ALMOND BOARD OF CALIFORNIA
ANNUAL REPORT - 1990

Project No. 90-C13 - Insect and Mite Research

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Objectives:

1) Provide traps and lures to Cooperative Extension Advisors to monitor population levels of navel orangeworm, peach twig borer, and oriental fruit moth on an ongoing basis. This information will be summarized and used to interpret and validate phenology models on almonds.

2) Field validate mite management software.

3) Initiate studies of navel orangeworm pheromone.

4) Field test *Bacillus thuringiensis* for control of navel orangeworm and peach twig borer.

Results:

1) *Population monitoring.* In 1990, we purchased insect monitoring supplies for 8 Cooperative Extension Farm Advisors. A total of 200 wing-style traps, 450 trap bottoms, and 50 navel orangeworm traps were purchased, along with over 700 peach twig borer lures, 200 oriental fruit moth lures, and navel orangeworm bait. Joe Connell, Rich Coviello, John Edstrom, Mark Freeman, Joe Grant, Janine Hasey, Lonnie Hendricks and Wilbur Reil all unselfishly contributed their labor to this effort. Data obtained from their

efforts will be assembled at Davis, and will become part of our database on pest phenology in almonds. We hope to continue this objective in future years.

2) *Mite Management Program.* Development of a computer program for predicting development of spider mite and predator populations, and for relating presence-absence or brush and count monitoring to mite-day thresholds was initiated in September, 1988. The development of such a program seemed useful to address the different approaches to sampling and determining treatment thresholds. The program developed is based on the observation that if the fraction of leaves containing spider mites and the fraction containing predacious mites are plotted as functions of time then both of these curves are approximately logistic, or S - shaped. The model used consists of fitting a logistic curve to the two data sets using least squares regression, extrapolating the curves in time, and determining whether these curves intersect, and if so, where they intersect (Figure 1). If the two curves intersect below the economic threshold then the predators can be expected to control the spider mites and no pesticide is needed. If the two curves intersect at a point above the economic threshold, then depending on the projected level of infestation when they intersect, a reduced level of pesticide can be recommended that will provide sufficient control to assist the predators to achieve control. Either binomial sampling or actual spider mite counts can be used for projections.

Data sets had been collected from almond orchards in 3 counties for initial development of the model and testing of the program. These data sets consisted of proportion of leaves infested with spider mites and predator mites throughout the season. The model was modified using these data sets by constructing the regression curves, projecting the curves to future time values, and comparing the projected data values with those actually obtained.

In 1990, two orchard were monitored in Yolo County to validate projections made by the program. In the first orchard (Figure 2), spider mites remained at fairly consistent, but relatively high levels throughout the season. The model projections also predicted that the populations based on these trends would only gradually increase. The same was true of predator mite populations which declined slightly during the period as was predicted from projections from the initial 3 counts. The program would have indicated that an acaricide should be applied to the orchard at some point in late July. The second orchard (Figure 3) provided a much better test of the model as initial counts were made before spider mite population began to rise. It can be seen the the spider mite population trend closely approximated a logistic curve as predicted by the regression model. The predator mite population did not increase until later in the season. The program did not predict the spider mite and predator populations would cross, and an acaricide treatment was projected. This seems promising on the surface, but the orchards really did not provide the opportunity to test the most critical part of the program, the point at which predator and prey populations would cross. Because of the difficulties in finding the proper conditions under which to test this program, it will be necessary to continue to gather data sets of spider mite and predator populations. Data sets obtained for all purposes in the next season will be used as validation sets.

3) *Navel Orangeworm Pheromones and Other Semiochemicals.* In 1989, we established a colony of navel orangeworm at Davis, and supplied Dr. Les McDonough with pupae from this colony through the summer of 1990. We also provided freshly collected worms from field samples for comparison. We shipped the specimens via Federal Express to Dr. Mc Donough at the quarantine facility of the USDA Tree Fruit Lab at Yakima, Washington at intervals of approximately 2 weeks. Extracts from the female moths were tested on male moths in a flight tunnel. It was our intent to field test the extracts in California when his laboratory results indicated a candidate material with potential for field success.

Dr. McDonough has encountered considerable difficulty in his studies because of the behavior of navel orangeworm in his flight tunnels. Apparently, the adult males do not readily fly. Therefore, he has been working with Dr. Harry Davis of the same laboratory to determine flight stimula. In September, Drs. McDonough and Davis informed me that they would no longer be able to pursue these studies as their lab has been redirected entirely into work on pests of apples. They were very disappointed. Apparently this is one result of the current budget problems of the USDA. Therefore, we will be unable to pursue this work.

Ovipositional disruptant. In 1990, we were approached by Jim Gaggero of Pacific Biocontrol Ltd. to validate the effect of an ovipositional disruptant they are they are trying to license which is based on the technology developed by Tom Baker and Larry Phalen.

