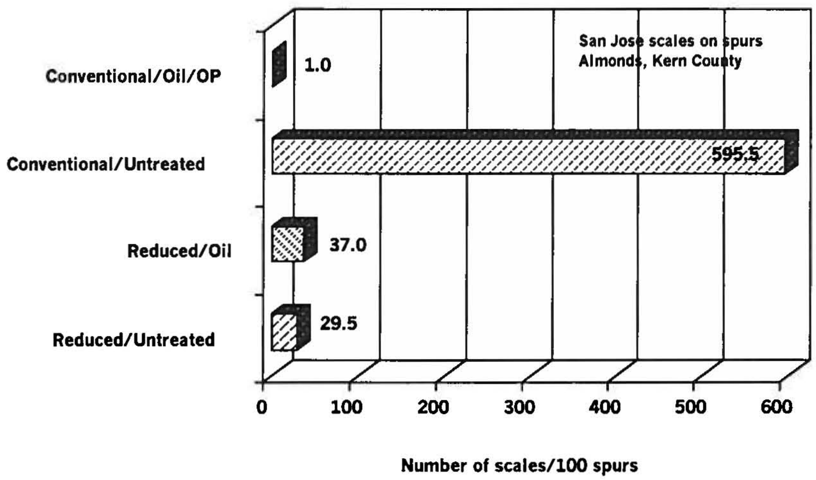
San Jose scale crawler abundance on sticky tapes was low when first collected on April 9. Peak crawler emergence from the first generation occurred on May 7 (Figure 5). Second generation crawler captures reached a peak on July 23, and the third generation on August 27. The number of first generation crawlers per square inch of tape averaged 0.27, 4.5, 70.3, and 829.8 for the 'Conventional' (with dormant organophosphate plus oil spray), 'Reduced Input' - Dormant Oil, 'Reduced Input' (no dormant spray), and 'Conventional - No Dormant Spray' treatments, respectively. The 'Conventional - No Dormant Spray' had a significantly greater number of San Jose scale crawlers for the first generation ($p<0.06$, Fisher's Protected LSD) than did the other three treatments. The other three treatments did not differ significantly from one another.

Figure 5. San Jose scale seasonal crawler abundance, Kern County almonds, 2002.



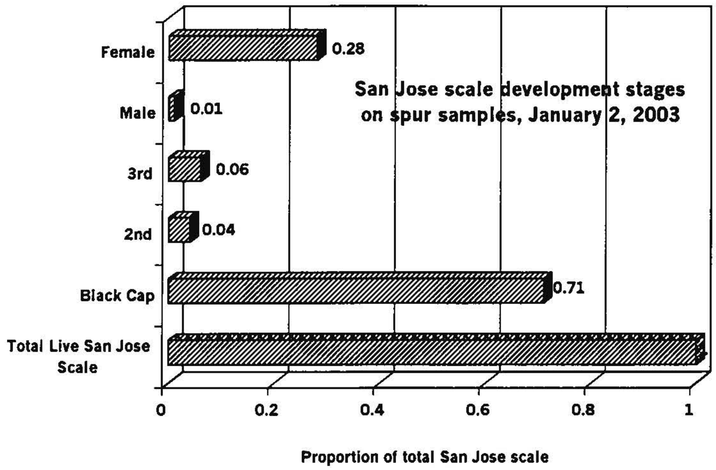
One hundred spurs were collected from each plot on January 2, 2003. The average number of adult scales found per 100 spurs is shown on Figure 6. An average of 59.5 scales per spur were found in the 'Conventional - No Dormant Spray' treatment. The lowest abundance of San Jose scales was found in the 'Conventional - Dormant Spray' plots where an average of 0.01 scales per spur was recorded. The 'Reduced Input - Dormant Oil treatment averaged 0.37 scales per spur, and the 'Reduced Input - No Dormant Oil' treatment averaged 0.30 scales per spur. An analysis of variance of the number of infested spurs resulted in 50.5 scales per spur in the 'Conventional No Dormant Spray', 0.25 in the Conventional Dormant, 12.25 in the Reduced Input, No Dormant Oil, and 10.5 in the Reduced Input , Dormant Oil. Only the Conventional, No Dormant Treatment was significantly different from the remaining three treatments (p<0.01, Fisher's Protected LSD).

