PEST MANAGEMENT ALLIANCE

FINAL REPORT

AGREEMENT No. 99-0258

CALIFORNIA TREE FRUIT AGREEMENT

DECEMBER 17, 2001

Pest Management Alliances Final Report

Agreement No. 99- 0258

Development of an Integrated System for Controlling San Jose Scale, Peach Twig Borer and Oriental Fruit Moth in Clingstone Canning and Fresh Shipping Peaches, Plums and Nectarines

Principal Investigator: Jonathan Field

Contractor Organization: California Tree Fruit Agreement

Date: December 17, 2001

Prepared for California Department of Pesticide Regulation

Disclaimer

The statements and conclusions in this report are those of the contractor and not necessarily those of the California Department of Pesticide Regulation. The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as actual or implied endorsement of such products.

ACKNOWLEDGEMENTS

Pest Management Alliance Team Members

Name	Title	Affiliation
Jonathan Field	P.I., Manager	California Tree Fruit Agreement 30 years agricultural experience
Gary Van Sickle	Research Director	California Tree Fruit Agreement 36 years agricultural experience
Heidi Sanders	Research Coordinator	Cal. Cling Peach Growers Advisory Board 10 years agricultural experience
Dr. Kent Daane	Entomologist	UC Berkley - Kearney Ag Center Researches and implements biological control practices
Walt Bentley	UC IPM Regional Pest Management Advisor	UCCE - Kearney Ag Center Researches and implements reduced risk / IPM practices
Janine Hasey	Farm Advisor	UCCE - Sutter and Yuba Counties Researches and implements reduced risk / IPM practices
Carolyn Pickel	IPM Advisor	UCCE - Sacramento Valley Researches and implements reduced risk / IPM practices
Kevin Day	Farm Advisor	UCCE - Tulare County Pomologist for stone fruit
Richard Coviello	Entomologist	UCCE - Fresno County Researches and implements reduced risk practices
Beth Grafton-Cardwell	Entomologist	UC Riverside – Kearney Ag Center Extensive experience with scale
Harry Andris	Farm Advisor	UCCE – Fresno County Stone and pome fruits
Shawn Steffan	Staff Research Associate	Kearney Ag Center Coordinates field activities
Steve Strong	Grower/PCA	CTFA Research Subcommittee Rubicon Orchards
Bill Green	PCA/Grower Relations	CTFA Research Subcommittee, LVR Corp.
Rod Milton	PCA/Grower	CTFA Research Subcommittee
John Tos	Grower	CTFA Peach Administrative Committee, Tos Farms, Inc.
Bill Tos	PCA/Grower	CTFA Research Subcommittee Tos Farms Inc., grower participant
Rick Schellenberg	Grower	CTFA Grade Standards Task Force Chair Schellenberg Farms, grower participant
Norman Kline	Grower	CCPGAB Research Chairman
Sarb Johl	Grower	CCPGAB Committee

This report was submitted in fulfillment of Agreement No. 99-0258, Development of an Integrated System for Controlling San Jose Scale, Peach Twig Borer and Oriental Fruit Moth in Clingstone Canning and Fresh Shipping Peaches, Plums and Nectarines by California Tree Fruit Agreement under the [partial] sponsorship of the California Department of Pesticide Regulation. Work was completed as of December 31, 2001.

Table of Contents

LIST OF TABLES

LIST OF TABLES (Continued)

EXECUTIVE SUMMARY

The objective of this ongoing project, is to develop an integrated and sustainable pest management program for peaches, plums, and nectarines in California. The research has focused on San Jose scale (SJS), peach twig borer (PTB), Oriental fruit moth (OFM), omnivorous leafroller (OLR), and Western flower thrips. ***Due to the overlap of the production seasons and adjustment of the timetable for PMA projects by the Department, several progress reports for year 3 (#00-0212S) will include some of the continuing analysis from year 2 of the PMA project (#99-0258) as well as preliminary data for year 3 of the project. Most of the activities discussed in this report are from the 2000 season, but selected references will be made to some activities from the 2001 season. The most recent progress report for year 3 (9-15-01) is attached as an addendum to this report.*** Most elements of the Pest Management Alliance's activities have been presented at grower and PCA demonstration plots and meetings. In addition, information developed as a part of this research effort was disseminated through grower newsletters and on both the CTFA website and the Kearney Agricultural Center website.

Stone fruit production has traditionally relied upon organophosphate (OP) and carbamate insecticides to control the majority of pests. Due to environmental and human health concerns, a movement away from these types of materials has been initiated. The testing of commercially available oils, pheromone dispenser systems, and reduced risk pesticides in controlled research situations has provided the basis for the development of best management practices for utilizing more integrated pest management approaches. In addition, the evaluation and development of an augmentative biological control program may increase SJS, PTB, OFM and thrips parasitism levels and further reduce the need for insecticide applications.

During the second year (and third) of a multi-year project, progress towards meeting the objectives was met or continues. First, efficacy trials of two commercially available oils as the single component in a dormant spray for controlling SJS have been conducted. The results suggest that both oil formulations may abate overwintering populations of SJS under low to moderately infested conditions. Second, a preliminary survey of endemic and commercially reared natural enemies of SJS is in progress. One commercially available, and two endemic enemies have been identified. Insectary rearing of these potential parasitoids for augmentative release and field testing is underway. Third, field comparisons and aging studies of commercially available PTB and OFM pheromone formulations and dispensers have yielded data to further refine application rates. Fourth, the reduced risk chemical Success® has shown potential to be an alternative to the industry standard, Carzol®, for thrips control. The information will be used to develop practical recommendations designed to reduce grower uncertainty and potential failure when utilizing this technology. Industry education and information dissemination continues through industry sponsored educational field days, research newsletters and several websites. Finally, there is now preliminary evidence that possibly two-thirds of the stone fruit industry are now employing various reduced risk practices in their farming operations.

Report

A. Introduction

The majority of OPs and carbamates applied on clingstone canning and fresh market peach, plum and nectarine acreage in California are used to control SJS, PTB and OFM. This accounts for the use of these materials on 131,000 acres under stone fruit production from Tehama to San Bernadino Counties. In a survey of growers previously conducted by the California Tree Fruit Agreement (CTFA), 50% of those who responded stated they had some difficulty controlling SJS in the past. Further, 13% of the respondents stated they had removed orchards due to the inability to control SJS. Based on previous scientific evidence, SJS may be exhibiting resistance to OPs and carbamates placing growers in a cycle of increasing material usage with declining pest control returns. In addition, technical challenges in using pheromone mating disruption for PTB and OFM have resulted in growers experiencing unacceptable fruit damage and has resulted in the return to the traditional use of OPs and carbamates. Accordingly, future strategies must include reducing SJS to the exposure of OPs and carbamates, including thorough management of other primary (PTB and OFM) pests.

Therefore, the scope and the purpose of the project is to take a statewide approach, through the support of the Department of Pesticide Regulation and combined efforts of the California Tree Fruit Agreement (CTFA), the California Cling Peach Growers Advisory Board (CCPGAB), the University of California (UC), the California State University Agricultural Research Initiative (CSU-ARI), Schellenberg Farms, Tos Farms, Quinco Corporation, Dow AgriSciences, Ecogen and Exxon. It is intended to advance the benefits of a coordinated comprehensive SJS, PTB and OFM research effort, with no one area of the research promising complete solutions to the problems currently being experienced by the stone fruit industry. This is being accomplished through the development of a system where the combination of replacing OPs with oil, pheromone mating disruption and development of an augmentative natural enemy release program will maintain SJS, PTB and OFM populations below economic injury levels.

The attainment of the multiple pest management system, where OP and carbamate use is reduced or eliminated, is designed to curtail the potential for pest outbreaks, conserve endemic and augmented natural enemies, increase grower confidence in the efficacy of alternative reduced risk materials, such as oils and pheromone mating disruption and sustain the economic viability of production costs over time. Moreover, the project is intended to mitigate environmental impacts from the use of OPs and carbamates by reducing the influx of runoff into surface and subterranean water systems.

B. Materials and Methods (Objectives)

1. <u>Assess the SJS population dynamics and evaluate the potential of natural and augmented biological control.</u>

The tasks included: a) Survey stone fruit orchards with and without SJS infestations to determine if resident natural enemies have potential to control pest populations. This was accomplished

using a variety of sampling techniques: Pheromone traps, visual inspection of plant material and double sided sticky tapes aided in determining the distribution and abundance of SJS in the field. b) Establish insectary colonies of the more common and effective resident SJS parasitoids. To evaluate which parasitoids would be colonized, SJS infested squash were placed in select orchards for a 2-3 week period and later the squash were returned to the laboratory to determine parasitoid composition and percent parasitism. c) Determine the effect of commonly used insecticides on selected natural enemies. Laboratory studies included a leaf dip bioassay to determine the relative toxicity of commercially used insecticides to natural enemies. d) In laboratory trials, test the effectiveness of commercially available SJS parasitoids. The principal investigator for this project is Dr. Kent Daane, University of California Center for Biological Control Entomologist.

2. Assess the efficacy of "soft" insecticides (e.g. Dimilin®, Success®, Confirm®) against moth pests (i.e., Oriental fruit moth and peach twig borer) in laboratory and field trials and determine their potential effects on non-target insects.

To accomplish this, registered insecticides were applied in commercial orchards at the labeled rate and at a 2X rate in a randomized complete block experimental design. Samples of larvae were collected from the treated fields at regular intervals and analyzed in the laboratory, up to six days after collection, to determine percent mortality. The principal investigator for this project is Dr. Kent Daane, University of California Center for Biological Control Entomologist.

3. Compare and demonstrate the efficacy of pest control techniques that *do not* rely on OP, carbamate, or pyrethroid inputs to control stone fruit pests at on farm sites in several counties throughout California.

Three grower demonstration orchards were established in Fresno, Kings and Yuba Counties. The grower cooperators were Schellenberg Farms of Fresno County who contributed peach, plum and nectarine sites; Tos Farms of Kings County who contributed nectarine sites; and Quinco Corporation of Yuba County who contributed cling peach sites. The total acreage involved is approximately 40 acres. (During the 2001 season the number of grower cooperators increased to eight and the approximately 120 acres were involved in the project.) The reduced risk pest management practices implemented included a pre-dormant spray, mite and scale damage assessment and OP free dormant application (oil only); use of *Bacillus thuringiensis* (Bt) and pheromone mating disruption for control of PTB and OFM; monitoring of PTB and OFM with pheromone baited traps and shoot strike evaluations; SJS monitoring with double sided sticky tapes and pheromone traps to determine both scale and parasitoid populations and percentage of pest damage at the time of harvest. Monitoring of traps was conducted weekly for each site. Mite and katydid populations were also monitored. During the course of the project, the reduced risk material Success® was registered and used to control thrips and mites. Each site was compared to a comparable acreage of a monitored commodity treated with traditional OP dormant and in-season sprays. A major component of this project was to track the input costs and levels of control of a non-disruptive program in comparison to traditional pest management programs. Two of the grower participant sites were used for PMA demonstration field days. The principal investigators for this project are Walt Bentley, UC IPM Entomologist; Dr. Kent Daane,

University of California Center for Biological Control Entomologist; and Janine Hasey, UCCE Sutter/Yuba County Farm Advisor.

4. Conduct evaluations of reduced-risk material efficacy trials for controlling thrips under controlled research plot conditions.

The experiment was conducted as a randomized complete block design. Treatments were applied with a high-pressure handgun spray rig. The materials Agri-Mek® (Abamectin), Success® (Spinosad), and Esteem® (Pyriproxyfen) were compared to the traditional Carzol® (Formentanate HCL). An untreated control was also included. The evaluation of treatments was done by examining fruit for thrips damage at thinning and at harvest. In addition, measures were taken to ascertain the effects of the materials on non-target organisms. Richard Coviello, UCCE Fresno County Farm Advisor, is the principal investigator of this project.

5. Develop a bioassay to evaluate resistance to OP and carbamate insecticides used for SJS control in California and develop a comprehensive resistance management plan.

Laboratory colonies were established on squash with SJS collected from plum and apple orchards where insecticide resistance was suspected. San Jose scale were then exposed to Lorsban®, Supracide®, Sevin® and Diazinon utilizing a dip method. The occurrence of mortality in the suspected resistant group was then compared to that of a known susceptible colony. LD 50's and LD 90's are currently being calculated from replicated trials and the results will be compared to evaluate susceptibility against resistance levels. Currently, colorimetric testing and electrophoretic methods are being developed as a bioassay method to identify pesticide-resistant SJS populations. Dr. Beth Grafton-Cardwell, UC Riverside Entomologist stationed at the Kearney Agricultural Center, is the principal investigator for this project.

6. Enhance communication and implement grower information dissemination.

The communications infrastructure of CTFA and CCPGAB are being utilized in cooperation with participating UC personnel to enhance the exchange of information between researchers, growers, pest control advisors, pest control operators and others in the stone fruit industry. Dissemination of information has been accomplished by conducting "field days," mailing newsletters and updating CTFA's and KAC's web sites. Gary Van Sickle, CTFA, and Heidi Sanders, CCPGAB, are responsible for this portion of the project.

C. Results

1. Assess the SJS population dynamics and evaluate the potential of natural and augmented biological control.

Numerous pheromone traps and sticky-tapes have been collected from orchards with and without San Jose scale populations through the surveying process. The surveying process was completed in late January 2001. Consequently, data from the bioassay is still being analyzed. The establishment of laboratory colonies of the more common and effective parasitoids, *Aphytis*

vandenboschi and *Encarsia perniciosi,* has been successful. Laboratory trials have been completed regarding the effectiveness of the only commercially available scale parasitoid, *Aphytis melinus*. Laboratory trials indicate that *A. melinus* will parasitize SJS, but only if SJS is the only host available. Also, the level of parasitism by *A. melinus* was lower than expected. Inundative releases made at a 1:10 ratio for *Aphytis vandenboschi* were found to be at an approximate 25% parasitism level when the SJS were dissected. The leaf-dip bioassay to determine the relative toxicity of commercially used insecticides to natural enemies concluded in late December, 2000. Analysis of the data continues. Thus, further study will be required before an evaluation can be made.

Financial Summary for Task 1: The total cost for achieving the objectives of Task 1 was budgeted at $24,333. To date, $40,661.83 has been spent towards completing Task 1.

2. Assess the efficacy of "soft" insecticides (e.g. Dimilin®, Success®, Confirm®) against moth pests (i.e., Oriental fruit moth and peach twig borer) in laboratory and field trials and determine their potential effects on non-target organisms.

Preliminary testing of Dimilin®, Success®, and Confirm® for control of Oriental fruit moth and peach twig borer has been conducted in an almond orchard to determine the potential effects on non-target organisms. The day following application, samples of treated nuts were collected from the field. Non-target organisms (*Encarsia sp., Aphytis spp., Chrysoperla sp. and Goniouzus*) were exposed to the treated nuts under laboratory conditions and monitored for mortality. Researchers continue to analyze data from the exposure process. They were successful in replicating the experiment with all field tests completed in October of 2000 and again during the 2001 season. Leaf-dip tests to determine the potential effects of these materials on non-target organisms began in October and concluded in late December 2000. Results from this study are still being processed. Data suggest that both Dimilin® and Success® cause mortality of *Goniozus legneri* and *Aphytis vandenboschi.* There was less mortality of tested beneficial insects in the Success® treatment.

Financial Summary for Task 2: The total cost for achieving the objectives of Task 2 was included in the budget for Task 1. Expenditures have been included under Task 1.

3. Compare and demonstrate the efficacy and profitability of using stone fruit pest control techniques that *do not* rely on OP, carbamate, or pyrethroid inputs in "on farm" sites in several counties throughout California.

The results presented are from all three orchard locations, Fresno County, Kings County and the Yuba County. The term (PMA) is used here and in the data tables to identify the orchards where reduced-risk materials and practices were implemented. The term (CON) is used here and in the data tables to identify the orchards that implemented conventional materials and management practices.

Extensive monitoring of both the reduced-risk and the conventional sites has produced valuable information for future use by the stone fruit industry. Trends between the two programs remain

consistent. The data obtained from this year's demonstration blocks illustrate, in general, higher insect activity in the PMA blocks, compared to the CON blocks (Figures 1.1-5.6). However, there were also higher populations of the SJS parasitoids *Aphytis* spp. (Figures 1.5, 2.4, 3.4, 4.4, 5.5) and *Encarsia perniciosi* (Figures 1.6, 2.5, 3.5, 4.5, 5.6) in the PMA blocks.

The approach used in the Yuba County orchards relied primarily on the use of pheromones for mating disruption of OFM and PTB. The pheromone disruptant used for OFM was Isomate M-100®, by Pacific BioControl and the disruptant used for PTB was Checkmate PTB®, by Consep. The disruptants appeared to manage the populations of OFM and PTB. However, secondary pests such as lygus and obliquebanded leafroller (OBLR) required treatments of DiPel ® (Bacillus thuringiensis or Bt) or Success® (Spinosad). Additionally, puffer technology and paraffin wax emulsion mixtures were not used this season. The Bt treatment can be used for control of OBLR, although treatments with Success® were quite effective on this pest. Currently, there are no good alternatives to managing lygus or stinkbug. Until effective products become available, these pests will be managed with OP or carbamate materials.

In the Yuba orchards, worm damage attributed to OFM and PTB was detected in only the Starn/Hesse comparison PMA block. Since only live OFM were found, damage was attributed to that species. In the conventional comparison block (Hesse) there was 1.2% worm infestation, while the Starn PMA comparison resulted in 4.4% (Table 8). The Starn PMA orchard, using OFM mating disruption, was sampled from the north (6.5% infested fruit) and the south (3% infested fruit). The PMA orchard was only 6.5 acres in size, and long and narrow in shape. The size and shape would allow for easy movement of mated moths from untreated areas. Yield was also relatively low providing fewer fruit on which mated moths could concentrate. None of the other comparisons resulted in OFM or PTB damage.

Obliquebanded leafroller (OBLR) became a problem in the Yuba County PMA orchards. Although each of the PMA blocks in Yuba were treated with two Bt sprays in the spring for PTB, these treatments did not control OBLR in the late harvested (8/21/00 - 8/25/00) Starn and Hesse comparison. For the orchards in Yuba, OBLR caused the greatest amount of fruit damage. The conventional Hesse orchard resulted in 2.6% OBLR damage and the Starn PMA orchard resulted in 3.2% damage (Table 8). The Ross PMA block (harvested 8/14/00) resulted in 5% damage while the conventional block recorded 0.8% (Table 8).

Field samples of fruit were taken prior to harvest to record the percentage of fruit without insect damage. Within each variety there was no statistical significance between the two approaches, however, when the PMA and the conventional programs were grouped for "overall comparison of fruit without insect damage," the PMA blocks averaged 86.19%, while the conventional blocks averaged 89.34% (Table 6). This aspect of the data does not necessarily suggest that the conventional program outperformed the PMA program. Instead, the data regarding the percentage of unpackable fruit may more appropriately describe the efficacy of the PMA approach.

To gauge the profitability of the program that did not use OPs or carbamates, researchers have used the percentage of fruit "culled," or unpacked, because of insect damage, as an indication of

how the reduced-risk program preformed, compared to the conventional program. The data illustrates that within each variety there was no statistical difference between the two pest management programs. Furthermore, this was also true of the overall performance when both pest control methods were grouped in their respective programs. The PMA orchards averaged a cull rate of 5.69%, while their conventional counterparts averaged a cull rate of 4.53% (Table 7).

Economic data regarding input costs for the Fresno County, Kings County and Yuba County orchards illustrate differences among all varieties. The costs of the programs used varied considerably between varieties and between the northern Sacramento Valley cling peaches and the southern San Joaquin Valley peaches, nectarines and plums. Also, the approach to managing pests in the PMA orchards had a bearing on cost. In the San Joaquin Valley, the per acre least costly PMA program was $160 for the Grand Rosa plums and the most costly PMA program was $331 for the Summer Red nectarines. The conventional program costs, per acre, ranged from $156 for the Elegant Lady peaches to $322 for the Summer Red nectarines. During the 2000 season the average per acre cost of the PMA programs in the southern San Joaquin Valley was $221. The average conventional program costs was $222.

Results in the three comparison blocks in the Sacramento Valley varied more than that in the southern San Joaquin Valley. The costs for the three PMA programs ranged from $221 to $278. The costs for the conventional programs ranged from $103 to $171. The per acre average cost of the three PMA orchards in Yuba County was $240. The average cost of the three conventional orchards was $141. The greater cost in the PMA is due to the cost of a second OFM mating disruption product and application, and the PTB mating disruption product and application. The second OFM applications were not made and PTB was managed with Bt and spinosad in the Southern San Joaquin Valley. The comparison treatments and costs are presented in tables 9 through 17-b.

Financial Summary for Task 3: The total cost for achieving the objectives of Task 3 was modified from $63,900 to $74,400, based on adjustment to actual cost for one component of the project that occurred after the year two workplan proposal had been submitted. To date, $74,400 has been spent towards completion of Task 3.

4. Conduct evaluations of reduced-risk material efficacy trials for controlling thrips under controlled research plot conditions.

Evaluation of the bloom-time applications for all materials has been completed. All materials, except Esteem®, significantly reduced thrips damage. The results from this year's (2000) trials are consistent with the results of last year's trials, in that both reduced-risk materials, Success® and Agri-Mek®, were statistically equivalent to the traditional material Carzol® for control of thrips damage (Table 18). San Jose scale activity was also monitored following treatment. For the bloom-time application, none of the materials significantly reduced SJS fruit infestation below the untreated control block. However, the Carzol® treated block yielded significantly more scale-infested fruit than the control block. Analysis of the petal-fall applications were inconclusive due to substantial scarring from wind or other mechanical means or from lacy scab

which masked thrips damage. The amount of scarring which could be confidently attributed to thrips feeding was too low to allow for separation of treatment effects.

Financial Summary for Task 4: The total cost for achieving the objectives of Task 4 was budgeted at $6,945. To date, $6,945 has been spent towards completion of Task 4.

5. Develop a bioassay to evaluate resistance to OP and carbamate insecticides used for SJS control in California and develop a comprehensive resistance management plan.

During the first year of the project significant resistance in the suspected resistant apple and plum colonies was demonstrated when compared to the known susceptible colony. This was demonstrated by the use of bioassays in which San Jose scale-infested yams were dipped in Supracide®, Lorsban®, Sevin® and Diazinon. Using the synergist DEF, Dr. Grafton-Cardwell found that SJS might be using esterase enzymes to resist these pesticides. However, use of the synergist yields only slight differences between susceptible and resistant strains of SJS. Dr. Grafton-Cardwell is employing various methods, including electrophoresis, to more clearly distinguish the subtleties between susceptible and resistant strains of SJS. Colorimetric testing is being conducted as a means for quick screening of resistance to OP and carbamate insecticides in SJS. If successful, this method would allow quick detection and documentation of SJS resistance to OP and carbamate insecticides and could be used as the basis for the development of a regional comprehensive resistance management plan.