John Edstrom and I cooperated on a field trial conducted at Nickel's Estate in Colusa County to test this material. The trial consisted of 4 replicates of paired treated and untreated plots. The plots were treated on July 24, just after the initiation of hullsplit. Each plot was 7 x 7 trees in size. Egg traps were used to monitor oviposition, with 5 egg traps per replicate. At harvest which occurred on August 22, four, 500 nut samples were taken from the middle rows of the plots. All nuts were handcracked and checked for both navel orangeworm and peach twig borer damage. Data were analyzed using analysis of variance with a randomized complete block design. Data between the two treatments were not significantly different, but approached significance ($F=7.470$; $P=0.0706$; $n=4$). The mean ($\pm$ standard deviation) damage was 6.938 (2.882) for the untreated plots, and 3.875 (1.560) for the treated plots. The difference might have been significant with more replication, as if the data were analyzed as a completely randomized block (an incorrect statistical test in this case) a difference would have been seen ($F=5.155$; $P=0.0288$). No significant difference was seen for peach twig borer ($F=0.440$; $P=0.557$), although mean ($\pm$ standard deviation) damage was higher in the untreated (2.000 ± 2.843) plots than the treated plots (0.937 ± 0.898). Reduced oviposition as measured in egg traps was also observed in the treated plots (Figure 4).

4) *Bacillus thuringiensis* *research.* In 1989, we began to explore the possibility of using *Bacillus thuringiensis* (B.t.) for control of navel orangeworm. In 1990, this work was extended to peach twig borer.

Navel orangeworm. In 1989, 2 field trials were conducted using the registered B.t. product Javelin. One field trial was in Butte County with Joe Connell and another in Kern County with Walt Bentley. Treatments consisted of Guthion at 2 lb. AI per acre at hullsplit, Javelin at 1 lb. AI per acre at hullsplit, Javelin at 1 lb. AI per acre plus Guthion at 0.25 lb. AI per acre at hullsplit, an untreated control, Javelin at 1 lb. AI per acre at hullsplit and again 2 weeks later, and the Javelin plus Guthion treatment at hullsplit and Javelin at 1 lb. AI per acre 2 weeks later (Kern Co. plot only). Plot size in both trials was about 0.5 acres per treatment replicate. There were 4 replicates of each treatment in each trial. At harvest, 1000 nuts were taken from the the center of each treatment and returned to Davis where they were held in cold storage until cracking. Data were analyzed using analysis of variance and Duncan's multiple range test.

The results of the 1989 study are presented on Tables 1 and 2. The Javelin treatment applied at hullsplit and again at an interval of 2 weeks was the best treatment in the Butte County trial (Table 1), however none of the pesticide treatments (Javelin, Guthion, or various combinations) were significantly different from one another. All of the treatments performed somewhat better than no treatment, and control levels ranged from 44% to 30%. The traditional hullsplit Guthion treatment only afforded 32% control. Joe Connell who applied this plot said that the application was perhaps a little later than optimum. It is possible that Javelin applications delayed a bit provide better control than immediately upon hullsplit. It was interesting to note that the addition of a low rate of Guthion to the B.t. material did not provide synergistic action. Guthion gave the highest level of control in the Kern County trial (Table 2). None of the treatments applied in this trial were significantly different from the untreated control. Control levels did not exceed 29% for any of the treatments. The Javelin treatment applied at hullsplit and again at an interval of 2 weeks was the best of the treatments that included a B.t. material. Again, the addition of Guthion to the B.t. material did not provide evidence of synergism.

In 1990, the results were similar to that of the 1989 study. We did not try the Guthion and Javelin combination because of the relatively poor results in 1989, but we did incorporate a high rate (3 lb. formulated) treatment of Javelin in the Butte County plot. The results of the Butte County trial are presented on Table 3. All pesticide treatments applied were significantly better than the untreated control except the Javelin treatment applied two weeks after hullsplit. This treatment timing was probably too late to have a significant effect, however the level of control when compared to the control was still 35%. The other treatments provided between 61% and 75% control which seemed exceptionally high. The level of damage overall in this block was quite low, and it is possible that a lower infestation of navel orangeworm was responsible for the more effective control. The results of the Kern County trial (Table 4) showed only Guthion to be significantly better than the untreated control, and the level of control was about 44% which is not unusual when poulations are high such as they were in this orchard. Both Javelin treatments had control levels of about 35%, which was not different from either the Guthion or the untreated control.

Our results confirm the observations of many individuals that no currently registered insecticide provides adequate control of navel orangeworm. The only truly effective control we can recommend is good sanitation (mummy removal) and early harvest. If a chemical treatment is to be applied, Javelin at the 1 lb. rate applied at hullsplit is probably as good as any alternative when damage levels are expected to be relatively low. At high damage levels (5% or more) the Guthion application may be somewhat better. The Javelin treatments appeared to be somewhat more effective in Butte County than in kern County. It is possible that the environmental conditions in Kern County (slightly higher temperatures and solar radiation) may be less conducive to the B.t. at Hullsplit.