Figure 6. San Jose scale abundance recorded on spurs collected January 2, 2003, Kern County almonds.



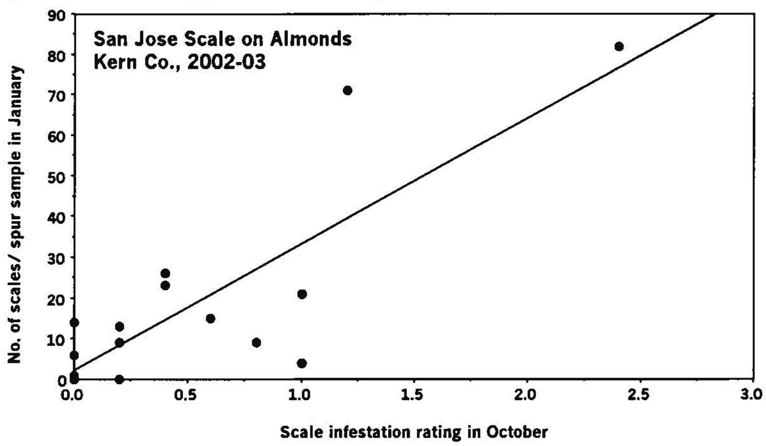
A subsample of 75 heavily infested spurs from the January sample was examined for stage of San Jose scale development. A total of 1972 live individuals were found. The first instar 'black cap' stage comprised 70% of the population (Figure 7). Trees that were rated for San Jose scale infestation in October, were the same trees from which spurs were subsequently collected in January. The results of the October severity rating (0 to 3) was similar to that of the spur infestation in January. The most severely damaged trees were found in the 'Conventional with No Dormant Spray' treatment (average rating of 1.1) The 'Conventional with a Dormant Spray' treatment had the lowest rating (0.05) and was significantly different from the 'Conventional with No Dormant Spray' treatment (p<0.05) by Fisher's Protected LSD. The lowest rated treatment was not different from the 'Reduced Input with Dormant Oil' Treatment (0.10 rating) or the 'Reduced Input with No Dormant' treatment (0.85 rating). The 'Reduced Input with No Dormant' treatment was not significantly different (p>0.05) from the 'Conventional with No Dormant Spray' treatment.

Figure 7. San Jose scale development stages on spurs collected January 2, 2003, from almond trees, Kern County.



A simple regression analysis was performed using the number of infested spurs as the independent variable and the infestation rating as the dependent variable (Figure 8). A highly significant (p<0.0001) regression resulted from the analysis ($y=2.12+30.96x$; $R^2=0.667$). Further regression analysis to determine relationship of scale crawlers on sticky bands to scales on dormant spurs has not yet been completed.

Figure 8. Regression analysis of San Jose scale severity rating in October to number of scales on spurs in January, Kern County.



Objective 3, San Jose scale and peach twig borer control. Two studies to determine the effect of treatment timing on dormant spray efficacy were conducted in an almond orchard east of Waterford in Stanislaus Co., and a prune orchard near Sutter in Sutter Co. Treatment timing may be important to reducing organophosphate runoff as it is presumed that applications made before the soil is saturated will be absorbed into the soil where microorganisms can destroy the chemical naturally. Results from winter 2000-01 reported last year indicated no significant difference (p>0.05) between early, middle and late treatment timings for either San Jose scale or peach twig borer control in almond orchards monitored in Stanislaus and Merced County.