Dr. Grafton-Cardwell studied esterase enzymes, GSH transferase, mixed function oxidase enzymes and altered acetylcholinesterase. There was an elevated Ache (a specific esterase) and general esterase enzymes in the resistant strain of SJS. There was little or no involvement of GSH transferase, mixed function oxidases, or altered shape of the Ache. She attempted to develop a colorimetric test for the elevated esterase enzymes, however, she was unsuccessful because of the tiny amount of enzyme in SJS bodies and the very slight difference between resistant and susceptible strains. It is likely that SJS has more than one mechanism to resist organophosphate and carbamate insecticides. In addition some of the mechanisms are not enzyme-linked, thus, a colorimetric test cannot be developed at this time. An example of another mechanism of resistance might be a change in the outer covering of the scale (cuticle) that slows down the penetration of the pesticide into the scale body. In spite of Dr. Graften-Cardwell's inability to develop a colorimetric test for resistance, she is convinced that organophosphate and carbamate resistance is a serious problem for San Jose scale. She has recommended that new insecticides and nonchemical alternatives to insecticides continue to be studied to maintain control of this pest.

Financial Summary for Task 5: The total cost for achieving the objectives of Task 5 was budgeted at $49,521. To date, $49,521 has been spent towards completion of Task 5.

6. Enhance communication and implement grower information dissemination.

During 2000 three PMA field days sponsored and publicized by California Tree Fruit Agreement, California Cling Peach Growers Advisory Board and the University of California were

conducted. The events were held to inform growers, pest control advisors, pest control operators, the stone fruit industry and the public about progress made on the PMA project. A cling peach Pest Management Alliance update meeting was held on June 30th at the demonstration block located in Yuba County with over 25 people attending the event. The second and third PMA update meetings where held on July 13th and October 11th at the University of California Kearney Agricultural Center (UC KAC). Over 130 growers, pest control advisors, pest control operators, shippers, researchers and other interested parties attended each of the UC KAC events. In addition to printed information provided by UC researchers, CTFA's annual Research Report was made available during the events.

CTFA's July 2000 and October 2000 issues of the research newsletter, *A Closer Look*, summarized key points and progress of the project. The January 2001 issue of *A Closer Look* reviewed best management practices for spray applications. While not directly out of the PMA project the article was significant due to the request from DPR to the agricultural industry to voluntarily reduce the use of OP's in dormant applications to stone fruit. CTFA's quarterly newsletter is mailed to over 2,600 growers, PCAs, PCOs, shippers, packers and other parties associated with the clingstone canning and fresh market stone fruit industries. CCPGAB also mailed newsletters to over 400 cling peach growers, PCAs and PCOs explaining progress made on the PMA project. Information from the project has also been made available to the public via CTFA's and KAC's web site. ***Additional information regarding grower outreach during 2001 is discussed in detail in the 9/15/01 progress report for project #00-0212S, which is attached as an addendum.***

Financial Summary for Task 6: The total cost for achieving the objectives of Task 6 was budgeted at $29,590. To date, $35,258.76 has been spent towards meeting the objectives of Task 6.

D. Discussion

Technical challenges, including increasing evidence SJS is resistant to OPs, growers experiencing unacceptable fruit damage while using pheromone mating disruption for PTB and OFM, and grower concerns of economic loss during the transition of instituting reduced risk practices, have been barriers to developing a comprehensive integrated pest management program for clingstone canning and fresh shipping peaches, plums and nectarines. The testing of commercially available oils, pheromone dispenser systems and reduced risk pesticides in a controlled research environment has provided a representation of best management practices for utilizing a more intense integrated pest management approach. Furthermore, development of a biological control program with augmentation of natural enemies may increase SJS, PTB and OFM parasitism levels and further reduce the need for OP/carbamate applications.

Overall, advancement in the objectives for the second year of the project has been made. A tentative analysis of the data indicates SJS, PTB and OFM populations may be maintained below an economic injury level in stone fruit without, or with minimal use of, OPs and carbamates. As noted above, the cost for implementing a PMA approach is similar to the cost of a conventional

program ($221 v. $222 in Fresno/Kings Counties) and preliminary data for 2001 indicates the two approaches have similar costs.

Thus, three grower demonstration plots were established for the 2000 season, which incorporated the reduced risk practices outlined in this project. The implementation of the demonstration blocks intended to addresses the dynamic pest management pressures in a commercial setting, from dormant sprays to beyond harvest. The successful performance of the combination of replacing OPs with oil, pheromone mating disruption and augmenting with natural enemies, under conditions and acreages growers typically contend with, should increase grower confidence in the efficacy of alternative materials, such as Success®, and reduced risk practices.

E. Summary and Conclusions

This was the second year of a comprehensive pest management project where a systems approach (intensive field monitoring, use of mating disruption, use of biological agents and implementation of reduced risk materials) was taken to examine reduced risk alternatives for controlling SJS, PTB and OFM in clingstone and fresh market peaches, plums and nectarines. The objectives of this multi-year project distinctly seek to substantially reduce reliance on OPs and/or carbamates and provide a model sustainable pest management system for stone fruit growers throughout the state of California.

This phase of the project compared the efficacy of commercially available horticultural oil as the single component in a dormant spray for controlling SJS, compared to a traditional OP application, and found moderate populations of scale could be reduced under dilute application conditions.

Work has also progressed in developing a biologically and economically viable inundating release program for natural enemies of SJS. Commercial orchards were surveyed and endemic natural enemies of SJS were identified. As a result, laboratory colonies of two potential groups of parasitoids, *Aphytis vandenboschi* and *Encarsia perniciosi,* have been established for future use as potential augmentative biological control agents against SJS.

Moreover, work was completed to evaluate the efficacy of experimental and commercially available pheromone mating disruption dispensers and formulations for controlling larvae damage from OFM and PTB. Work was completed to evaluate the efficacy of commercially available pheromone mating disruptants for controlling damage from OFM and PTB. The efficacy results indicate that OFM and PTB can be successfully managed by utilizing pheromone disruptants.

Progress was made regarding control of thrips. Two potential alternatives, Success® and Agri-Mek®, again demonstrated satisfactory control compared to the industry standard Carzol® and have reaffirmed the results of last year's trials. Grower feedback is now being received regarding successful results from Success® this past season when used as an in-season treatment.

The CTFA and CCPGAB continue to utilize their communications infrastructures to: sponsor and publicize UC grower education days, publish quarterly newsletters and maintain active websites highlighting progress made on the PMA project. Through this continued effort, hundreds of growers and professional crop care consultants have been exposed to alternative, reduced-risk practices that effectively address the pest complexes of the stone fruit industry.

Finally, the successful demonstration of utilizing horticultural oils in dilute dormant applications in combination with pheromone mating disruption, use of new reduced-risk materials and the development of an augmentative parasitoid program in a commercial setting, should increase grower confidence in the efficacy of alternative materials and reduced risk practices.

Measuring success for this type of program is difficult, but there are some emerging trends that are pointing to program adoption by growers. The current combined acreage for clingstone canning and fresh market peaches, nectarines and plums is approximately 134,500 acres and is farmed by approximately 2,500 growers. At a recent PMA workshop the participants were asked to complete a meeting evaluation. Several questions on the evaluation asked if they were a grower or PCA and if they applied any of the reduced risk practices presented at the PMA meetings to their operations. It is noteworthy that out of those returning the evaluation, 45 were growers and/or PCAs and they represented 39,284 acres of fruit. Out of that group were 30, representing 28,804 acres, who stated they were applying what they learned at the PMA meetings to their operations. Thus, it could be suggested that approximately 2/3rds of stone fruit growers, on 2/3rds of the acreage, are now practicing reduced risk practices from the PMA project.

REFERENCES

Bentley, Walt, Pest Management in Stone Fruits, a Demonstration and Feasibility Evaluation. California Tree Fruit Agreement, Research Report, 2000.

Coviello, Richard L., Thrips Control On Fresh Shipping Fruit. California Tree Fruit Agreement, Research Report, 2000.

Daane, Kent M. , San Jose Scale Natural Enemies: Investigating Natural or Augmented Controls. California Tree Fruit Agreement, Research Report, 2000.

Grafton-Cardwell, Elizabeth. Development of a Biochemical Assay for San Jose Scale Resistance to Insecticides. California Tree Fruit Agreement, Research Report, 2000.

Appendix

III. Tables

Elegant Lady Peaches Pheromone Trapping Counts

Table 1.1

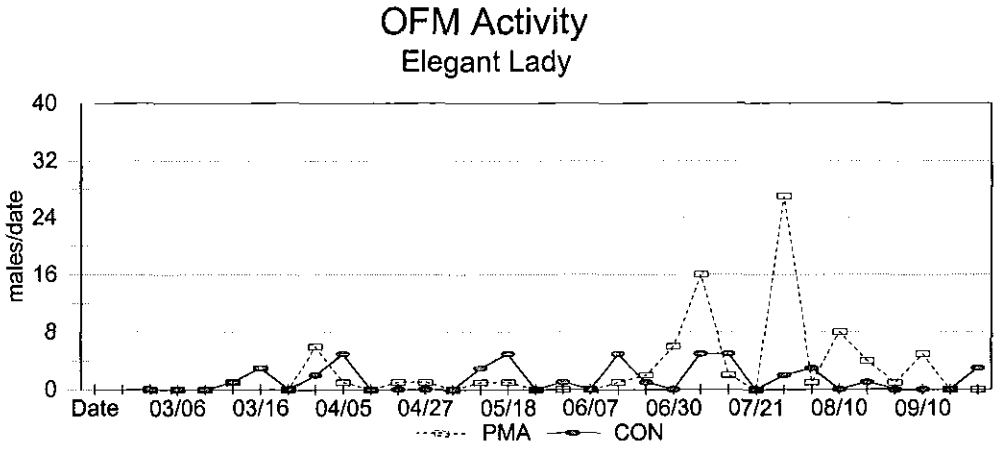


Table 1.2

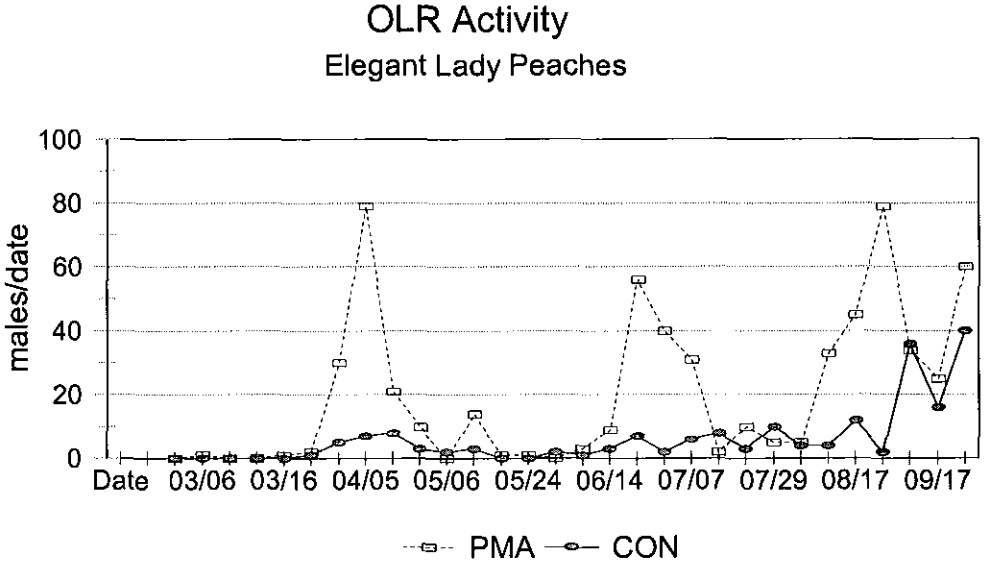


Table 1.3

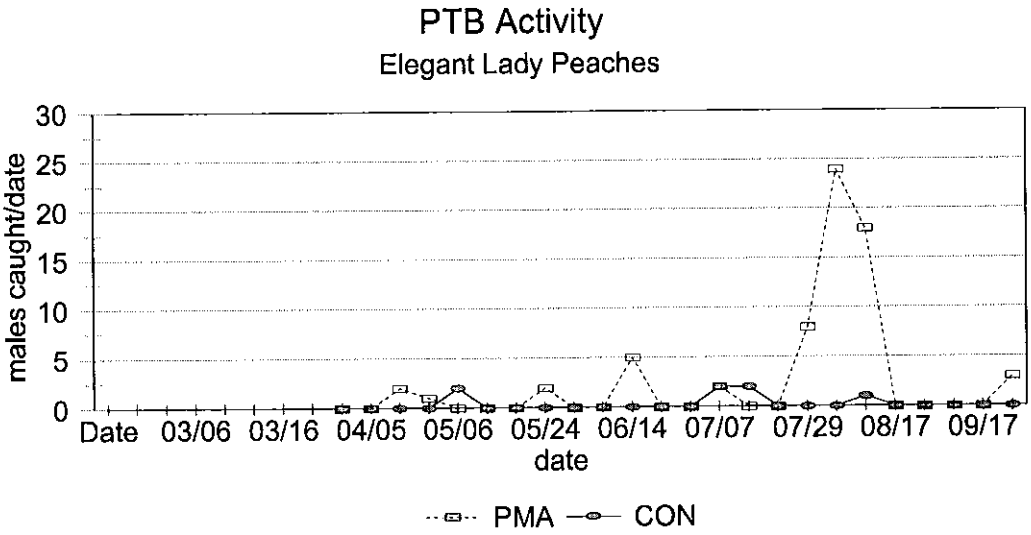


Table 1.4

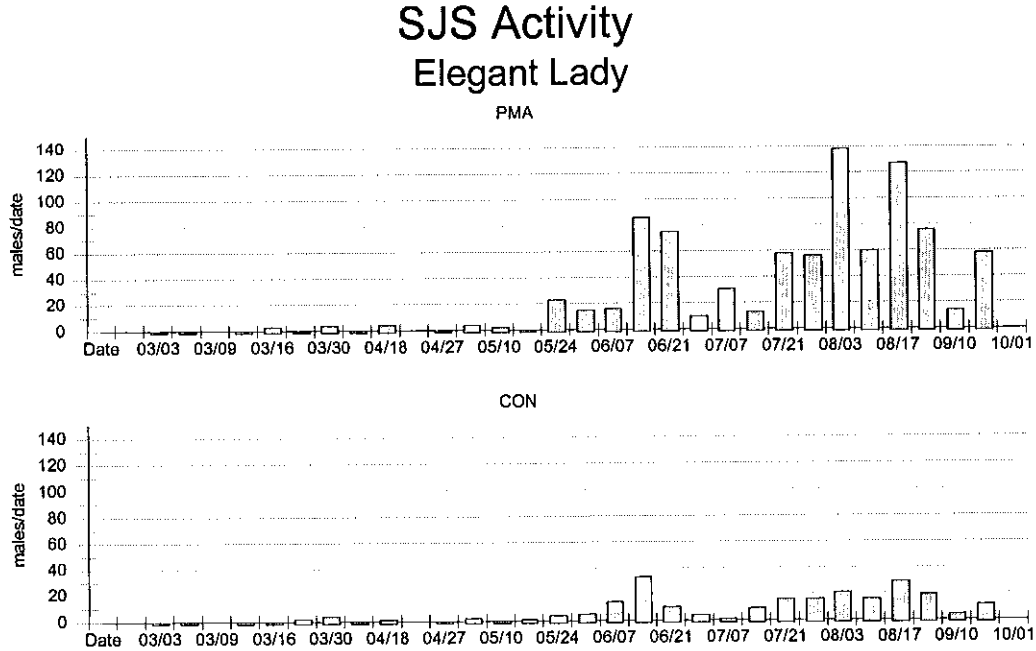


Table 1.5

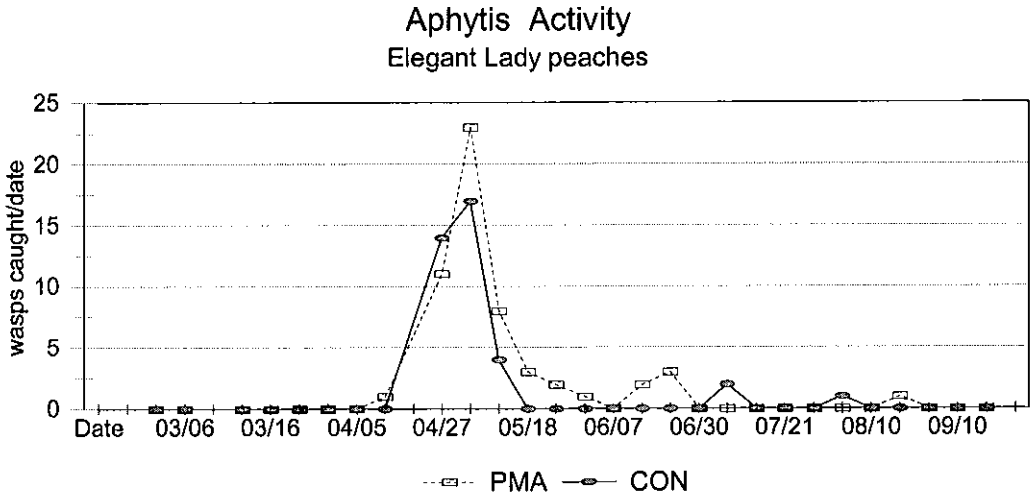
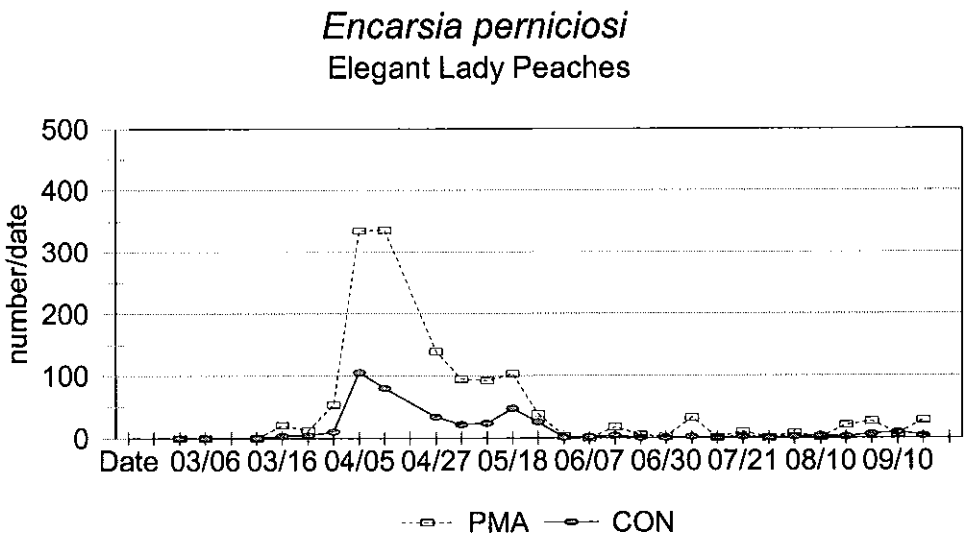