Peach twig borer. A field trial was conducted at Nickel's Estate in Colusa County with John Edstrom to determine the effect of Javelin applied during bloom on the peach twig borer. Applications were made at 4 different treatment timings: bud swell (February 21), early bloom (March 3), late bloom-petal fall (March 13) and early leaf (March 23), and 2 application rates: 0.75 (moderate rate) and 0.375 (low rate), and were compared to Supracide 2E (1 qt. per 100 gallons) checks and an untreated control. Full bloom occurred on March 8. The two year old almonds (var. Butte) were treated by handgun sprayer at 200 p.s.i. applying 1.5 gallons per tree at 145 trees per acre (218 gallons per acre). Ten single tree relicates of each treatment were arranged in a randomized complete block design.

Result of this trial are presented on Table 5. Although results must be considered preliminary, it appeared that 2 treatments of Javelin bracketing bloom, one when color is showing and another 1 week later gave up to 80% control. Treatment at this timing targets the larvae emerging from hibernaculae and moving to expanding buds or shoot tips to feed. If a lethal dose of B.t. is ingested by the larvae while feeding externally before entering the shoots, mortality can be achieved. It is critical to time such treatments to expose as large a cohort of the larvae as possible to the B.t. before they enter the shoots where they would no longer feed upon the material.

Bill Barnett and Rich Coviello conducted a similar test on peaches and nectarines in Kingsburg, Fresno County. Their results were very promising, but the infestation levels were much lower than in the Colusa County trial. They had many different treatment timing combinations of Javelin WP (0.8 lb. per 100 gallons) applied at pink bud-shoots 0.5" (March 1), 20% bloom-shoots 1" (March 9), beginning of petal fall (March 15), 90% petal fall (March 22) and jackets off 20%-shoots 3-6" (March 29). Diazinon (1 lb. A.I. per 100 gallons and oil was the treated check and an untreated control was also included. There were 7 single tree replicates of each treatment. The best single treatment appeared to be at 20% bloom, and the best two spray timings were those applied at pink bud and again at bloom or early petal fall. No additional control was achieved by using either three, four or five sprays.

Additional Objective, Entomological Component of the Dormant Spray Plots to Mitigate Effects on Red Tailed Hawks. In 1990, we cooperated with the large project being conducted by Barry Wilson in cooperation with Jim Seiber, Bill Steinke and Wes Asai, and provided the entomological component of the project. Insects sampled were peach twig borer and San Jose scale.

Peach Twig Borer. Two methods of sampling were attempted as discussed in the proposal, counting twig strikes resulting from feeding of overwintering larvae emerging from their hibernacula, and trapping adult males in pheromone traps.

Twig strikes. The middle 3 trees from each of the 5 replicates of the 3 treatments (untreated, mister miser, and air blast), were used for this trial. The total number of twig strikes per tree was counted on April 3 by individuals who climbed into the upper tree canopy using orchard ladders. Differences between treatments were significant ($F=4.61$, $P=0.0012$) by ANOV. Means were all significantly different by Duncan's multiple range test (Table 6).

Pheromone traps. Wing style traps baited with a pheromone lure were placed in the 3 treatment areas on April 3, and checked each week thereafter until the end of the first flight in mid June. It is interesting to note that moth catches on the first observation date (April 10) had relative densities similar to what we observed for twig strikes on the same date (air blast 4, mister miser 9, unsprayed check 15). Moth migration would have been limited on this first date, so it could confirm the results of our twig strike counts. On each of the sampling dates thereafter, no differences were observed between treatments. Peach twig borer is a very mobile insect, and it is likely there was extensive migration of moths between treatments. Obviously, pheromone traps are not a good method of estimating peach twig borer population differences on small plots, especially after the first week of emergence.

San Jose Scale - Few scales were seen in visual examinations of the orchard before treatment. Two methods of sampling were attempted, using 2 sided sticky tapes which were wrapped around twigs and trapping male scales on tent type pheromone traps.

Sticky tapes. Two tapes were wrapped around twigs on the center 3 trees from each of the 5 replicates of the 3 treatments. The sticky tapes were removed and replaced twice during May and returned to the laboratory where they were examined under the microscope. No scale crawlers were found on any of the sticky tapes.