The Stanislaus Co. orchard was divided into plots of ~500 trees. Four treatments, each replicated 3 times, were assigned to the plots in a randomized complete block design. The treatments were

4 pts/ac Chlorpyrifos 4E with 4 g/ac of horticultural mineral oil and 50 g/ac of water applied on either December 13, 2001, January 7, 2002, or January 30, 2002 and untreated. The Sutter Co. orchard was divided into 9 replicate areas, each 10 rows wide and over 100 trees long. Three treatments, each replicated 3 times were assigned to the plots in a randomized complete block design. The treatments were 4 pts/ac Diazinon with 3 g/ac of horticultural mineral oil and 100 g/ac of water applied on either January 12, 2002, February 2, 2002, or February 22, 2002. The trees were planted on berms, allowing us to monitor water runoff from the plots. Our autosampler units were located in the middle row of each treated lot, and 150 feet from the upslope end of the row. Runoff volume measurements were recorded from each significant storm event, and composited water samples were collected for chemical analysis and non target bioassays.

At both sites, SJS adult males were monitored using SJS pheromone traps (Trece Inc., Salinas, CA, USA). Both the trap and the lure were changed every four weeks. Two of the traps were placed in trees in the center row of each treatment replicate at a height of about 2 m in mid-March. The number of SJS males per pheromone trap were summed for the first generation. At the Stanislaus Co. site, peach twig borer density in each treatment was assessed by monitoring 25 watersprouts randomly collected from trees near the center of each plot. A significant difference (F=6.259, P=0.0171, df=3,8) in SJS males captured in pheromone traps was observed between treatments in the Stanislaus Co. orchard (Table 2). No significant difference (F=1.193, P=0.3662, df=2,6) in mean ($\pm$SD) SJS males captured in pheromone traps was observed between treatments in the Sutter Co. orchard (early = 41.0$\pm$20.7; middle = 21.0$\pm$5.6; late = 30.3$\pm$17.2.

Table 2. Total San Jose scale males per trap during the first flight, 2002, Stanislaus Co.

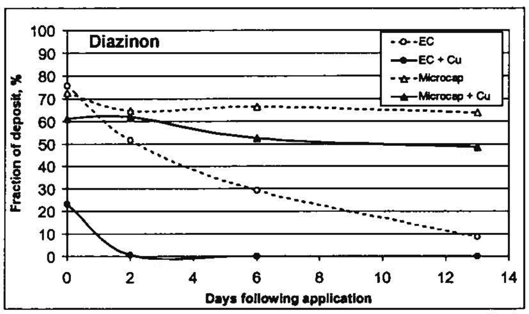
Treatment	Mean	$\pm$ SD
Untreated	225.3	$\pm$ 114.7 b
Diazinon mid-December	26.0	$\pm$ 10.4 a
Diazinon early January	54.7	$\pm$ 36.7 a
Diazinon late January	70.7	$\pm$ 26.6 a

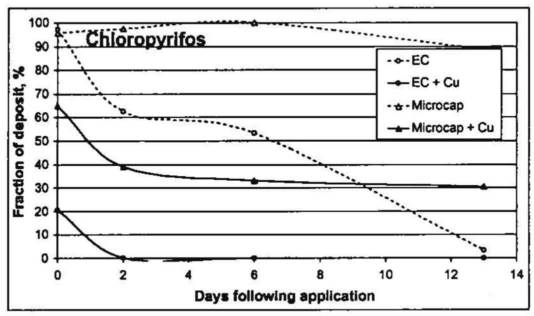
Means followed by the same letter do not differ significantly (P>0.05) by Fisher's Protected LSD.

Unlike more typical winters when large rainfall events occur during the months of January and February, only one significant storm occurred (1.5 inch on March 11) that was sufficient to result in any measurable runoff. Cumulative rainfall following the diazinon application in the 3 treatments was 4.14, 3.37 and 1.98 inches in the early, middle and late treatment timings, respectively. Average Diazinon concentrations for runoff collected following the March 11 rainfall event was 3.60, 11.46 and 31.32 ppb for the early, middle and late treatment timings. Bioassay results for the nontarget indicator species *Ceriodaphnia dubia* followed this trend. These data suggest that runoff following winter applications of diazinon can be mitigated by shifting to earlier dormant applications. However, concern exists for the potential for trees to be "burned" as a result of the application of oils that are a normal component of dormant sprays.