Table 1.6



Grand Rosa Plums Pheromone Trapping Counts

Table 2.1

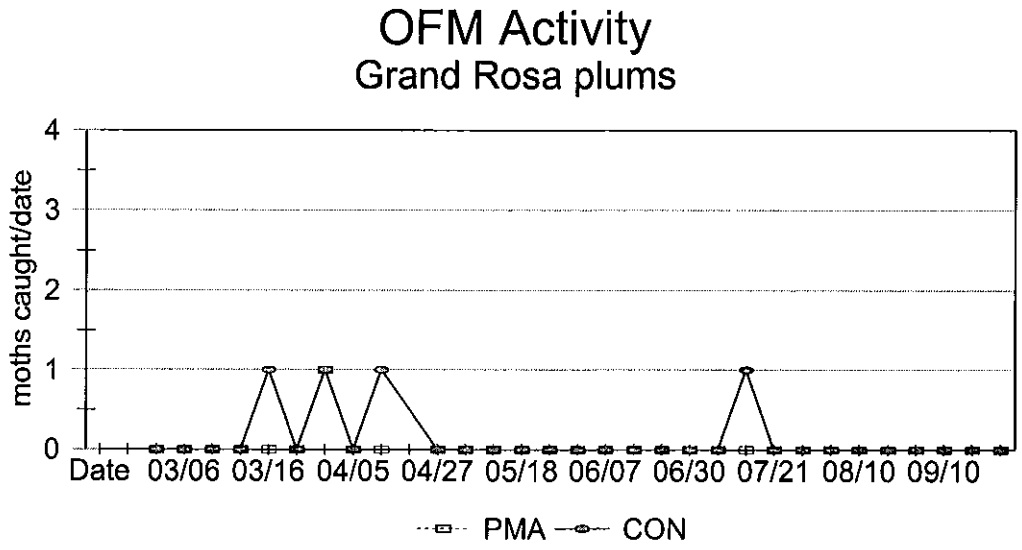


Table 2.2

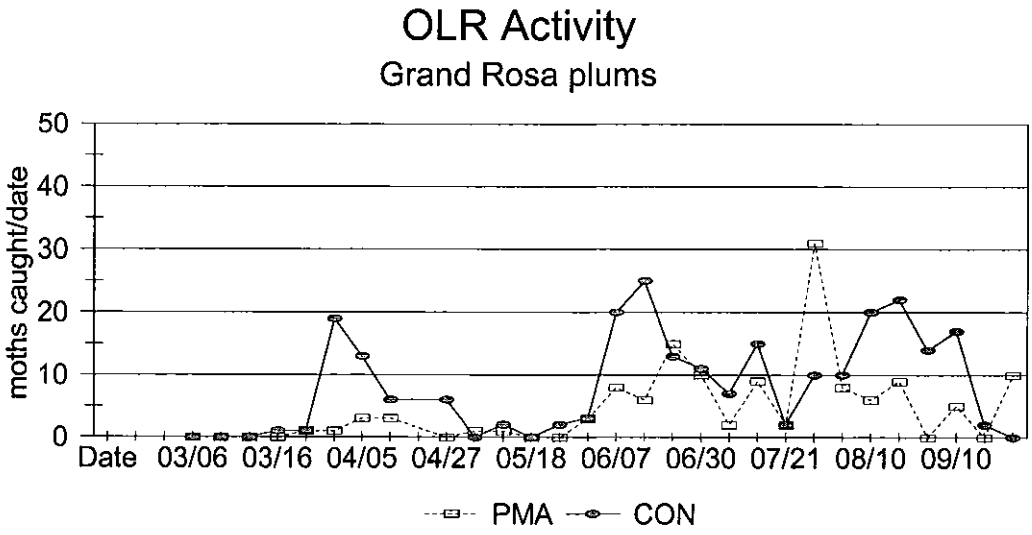


Table 2.3

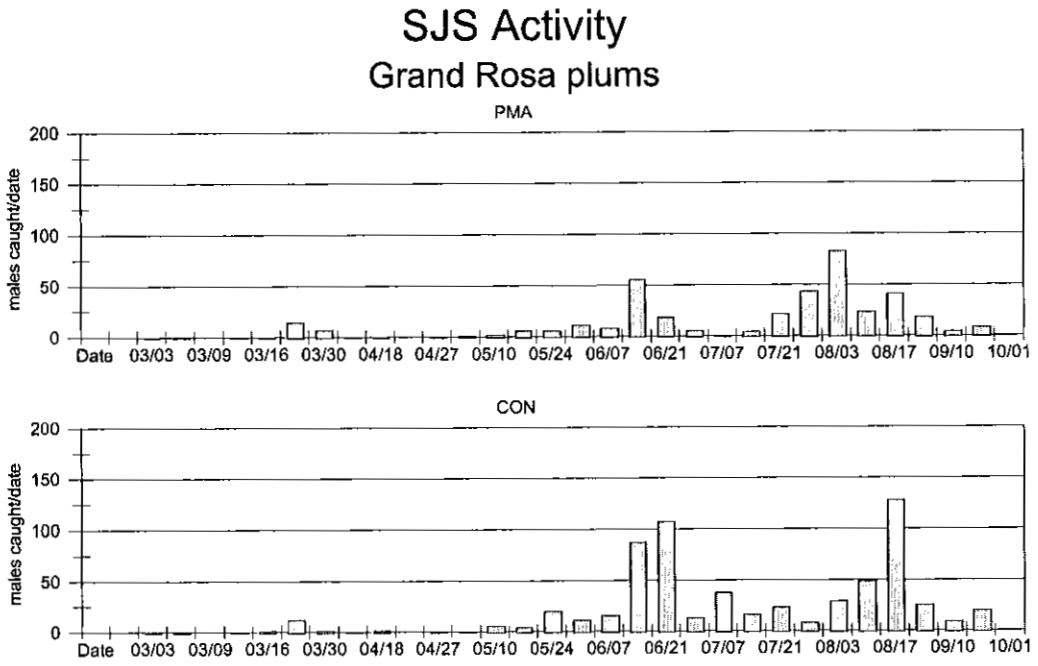


Table 2.4

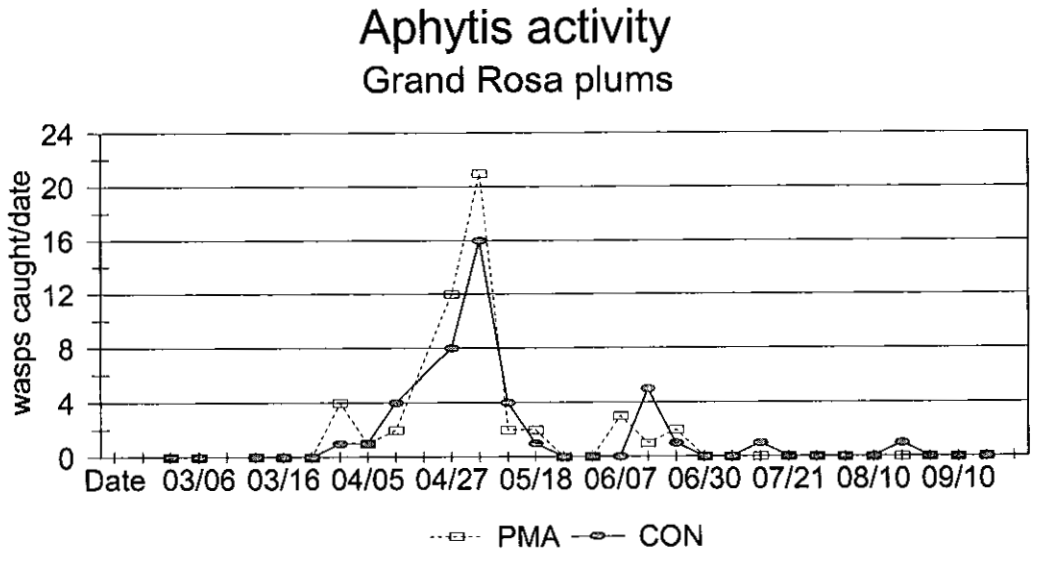
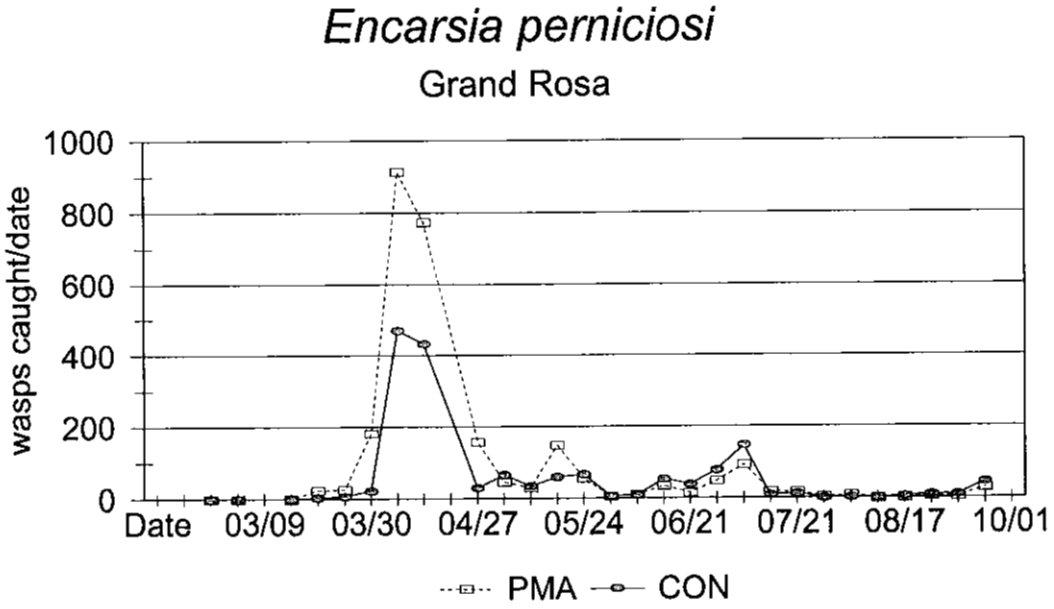


Table 2.5


Encarsia perniciosi
Grand Rosa
wasps caught/date
1000
800
600
400
200
0
Date
03/09
03/30
04/27
05/24
06/21
07/21
08/17
10/01
PMA
CON

Red Jim Nectarines Pheromone Trapping Counts

Table 3.1

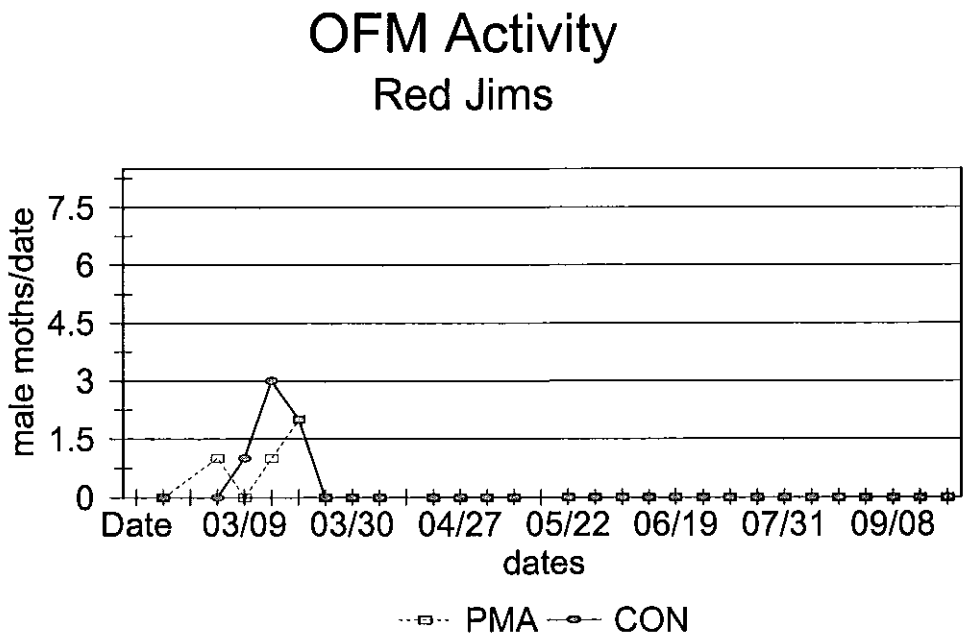


Table 3.2

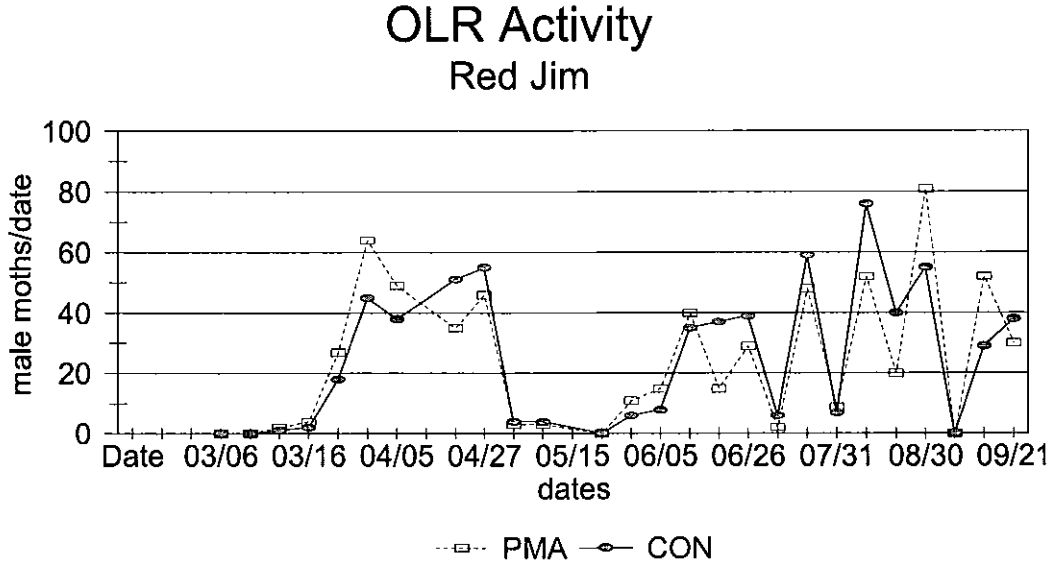


Table 3.3

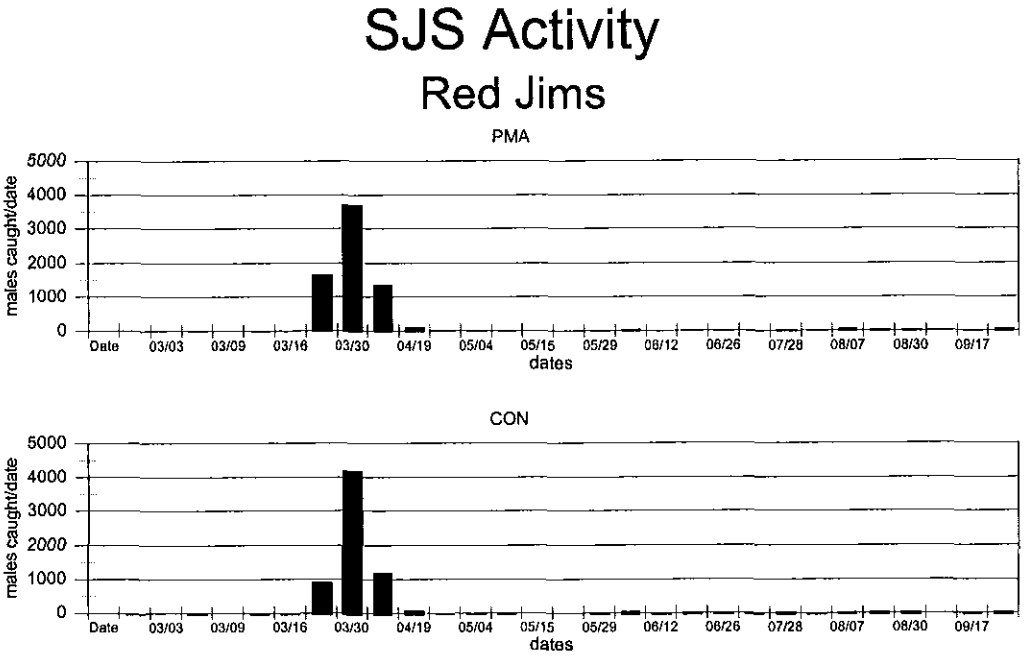


Table 3.4

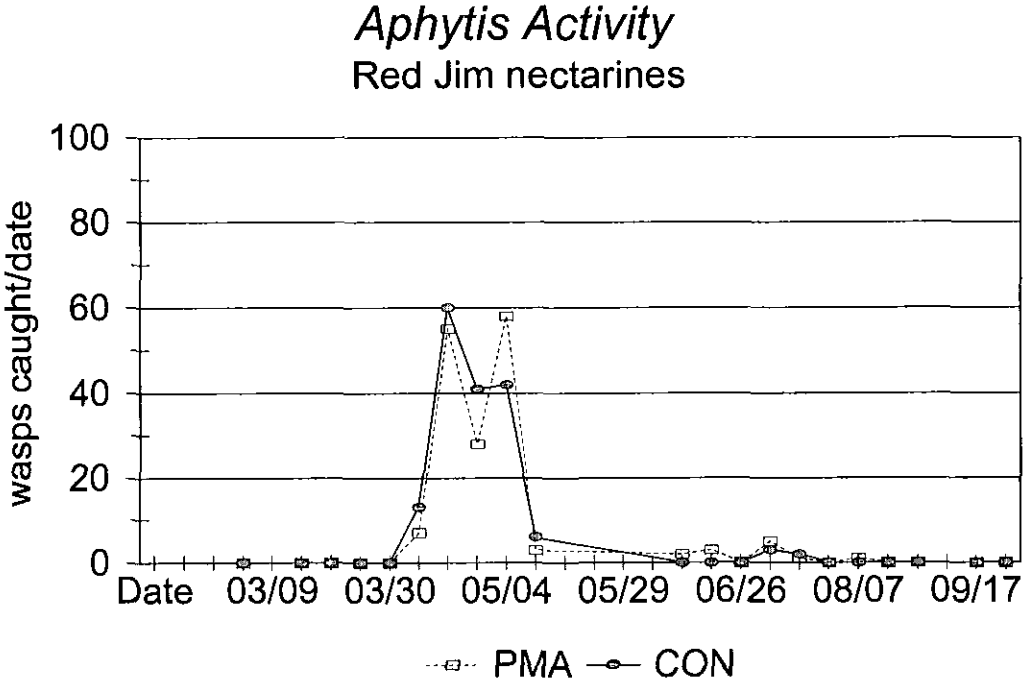
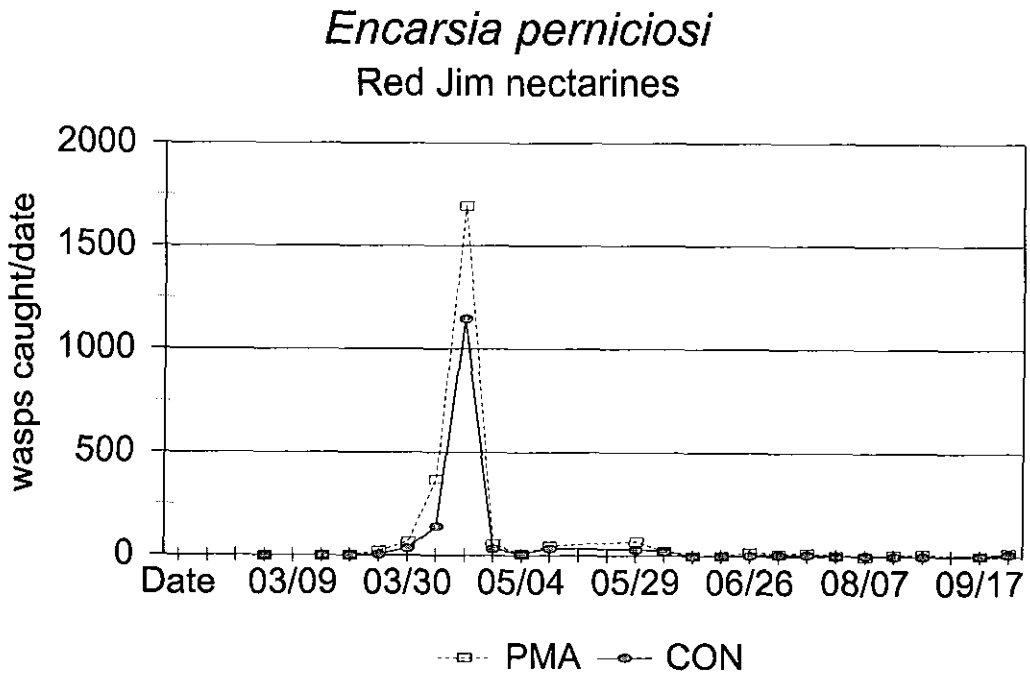


Table 3.5


Encarsia perniciosi
Red Jim nectarines
wasps caught/date
2000
1500
1000
500
0
Date
03/09
03/30
05/04
05/29
06/26
08/07
09/17
PMA
CON