Pheromone traps. Three pheromone traps were placed in each of the 3 treatment areas. The traps were not examined on a weekly basis, but rather the traps were removed on May 25 and returned to Davis for counting. The traps were replaced in the same trees and removed again on June 20. This period represented the flight period of the male scales. No significant difference ($p>0.05$) was found between treatments by ANOV for either of the sampling periods. However, it is interesting to note that in both instances more male scales were trapped in the untreated areas than in the mister miser or air blast sprayer plots (Table 7). While pheromone traps are not a preferred estimator of relative population size in most instances, it is possible that in the case of male scale insects, which are not strong fliers, pheromone traps could be used as a toll in comparing relative population size.

Table 1. Hullsplit sprays of Javelin and Guthion applied for navel orangeworm, Butte Co., in 1989.

Treatment	Damage (%) Mean	SD	
Javelin (1 lb., Hullsplit; +1 lb. Javelin 10 days later)	4.38	1.45	a
Javelin (1 lb., Hullsplit)	4.56	0.90	a
Guthion (2 lb., Hullsplit)	5.38	2.32	ab
Javelin (1 lb.)+Guthion (.25 lb) Hullsplit; +1 lb. Javelin 10 days later	5.38	1.03	ab
Javelin (1 lb.)+Guthion (.25 lb.) Hullsplit	5.50	0.71	a
Untreated	7.81	2.44	b

Table 2. Hullsplit sprays of Javelin and Guthion applied for navel orangeworm, Kern Co., in 1989.

Treatment	Damage (%) Mean	SD	
Guthion (2 lb. Hullsplit)	4.94	1.16	a
Javelin (1 lb. Hullsplit) + Javelin (1 lb. 10 days later)	5.00	1.51	a
Javelin (1lb. Hullsplit)	5.81	1.84	a
Untreated	7.00	3.24	a
Javelin (1 lb.)+ Guthion (.25 lb.) Hullsplit	7.81	2.35	a

Table 3. Hullsplit sprays of Javelin and Guthion applied for navel orangeworm, Butte Co., in 1990. Plots were harvested on 8/30/90.

Treatment	Mean *
Javelin (3 lb., Hullsplit)	1.75 a
Guthion (2 lb. A.I., Hullsplit)	2.50 a
Javelin (1 lb., Hullsplit + 1 lb., 2 weeks later)	2.75 a
Javelin (1 lb., Hullsplit)	2.75 a
Javelin (1 lb., + 2 weeks)	4.50 ab
Untreated	7.00 b

* means followed by the same letter are not significantly different by Duncan's multiple range test.

Table 4. Hullsplit sprays of Javelin and Guthion applied for navel orangeworm, Kern Co., in 1990. Treatments were applied on 7/13/90.

Treatment	Mean *
Guthion (2 lb. A.I., Hullsplit)	12.93 a
Javelin (1 lb., Hullsplit)	14.85 ab
Javelin (1 lb., Hullsplit + 1 lb., 2 weeks later)	15.28 ab
Untreated	22.98 b

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Table 5. Bilom sprays applied for control of Peach Twig Borer at Nickel's Estate, Colusa Co., 1990.

Treatment	mean *
Untreated	24.01a
Javelin (high), 2/21	21.44ab
Javelin (high), 3/23	20.43ab
Javelin (high), 3/13	19.71ab
Javelin (low), 3/3	17.64ab
Javelin (high), 3/3	13.76 bc
Javelin (low), 3/13	7.18 cd
Methidathion, Dormant	6.35 d
Javelin (all 4 timings)	4.88 d
Methidathion + Kocide	1.21 e

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Table 6. Peach twig borer twig strikes per tree (3 trees per replicate with 5 replicates).

Treatment	Mean *
Untreated	8.34 a
Mister Miser	5.38 b
Air Blast	1.88 c

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Table 7. Cumulative number of San Jose scale males trapped in pheromone traps (n=3).

	Sample Date	
Treatment	5/25/90	6/20/90
Untreated	56.67	36.00
Mister Miser	41.33	22.70
Air Blast	38.67	16.00

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Peach twig borer. A field trial was conducted at Nickel's Estate in Colusa County with John Edstrom to determine the effect of Javelin applied during bloom on the peach twig borer. Applications were made at 4 different treatment timings: bud swell (February 21), early bloom (March 3), late bloom-petal fall (March 13) and early leaf (March 23), and 2 application rates: 0.75 (moderate rate) and 0.375 (low rate), and were compared to Supracide 2E (1 qt. per 100 gallons) checks and an untreated control. Full bloom occurred on March 8. The two year old almonds (var. Butte) were treated by handgun sprayer at 200 p.s.i. applying 1.5 gallons per tree at 145 trees per acre (218 gallons per acre). Ten single tree relicates of each treatment were arranged in a randomized complete block design.