Copper ions are known to catalyze the hydrolytic decomposition of organophosphate insecticides, and may result in accelerated decomposition of the organophosphate on the tree surface requiring higher rates to achieve control. Laboratory experiments using diazinon and chlorpyrifos were conducted using both emulsifiable concentrate (Diazinon 4EC and Lorsban 4EC, respectively) and microcapsule (Knox Out 2FM and Empire 20, respectively) formulations. Copper hydroxide was chosen as the copper fungicide in these experiments as it is one of the most common forms of copper used in dormant spray tank mixes. The laboratory experiments were conducted using glass microscope concave well slides into which field rates of organophosphate and copper hydroxide mixtures were introduced for 2 hours, allowed to dry and stored in a 100% relative humidity chamber. The slides were withdrawn after 0, 2, 6 and 12 days, and analyzed for remaining insecticide. Results indicate that the presence of copper hydroxide accelerates organophosphate decomposition, and that the microencapsulation mitigates the catalytic decomposition (Figure 9). Further laboratory work is being planed to determine whether the addition of oil to the tank mix might mitigate the catalytic effects of the copper on the organophosphate. We are also following up on this laboratory study with a field evaluation of whether copper with and without oil might influence the efficacy of the organophosphates.

Figure 9. Percent of diazinon and chlorpyrifos remaining 0, 2, 6 and 12 days after application.

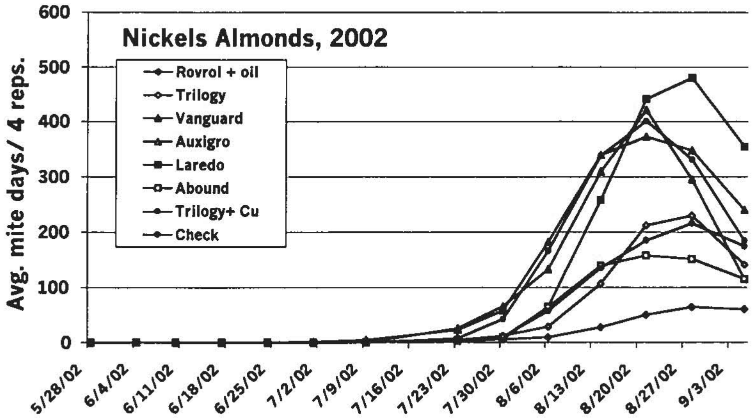




Objective 4, Spider mite and predator bioassays. John Edstom has been working with Beth Teviotdale on fungicides for control of brown rot and leaf blight at Nickels Estate in Arbuckle. Observations of their experimental plots in July and August, 2000 indicated the possibility that there might be some effects of the fungicides on webspinning spider mites. In 2001, we reported significantly more spider mite-days accumulated on individual trees treated with Laredo 2EC (12.8 oz/ac) or Auxigro WP (4 oz) than with Trilogy (neem oil, 1% by volume) or left untreated. In lab bioassays, we also showed that the fungicides Abound, Auxigro, Captan, Flint, Rovral, Laredo and Ziram did not significantly increase mortality of the predator mite *Galendromus occidentalis* at rates up to 10 times the label rate. Trilogy did cause significant mortality to the predator mite. These data suggest that fungicide impact on this mite predator did not result in our observation of increased mite-days following their application.