Royal Glo Nectarines Pheromone Trapping Counts

Table 4.1

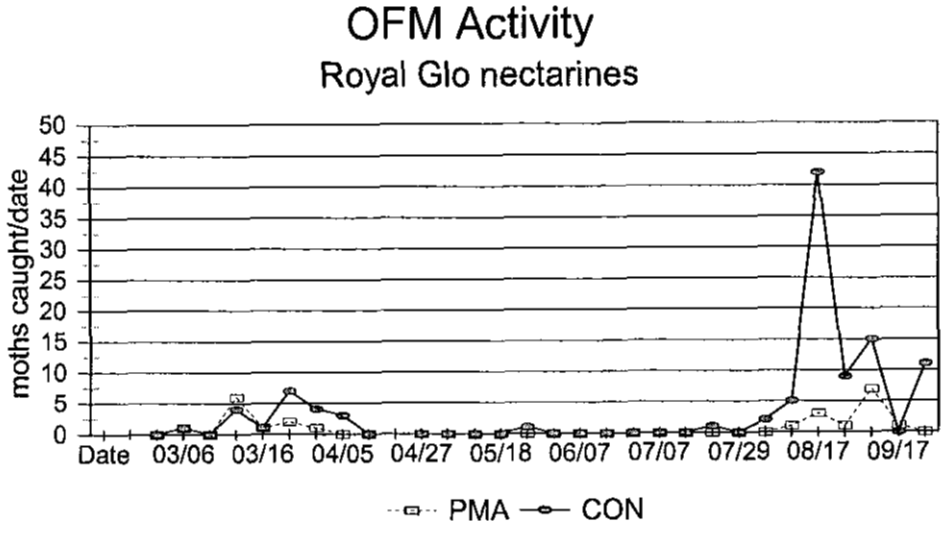


Table 4.2

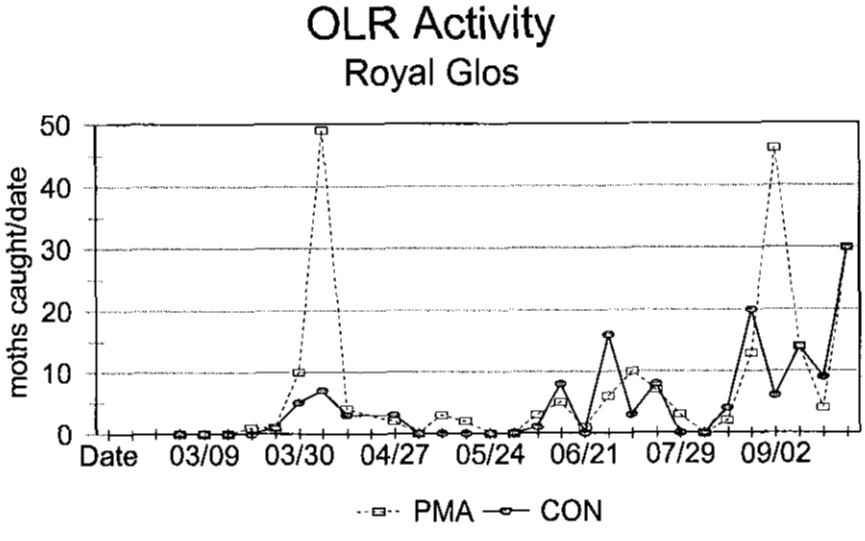


Table 4.3

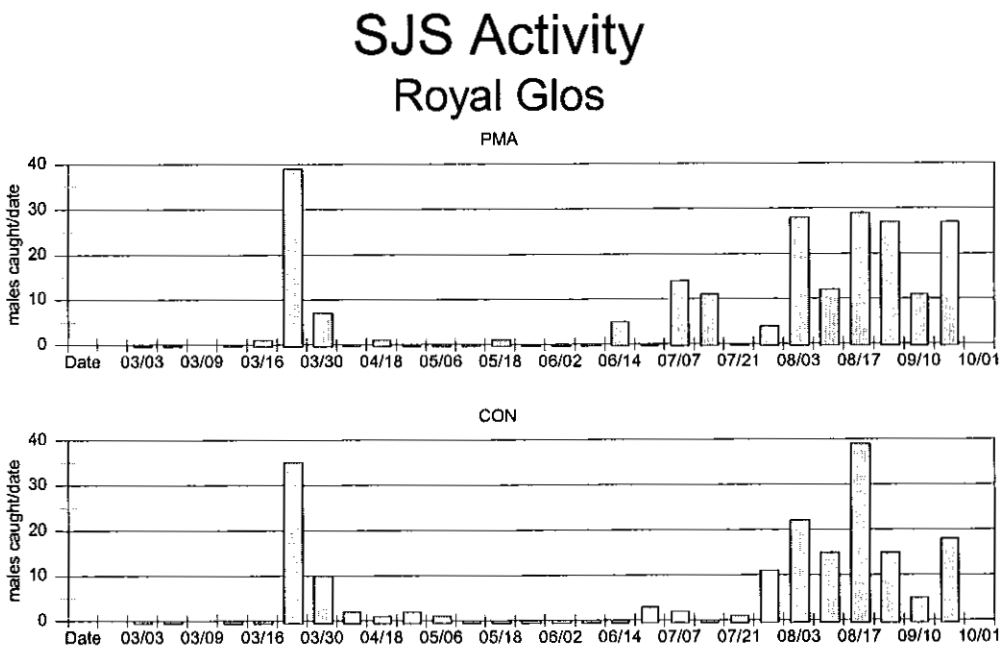


Table 4.4

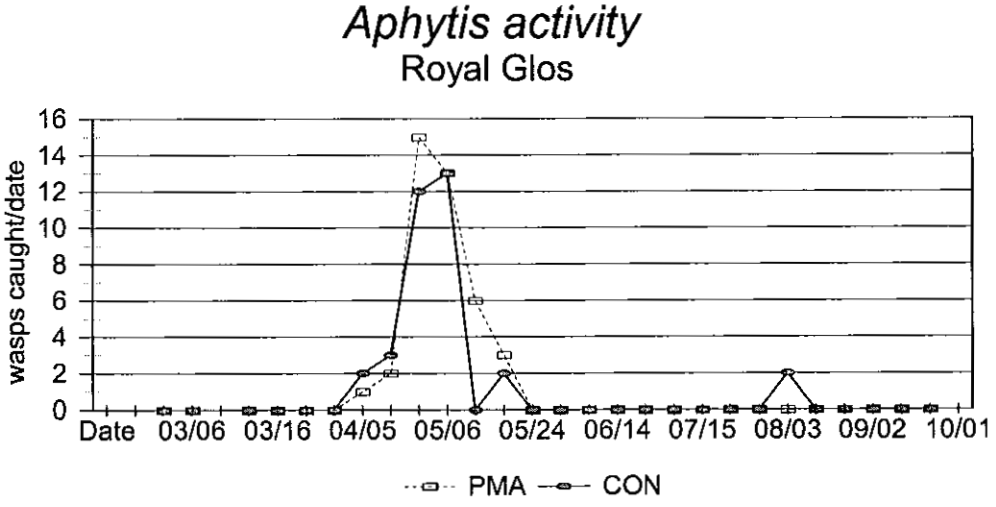
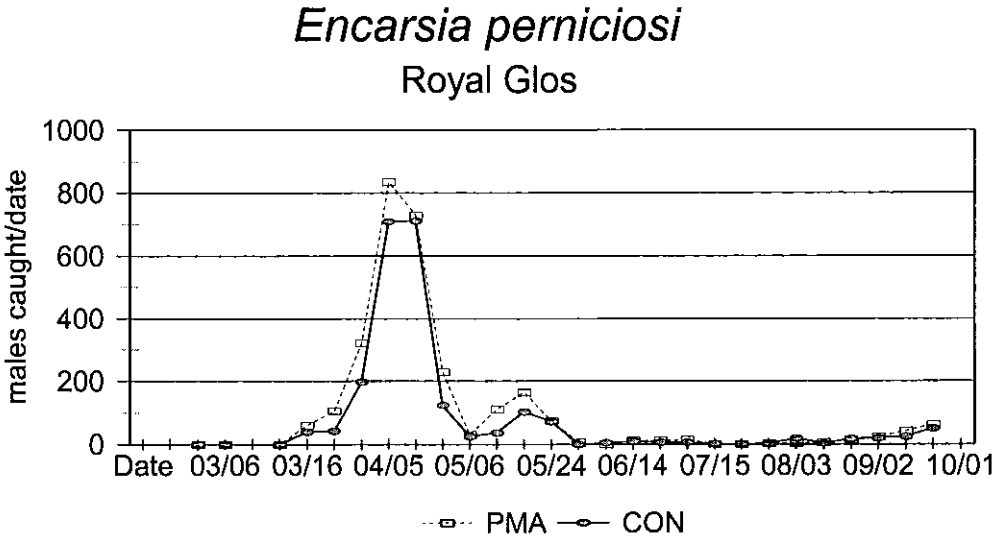


Table 4.5


Encarsia perniciosi
Royal Glos
1000
800
600
400
200
0
males caught/date
Date 03/06 03/16 04/05 05/06 05/24 06/14 07/15 08/03 09/02 10/01
PMA
CON

Summer Red Nectarines Pheromone Trapping Counts

Table 5.1

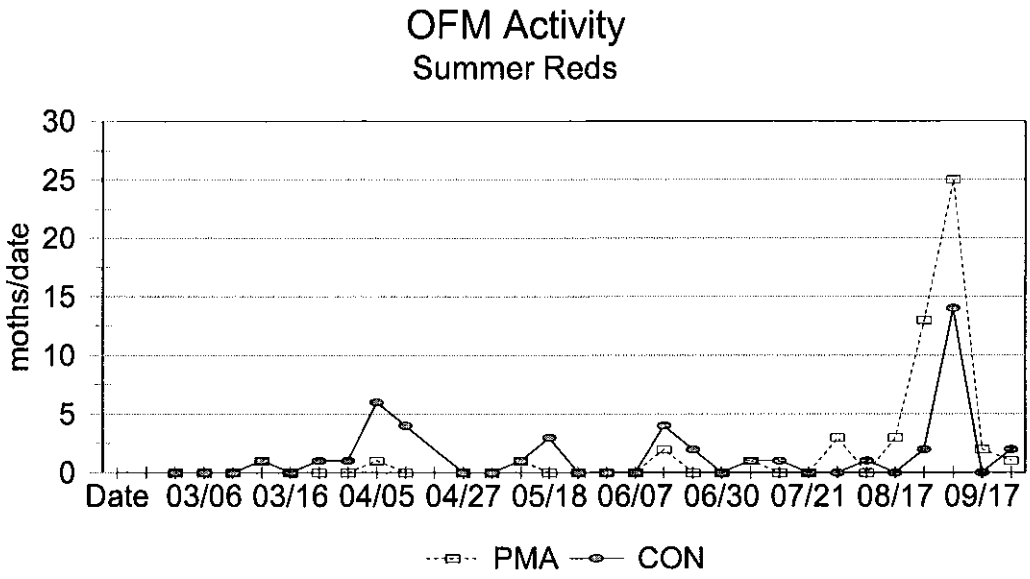


Table 5.2

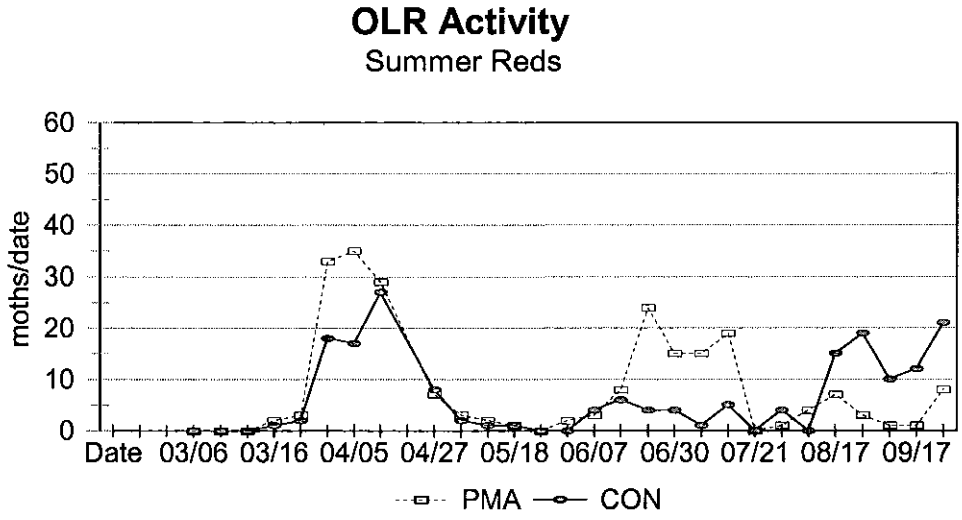


Table 5.3

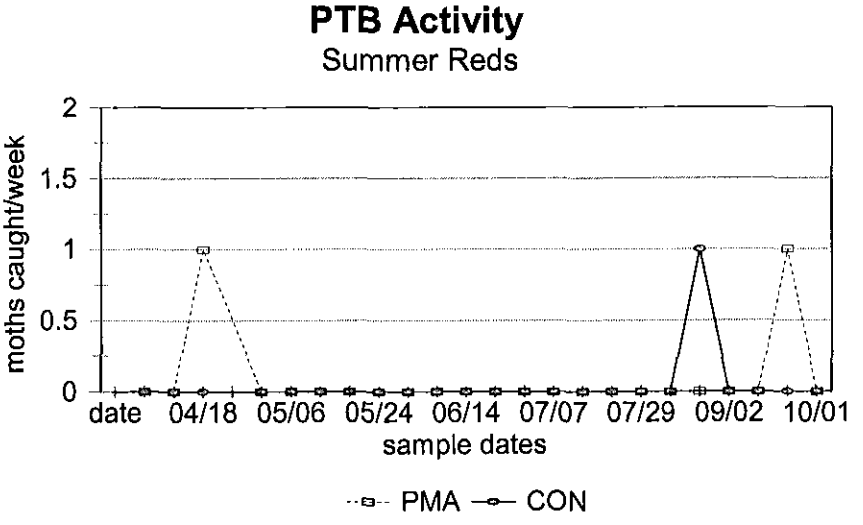


Table 5.4

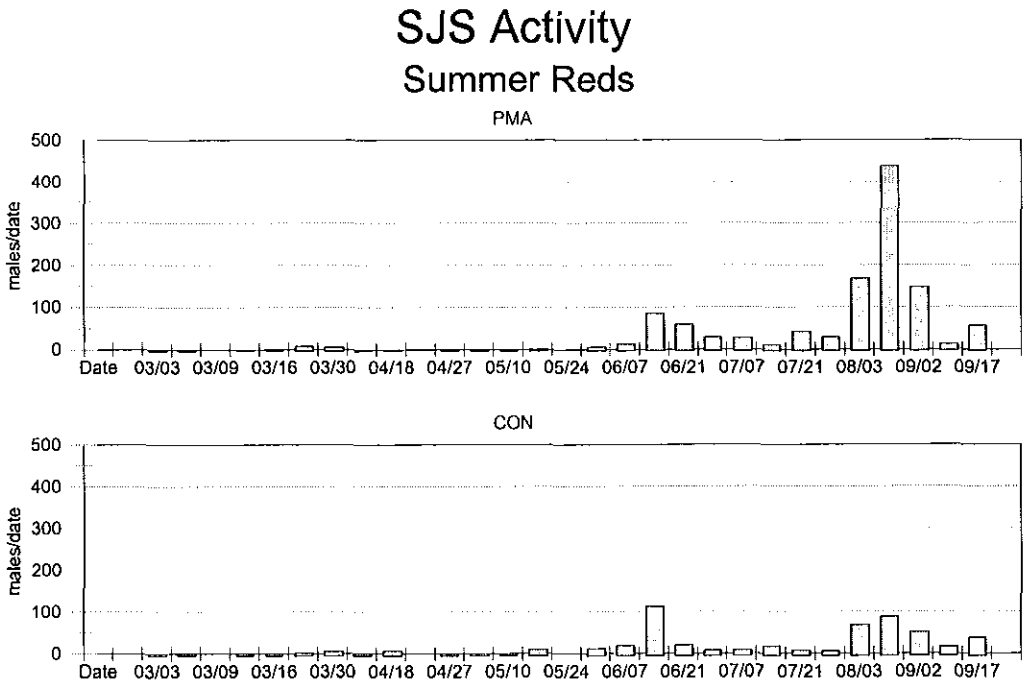


Table 5.5

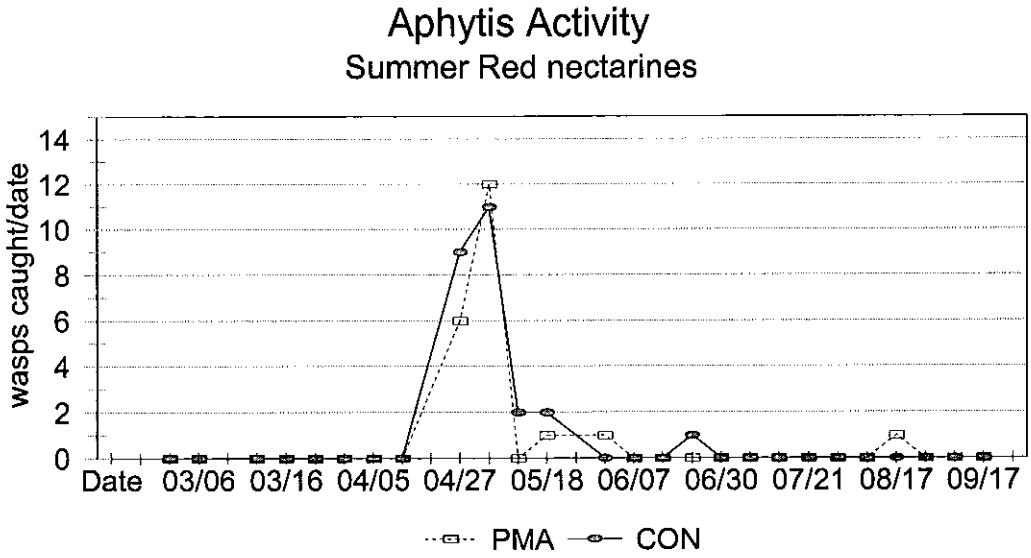


Table 5.6

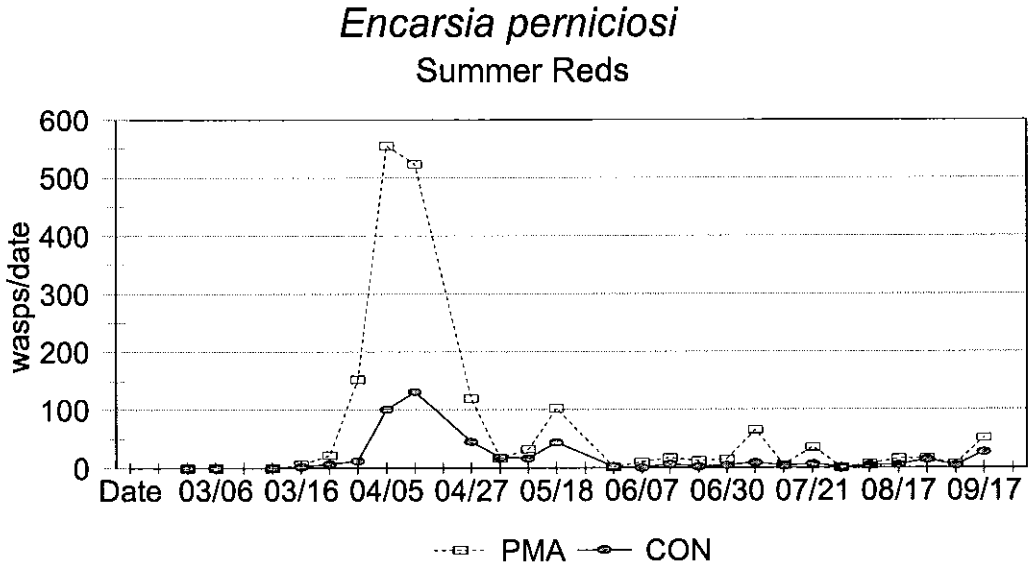


Table 6.

% Fruit Without Insect Damage*

	EL	SR	RG	GR	RJ	Overall
PMA	98.4% a *N = 900*	88.8% a *N = 1300*	90.5% a *N = 500*	81.7% a *N = 1100*	77.9% a *N = 1400*	86.19% a *N = 5200*
CON	99.2% a *N = 900*	91.3% a *N = 1300*	91.4% a *N = 500*	88.2% a *N = 1000*	81.4% a *N = 1400*	89.34% b *N = 5100*

* Differing letters in each column indicate significant differences (paired t-test, alpha = 5%)

Table 7.

Cull Rate at Harvest[1]

	EL	SR	RG	GR	RJ	Overall
PMA	1.0% a *N = 200*	4.5% a *N = 400*	14.0% a *N = 100*	11.0% a *N = 300*	2.3% a *N = 300*	5.69% a *N = 1,300*
CON	1.0% a *N = 200*	3.5% a *N = 400*	14.0% a *N = 100*	7.0% a *N = 300*	2.7% a *N = 300*	4.53% a *N = 1,300*

[1] Differing letters in each column indicate significant differences (ANOVA, alpha = 5%)

The following abbreviations are used to describe the varieties in Table 6 and Table 7.
EL = Elegant Lady peach, **SR** = Summer Red nectarine
RG = Royal Glo nectarine, **GR** = Grand Rosa plum
RJ = Red Jim nectarine

Table 8.

Percentage of Insect Damage (Yuba County)

Practice/variety/county	OFM	PTB	Total OFM/PTB	OBLR	SJS	Katydid	Thrips	Lygus	Total % damage
PMA/C-Yuba	0	0	0.4	2.0	0	0	0	2.2	4.6
Convent/C-Yuba	0	0	0	1.8	0	0	0	2.8	4.6
PMA/R-Yuba	0	0	0	5.0	0	0	0	1.6	6.6
Convent /R-Yuba	0	0	0	0.8	0	0	0	0.2	1
PMA/SH-Yuba	0.1	0	4.4	3.2	0	0	0	0.7	8.3
Convent /SH-Yuba	0.1	0	1.2	2.6	0	0	0	0.3	4.1

The following abbreviations are used to describe the varieties in Table 8.

C= Carson peach (harvested 7/24 and 7/25)

R=Ross peach (harvested 8/14 and 8/15)

SH= Starn peach (harvested 8/21 and 8/22) or Hesse Peach (harvested 8/24)

Table 9. Fresno/Kings counties Stone Fruit Pest Management Alliance cost analysis for cv. Elegant Lady peaches

	PMA Block				*Conventional Block*			
Stage	**Product**	**Date**	**Rate/acre**	**Cost/acre**	**Product**	**Date**	**Rate/acre**	**Cost/acre**
Dormant	Hort. Oil	1/29/2000	6 gal.	$18	Hort. Oil	1/29/2000	3 gal.	$9
	Application			$15	Asana	1/29/2000	8 oz	
					Lorsban 4E	1/29/2000	2 qt.	$20
					Application			$15
Subtotal				$33				$44
Bloom								
Subtotal				$0				$0
Pheromone	Isomate ties	late-Mar	100 ties	$35				
Application	Application			$4				
Subtotal				$39				$0
In season	Success	5/21/2000	6 oz.	$29	Success	5/21/2000	6 oz.	$29
	Application			$15	Application			$15
	Success	6/12/2000	6 oz.	$29	Imidan	6/12/2000	4 lbs.	$26
	Application			$15	Application			$15
	Crymax Bt	6/28/2000	1 lb.	$12	Crymax Bt	6/28/2000	1 lb.	$12
	Application			$15	Application			$15
Subtotal				$115				$112
Total				**$187**				**$156**

Table 10. Fresno/Kings counties Stone Fruit Pest Management Alliance cost analysis for cv. Summer Red nectarines

	PMA Block				*Conventional Block*			
Stage	**Product**	**Date**	**Rate/acre**	**Cost/acre**	**Product**	**Date**	**Rate/acre**	**Cost/acre**
Dormant	Hort. Oil	1/29/2000	6 gal.	$18	Hort. Oil	1/29/2000	3 gal.	$9
	Application			$15	Asana	1/20/2000	8 oz	$16
					Lorsban 4E	1/29/2000	2 qt.	$20
					Application			$15
Subtotal				$33				$60
Bloom								
Subtotal				$0				$0
Pheromone	Isomate ties	late-Mar	100 ties	$35	Carzol SP	3/17/2000	1 lb.	$38
Application	Application			$4	Application			$15
	Success	3/17/2000	6 oz.	$29				
	Application			$15				
Subtotal				$83				$53
In season	Success	5/21/2000	6 oz.	$29	Success	5/21/2000	6 oz.	$29
	Application			$15	Application			$15
	Apollo	5/25/2000	6 oz.	$68	Apollo	5/25/2000	6 oz.	$68
	Application			$15	Application			$15
	Success	6/12/2000	6 oz.	$29	Imidan	6/12/2000	4 lbs.	$26
	Application			$15	Application			$15
	Success	6/29/2000	6 oz.	$29	Imidan	6/29/2000	4 lbs.	$26
	Application			$15	Application			$15
Subtotal				$215				$209
Total				**$331**				**$322**

Table 11. Fresno/Kings counties Stone Fruit Pest Management Alliance cost analysis for cv. Royal Glo nectarines

	PMA Block				*Conventional Block*			
Stage	**Product**	**Date**	**Rate/acre**	**Cost/acre**	**Product**	**Date**	**Rate/acre**	**Cost/acre**
Dormant	Hort. Oil	1/29/2000	6 gal.	$18	Hort. Oil	1/29/2000	3 gal.	$9
	Application			$15	Asana	1/29/2000	8 oz	$16
					Lorsban 4E	1/29/2000	2 qt.	$20
					Application			$15
Subtotal				$33				$60
Bloom	Mycotrol	3/17/2000	6 oz.	$33	Carzol SP	3/17/2000	1 lb.	$38
	Application			$15	Application			$15
Subtotal				$48				$53
Pheromone	Isomate ties	Late-Mar	100 ties	$35				
Application	Application			$4				
Subtotal				$39				$0
In season	Crymax Bt	5/16/2000	1 lb.	$12	Crymax Bt	5/16/2000	1 lb.	$12
	Application			$15	Application			$15
	Lannate	5/24/2000	10 oz.	$15	Lannate	5/24/2000	10 oz.	$15
	Application			$15	Application			$15
Subtotal				$57				$57
Total				**$177**				**$170**

Table 12. Fresno/Kings counties Stone Fruit Pest Management Alliance cost analysis for cv. Grand Rosa plums

	PMA Block				*Conventional Block*			
Stage	**Product**	**Date**	**Rate/acre**	**Cost/acre**	**Product**	**Date**	**Rate/acre**	**Cost/acre**
Dormant	Hort. Oil	1/29/2000	6 gal.	$18	Hort. Oil	1/29/2000	3 gal.	$9
	Application			$15	Asana	1/29/2000	8 oz	$16
					Lorsban 4E	1/29/2000	2 qt.	$20
					Application			$15
Subtotal				$33				$60
Bloom								
Subtotal				$0				$0
Pheromone	Isomate ties	late-Mar	100 ties	$35	Carzol SP	3/17/2000	1 lb.	$38
Application	Application			$4	Application			$15
	Success	3/17/2000	6 oz.	$29				
	Application			$15				
Subtotal				$83				$53
In season	Success	5/21/2000	6 oz.	$29	Success	5/21/2000	6 oz.	$29
	Application			$15	Application			$15
					Imidan	7/11/2000	4 lb.	$26
					Application			$15
Subtotal				$44				$85
Total				**$160**				**$198**

Table 13. Fresno/Kings counties Stone Fruit Pest Management Alliance cost analysis for cv. Red Jim nectarines

	PMA Block				*Conventional Block*			
Stage	**Product**	**Date**	**Rate/acre**	**Cost/acre**	**Product**	**Date**	**Rate/acre**	**Cost/acre**
Dormant	Hort. Oil	mid-Jan	8 gal.	$24	Hort. Oil	mid-Jan	3 gal.	$9
	Application			$15	Asana	mid-Jan	8 oz	$16
					Diazinon	mid-Jan	3 lbs.	$15
					Application			$15
Subtotal				$39				$55
Bloom	Success	3/17/2000	6 oz.	$29	Carzol SP	3/17/2000	1 lb.	$38
	Crymax Bt	3/17/2000	1 lb.	$12	Crymax Bt	3/17/2000	1 lb.	$12
	Application			$15	Application			$15
Subtotal				$56				$65
Pheromone	Isomate ties	late-Mar	100 ties	$35	Crymax Bt	4/5/2000	1 lb.	$12
Application	Application			$4	Application			$15
	Crymax Bt	4/5/2000	1 lb.	$12				
	Application			$15				
Subtotal				$66				$27
In season	Success	4/15/2000	6 oz.	$29	Success	4/15/2000	6 oz.	$29
	Application			$15	Application			$15
	Success	5/4/2000	6 oz.	$29	Imidan	5/4/2000	4 lbs.	$26
	Application			$15	Apollo	5/4/2000	3 oz.	$34
					Application			$15
Subtotal				$88				$119
Total				**$249**				**$266**

Table 14. Sutter/Yuba counties Stone Fruit Pest Management Alliance cost analysis for cv. Carson

	PMA Block				*Conventional Block*			
Stage	**Product**	**Date**	**Rate/acre**	**Cost/acre**	**Product**	**Date**	**Rate/acre**	**Cost/acre**
Dormant	Volck Supreme	2/5/2004	6 gal.	$15	Ambush	2/4/2004	12 oz.	$10
	Micro Flo Basic Cop	2/5/2004	20 lbs.		Micro Flo Basic Cop + Volck Supreme	2/4/2004	6 gal.	$15
	Application			$15	Application			$15
Subtotal				$30				$40
Bloom	Dipel DF	3/11 & 29	1 lb	$20	Success	3/29/2004	6 oz.	$30
	Application			$15	Application			$15
Subtotal				$35				$45
Pheromone	OFM Isomate	2/28/2004	150 disp.	$48	OFM Isomate	3/8/2004	100 disp.	$33
Application	Application			$4	Application			$3
	OFM Isomate	6/1/2004	150 disp.	$48				
	Application			$4				
	PTB Checkmate	5/3/2004	150 disp.	$49				
	Application			$3				
Subtotal				$157				$36
In season					Ambush	6/26/2004	14 oz.	$12
					Application			$15
Subtotal								$27
Total				**$221**				**$148**

Dipel DF spray application 3/11/00 applied with fungicide so application cost not included.