Result of this trial are presented on Table 5. Although results must be considered preliminary, it appeared that 2 treatments of Javelin bracketing bloom, one when color is showing and another 1 week later gave up to 80% control. Treatment at this timing targets the larvae emerging from hibernaculae and moving to expanding buds or shoot tips to feed. If a lethal dose of B.t. is ingested by the larvae while feeding externally before entering the shoots, mortality can be achieved. It is critical to time such treatments to expose as large a cohort of the larvae as possible to the B.t. before they enter the shoots where they would no longer feed upon the material.

Bill Barnett and Rich Coviello conducted a similar test on peaches and nectarines in Kingsburg, Fresno County. Their results were very promising, but the infestation levels were much lower than in the Colusa County trial. They had many different treatment timing combinations of Javelin WP (0.8 lb. per 100 gallons) applied at pink bud-shoots 0.5" (March 1), 20% bloom-shoots 1" (March 9), beginning of petal fall (March 15), 90% petal fall (March 22) and jackets off 20%-shoots 3-6" (March 29). Diazinon (1 lb. A.I. per 100 gallons and oil was the treated check and an untreated control was also included. There were 7 single tree replicates of each treatment. The best single treatment appeared to be at 20% bloom, and the best two spray timings were those applied at pink bud and again at bloom or early petal fall. No additional control was achieved by using either three, four or five sprays.

Additional Objective, Entomological Component of the Dormant Spray Plots to Mitigate Effects on Red Tailed Hawks. In 1990, we cooperated with the large project being conducted by Barry Wilson in cooperation with Jim Seiber, Bill Steinke and Wes Asai, and provided the entomological component of the project. Insects sampled were peach twig borer and San Jose scale.

Peach Twig Borer. Two methods of sampling were attempted as discussed in the proposal, counting twig strikes resulting from feeding of overwintering larvae emerging from their hibernacula, and trapping adult males in pheromone traps.

Twig strikes. The middle 3 trees from each of the 5 replicates of the 3 treatments (untreated, mister miser, and air blast), were used for this trial. The total number of twig strikes per tree was counted on April 3 by individuals who climbed into the upper tree canopy using orchard ladders. Differences between treatments were significant ($F=4.61$, $P=0.0012$) by ANOV. Means were all significantly different by Duncan's multiple range test (Table 6).

Pheromone traps. Wing style traps baited with a pheromone lure were placed in the 3 treatment areas on April 3, and checked each week thereafter until the end of the first flight in mid June. It is interesting to note that moth catches on the first observation date (April 10) had relative densities similar to what we observed for twig strikes on the same date (air blast 4, mister miser 9, unsprayed check 15). Moth migration would have been limited on this first date, so it could confirm the results of our twig strike counts. On each of the sampling dates thereafter, no differences were observed between treatments. Peach twig borer is a very mobile insect, and it is likely there was extensive migration of moths between treatments. Obviously, pheromone traps are not a good method of estimating peach twig borer population differences on small plots, especially after the first week of emergence.

San Jose Scale - Few scales were seen in visual examinations of the orchard before treatment. Two methods of sampling were attempted, using 2 sided sticky tapes which were wrapped around twigs and trapping male scales on tent type pheromone traps.

Sticky tapes. Two tapes were wrapped around twigs on the center 3 trees from each of the 5 replicates of the 3 treatments. The sticky tapes were removed and replaced twice during May and returned to the laboratory where they were examined under the microscope. No scale crawlers were found on any of the sticky tapes.

Pheromone traps. Three pheromone traps were placed in each of the 3 treatment areas. The traps were not examined on a weekly basis, but rather the traps were removed on May 25 and returned to Davis for counting. The traps were replaced in the same trees and removed again on June 20. This period represented the flight period of the male scales. No significant difference ($p>0.05$) was found between treatments by ANOV for either of the sampling periods. However, it is interesting to note that in both instances more male scales were trapped in the untreated areas than in the mister miser or air blast sprayer plots (Table 7). While pheromone traps are not a preferred estimator of relative population size in most instances, it is possible that in the case of male scale insects, which are not strong fliers, pheromone traps could be used as a toll in comparing relative population size.

Table 1. Hullsplit sprays of Javelin and Guthion applied for navel orangeworm, Butte Co., in 1989.

	Damage (%)		
Treatment	Mean	SD	
Javelin (1 lb., Hullsplit; +1 lb. Javelin 10 days later)	4.38	1.45	a
Javelin (1 lb., Hullsplit)	4.56	0.90	a
Guthion (2 lb., Hullsplit)	5.38	2.32	ab
Javelin (1 lb.)+Guthion (.25 lb) Hullsplit; +1 lb. Javelin 10 days later	5.38	1.03	ab
Javelin (1 lb.)+Guthion (.25 lb.) Hullsplit	5.50	0.71	a
Untreated	7.81	2.44	b

Table 2. Hullsplit sprays of Javelin and Guthion applied for navel orangeworm, Kern Co., in 1989.