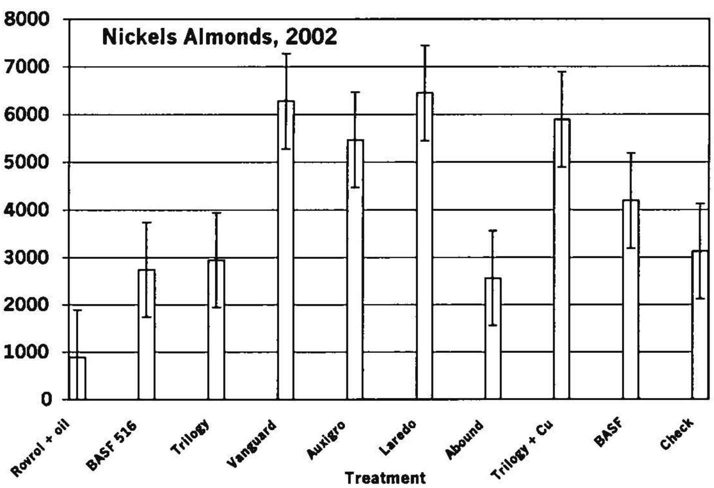
The 2002 fungicide trial at Nickels Estate was sprayed using a handgun sprayer to runoff with label rates of Abound, Auxigro, Laredo, Vanguard, Rovrol, Rovrol plus copper, Trilogy, Trilogy plus copper, and 2 numbered BASF materials. Single tree treatments were arranged in four randomized complete blocks each with an untreated control. Ten leaves were collected per treatment replicate beginning April 23, 2002, and returned to the laboratory where they were mite-brushed and counted. Sampling continued at weekly intervals through mid September.

Figure 10. Mite days per weekly sampling period in almond trees treated with fungicides during spring, 2002, at Nickels Estate, Colusa Co. (n=4).



As in 2001, certain spring applied fungicides appeared to influence the abundance of spider mites found on individual treated trees later in the 2002 growing season (Figure 10). Difference between treatments were significant by ANOVA (F=2.491; df=9,30; p=0.0293), and once again trees treated with Laredo and Auxigro developed greater spider mite densities than did the untreated check. Mechanisms for this are not known, but the observation suggests that practices used for controlling certain target pests may have unintended impacts on other pests species.

Figure 11. Average total mite days (± 5% SE) per treatment (n=4) for almond trees treated with different fungicides during spring 2002, at Nickels Estate, Colusa Co.



Lab bioassays of 5 registered miticides were conducted on the predator mite, *G. occidentalis*. The predator mites were individually transferred to treated petri dish arenas that contained spider mite eggs as a food source. Each arena contained 5 predator mites, and each treatment was replicated 4 times. Survival was assessed after 72 hours, providing a residual

Table 3. Proportion of the high label rate of registered almond miticides at which 50% (LD50) and 90% (LD90) of *Galandromus occidentalis* survive 72 hours after exposure in a Petri dish bioassay.

	Proportion of field rate

Trade name	Chemical name	LD50	LD90
Agrimek	abamectin	0.006	0.049
Apollo	clofentezine	253.075	2112.850
Omite	propargite	1.040	9.177
Pyramite	pyridaben	0.015	0.012
Valero	Cinnamic aldehyde	0.229	1.862

bioassay. Table 3 presents the LD50 and LD90 values for the miticides tested. These data indicate that 50% of a population will survive a standard Omite treatment. We have always considered Omite to be a 'selective' miticide because of relatively good predator survival even at the full label rate. Previous field trials have also shown that an even greater proportion of *G. occidentalis* will survive below label rates of Omite. The other miticides tested except Apollo proved to be less selective than Omite. Apollo was relatively nontoxic to the adult predators, but this probably reflects the ovicidal activity of this chemical. Our study does not examine the effects on *G. occidentalis* eggs or any reduction in fecundity that might result from exposure. We have not been able to test additional miticides this year as the Staff Research Associate that had been conducting these tests resigned midway through the year. We are in the process of training a new Staff Research Associate and will complete the study during 2003.

Additional research on almonds: We continue to work with agencies and stakeholder groups on the development of mitigation practices for dormant organophosphate and pyrethroid sprays used on almond and stone fruit orchards. This work is currently funded by a 2 year contract with the California Department of Pesticide Regulation to Frank Zalom at a level of approximately $115,000 per year. Information from this work is presented at various meetings during the year, and we can make reports available to the Almond Board of California.