Table 15. Sutter/Yuba counties Stone Fruit Pest Management Alliance cost analysis for cv. Ross

	PMA Block				*Conventional Block*			
Stage	**Product**	**Date**	**Rate/acre**	**Cost/acre**	**Product**	**Date**	**Rate/acre**	**Cost/acre**
Dormant	Volck Supreme	2/5/2004	6gal.	$15	Ambush	2/4/2004	12 oz.	$10
	Micro Flo Basic Cop	2/5/2004	20 lbs.		Volck Supreme	2/4/2004	6 gal.	$15
	Application			$15	Micro Flo Basic Cop	2/4/2004		
					Application			$15
Subtotal				$30				$40
Bloom	Dipel DF	3/11 &3/29	1 lb	$20				
	Application			$15				
Subtotal				$35				
Pheromone	OFM Isomate	2/28/2004	150 disp.	$48	OFM Isomate	3/8/2004	100 disp.	$33
Application	Application			$4	Application			$3
	OFM Isomate	6/1/2004	150 disp.	$48				
	Application			$4				
	PTB Checkmate	5/3/2004	150 disp.	$49				
	Application			$3				
Subtotal				$156				$36
In season					Ambush	6/26/2004	14 oz.	$12
					Application			$15
Subtotal								$27
Total				**$221**				**$103**

Dipel DF spray application 3/11/00 applied with fungicide so application cost not included.

Table 16. Sutter/Yuba City counties Stone Fruit Pest Management Alliance cost analysis for cv. Starn (PMA block) and cv. Hesse (Conventional block)

	PMA Block				*Conventional Block*			
Stage	**Product**	**Date**	**Rate/acre**	**Cost/acre**	**Product**	**Date**	**Rate/acre**	**Cost/acre**
Dormant	Volck Supreme	2/5/2004	6gal.	$15	Ambush	2/4/2004	12 oz.	$10
	Micro Flo Basic Cop	2/5/2004	20 lbs.		Micro Flo Basic Cop + Volck Supreme	2/4/2004	6 gal.	$15
	Application			$15	Application			$15
Subtotal				$30				$40
Bloom	Dipel DF	3/11 &3/29	1 lb	$20				
	Application			$15				
Subtotal				$35				
Pheromone	OFM Isomate	3/3/2004	150 disp.	$48				
Application	Application			$4				
	OFM Isomate	6/1/2004	150 disp.	$48				
	Application			$5				
	PTB Checkmate	5/3/2004	150 disp.	$49				
	Application			$5				
	PTB Checkmate	8/3/2004	150 disp.	$49				
	Application			$5				
Subtotal				$213				

Table 16 continued.

	PMA Block				*Conventional Block*			
Stage	**Product**	**Date**	**Rate/acre**	**Cost/acre**	**Product**	**Date**	**Rate/acre**	**Cost/acre**
In season					Ambush	5/26/2004	14 oz.	$12
					Ambush	6/28/2004	14 oz.	$12
					Ambush	8/9/2004	14 oz.	$12
					Kelthane	8/9/2004	3 lbs.	$37
					Kinetic	8/9/2004	12 oz.	$13
					3 Applications @ $15/Each			$45
Subtotal								$131
Total				$278				$171

Dipel DF spray application 3/11/00 applied with fungicide so application cost not included

Table 17-a. Demonstration Sites Average Material Input Costs Per Program – Fres.-Kings

	PMA Blocks	*Conventional Blocks*
Variety	Cost Per Acre	Cost Per Acre
Elegant Lady peach	$187	$156
Grand Rosa plum	$160	$198
Red Jim nectarine	$249	$266
Royal Glo nectarine	$177	$170
Summer Red nectarine	$331	$322
subtotal	$1,104	$1,112
Average Cost	**$220.80**	**$222.40**

Table 17-b. Demonstration Sites Average Material Input Costs Per Program – Yuba

	PMA Blocks	*Conventional Blocks*
Variety	Cost Per Acre	Cost Per Acre
Carson peach	$221	$148
Ross peach	$221	$103
Starn peach	$278	$171
subtotal	$720	$422
Average Cost	**$240.00**	**$140.67**

Table 18. Results of bloom-time applications at 50% petal-fall for thrips control.

Materials Tested	Thrips Damage (%)	SJS Present (%)	Undamaged Fruit (%)
Agri-Mek®	12.1a	8.9a	63.2a
Carzol®	7.5a	58.1 b	35.6 b
Esteem®	15.8ab	15.9a	60.9a
Success®	10.4a	30.3a	57.2a
Untreated	22.3 b	33.4a	45.9ab

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

Addendum 1

Vol. IV No. 3

July 24, 2000

A CLOSER LOOK

CALIFORNIA TREE FRUIT AGREEMENT
Editor: Jason Chavez

PO Box 968
Reedley, CA 93654
e-mail: jchavez@caltreefruit.com

Phone: 559-638-8260
Fax: 559-638-8842

This Newsletter provides information on research supported by the California Tree Fruit Agreement

2000 Research Program Approved

With the adjournment of the Spring Meetings for the California Plum Marketing Board on April 27, and for the Peach Commodity Committee and Nectarine Administrative Committee on May 2, the 2000 operating budgets for CTFA have been recommended by the full committees and approved by the USDA and CDFA.

For research, the total expenditure for the upcoming season totals $427,417, prior to off-set by grant funds (see grant article). This money will fund 18 projects submitted by 13 different researchers. The projects vary diversely in scope and scientific discipline. The committees funded the following number of projects per research category: 4 entomology, 3 plant nutrition, 2 rootstock, 3 post harvest, 2 cultural practice , 1 disease management, 1 soil, 1economic / marketing and 1 microbial / food safety project.

The 2000 budget represents a 29% increase over the 1999 season. The increase reflects the industry's commitment to developing and refining IPM practices and concern for food safety. For the 1999 season, the total budget was $331,328.

The 1999 Research Reports are now available and can be obtained at our office or by contacting CTFA.

UC Stone Fruit Cost Studies

The University of California Cooperative Extension has just released revised cost studies on the establishment and management costs for mid-season peaches, plums and nectarines grown in the Southern San Joaquin Valley. The studies are intended as guides to help farmers make production decisions, determine potential returns, prepare budgets and evaluate production loans. The guides have a section titled *Your Cost*, where growers can enter their own costs to tailor the guides to their own operations. The guides include tables that consider all expenses related to stone fruit production. Of particular interest to growers are, the *Ranging Analysis* tables in the guides. These tables illustrate the total cost per box at varying yields per acre and are designed to help farmers determine their break-even point at different "pack-outs" per acre. The tables are summarized as follows:

Peach / Nectarine

Boxes / Acre	980	1,400	1,820
Total Cost	$8.89	$7.77	$7.16

Plum (Friar)

Boxes / Acre	750	900	1,050
Total Cost	$11.35	$10.47	$9.83

The guides can be obtained at your local cooperative extension office or online at www.agecon.ucdavis.edu.

CTFA and CCPGAB Awarded Grants

California Tree Fruit Agreement and the California Cling Peach Growers Advisory Board were awarded a grant on June 1, 2000 from the Department of Pesticide Regulation for $51,251 to augment the costs of the second year of the Pest Management Alliance project. The PMA project seeks to implement and refine reduced risk material use and management practices in the cling peach and fresh market stone fruit industries.

In addition, CTFA and CCPGAB were recently awarded a grant for $9,568 from the U.S. Environmental Protection Agency, under the Agricultural Initiative / FQPA program. Under this program funds are intended to augment the cost of education and outreach to growers and pest control advisors affected by the Food Quality Protection Act (FQPA).

CTFA and the California Agricultural Technology Institute, located at the California State University, Fresno campus, have formed a partnership under the California State University Agricultural Research Initiative. The project is based on the PMA demonstration project. The California State University program has shown their commitment by contributing $47,500 to the PMA project.

PMA Field Day Update

On July 13, 2000 CTFA and the California Cling Peach Growers Advisory Board in cooperation with the University of California, Department of Pesticide Regulation, Environmental Protection Agency, California State University, Schellenberg Farms, Tos Farms, Dow AgriSciences, Ecogen and Exxon held the second Pest Management Alliance Field Day at the Kearney Agricultural Center, Parlier, California. The event was held primarily to inform growers and pest control advisers of the results of the 1999-2000 project which focused on the use of "softer" materials as alternatives to many of the current industry standards. Over 130 people attended the event. Several speakers provided details and insight on each aspect of the project and other related topics.

Shawn Steffan, UC Staff Research Associate addressed preliminary economic results for the demonstration blocks. The average cost of materials on the PMA blocks, as of the field day, totaled approximately $151 per acre. The average cost of materials for the conventional blocks was about $157 per acre. The economic results of the demonstration indicate that reduced-risk practices may be comparable to conventional practices. One concern of the participants was the emergence of secondary pests. The pests of primary concern were forktailed bush katydids and Western flower thrips. "One of the valuable things that we can gather from a demonstration like this is preliminary information as to this pest's characteristics and life cycles when in stone fruit orchards. The reason we currently lack information on katydids is because, they have been traditionally controlled by the use of OPs or carbamates during dormant applications," Steffan added.

Walt Bentley, UC Regional IPM Advisor, reviewed long-term Oriental Fruit Moth strategies and mite sampling techniques. Mating disruption of OFM can be successfully accomplished by the use of paraffin emulsion. Prior research has shown that results are best when at least 27grams of the active ingredient are incorporated into the wax and then applied by "painting" or "shooting" the material onto the trees. Research has shown that temperature is the main factor regarding the longevity of the material. In the spring, pheromones can last for approximately 6-8 weeks depending on temperature, weather and geographic location. In the summer, pheromones may only last for 4 weeks because of the higher temperatures. Generally, two to three applications are recommended per season. Bentley also stressed that this technique was most effective in orchards that had a history of low OFM populations. Bentley also showed growers and pest control advisors how to use the Web-Spinning Mite Sampling Form.

Harry Andris, Fresno Co. Farm Advisor, reviewed orchard management practices that help reduce the occurrence of powdery mildew. Andris also explained warm humid conditions, when temperatures range between 70 – 80 degrees Fahrenheit, are most favorable for mildew development. Andris stressed that sulfur is only a *preventative* material and other fungicides should be used after mildew is detected in the orchard.

Rick Schellenberg, grower participant, commented that efforts like the PMA project are necessary now while conventional materials are still available. He stated "It is necessary to refine these techniques and alternative materials before our 'proven tools' are lost to the FQPA's re-registration process. The PMA project is an example of growers, crop care companies and researchers coming together in an effort to deal with our current problems."

Rich Coviello, Fresno Co. Farm Advisor, presented a history of the two diseases that affect stone fruits which can be transmitted by the Glassy Winged Sharp Shooter (GWSS). The first, Phony Peach Disease, trees are described as being "stunted" in growth with a compact canopy that does not allow light to filter through to the ground. The leaves look intensely green and the fruit never reaches maturity. Also, a high percentage of "fruit-drop" is typical of the disease. The second disease transmitted by GWSS is Plum Leaf Scald. In this disease, leaves appear to be "burnt" or "scorched" around the edges and eventually the trees die. Currently, there are no known remedies for either disease.

Vol. IV No. 4

October 25, 2000

A CLOSER LOOK

CALIFORNIA TREE FRUIT AGREEMENT
Editor: Jason Chavez

PO Box 968
Reedley, CA 93654
e-mail: jchavez@caltreefruit.com

Phone: 559-638-8260
Fax: 559-638-8842

This Newsletter provides information on research supported by the California Tree Fruit Agreement

PMA Field Day Update

The third Pest Management Alliance (PMA) Field Day was held October 11, 2000 at the Kearney Agricultural Center, Parlier, CA. The event was hosted by CTFA and the University of California. Other members of the alliance include: California Cling Peach Growers Advisory Board, California Department of Pesticide Regulation, California State University, Dow AgriSciences, Ecogen, Exxon, Schellenberg Farms, Tos Farms and the U.S. Environmental Protection Agency.

The event was held primarily to inform growers and pest control advisers of results from the 1999-2000 project which focused on the use of "softer" materials as alternatives to many of the current industry standards. Over 130 people attended the event. Several speakers provided details and insight on each aspect of the project and other related topics.

Jason Chavez, CTFA Research Coordinator, explained the premise of the Pest Management Alliance (PMA). "The goal of the project is to develop and demonstrate effective alternatives to traditional pest control practices in commercial settings, while reducing the risks associated with pesticide use," Chavez stated.

Walt Bentley, UC Regional IPM Advisor, reviewed katydid identification, damage and management. Katydids look very much like grasshoppers, except they are much larger. During the season, growers experienced damage to fruit caused by katydids. Damage characteristics include: hollowing of leaf centers, "scabbing" of immature fruit, and circular gouges or "chunks" out of maturing fruit. "We have noticed that katydids do not feed in a single location. They move often during feeding," explained Bentley. The material Success®, (Spinosad) has demonstrated control of the pest, yet further study of katydid biology is needed.

Shawn Steffan, UC Staff Research Associate, addressed year-end results for the demonstration blocks. "In terms of overall 'fruit damage' between the blocks that used OPs in their dormant program, compared to the blocks that only used oil, there was no statistical difference between the two," explained Steffan. The average cost for materials in the reduced risk blocks was $151 per acre and the average cost for the conventional blocks was $157 per acre. The results suggest that the reduced risk techniques demonstrated can be economically comparable to conventional pest control practices.

Rich Coviello, Fresno Co. Farm Advisor, presented results from this year's thrips control trials. Evaluation of the bloom-time applications showed the material Success® to be equivalent to Carzol® for control of thrips. The material Agri-Mek®, by Novartis, was also tested and showed significant control for thrips. Presently, Agri-Mek® is not registered for stone fruit. Novartis is pursuing federal registration for the material.

Dr. Kent Daane, UC Biological Control Specialist, reviewed manipulation of biological control agents in stone fruit orchards. Daane explained, "We've found that gray ants are one of the most effective agents against Peach Twig Borer (PTB). However, gray ants only kill PTB incidentally. We have discovered that the ants are actually searching for nectaries on the new growth of the trees, and are extremely difficult to manipulate." Daane explained bio-control should be viewed in terms of a "range of control" and not "absolutes."

Parry Klassen, Director of the Coalition for Urban / Rural Environmental Stewardship (CURES), presented growers an overview of the Sacramento River Watershed Program, (SRWP). The SRWP is composed of government agencies, conservancies, commodity groups, growers and crop care

consultants seeking to enhance and maintain the water quality of the Sacramento River and other California tributaries. Recently, diazinon and other pollutants were detected in the Sacramento River. SRWP is trying to reduce the amount of urban and agricultural pesticide run-off into water systems through educational efforts. It is hoped that if voluntary actions by urban and agricultural users of pesticides reduce the amount of pollutants found in water systems, regulatory sanctions can be avoided.

Methyl Bromide Alternatives

Methyl Bromide (*MeBr*) is often used as a pre-plant soil fumigant to eliminate nematodes, weeds and pathogens, and also as a post-harvest fumigant for exported commodities. Because *MeBr* has been identified as an ozone depleter, it is scheduled to be completely phased out in the United States by 2005, with the exception of post-harvest quarantine treatments. This has prompted USDA-Agricultural Research Service (ARS) and University of California researchers to develop viable alternatives before the 2005 phase out.

To highlight recent research results, a Methyl Bromide Alternatives field day was held August 24th at the new USDA-ARS station in Parlier, CA. Dr. Tom Trout, USDA-ARS Agricultural Engineer, stated, "Telone® has shown to be an effective nematicide, and is the most likely alternative to *MeBr*. However, because it is not a broad spectrum material, and is limited to the amount that can be applied per township, other methods and materials need to be developed."

Dr. Cynthia Eayre, USDA-ARS Plant Pathologist, presented a research plot to attendants where Methyl Iodide (*MI*), which is not an ozone depleter, was compared to *MeBr*. Results from the trials suggest that *MI* treatments controlled peach replant disorder as effectively as *MeBr*. Trees were evaluated by measuring trunk diameter, height and weight of branches removed by pruning. There was no significant difference in trunk diameters between *MI* and *MeBr* treated plots. Diameter and weight of pruned branches in both *MI* and *MeBr* plots were greater than the control plots. Dr. Eayre commented, "Further research is necessary regarding phytotoxicity on plums." TomenAgro is pursuing registration for *Iodomethane* (Methyl Iodide) with the goal of registration by 2003. Dr. Eayre can be reached for information by email at: ceayer@asrr.arsusda.gov, or by phone at: (559)-453-3162.

Dr. Mike McKenry, UC-Kearney Agricultural Center Nematologist, presented the option of using Metam Sodium (Vapam HL®) as the main component of a pre-plant fumigation. This technique requires at least six acre-inches of water to penetrate moistened soil in a period of eight hours or less to be effective. In this "drench" application, Vapam HL® is applied at a rate of 75 gallons per 6-acre-inches of water, per acre. McKenry advises that this method be avoided if the final delivery depth will be less than 4 feet. Also, Vapam HL® will not adequately kill roots below 2 ½ feet soil depth, so treatments should follow a systemic herbicide (Round-Up®) application to tree trunks. In addition, this method is not recommended for soils where root lesion nematode is a problem.

For more information on this subject refer to "The Replant Problem and Its Management" at http://www.uckac.edu/nematode.

Mark Your Calendar

December 5, 2000 – CTFA's Annual Fall Meeting will be conducted at the Visalia Convention Center, 303 East Acequia Avenue, Visalia, CA. For further information, please contact Dovey Plain at (559)-638-8260 or dplain@caltreefruit.com.

December 6, 2000 – U.C. Winter Tree Fruit Meeting will be held at the Dinuba Memorial Hall, 249 S. Alta Avenue, Dinuba, CA. The meeting will cover current research topics in disease, pest management and other issues affecting the stone fruit industry. For further information, please contact Dr. Scott Johnson at (559)-646-6500.

January 5-7, 2001 – Southeast Peach Convention will be located at the Hyatt-Regency Hotel in Savannah, GA.

January 30- February 1, 2001 – Mid Atlantic Fruit & Vegetable Convention will held at the Hershey Convention Center in Hershey, PA.

For further information regarding these two conventions, please contact Gary Van Sickle at (559)-638-8260 or gvansickle@caltreefruit.com.

Vol. V No. 1

January 2, 2001

A CLOSER LOOK

CALIFORNIA TREE FRUIT AGREEMENT
Editor: Jason Chavez

PO Box 968
Reedley, CA 93654
e-mail: jchavez@caltreefruit.com

Phone: 559-638-8260
Fax: 559-638-8842

This Newsletter provides information on research supported by the California Tree Fruit Agreement

Best Management Practices (BMPs) for Spray Applications

The California Department of Pesticide Regulation (CDPR) has requested the agricultural industry voluntarily reduce the use of organophosphates (OPs) in dormant applications to stone fruit, in response to significant levels in surface waters. Since 1986, the Regional Water Quality Control Board and the U.S. Geological Survey have been conducting toxicity bioassays in the Sacramento River, Delta regions and the San Joaquin River. Particular attention has focused on the OPs diazinon and chlorpyrifos.

As a result of the studies, CDPR has confirmed the presence of OPs in the river systems peak during, and shortly after, winter storms. Additionally, run-off from treated orchards may be considered toxic, potentially compromising the health of the rivers and ecosystems. Consequently, CDPR may take action in order to significantly reduce the incidence of these materials in surface waters.

While CDPR is currently evaluating the impact of chlorpyrifos and diazinon from urban sources as well, it may impose agricultural restrictions on the use of these materials for dormant applications if high levels of incidence persist in the Sacramento and San Joaquin watersheds.