	Damage (%)		
Treatment	Mean	SD	
Guthion (2 lb. Hullsplit)	4.94	1.16	a
Javelin (1 lb. Hullsplit) + Javelin (1 lb. 10 days later)	5.00	1.51	a
Javelin (1lb. Hullsplit)	5.81	1.84	a
Untreated	7.00	3.24	a
Javelin (1 lb.)+ Guthion (.25 lb.) Hullsplit	7.81	2.35	a

Table 3. Hullsplit sprays of Javelin and Guthion applied for navel orangeworm, Butte Co., in 1990. Plots were harvested on 8/30/90.

Treatment	Mean *	
Javelin (3 lb., Hullsplit)	1.75	a
Guthion (2 lb. A.I., Hullsplit)	2.50	a
Javelin (1 lb., Hullsplit + 1 lb., 2 weeks later)	2.75	a
Javelin (1 lb., Hullsplit)	2.75	a
Javelin (1 lb., + 2 weeks)	4.50	ab
Untreated	7.00	b

* means followed by the same letter are not significantly different by Duncan's multiple range test.

Table 4. Hullsplit sprays of Javelin and Guthion applied for navel orangeworm, Kern Co., in 1990. Treatments were applied on 7/13/90.

Treatment	Mean *	
Guthion (2 lb. A.I., Hullsplit)	12.93	a
Javelin (1 lb., Hullsplit)	14.85	ab
Javelin (1 lb., Hullsplit + 1 lb., 2 weeks later)	15.28	ab
Untreated	22.98	b

* means followed by the same letter are not significantly different by Duncan's multiple range test.

Table 5. Bllom sprays applied for control of Peach Twig Borer at Nickel's Estate, Colusa Co., 1990.

Treatment	mean *
Untreated	24.01a
Javelin (high), 2/21	21.44ab
Javelin (high), 3/23	20.43ab
Javelin (high), 3/13	19.71ab
Javelin (low), 3/3	17.64ab
Javelin (high), 3/3	13.76 bc
Javelin (low), 3/13	7.18 cd
Methidathion, Dormant	6.35 d
Javelin (all 4 timings)	4.88 d
Methidathion + Kocide	1.21 e

* means followed by the same letter are not significantly different by Duncan's multiple range test.

Table 6. Peach twig borer twig strikes per tree (3 trees per replicate with 5 replicates).

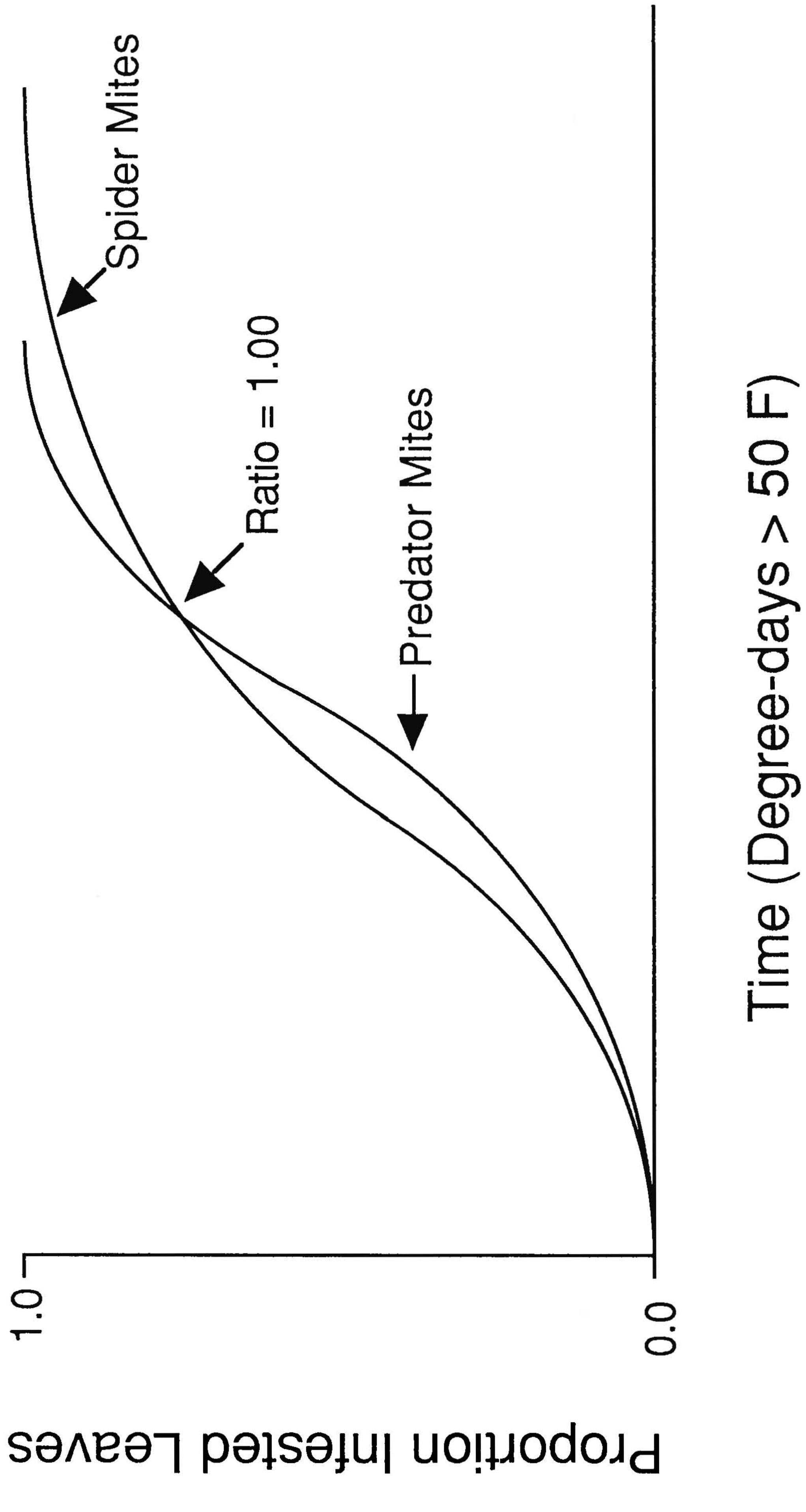
Treatment	Mean *
Untreated	8.34 a

Table 5. Bllom sprays applied for control of Peach Twig Borer at Nickel's Estate, Colusa Co., 1990.

Treatment	mean *
Untreated	24.01a
Javelin (high), 2/21	21.44ab
Javelin (high), 3/23	20.43ab
Javelin (high), 3/13	19.71ab
Javelin (low), 3/3	17.64ab
Javelin (high), 3/3	13.76 bc
Javelin (low), 3/13	7.18 cd
Methidathion, Dormant	6.35 d
Javelin (all 4 timings)	4.88 d
Methidathion + Kocide	1.21 e

* means followed by the same letter are not significantly different by Duncan's multiple range test.

Figure 1



Spider Mites
Ratio = 1.00
Predator Mites
Time (Degree-days > 50 F)
1.0
0.0
Proportion Infested Leaves