At a recent meeting, Parry Klassen, Director of the Coalition for Urban and Rural Environmental Stewardship (CURES), urged the agricultural industry to utilize the **voluntary** reduction requested by CDPR. Lack of grower response will lead to new state regulations to maintain water quality, directly impacting agriculture's use of pesticides. He suggested several "Best Management Practices" for dormant and in-season ground spray applications, which have the potential to reduce orchard water run-off:

- Always **turn off nozzles** at the end of the row.
- Most drift comes from spraying the outside rows. When spraying near sensitive areas, spray only the outsides of the two end rows (i.e., spray inward) at a slower speed for improved coverage. Reduced speed can help compensate for only treating one side and will reduce drift leaving the orchard.
- Mix and load tanks in contained areas (curbed concrete slab) or where runoff to sensitive areas cannot occur in heavy rains.
- Recycle rinsate by spraying it back on the field.
- Establish "berms" or barriers around the perimeter of the orchard to help contain irrigation / storm water run-off.
- Maintain wide vegetative buffer strips between orchards and waterways, such as streams or canals, to minimize the movement of materials off-site in irrigation / storm water runoff.
- Utilize cover crops, such as legumes, or native perennial grasses within orchards to increase water penetration and minimize run-off.
- Maintain and routinely service spray equipment to ensure proper calibration and leak prevention.

For more detailed information on the CDPR Dormant Spray Water Quality Program or mitigating measures for ground spray applications, please contact Kelly Briggs of the RWQCB at (916) 255-3090 or briggsk@rb5s.swrcb.ca.gov, or Parry Klassen of CURES at (559) 325-9855 or parryk@mediaone.net.

San Joaquin River and TMDLs

The lower San Joaquin River is a major tributary of the Sacramento-San Joaquin Delta servicing approximately four million acres of land in California's Central Valley. The lower San Joaquin River is listed among California's Clean Water Act, Section 303(d), of "impaired" water bodies due to elevated concentrations of pollutants (e.g., chlorpyrifos, diazinon, selenium, boron) and other unknown compounds.

Section 303(d) requires the state to identify bodies of water that do not or are not expected to meet applicable water quality standards with technology-based control alone. The Clean Water Act also requires the state to establish a priority ranking of water bodies on the 303(d) list of impaired waters and to establish a Total Maximum Daily Load (TMDL) for those listed.

Essentially, TMDLs are planning and management tools intended to identify, quantify and control the sources of pollution within a given watershed to the extent that *Water Quality Objectives* are achieved and the *Beneficial Uses* of water are fully protected.

In California, the authority and responsibility to develop TMDLs is assigned to Regional Water Quality Control Boards. The USEPA has federal oversight authority of the 303(d) program and may approve or disapprove TMDLs developed by the Boards. If USEPA disapproves a proposed TMDL established by a Board, USEPA is then required to establish the TMDL for that water body.

The immediate implications to the agricultural industry would be additional regulatory use conditions, or the loss of use for particular products within specific regions.

All growers are encouraged to learn how this process has the potential to change the way they farm and to participate in this process as it evolves. For more information please contact Shakoora Azimi of the Regional Water Quality Control Board at (916)-255-3092 or azimis@rb5s.swrcb.ca.gov.

Esteem® Section 18 Approved

On November 29, 2000, the California Department of Pesticide Regulation approved an Emergency Use Exemption (Section 18) for the Insect Growth Regulator (IGR) Esteem® (Pyriproxyfen). Esteem® is used to control San Jose scale on peaches, plums and nectarines. Research by the University of California indicates that the material is most effective when used during the dormant period. The product may be applied from December 1, 2000 through March 1, 2001. Growers must obtain a Supplemental Permit from their county Ag Commissioner prior to purchase and use of the material. Provisions of the Section 18 state Esteem® cannot be applied on a specific site more than once during a season and cannot be used on a site where applied during the previous season. Also, the Supplemental Permit and Supplemental Label must be at the work site **during application** in order to comply with state regulations.

Recycle Plastic Pesticide Containers

The Agricultural Container Research Council (ACRC) has found new uses for properly rinsed pesticide containers. Instead of incinerating or landfill dumping high-density polyethylene (HDPE) plastic containers, recycling has transformed these single use containers into fence posts, pallets, field drain pipes and marine dock lumber. ACRC has contracted with various local governmental agencies to collect these containers from county disposal sites. All containers delivered to county disposal sites must be triple rinsed, completely free of any "visible" materials and completely dry. For information regarding the nearest disposal site, contact your county Ag Commissioner's office.

Mark Your Calendar

January 17, TMDL Workshop for the San Joaquin River 1p.m.-3p.m. and 6p.m.-8p.m., at the Stanislaus County Ag Center, 3800 Cornucopia Way, Modesto, CA.

January 18, TMDL Workshop for the San Joaquin River 1p.m.-3p.m., at the Regional Water Quality Control Board, 343 Routier Road, Suite A, Sacramento, CA.

January 30 - February 1, Mid Atlantic Fruit & Vegetable Convention will held at the Hershey Convention Center in Hershey, PA. For further information regarding the convention, please contact Gary Van Sickle at (559)-638-8260 or gvansickle@caltreefruit.com.

Vol. V No. 2

April 10, 2001

A CLOSER LOOK

CALIFORNIA TREE FRUIT AGREEMENT
Editor: Gary Van Sickle
PO Box 968
Reedley, CA 93654
e-mail: gvansickle@caltreefruit.com
Phone: 559-638-8260
Fax: 559-638-8842

This Newsletter provides information on research supported by the California Tree Fruit Agreement

Preconditioning/Pre-ripening Tips for Peaches, Plums and Nectarines

Contributed by Dr. Carlos Crisosto, University of California Kearney Agricultural Center (carlos@uckac.edu)

Principle Findings

- Controlled delayed cooling can be used to precondition stone fruit susceptible to internal breakdown in order to maintain flavor and extend market life. Delayed cooling can also be used to pre-ripen susceptible and non-susceptible stone fruit varieties in order to deliver a more "ready to eat" product to the consumer. It is important to know what you want to accomplish with each cultivar before changing your program.

  1. In general, a 48-hour cooling delay at 68°F is the most effective preconditioning treatment to extend market life of internal breakdown susceptible peaches and nectarines.

  2. For peaches, nectarines and plums, the use of ethylene during the cooling delays (Preconditioning/Pre-ripening) did not increase market life with respect to internal breakdown symptom development.

  3. To pre-ripen stone fruit, delay cooling at 68°F for the minimum period of time necessary to achieve the desired level of ripeness (up to 6-8 lbf for peaches and nectarines, 5 lbf for plums measured on the weakest position on the fruit).

- Flesh firmness must be monitored on the weakest position on the fruit during the preconditioning/pre-ripening treatment. Peaches and nectarines become very susceptible to vibration injury during transportation when flesh firmness is <5 lbf.

- Peach, nectarine and plum market life is longer when the fruit is stored at 32°F rather than 41°F.

- Rapid cooling after preconditioning is important to stop further fruit flesh softening, senescent breakdown, decay and prevent prolonged exposure to 41°F temperatures. More refrigeration capacity may be needed to execute this system.

- More information can be found at http://www.uckac.edu/postharv/ http://postharvest.ucdavis.edu/, http://fruitsandnuts.ucdavis.edu/ and http://pom.ucdavis.edu/. A full research report will be published in the 2000 CTFA Research Report. A detailed article entitled "Preconditioned/Pre-ripening, A New California Fruit Delivery System Overview" is being prepared for publication as a University of California, DANR Publication Series.

Demonstration Days Planned

Stone fruit growers will have several chances this season to view results of the Pest Management Alliance (PMA) Demonstration Orchards. The test plots have incorporated reduced risk practices side by side with conventional practices. The project is a partnership with the following sponsors: University of California, CA State University-Agricultural Research Initiative, CA Department of Pesticide Regulation, CA Cling Peach Growers Advisory Board, CA Tree Fruit Agreement, Gowan, Dow AgriSciences, and Exxon. Grower participants this season includes: Daybreak Farms, Deniz Packing Co., Kovacevich & Sons, Pinkham Bros., Quinco Corporation, Rubicon Orchards, Schellenberg Farms, and Tos Farms.

Growers will have an opportunity to view one of the test plots at a PMA Field Day to be held April 25 at Daybreak Farms in Traver, CA. The event will begin at 8:30 a.m. with registration and coffee. Results from the 2000 season research will be presented at 9:00 a.m. Throughout the morning UC researchers will provide information on control of several pests from San Jose Scale to thrips to katydids. Brown rot control will also be discussed. Representatives from

the U.S. Environmental Protection Agency and CA Department of Pesticide Regulation will also be present to offer their thoughts on the project. The event will last until noon. Several hours of PCA credits have been requested.

Growers in the south valley will have an opportunity to hear a condensed version of the presentation in their own area on April 17 from noon to 1:00 p.m. at Kovacevich & Sons Ranch in Wheeler Ridge. Box lunches will be provided at 11:45 a.m. to those who RSVP to Gary Van Sickle @ (800)-636-8260.

Growers in the north valley will have an opportunity to attend the PMA Field Day for cling peaches. The meeting will be held on April 26 from 10:00 a.m. to 11:30 a.m. at the Hundal Ranch, on the south edge of Yuba City. Mating disruption of OFM and PTB will be discussed. Information is available from Heidi Sanders @ (530) 673-8526.

PMA Results From 2000

Extensive monitoring of both the reduced risk and the conventional plots has produced valuable information for future use by the stone fruit industry. Trends between the two programs remain consistent. The data obtained from this past year's demonstration blocks illustrates, in general, higher insect activity in the PMA plots, compared to the conventional plots. However, there were also higher populations of the SJS parasitoids, Aphytis spp. and Encarsia perniciosi.

To gauge the profitability of the program that did not use OPs or carbamates, researchers have used the percentage of fruit "culled" because of insect damage, as an indication of how the reduced risk program performed, compared to the conventional program. The data illustrates that within each variety there was no statistical difference between the two pest management programs. Furthermore, this was also true of the overall performance when both pest control methods were grouped in their respective programs. The PMA orchards averaged a cull rate of 5.69%, while the conventional averaged a cull rate of 4.53%.

The costs of the programs used varied considerably between varieties and between the northern Sacramento Valley cling peaches and the southern San Joaquin Valley plots. Also, the approach to managing pests in the PMA orchards had a bearing on cost. In the San Joaquin Valley, the per acre least costly PMA program was $160 for Grand Rosa plums and the most costly PMA program was $331 for Summer Red nectarines. The conventional program costs, per acre, ranged from $156 for Elegant Lady peaches to $322 for Summer Red nectarines. The average per acre cost of the PMA programs in the southern San Joaquin Valley was $221. The average conventional program cost was $222.

Results of the cling peach comparison blocks in Yuba County varied more than those in the south. The costs for the 3 PMA plots ranged from $221 to $278. The costs for the conventional programs ranged from $103 to $171. The per acre average cost of the PMA plots was $240, compared to the conventional orchards at $141.

Mark Your Calendar

April 17 - Pest Management Alliance Demonstration Day – Kern County. To be held at the Kovacevich Ranch at Wheeler Ridge, 12 noon to 1:00 p.m. RSVP to Gary Van Sickle for map. (559) 638-8260. A copy of the meeting notice and map is on the internet at http://www.uckac.edu/treefruitipm/PMA_1.htm.

April 25 - Pest Management Alliance Demonstration Day – Traver. To be held at Daybreak Farms, 36060 Burke Drive, Traver, CA, 8:30 a.m. to 12 noon. PCA Credits available. A copy of the meeting notice and map is on the internet at http://www.uckac.edu/treefruitipm/PMA_1.htm.

April 26 – No. Calif. Pest Management Alliance Demonstration Day. To be held at the Hundal Ranch at George Washington and Best Road, south of Yuba City, 10:00 a.m. to 11:30 a.m. Call Heidi Sanders for information @ (530) 673-8526.

May 3 – CTFA Spring Meeting, Visalia Convention Center, Visalia, CA, 7:30 a.m. to 4:30 p.m. Please RSVP to Dovey Plain, (559) 638-8260, if you plan to attend.

PMA Brown Bag Lunch Series. To be held at various grower orchard plots who are cooperators in the PMA program each Wednesday, May 9, 16, 23, and 30. Each session will be held during the lunch hour (12 noon to 1:00 p.m.) and feature an informal opportunity to hear from the researchers as to what the monitoring program is finding, what the current pest pressures are and what could be a potential threat in the near future. Bring your lunch and an appetite for knowledge. Call Gary Van Sickle for dates and maps to each of the sites at (800)-636-8260. A copy of the meeting schedule and maps will be on the internet at http://www.uckac.edu/treefruitipm/PMA_1.htm.

Vol. V No. 3

July 5, 2001

A CLOSER LOOK

CALIFORNIA TREE FRUIT AGREEMENT
Editor: Gary Van Sickle

PO Box 968
Reedley, CA 93654
e-mail: gvansickle@caltreefruit.com

Phone: 559-638-8260
Fax: 559-638-8842

This Newsletter provides information on research supported by the California Tree Fruit Agreement

Hot New Varieties!

Have you wondered how your neighbor always seems to have the newest varieties? Maybe he has made the trek to the breeding grounds to see the newest varieties unveiled. Several of the fruit breeders and nurseries hold weekly showings during the season. Interested growers are invited to attend. Please call in advance to confirm showings and for directions.

Zaiger Genetics, Modesto (209) 522-5813
Weekly showing every Wednesday at 9:00 a.m. conducted by Floyd and Leith Zaiger. Zaiger is associated with Dave Wilson Nursery. Tends to specialize in Summerwhite® varieties, low acid peach / nectarine varieties and Pluots®.

Bradford Farms, Le Grand (209) 389-4212
Weekly showing every Wednesday at 9:30 a.m. conducted by Glen Bradford. Bradford is associated with Bright's Nursery. Showings can also be confirmed at Bright's Reedley office, (559) 638-1107. Tends to specialize in nectarines.

Dave Wilson Nursery, Reedley (559) 638-6675
Weekly showing every Thursday at 9:00 a.m. conducted by Lee Sadler or Bill Morris. Showings are of Zaiger varieties grown at their Reedley location.

Burchell Nursery, Fowler (559) 834-1661
Weekly showing every Thursday, 8 a.m. – 5 p.m. conducted by John Slaughter. Tends to specialize in peaches and nectarines and recently introduced their Peppermint™ series of Summerwhite® varieties.

Others with occasional showings are Agri-Sun Nursery, Selma (George Howard) (559) 896-7444, and Dr. David Ramming with the USDA-ARS, (559) 453-3000.

PMA Update For Spring 2001

The stone fruit acreage involved in the 2001 season of the PMA Demonstration Project grew to approximately 120 acres, a 3-fold increase over last year's acreage in the San Joaquin Valley. Five new grower-cooperators joined the program, which spans much of the Valley. Up to date information can be found at the Kearney Ag. Center website: http://www.uckac.edu/treefruitipm/PMA_1.htm.

Results, YTD:

Dormant Season. The dormant application of high-rate, high-dilution mineral oil in the PMA blocks produced results similar to those of 2000. A substantial number of San Jose scale were eliminated with the mineral oil (winter black cap counts not yet analyzed). The degree of population suppression, however, was not as high as that of a typical organophosphate (OP) application. Despite these findings, much higher parasitoid populations are being found in the PMA blocks, which mirrors last season's findings. The parasitoids are very host-specific and well-synchronized early in the season; preliminary sampling using sentinel scale hosts indicates that the activities of *Encarsia* and *Aphytis* are removing over 50% of the scale population. The use of high-rate, high-dilution mineral oil for the dormant application can save growers approximately $20/acre.

Bloomtime. The spinosad (Success®) bloomtime application provided control of thrips populations, as indicated by low thrips scarring on early season

fruit. To date, no differences have been found between fruit damage in the blocks with spinosad and blocks where Carzol (formetanate hydrochloride) was applied.

In-season. Three different mating disruption programs were used at the various PMA blocks. A paraffin emulsion with OFM pheromone was applied to two nectarine blocks, one plum, and two peach blocks. The nectarine and peach blocks are being compared with adjacent blocks receiving either OFM pheromone ties or no mating disruption. Results, so far, indicate that the paraffin emulsion provides substantial disruption. Shoot strike data also show there was much more worm activity in blocks where Imidan (phosmet) was applied as opposed to blocks receiving the paraffin emulsion. Isomate ties were used in the remainder of the PMA blocks. The paraffin emulsion appears to be controlling moth populations as well as the ties.

The "puffer" technology is being used to dispense PTB pheromone in large blocks at four different sites. Results, to date, are inconclusive, since few moths have been caught in pheromone traps in fields under puffer control. Spinosad (Success®) has been applied at specific blocks for katydid control, and the populations were adequately controlled. Fruit and leaf damage has been minimal everywhere, with the possible exception of one block of nectarines, but the damage there is also attributable to a combination of hail and shot-hole. Bt has also been applied at most of the blocks for OFM and PTB control. Timing for these applications was optimized using the UC IPM insect development projections. As the season progresses, the differences between the PMA blocks and conventional blocks should be more evident.

Please call Walt Bentley, IPM Specialist at Kearney Ag. Center, (559) 626-6527 or Shawn Steffen, PMA Project Coordinator, (559) 626-6061 if you have any questions regarding the PMA project.

EPA Awards Grants to CTFA

Recently CTFA was notified that it received an $8,200 grant to be used for grower outreach. The grant is from EPA Region 9's Small Grants for Education and Demonstration on FQPA "Transition" Efforts program.

EPA also notified the California Plum Marketing Board that it was awarded a $38,000 grant to support research and demonstration for reduced risk practices. The grant is from EPA's Pesticide Environmental Stewardship Program (PESP).

Mark Your Calendar

July 13 – Variety Display and Research Update Seminar at Kearney Ag Center – Parlier. To be held at KAC 8:00 am to 10:00 am. Each monthly showcase devotes the first hour to nursery showings of new varieties, and then the second hour will focus on a research topic of general interest. This month will include a tour of the station with stops at several project sites. Call Scott Johnson, (559) 626-6547, or Kevin Day, (559) 685-~~3323~~ 3309, Ext. 211, for details.

August 7 - Variety Display and Research Update Seminar at Kearney Ag Center – Parlier. To be held at KAC 8:00 am to 10:00 am. Each monthly showcase devotes the first hour to nursery showings of new varieties, and then the second hour will focus on a research topic of general interest. Call Scott Johnson, (559) 626-6547, or Kevin Day, (559) 685-~~3323~~ 3309, Ext. 211, for details.

August 28 & 29 – "Bridging Pest Management Solutions Workshop" – Reno, Nevada. This workshop will be held at the Peppermill Hotel. The workshop will provide an opportunity for stakeholders to communicate various pest management tactics, issues and concerns within the western United States. The meeting announcement, agenda and details can be accessed on the internet at www.wrpmc.ucdavis.edu or call Linda Herbst at (530) 752-7010.

Vol. V No.4

October 3, 2001

A CLOSER LOOK

CALIFORNIA TREE FRUIT AGREEMENT
Editor: Gary Van Sickle

PO Box 968
Reedley, CA 93654
e-mail: gvansickle@caltreefruit.com

Phone: 559-638-8260
Fax: 559-638-8842

This Newsletter provides information on research supported by the California Tree Fruit Agreement

IPM Guideline for Replanting without MB

Contributed by Dr. Michael McKenry, University of California Kearney Agricultural Center (mckenry@uckac.edu)

In California 85% of almond, peach, nectarine and plum orchards are replanted on Nemaguard rootstock. There is only a 35 to 50% occurrence of soil pest/diseases across these orchards. Methyl bromide (MB) as a single treatment served the purpose of controlling soil pests and diseases while minimizing the rejection component of the replant problem and stimulating initial plant growth. To replace MB the IPM strategy is as follows and will take approximately 18 months before replanting:

a) Determine if root lesion and/or ring nematodes are present in the orchard site. Avoid replanting of orchards if oak root fungus disease is present, but if present and bacterial canker is not expected, plan to use Marianna 2624 rootstock; b) Harvest fruit before mid October, irrigate, cut off old trees at trunk level and paint a solution of 50 ml Roundup™ plus 100 ml MorAct to the cambium. (This treatment plus 18 months of wait will minimize by 85% the intensity of the rejection component of the replant problem where soil pests and diseases are absent.) [*Note:* On Feb. 16, 2000 the label for Roundup™ was modified to provide for application to cut stumps]; c) Wait at least 60 days before pushing stumps; d) backhoe or rip soil as needed, land level as needed, plant sudan x sorghum into moistened soil about mid April but before June 15 of the next year; e) mow and re-mow as sudan grass reaches four feet of height. If the sudan grass needs nitrogen fertilizer apply 650 lbs. per acre urea throughout a single, six-acre inch irrigation after mowing and before the end of June. The Roundup treatment will not kill eggs of root lesion nematode within roots. If either ring or root lesion nematode is present there will be need for soil fumigation: f) to deeply dried sandy or sandy loam soil apply a broadcast treatment of Telone II at 33.7 gallons per treated acre before there has been 2 inches of rainfall (by November 1); g) To deeply dried clay or clay loam soil apply an 8 foot wide strip of Telone II at 40 to 67 gallons per treated acre before 2 inches of rainfall (by November 1); h) Replant trees early the following spring, applying diverse micro and macronutrients.

Strip treatments such as the 8 foot strip will solve most of the rejection component of the replant problem but will not control nematodes for more than a year.

Fresh Fruit Audit Verification Program

At the request of California and other state departments of agriculture, USDA's Agricultural Marketing Service (AMS) is helping to develop an audit-based "food safety" verification service that will attest industry participants' voluntary adherence to the Food and Drug Administration's "Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables" and Good Agricultural Practices (GAP) and Good Handling Practices (GHP). The service will be provided by Shipping Point Inspection (SPI) via cooperative agreements between the state agencies and AMS. The primary users of these services will be fresh fruit and vegetable packers.

This service will initially be in a pilot status beginning October 2001 for twelve months and will involve several industries throughout the country. Participants that successfully meet the minimum audit parameters will be able to use the results of the

audit to show prospective buyers of their efforts. Information about successful participants will be posted to a readily accessible USDA website. For more information on these third party audits please contact Gordon Poulsen at Shipping Point Inspection (SPI) in Sacramento, (916) 654-0810.

DuPont pulls Benomyl Registration

Benomyl (Benlate) is a systemic preharvest fungicide previously registered for use on many crops, including stone fruits. Distribution or sale of existing stocks by DuPont was not lawful after August 8, 2001. Sale or distribution by any person of existing stocks will not be lawful after December 31, 2002. The Environmental Protection Agency (EPA) believes that the end use of any remaining existing stocks of Benomyl products will likely end in 2003. At this time EPA is determining how long treated food containing residues of benomyl could remain in the channels of trade assuming that the last treatment occurred on December 31, 2003, and will set the expiration date accordingly. Also, EPA continues to expedite new fungicides through its reduced risk initiative, which shortens the time required to register new chemicals and uses.

Pest Management Alliance (PMA) Update

Fruit infestation by OFM in test blocks was extremely low this past season, indicating that mating disruption appears to be an effective alternative to organophosphates (OPs) as a means to control OFM in stone fruits. Thrips damage was predominantly scarring caused during petal-fall and soon thereafter. Most fields had such scarring and it was often around 3 percent.

Puffer technology was used to dispense peach twig borer (PTB) pheromone in large blocks at several PMA orchards. Counts of PTB were exceedingly low, but substantial differences between disrupted and non-disrupted blocks were observed. When puffers were removed from one site after harvest the PTB counts went up considerably soon afterwards.

Overall cull rates due to insect feeding in the PMA orchards was 7.8 percent while the conventionally farmed blocks had 7.5 percent. These values represent 6,400 fruit examined through August and are very similar. Most importantly, damage from the primary pests in the PMA blocks was similar to that found in the conventional blocks. Last year's PMA and conventional rates were 5.7 and 5.6 percent, respectively.

Spinosad (Success®) was successfully applied on specific blocks for young forktailed bush katydid nymph control. Controlling older nymphs, however, still requires OPs or pyrethroid applications. Angular-wing katydids appear to be controlled well with spinosad. Most fields had less than 1 percent damage due to katydids, but two nectarine varieties in the Farmersville area brought that average up to almost 3 percent.

Unsurprisingly, as reduced risk practices are employed, another secondary pest made its appearance this season. The Western spotted cucumber beetle, *Diabrotica undecimpunctata*, caused substantial damage in the Farmersville PMA nectarine orchard.

Please call Walt Bentley, IPM Specialist at Kearney Ag. Center, (559) 646-6527 or Shawn Steffan, PMA Project Coordinator, (559) 646-6572 if you have any questions regarding the PMA project.

Mark Your Calendar

Dec. 5 UC Winter Stone Fruit Research Meeting, Dinuba Memorial Building. Call Scott Johnson for start time and information. (559) 646-6547

January 11-13, 2002 Southeast Peach Convention, Savannah, Georgia.

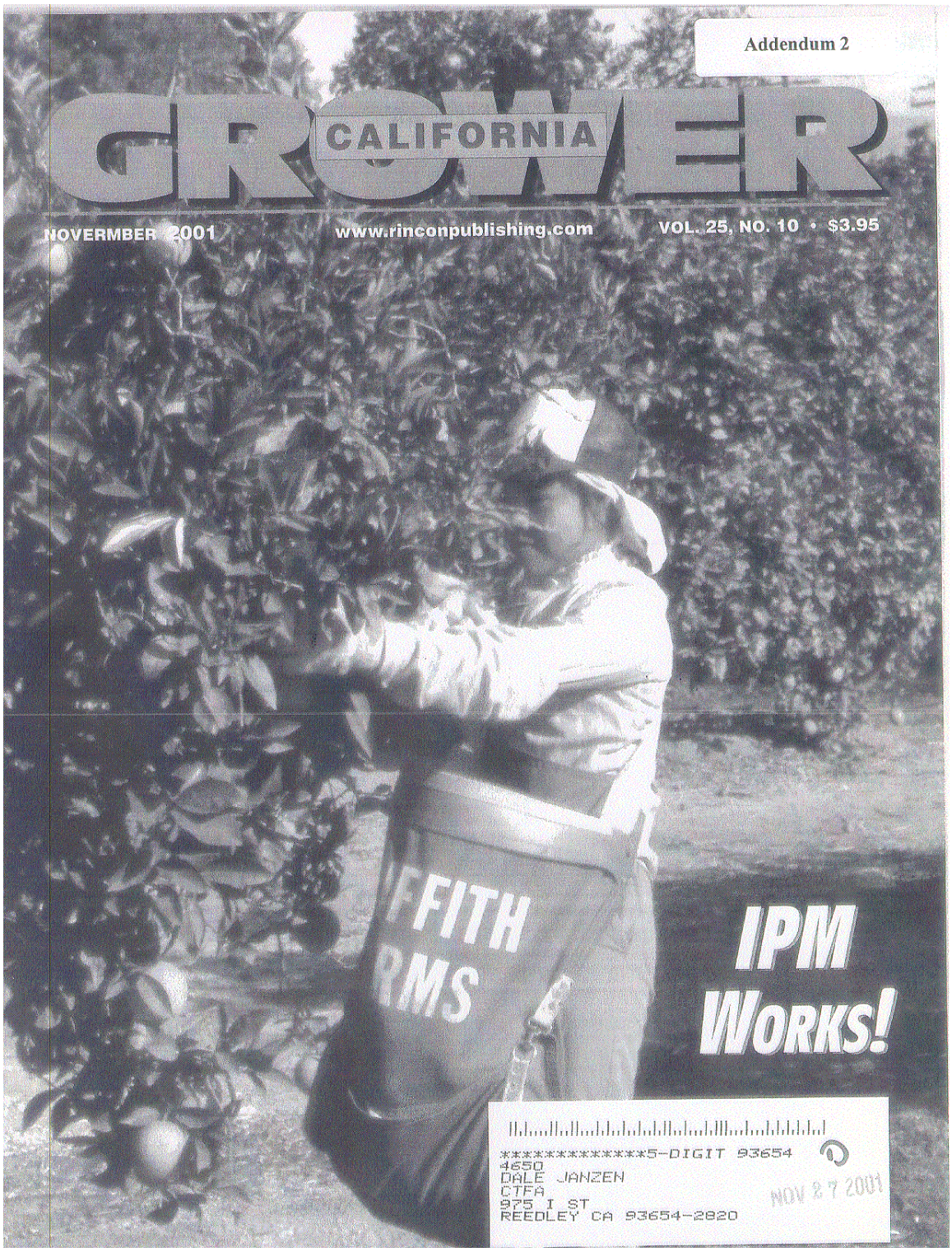
January 29-31, 2002 Mid-Atlantic Fruit and Vegetable Conference, Hershey, Penn.

For information on either of these meetings please call Gary Van Sickle. Both meetings are structured to present research findings and current affairs information to the fruit industry.

Addendum 2

CALIFORNIA GROWER

NOVERMBER 2001 www.rinconpublishing.com VOL. 25, NO. 10 • $3.95



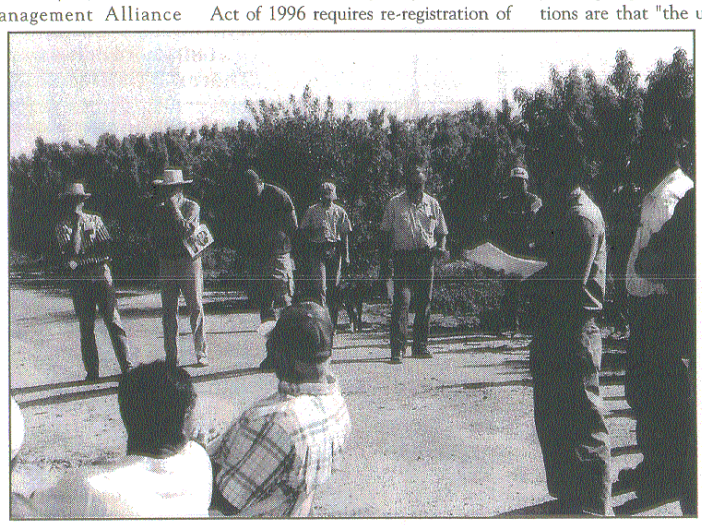
IPM WORKS!

Pest Management Alliance Shows Soft Approach Works

by Ron Goble

A pest management project is showing great promise for California fruit growers and consumers, alike. Just completing its second year, the Stonefruit Pest Management Alliance (PMA) demonstration project is reporting results that indicate growers are able to control pests with softer, "reduced-risk" chemicals.

The Stonefruit PMA is a collaborative effort between University of California researchers (specialists, IPM advisors, farm advisors), commodity groups (California Tree Fruit Agreement, California Cling Peach Growers Advisory Board), California Department of Pesticide Regulation, California State University-Fresno, agricultural industry (Dow AgroSciences, Ecogen and Exxon) and private growers. The Alliance was formed to develop and demonstrate the effective use of reduced-risk insecticides. The need for reduced-risk materials is important because the Food Quality Protection Act of 1996 requires re-registration of all organophosphates and all other pesticides registered before 1982.



Growers in the San Joaquin Valley came together to listen results of the Pest Management Alliance Demonstration Project. They heard there was virtually no difference between conventionally treated orchards and those treated with reduced risk techniques. Walt Bentley photo.

Under the umbrella of the California Tree Fruit Agreement, researchers and grower cooperators have been monitoring some 200 acres of peaches, plums and nectarines that stretch from Bakersfield to Yuba City for the last two years. Each research plot is approximately 20 acres.

Walt Bentley, a UC Davis Integrated Pest Management (IPM) entomologist and project director, says the project is going very well and all indications are that "the use of soft chemicals has not cost the growers any greater crop losses or expense in fighting pests."

Two Issues Confront Growrrs

Bentley noted two key issues that concern the tree fruit industry. First, the threat that they may be required to give up the use of organophosphates and secondly, that the pest resistance that naturally builds over time with those types of materials. Besides Bentley, Shawn Steffan is project coordinator for the effort, which is headquartered at the Kearney Agricultural Center near Parlier.

"We are trying to incorporate other methods for managing pests in tree fruit," Bentley said. "We're looking to alternatives and attempting to demonstrate that other materials can be used

Ron Goble is a field editor for California Grower *magazine.*

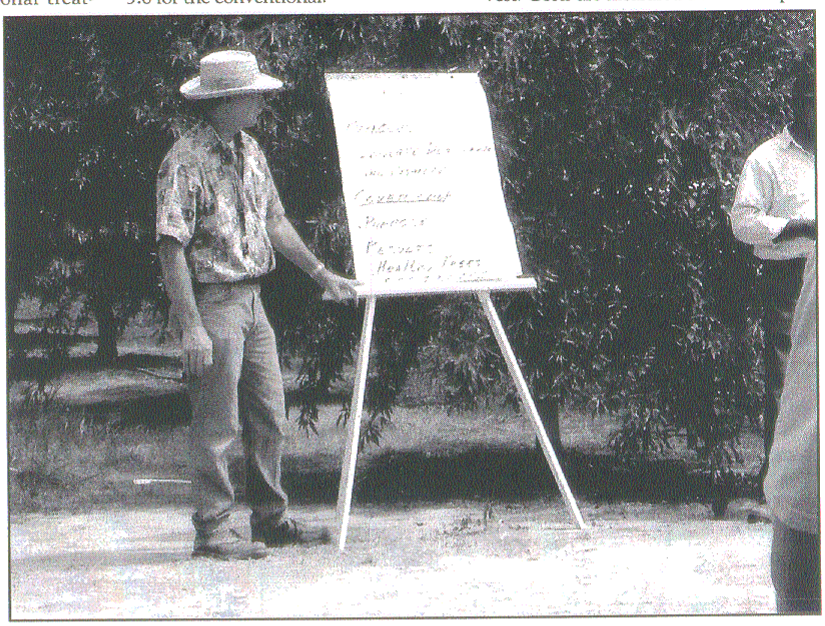
effectively."

Last year, it cost an average of $130 per acre for the conventional treatment of the project orchards. By comparison, the soft program cost growers $128 per acre. The first season the program included mostly peaches and nectarines, with one plum orchard. This year the overall plum acreage was increased so all three commodities were well represented, reported Gary W. Van Sickle, research director for the California Tree Fruit Agreement in Reedley.

"Following reduced-risk practices will allow the industry to protect crops while making the orchard a safer place for workers and lower residues on fruits which translates into a safer food supply for consumers," Van Sickle said. "Residues on our fruit supply are already below allowable thresholds. However, this will push the residue levels even lower. This project should give consumers even more confidence in the safety of the food we eat."

Van Sickle explained that the California Department of Food and Agriculture's Department of Pesticide Regulation offered financial incentives in the form of an $89,000 grant, which is matched by the CTFA to conduct the demonstration program. Grower assessments make up a major part of the project financing and provides a positive impact on the environment, he said.

Bentley reported that during the 2001 study, final infestation data show an average of 7.8 percent total insect damage with the reduced-risk program, compared to 7.5 percent total insect damage for conventional orchards. The researcher stressed that the later in the season, the more pest pressures were evident. The span of damage ranged from one percent early in the season to 15 percent by harvest time. Last year, total insect damage was reported at 5.7 percent for the reduced risk system and 5.6 for the conventional.



This year, according to IPM specialist Walt Bentley, the reduced risk pesticide program produced 7.8% total insect damage while conventionally treated orchards had a damage rate of 7.5%. Damage was slightest early in the season in both orchards, growing more severe as the season progressed. Walt Bentley photo.

One of the major objectives, according to Bentley, is to detect and learn to manage unanticipated problems in the use of or transition to alternative pest management programs. The demonstration project includes collaboration by CTFA with eight stonefruit growers and numerous pest control advisors.

They emphasized monitoring and regular walks into the orchards to check indictor traps.

Where possible, side-by-side blocks are set up to compare the efficacy of standard materials (Lorsban, Diazinon, Asana, Lannate) with reduced-risk materials (horticultural oil, Success, Bt, and pheromone mating disruption). Efficacy is measured in terms of pest numbers, damage, and cull rate at harvest. Costs are measured in terms of per-acre insecticide costs.

"We are trying to incorporate other methods for managing pests in tree fruit, we're looking to alternatives and attempting to demonstrate that other materials can be used effectively."

Oriental Fruit Moth problems were handled by pheromone confusion techniques. Thrips, katydids and peach twig borer were treated with spinosad (Success). Bentley said they are seeing "new" pests that they haven't seen since the 1930s, such as the spotted cucumber beetle and katydid, but are able to control them. They are also monitoring OFM, PtB, OLR and thrips.

Grower cooperators include: John Kovacevich, Kern County; Bill Tos, Hanford; Rick Schellenberg, Parlier; Steve Strong, Farmersville; Pat Pinkham, Exeter; Rob Jackson, Traver; Deniz Packing, Madera; and Gureet Hundal, Yuba City.

2000 Growing Season

Within each variety, there was usually more fruit injury due to insect activities in the PMA blocks than in the conventional blocks. However, these observations did not translate into greater culling of fruit. Cull rates were very similar across all the varieties, and overall, there was not a

significant difference in fruit quality between the PMA and conventional blocks. Looking at the main pests this year — Oriental fruit moth (OFM), fork-tailed bush katydids, and Western flower thrips — researchers found most fruit injury was due to thrips scarring. However, most culls were due to a combination of thrips, katydids, and OFM damage.

Shawn Steffan, Pest Management Alliance coordinator, works with the Tree Fruit Agreement, Cling Peach Growers Advisory Board, Dept. of Pesticide Regulation, Cal State, Fresno, Dow AgroSciences, Exxon and Ecogen to coordinate research in stonefruit orchards throughout the San Joaquin and Sacramento Valleys. Walt Bentley photo.

Pest populations were controlled with reduced-risk materials, and costs were very similar between the PMA and conventional blocks (an average of approximately $155 per acre). These costs savings were accomplished by being able to eliminate some sprays for mites. Thrips populations in the PMA blocks were controlled effectively with spinosad applications, and the resultant populations were equal to those in the conventional orchards. Spinosad also appears to knock down nymphal katydid populations when applied by early May. OFM populations, as indicated by trap catches and shoot strikes, were relatively low in all blocks, although the PMA Elegant Lady peaches had a substantial pulse in numbers by July. This population, however, did not appear to significantly affect fruit quality or harvestable quantities. It should be noted, scientists said, that the lower trap catches of OFM in the PMA blocks are likely the effect of the pheromone mating disruption program.

San Jose scale populations were markedly higher in the PMA blocks in the spring, but *Encarsia perniciosi*, an important parasitoid, was also much higher in the PMA blocks. By mid-season, scale counts had dropped and were equal to those of the conventional blocks, which may be attributable to parasitoid activity.

"Residues on our fruit supply are already below allowable thresholds. However, this will push the residue levels even lower. This project should give consumers even more confidence in the safety of the food we eat."

2001 Growing Season

Observers saw again this year that a large emergence of parasitoids in the PMA blocks compared to the conventional acreage. In addition, fruit infestation by OFM in test blocks was extremely low, indicating that mating disruption may be an effective alternative to organophosphates as a means to control OFM in stonefruits.

Spinosad was successfully applied on specific blocks for young forktailed bush katydid nymph control. To control older nymphs, however, still requires organophosphate or pyrethroid applications. Angular-wing katydids appear to be controlled well with spinosad. Most fields had less than one percent damage due to katydids, but two nectarine varieties at the Farmersville site brought that average up to almost three percent. Thrips damage was predominantly scarring caused during petal-fall and soon thereafter. Most fields had such scarring, and it was often around three percent.

Overall cull rates due to insect feeding in the PMA orchards was 7.8 percent while the conventionally farmed blocks had 7.5 percent. These values represent 6,400 fruit examined through August and are very similar. Most importantly, damage from the primary pests in PMA blocks was similar to that found in the conventional blocks. Last year's PMA and conventional cull rates were 5.7 and 5.6 percent, respectively.

The standout pest this season, however, was the Western spotted cucumber beetle, *Diabrotica undecimpunctata*. This beetle caused substantial damage in a Farmersville PMA nectarine orchard, and this one harvest count helped raise the overall PMA damage percentage above the conventional.

Puffer technology was used to dispense peach twig borer pheromone in large blocks at four different sites. Counts of PTB were exceedingly low, but a substantial difference between the disrupted and non-disrupted block was seen at one site. When puffers were removed from the Farmersville site after harvest, the PTB count went up considerably soon afterwards, Van Sickle reported. **CG**

Pest Management Alliances Progress Report

Agreement No. 00-0212S

Development of an Integrated System for Controlling San Jose Scale, Peach Twig Borer and Oriental Fruit Moth in Clingstone Canning and Fresh Shipping Peaches, Plums and Nectarines

Principal Investigator: Jonathan Field

Contractor Organization: California Tree Fruit Agreement

Date: September 15, 2001

Prepared for California Department of Pesticide Regulation

Table of Contents

I. Summary

The objective of this ongoing project is to develop an integrated and sustainable pest management program for peaches, plums, and nectarines in California. The research has focused on San Jose scale (SJS), peach twig borer (PTB), oriental fruit moth (OFM), omnivorous leafroller (OLR), and Western flower thrips. Most elements of the Pest Management Alliance (PMA) grant's activities, are being presented at grower and pest control advisor (PCA) demonstration plots and meetings. In addition, information developed as a part of this research effort is being disseminated through grower newsletters and on both the CTFA website and the Kearney Agricultural Center website.

Stonefruit production has traditionally relied upon organophosphate (OP) and carbamate insecticides to control the majority of pests. Due to environmental and human health concerns, a movement away from these types of materials has been initiated. The testing of commercially available oils, pheromone dispenser systems and reduced risk pesticides in controlled research situations has provided the basis for the development of best management practices for utilizing more integrated pest management approaches. In addition, the evaluation and development of an augmentative biological control program may increase SJS, PTB, OFM and thrips parasitism levels and further reduce the need for insecticide applications.

During the third year of a multi-year project progress towards meeting the objectives continues. First, efficacy trials of two commercially available oils as the single component in a dormant spray for controlling SJS have been conducted. The results suggest that both oil formulations should abate overwintering populations of SJS under low to moderately infested conditions. Second, a preliminary survey of endemic and commercially reared natural enemies of SJS is in progress. One commercially available, and two endemic enemies have been identified. Insectary rearing of these potential parasitoids for augmentative release and field testing is underway. Third, field comparisons and aging studies of commercially available PTB and OFM pheromone formulations and dispensers have yielded data to further refine application rates. Refinement continues. Fourth, the reduced risk chemical Success® has shown potential to be an alternative to the industry standard, Carzol®, for thrips control. The information will be used to develop practical recommendations designed to reduce grower uncertainty and potential failure when utilizing this technology. Fifth, biology of secondary pests, such as katydids, continues especially in regards to their actions since the implementation of reduced risk practices. Finally, industry education and information dissemination continues through industry sponsored educational field days, research newsletters and several websites.

II. Report

A. Introduction

The project is intended to develop and promote a truly integrated and sustainable pest management program for control of the various pest complexes found in stonefruit orchards throughout California. Research, demonstration and educational outreach programs are being conducted in a variety of locations extending from Kern County in the South up to Sutter / Yuba

Counties in the North. The research includes work on SJS, PTB, OFM, Western flower thrips, katydids and soft scale, with no one area of the research promising complete solutions to the problems currently being experienced by the stone fruit industry. Technical challenges, including increasing evidence SJS may be resistant to OPs, growers experiencing unacceptable fruit damage using pheromone mating disruption for PTB and OFM, the influx of secondary pests as a result of implementing reduced risk practices and grower concerns of economic loss during the transition to instituting reduced risk practices have been barriers to developing a comprehensive integrated pest management program for clingstone canning and fresh shipping peaches, plums and nectarines. The testing of commercially available oils, pheromone dispenser systems, and reduced risk pesticides in commercial settings under controlled research methodology will provide actual representations for development of best management practices. In addition, development of a biological control program of augmentation of natural enemies may increase SJS, PTB, and OFM parasitism levels and further reduce the need for pesticide applications. All elements of the proposed program have been adapted and implemented in grower demonstration plots where comprehensive grower education and information dissemination has and will continue to take place. In addition, information developed as a part of this research effort will continue to be disseminated in grower and pest control advisor (PCA) newsletters, commodity group and pest management websites, and through the University of California's Integrated Pest Management Guidelines.

B. Materials and Methods (Objectives)

1. Continue to assess the SJS population dynamics and evaluate the potential of natural and augmented biological control.

The tasks include: a) Continue to assess the SJS population dynamics and evaluate the potential of natural and augmented biological control. Field monitoring of adults and immatures will be accomplished using a variety of sampling techniques: Pheromone traps, visual inspection of plant material, and double sided adhesive tapes will all help in determining the distribution and abundance of SJS in the field. b) To evaluate parasitoid activity, SJS infested squash will be placed in selected orchards for a 2–3 week period and later the squash will be returned to the insectary to determine parasitoid composition and percent parasitism. Field collections of parasitoids will also be made throughout the season to assess levels of parasitism and distribution within the tree canopy. Destructive samples will also be obtained to correlate plant infestation data with trap data. The appropriate experimental designs and statistical analyses will be utilized to evaluate population information. The principal investigator for this project is Dr. Kent Daane, University of California Center for Biological Control Entomologist. Cooperating with Dr. Daane to collect and analyze data will be Glenn Yokota, Staff Research Associate, and Rodrigo Krugner, Laboratory Assistant, of the UC Kearney Ag Center.