Figure 2

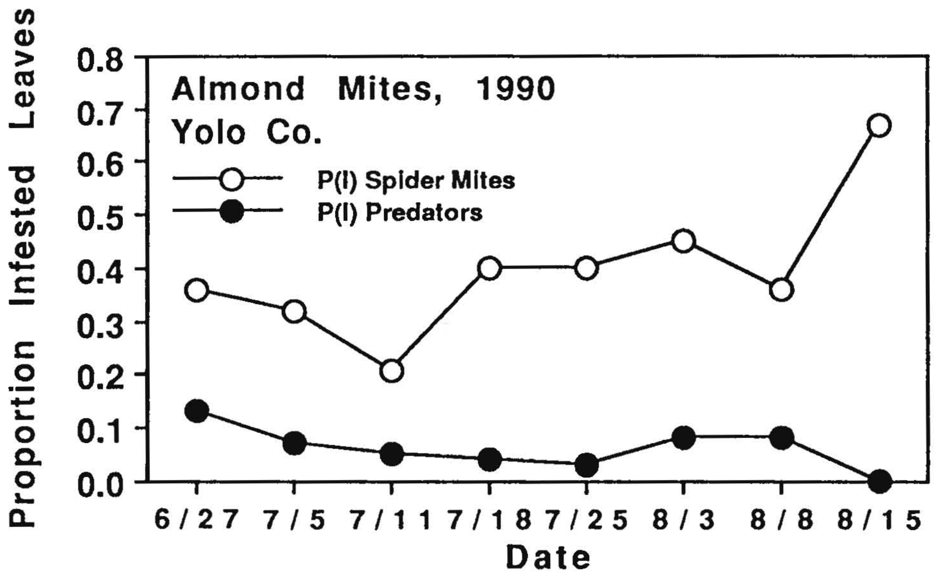


Figure 3

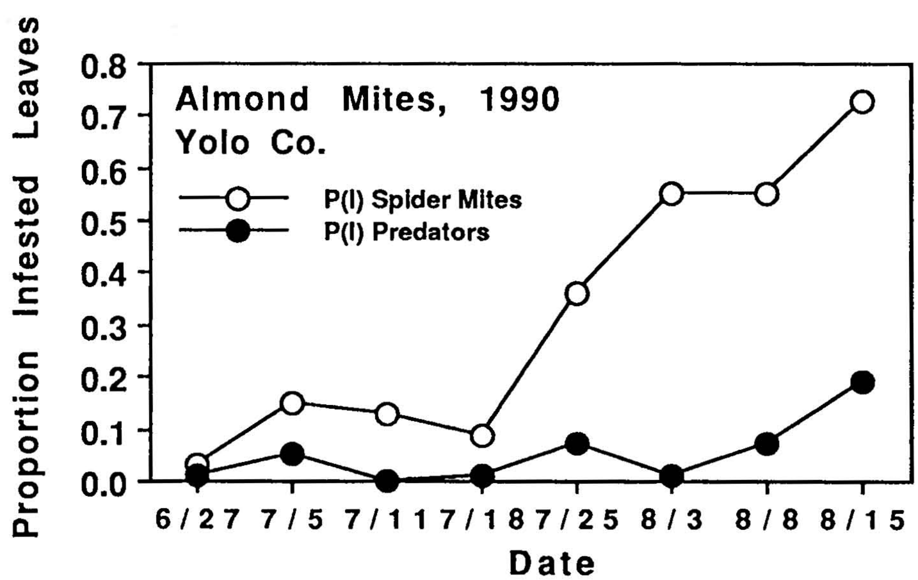
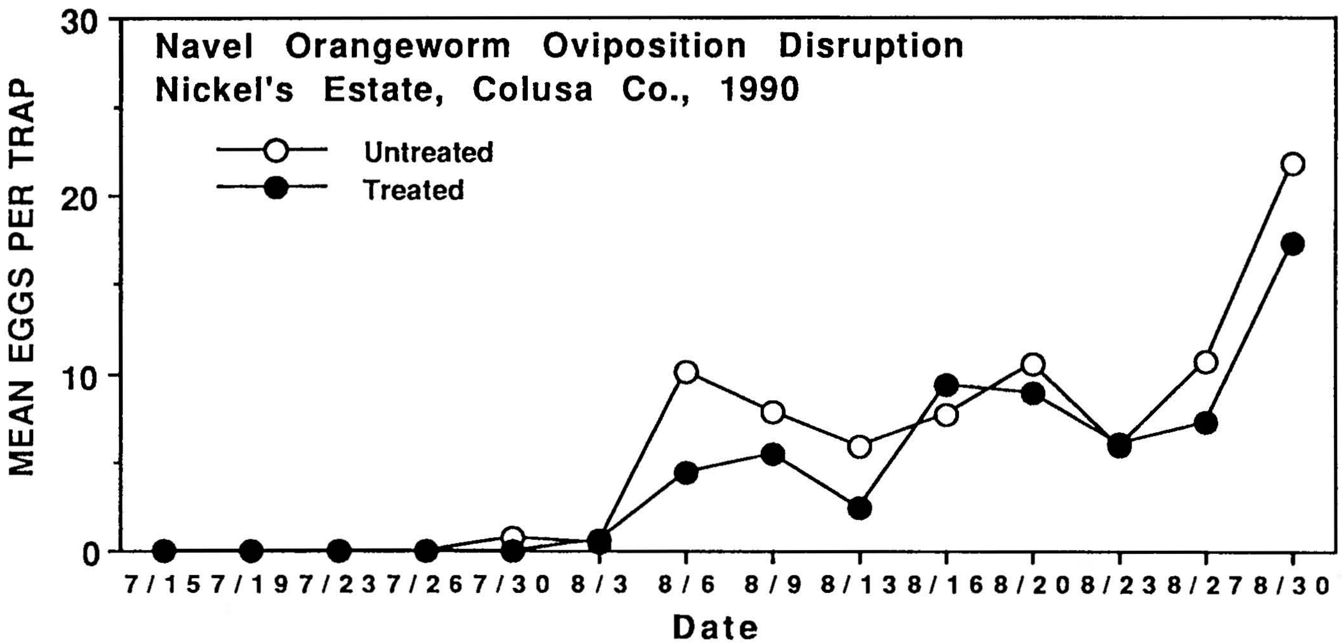


Figure 4



Navel Orangeworm Oviposition Disruption
Nickel's Estate, Colusa Co., 1990
Untreated
Treated
MEAN EGGS PER TRAP
30
20
10
0
7/15
7/19
7/23
7/26
7/30
8/3
8/6
8/9
8/13
8/16
8/20
8/23
8/27
8/30
Date

POMOLOGY DEPARTMENT

ANNUAL FIELD FACILITIES PROJECT REPORT

Project 204 (WEO F5)

Project title: Almond variety collection
D. Kester, T. Gradziel

Project activity during 1990

Trees have been pruned and managed to establish a germplasm and departmental variety block. This block is at same level of development as Field 10D but is about a year behind due to the poor growth during 1988 and 1989. Crop estimates were made but no nut samples were obtained. Some trees are missing and the collection inventory should be evaluated for its appropriateness and completeness. Virus indexing was carried out by Dr. Jerry Uyemoto, USDA Plant Path.

Publications: None