2. Determine the effect of commonly used OP insecticides, (e.g., Lorsban®, Carzol®) on selected natural enemies of SJS.

The tasks include: a) Determine the effect of commonly used OP pesticides, (e.g., Lorsban®, Carzol®) on selected natural enemies of SJS. To test the effect of OP pesticides on natural

enemies of SJS, field and laboratory trials will be conducted. Leaf or twig samples will be collected from peach trees treated with conventional OP pesticides to conduct a leaf-dip bioassay. Leaves will be dipped in different pesticides at different percentages of a field-rate dilution. Leaf material will be allowed to dry and then placed in open-ended glass tubes. Parasitoids will be added to the tubes, which will be sealed with organdy cloth. Each day thereafter, the condition (live or dead) of the parasitoids will be determined. The second test will be more complex. At the Kearney Agricultural Center, trees will be sprayed with the same pesticides at label rates and at the appropriate time. Thereafter, leaves will be removed from the trees on different days after pesticide application dates. These "field-sprayed" leaves will be used to bioassay SJS parasitoids as described above (leaf-dip bioassay), which will determine the number of days after field application the pesticides cause mortality of parasitoids. The value of this experiment is that it provides a more realistic determination of a pesticide's effect on parasitoids after a number of days following application, with pesticide degradation progressing under actual field conditions. This work is needed to determine if small amounts of residual pesticides cause mortality of parasitoids, which may explain the poor natural regulation of SJS after orchards receive only 1 to 2 pesticide applications (often for moth or mite pests). The principal investigator for this project is Dr. Kent Daane, University of California Center for Biological Control Entomologist. Field and laboratory trials will be accomplished through the efforts of GlennYokota, and Rodrigo Kugner, of the UC Kearney Ag Center.

3. Examine the effects of reduced risk materials, e.g., oils and the Insect Growth Regulators (IGRs), Esteem® and Applaud® on various life stages of male and female SJS to determine the most effective timing for application of the materials. Second, determine if OP resistant SJS have any cross-resistance to the IGRs. Results will be incorporated into the development of a comprehensive resistance management plan for stone fruits.

The tasks include: a) Examine the effects of reduced risk materials, e.g., oils and the Insect Growth Regulators (IGRs), Esteem® and Applaud® on various life stages of male and female SJS to determine the most effective timing for application of the materials. First, second and third instars of male and female SJS will be tested for their susceptibility to oils and the IGRs Esteem® and Applaud®. b) The second part of the objective will be accomplished by testing the OP resistant and susceptible colonies of SJS with each of the IGRs Esteem® and Applaud® to see if there is any cross-resistance between these materials. All information collected on the nature, mechanism, and level of resistance present in SJS will enable researchers to develop a comprehensive resistance management plan to be used in an overall pest management strategy for stone fruit pests in California orchards. Dr. Beth Grafton-Cardwell, UC Riverside Entomologist stationed at the Kearney Agricultural Center will be in charge of this project. Other participating individuals include: Walt Bentley, UC IPM Entomologist and Yuling Ouyang, SRA III, UC Riverside Entomology, Kearney Ag Center.

4. Demonstrate and compare the efficacy and economics of pest control techniques that *do not* rely on OP, carbamate, or pyrethroid inputs to control stone fruit pests in "grower participant" sites in several counties throughout California. In addition to the grower sites in Fresno, Kings and Yuba Counties established during the previous year of the project, this

objective seeks to expand the project to include 3-4 additional grower participant sites in Kern, Madera and Tulare Counties.

The tasks include: a) Demonstrate and compare the efficacy and economics of pest control techniques that *do not* rely on OP, carbamate, or pyrethroid inputs to control stone fruit pests in "grower demonstration" sites in several counties throughout California. In addition to continuing the grower demonstration plots established in Fresno, Kings and Yuba/Sutter Counties, potential cooperators in Kern, Madera and Tulare Counties have been identified and will be asked to participate. Reduced risk pest management practices developed during the previous year of the PMA demonstration project will be implemented in these additional grower sites. Reduced risk practices include: pre-dormant application mite and scale damage assessment; OP free dormant application (oil only); use of *Bacillus thuringiensis* and pheromone mating disruption for control of PTB and OFM; monitoring of PTB and OFM with pheromone baited traps and shoot strike evaluations; SJS monitoring with double sided sticky tapes, fruit samples and pheromone traps to determine both scale and parasitoid populations and percent damage at the time of harvest. Monitoring of traps will be accomplished weekly for each site. Mites and katydids will also be monitored and low impact oils or pesticides will be used according to labeled rates. The reduced risk material Success® (Spinosad), will be used to control katydids and thrips. Mite control will be accomplished with the reduced risk material Apollo®, (Clofentezine). Each site will be compared to a comparable acreage of a monitored commodity treated with traditional OP dormant and in-season sprays. In addition, the costs associated with the relative levels of control in the non-disruptive and conventional pest management programs will be recorded to illustrate the competitiveness of the reduced risk approaches. Several of these sites will also be used for demonstration at grower / PCA field days. The principal investigators for this project are Walt Bentley, UC IPM Entomologist, and Dr. Kent Daane, University of California Center for Biological Control Entomologist. Assisting in the collection and analysis of data will be Shawn Steffan, UC Staff Research Associate. Assisting in establishment of the demonstration sites will be Gary Van Sickle, CTFA Research Director, Heidi Sanders, CCPGAB Research Coordinator, Kevin Day, UCCE Tulare County Farm Advisor, Harry Andris, UCCE Fresno County Farm Advisor Janine Hasey, UCCE Sutter/Yuba County Farm Advisor, Bob Beede, UCCE Kings County Farm Advisor and Brent Holtz, UCCE Madera County Farm Advisor.

5. Study and document the biology of secondary pests (i.e., katydids and soft-bodied scale) that have increased in population, in certain environments, due to implementation of reduced risk practices.

The tasks include: a) Study and document the biology of secondary pests (i.e., katydids and soft-bodied scale) that have increased in population, in certain environments, due to implementation of reduced risk practices. Sampling methods during the growing season will include leaf damage assessment, sweep net counts and beating tray counts for katydids. Katydid eggs will be collected from "cages" and maintained for evaluation of over-wintering emergence and survival in the spring. Soft-bodied scale will be surveyed in the field and counts will be recorded. The principal investigator for this objective will be Walt Bentley, UC IPM Entomologist. Assisting with the collection and analysis of data will be Shawn Steffan, UC Kearney Agricultural Center, Staff Research Associate.

6. Continue to enhance communication and information dissemination to the stone fruit grower community.

The tasks include: a) Continue to enhance communication and information dissemination to the stone fruit grower community. The communications infrastructure of CTFA and CCPGAB, along with cooperating University of California Cooperative Extension personnel, will continue to enhance the exchange of information regarding project progress between researchers, growers, and PCAs. Both industry organizations will provide clingstone canning and fresh market peach, nectarine and plum growers with quarterly updates of project progress through industry websites and newsletters. In addition, CTFA will coordinate 5 field days, one each in late March or early April, June, July, August and October in cooperation with the University of California, so researchers may communicate directly with growers and PCAs. CCPGAB will coordinate at least 2 field days at demonstration orchards in Yuba County. CTFA and CCPGAB will provide an annual report of research progress published in their respective Annual Research Reports. Research results will be incorporated into appropriate internet sites and University Pest Management guidelines. Gary Van Sickle, CTFA Research Director and Heidi Sanders, CCPGAB Research Coordinator will be responsible for completion of this portion of the project.

C. Results

1. Continue to assess the SJS population dynamics and evaluate the potential of natural and augmented biological control.

Progress to date has not yet been reported by the researcher, although there is some preliminary information available from the demonstration plots regarding the parasitoids. This season much higher parasitoid populations are being found in the PMA blocks, which mirrors last season's findings. The parasitoids are very host-specific and well-synchronized early in the season; preliminary sampling using sentinel scale hosts indicates that the activities of *Encarsia* and *Aphytis* are removing over 50% of the scale population.

Financial Summary for Task 1: The total cost for achieving the objectives of *Task 1* was budgeted at $25,000. To date, $0 has been spent towards completing *Task 1*.

2. Determine the effect of commonly used OP insecticides, (e.g., Lorsban®, Carzol®) on selected natural enemies of SJS.

Progress to date has not yet been reported by the researcher.

Financial Summary for Task 2: The total cost for achieving the objectives of *Task 2* was included in the budget for *Task 1*. Expenditures have been included under Task 1.

3. Examine the effects of reduced risk materials, e.g., oils and the Insect Growth Regulators (IGRs), Esteem® and Applaud® on various life stages of male and female SJS to determine the most effective timing for application of the materials. Second, determine if OP resistant SJS

have any cross-resistance to the IGRs. Results will be incorporated into the development of a comprehensive resistance management plan for stone fruits.

Most of the data has not yet been analyzed. Preliminary results for one of the reduced risk materials Dr. Grafton-Cardwell is studying, volck oil, has been found to control SJS first and second instars at a 6% concentration level. The third instar stage female is very difficult to control, but during the dormant time period, most of the instars present are first and seconds, and those life stages have been found to be more susceptible to the oil. Thus, results are showing increasing mortality and decreasing fecundity with increasing percentage of oil. This data will help direct the industry as to the best concentration of oil and volume of oil to maximize control of SJS.

While more on the order of meeting objective 6, Dr. Grafton-Cardwell held a two-day workshop to train industry PCA's about San Jose scale. The dates were March 20-21, 2001. The first day participants studied the life stages of San Jose scale using microscopes and laboratory-reared San Jose scale. In the afternoon they studied what scale looks like when parasitized by Aphytis or Encarsia wasps. They then examined San Jose scale on field-collected plum twigs and discussed the difference between healthy and parasitized scale. Lectures were presented by Walt Bentley, Kent Daane and Dr. Grafton-Cardwell on various aspects of scale and parasite biology. At the end of the day a 10 point quiz was given questioning topics discussed during the day and the average score was 80% correct. On the second day, Walt Bentley took the group out to a plum orchard to discuss how to estimate scale densities by examining plum spurs. There were 16 participants (PCAs and farm advisors) who attended.

Financial Summary for Task 3: The total cost for achieving the objectives of *Task 3* was budgeted at $33,600. To date, $12,380.25 has been spent towards completion of Task 3.

4. Demonstrate and compare the efficacy and economics of pest control techniques that *do not* rely on OP, carbamate, or pyrethroid inputs to control stone fruit pests in "grower participant" sites in several counties throughout California. In addition to the grower sites in Fresno, Kings and Yuba Counties established during the previous year of the project, this objective seeks to expand the project to include 3-4 additional grower participant sites in Kern, Madera and Tulare Counties.

Prior to the 2001 bloom additional grower participant sites were recruited to become a part of the PMA project for this year. Gary Van Sickle and Walt Bentley met with the potential participants to explain the program to them and the expectations of participants. For 2001 several participant sites joined the project. They include: Daybreak Farms (Tulare County), Rubicon Orchards (Tulare County), Pinkham Bros. (Tulare County), Kovacevich & Sons (Kern County) and Deniz Packing Co. (Madera County). This brings the number of grower sites involved in the project from 3 up to 8 for this year. The stone fruit acreage involved grew to approximately 120 acres, a 3-fold increase over last year's acreage.

YTD Demonstration Results:

Dormant Season: The dormant application of high-rate, high-dilution mineral oil in the PMA blocks produced results similar to those of 2000. A substantial number of San Jose scale were eliminated with the mineral oil (winter black cap counts not yet analyzed), although not to the same degree that typical organophosphate applications suppress scale populations. However, much higher parasitoid populations are being found in the PMA blocks, which mirrors last season's findings. The parasitoids are very host-specific and well-synchronized early in the season; preliminary sampling using sentinel scale hosts indicates that the activities of *Encarsia* and *Aphytis* are removing over 50% of the scale population. The use of high-rate, high-dilution mineral oil for the dormant application can save growers approximately $20 / acre.

Bloomtime: The Spinosad (Success) bloomtime application provided control of thrips populations, as indicated by low thrips scarring on early-season fruit. To-date, no differences can be found between fruit damage in the blocks with spinosad and blocks where Carzol (formetanate hydrochloride) was applied.

In-season: **Insect trapping of Oriental fruit moth, omnivorous leafroller, peach twig borer, San Jose scale, *Encarsia perniciosi*, *Aphytis* wasps, and codling moth was conducted weekly during the 2001 season. Noteworthy phenomena observed this year was the large emergence of parasitoids in the PMA blocks relative to the Conventional blocks. This mirrors last year's results, with the exception of the nectarine blocks in Farmerville. The conventional block of the Bright Pearl nectarines at this site had a much larger SJS and parasitoid population heading into the season, which likely accounted for the higher parasitoid counts early in the season. The other PMA blocks with adjacent conventional blocks produced significantly more parasitoids. Trapping will continue for SJS and OFM through the fall.** Fruit and leaf damage has been minimal everywhere, with the possible exception of one block of nectarines, but the damage there is also attributable to a combination of hail damage and shot-hole. Bt has also been applied at most of the blocks for OFM and PTB control. Timing for these applications was optimized using the UC IPM insect development projections.

Three different mating disruption programs were used at the various PMA blocks. A paraffin emulsion with OFM pheromone was applied to two nectarine blocks, one plum, and two peach blocks. The nectarine and peach blocks are being compared with adjacent blocks receiving either OFM pheromone ties or no mating disruption. Results, so far, indicate that the paraffin emulsion provides substantial disruption. Shoot strike data also show there was much more worm activity in blocks where Imidan (phosmet) was applied, as opposed to blocks receiving the paraffin emulsion. Isomate ties **or chemical treatments** were used in the remainder of the PMA blocks. The paraffin emulsion appears to be controlling moth populations as well as the ties. **Both of these disruption techniques sufficiently disrupted the mating of OFM. The blocks where no disruption was used produced stark contrasts between the disrupted and non-disrupted trap catches. Note the OFM graphs for the Elegant Lady peaches and the Summer Red nectarines. (Tables 4 & 5.) Fruit infestation by OFM in these blocks was extremely low, indicating that paraffin**

emulsion mating disruption may be an effective alternative to OP insecticides as a means to control OFM in stone fruits.

The "puffer" technology is being used to dispense PTB pheromone in large blocks at 4 different sites. **Three blocks were set up with two puffers per acre and the fourth block was set up at one per acre. Counts of PTB were exceedingly low, but a substantial difference between the disrupted and non-disrupted block was seen at the Hanford/Red Jim site. (See Table 6.) Puffers were removed from the Farmersville site after the harvest (July 11) and the PTB counts went up considerably soon afterwards. (Table 7.)**

Spinosad has been applied at specific blocks for **young forktailed bush** katydid **nymphs** control, and the populations were adequately controlled. **Older nymphs and adults will require OP or pyrethroid applications for control. Angular-wing katydids appear to be controlled well with spinosad.**

Fruit Harvest: **Overall cull-rates due to insect feeding in the PMA were approximately 7.8%, while the conventionally managed blocks had approximately 7.5%. These values represent 6,400 fruit examined (thru Aug.) and are very similar, especially considering the variability from block-to-block and region-to-region (See Tables 1 & 2.) Of the primary moth pests, only OFM and OLR were of concern. Numerous OLR were caught; few OFM moths were caught, despite mating disruption programs. Fortunately, very little moth or scale damage was observed in the blocks harvested. The greatest fruit damage, so far, has been from katydid and thrips feeding. Most fields had less than 1% damage due to katydids, but two nectarine varieties at our Farmersville site brought that average up to almost 3%. Thrips damage was predominantly scarring caused during petal-fall and soon thereafter. Most fields had such scarring, and it was often around 3%. Most importantly, damage from the primary pests in PMA blocks was similar to that found in the Conventional blocks. The standout pest this season, however, was the Western spotted cucumber beetle, *Diabrotica undecimpunctata.* This beetle caused substantial damage in the Farmersville PMA nectarine block, and this one harvest count helped raise the overall PMA damage percentage above the conventional block percentage. This new secondary pest and its feeding damage is now "on the radar screen" for next year.**

Last year's PMA and Conventional cull-rates were 5.7% and 5.6%, respectively, which demonstrates that the PMA approach has produced fruit with cull-rates that are almost identical to conventionally produced fruit for the second year in a row. The current-year percentages may change, however, as the last round of counts is factored into the average. Economic information will be forthcoming at a later date, but at this time the expenditures are expected to be very similar between the PMA and Conventional blocks. (Data from the Yuba sites are not yet available.)

Financial Summary for Task 4: The total cost for achieving the objectives of *Task 4* was budgeted at $115,000. To date, $2,205.44 has been spent towards completion of Task 4.

5. Study and document the biology of secondary pests (i.e., katydids and soft-bodied scale) that have increased in population, in certain environments, due to implementation of reduced risk practices.

Katydid biology and control investigations were also continued from last season's work. Forktailed bush katydids and angular-winged katydids are being studied in cages at the Kearney Ag Center. The forktailed bush katydids appear to emerge over a long duration in winter and spring, with early nymphs being found in late-March and the latest nymphs from this early generation being found in early-June. By mid-July, very small nymphs were again found, suggesting that these are the second generation of katydids. From the cage trials, it was found that not all the eggs from the winter/spring generation hatch in the summer. Some remain dormant throughout the summer and hatch the following winter/spring. The evidence for this is the fact that eggs laid in spring 2000 emerged in the spring of 2001. Additionally, eggs laid in the summer of 2000 emerged in spring, 2001. Thus, the katydids effectively distribute their young in both space and time. The only non-organophosphate tested on katydids was spinosad, and it worked very well on young nymphs. Older nymphs and adults will still require OP or pyrethroid applications. Angular-winged katydids are also controlled well with spinosad, though they are rarer and don't emerge until May. They appear to have only one generation a year. Both species are in culture at Kearney and will have alternative materials tested on them next year.

Financial Summary for Task 5: The total cost for achieving the objectives of *Task 5* was included in the budget for *Task 4*. Expenditures have been included under Task 4.

6. Continue to enhance communication and information dissemination to the stone fruit grower community.

To date, **four** PMA field days sponsored and publicized by California Tree Fruit Agreement, California Cling Peach Growers Advisory Board and the University of California have been conducted. The events were held to inform growers, pest control advisors, pest control operators, the stone fruit industry and the public about progress made on the PMA project. On April 17 an update meeting was held at the Kovacevich demonstration block located in Kern County. There were approximately a dozen growers who attended. The second PMA update meeting was held on April 25 in Traver (Tulare County) at the Daybreak Farms' demonstration block. Approximately 45 growers and PCAs attended. There was also a film crew from the PBS series "American Environmental Review" that attended, shot footage and interviewed some of the participants. The clip should be on the show sometime this summer. A cling peach PMA update meeting was held on April 26th at the demonstration block located in Yuba County with 26 attending the event.

On August 9 mid-season PMA meeting was held at the Kearney Ag. Center. Approx. 90 growers, PCAs and interested persons were in attendance. The meeting started with a showing of the film clip that was filmed at the spring update meeting at Traver. (Agenda attached.)

Also, during the month of May (9, 16, 23 & 30) a series of Brown Bag Lunch meetings were held at various PMA plots in Tulare, Kings and Madera counties. Attendance was very disappointing, but those few who attended got an hour of almost one-on-one time with the UC researchers. The low attendance should not be interpreted as low interest; May is a busy month for growers as many are thinning, starting to pack and involved in treatments for various pests. Plans are underway for mid-season and post-season meetings.

CTFA's April issue (copy attached) of the research newsletter, *A Closer Look*, summarized key points and progress through the second year of the project. **CTFA's July issue provided an update of activities for the current year, including work done during the dormant period, at bloomtime and early in-season.** CTFA's newsletter is mailed to over 2,600 growers, PCAs, PCOs, shippers, packers and other parties associated with the clingstone canning and fresh market stone fruit industries. CCPGAB also mailed newsletters to over 400 cling peach growers, PCAs and PCOs explaining progress made on the PMA project. Information from the project has also been made available to the public via CTFA's and KAC's web site. CTFA's annual research report, which includes the individual progress reports from the UC researchers associated with the PMA project was recently published and made available to growers / PCAs.

Posters explaining various aspects of the project were exhibited at several recent events, including the "Partnerships for Sustaining California Agriculture: Profit, Environment and Community" seminar on March 27-28 at Woodland and at the annual Spring Meetings of the California Tree Fruit Agreement at Visalia on May 3.

Financial Summary for Task 6: The total cost for achieving the objectives of *Task 6* was budgeted at $46,650.66. To date, approximately $7,262.57 has been spent towards meeting the objectives of Task 6.

D. Discussion

Technical challenges, including increasing evidence SJS is resistant to OPs, growers experiencing unacceptable fruit damage while using pheromone mating disruption for PTB and OFM, and grower concerns of economic loss during the transition of instituting reduced risk practices, have been barriers to developing a comprehensive integrated pest management program for clingstone canning and fresh shipping peaches, plums and nectarines. The testing of commercially available oils, pheromone dispenser systems and reduced risk pesticides in a controlled research environment has provided a representation of best management practices for utilizing a more intense integrated pest management approach. Furthermore, development of a biological control program with augmentation of natural enemies may increase SJS, PTB and OFM parasitism levels and further reduce the need for OP/carbamate applications.

Overall, advancement in the objectives as we **complete** the third year of the project is being made. An analysis of the data from last year, **and again this past season,** indicates SJS, PTB and OFM populations should be maintained below an economic injury level in stone fruit without, or with minimal use of, OPs and carbamates. Thus, 8 grower demonstration plots were established during the winter / spring of 2000-01, which have incorporated the reduced risk

practices outlined in this project. The implementation of these demonstration blocks intend to addresses the dynamic pest management pressures in a commercial setting, from dormant sprays to beyond harvest. The successful performance of the combination of replacing OPs with oil, pheromone mating disruption and augmenting with natural enemies, under conditions and acreages growers typically contend with, should increase grower confidence in the efficacy of alternative materials and reduced risk practices.

E. Summary and Conclusions

This is the third year of a comprehensive pest management project where a systems approach (intensive field monitoring, use of mating disruption, use of biological agents and implementation of reduced risk materials) **was** taken to examine reduced risk alternatives for controlling SJS, PTB and OFM in clingstone and fresh market peaches, plums and nectarines. The objectives of this multi-year project distinctly seek to substantially reduce reliance on OP's and / or carbamates and provide a model sustainable pest management system for stone fruit growers throughout the state of California.

Previously the project compared the efficacy of commercially available horticultural oil as the single component in a dormant spray for controlling SJS, compared to a traditional OP application, and found moderate populations of scale could be reduced under dilute application conditions.

Work has also progressed in developing a biologically and economically viable inundating release program for natural enemies of SJS. Commercial orchards have been surveyed and endemic natural enemies of SJS have been identified. As a result, laboratory colonies of two potential groups of parasitoids, *Aphytis vandenboschi* and *Encarsia perniciosi*, have been established for future use as potential augmentative biological control agents against SJS. Preliminary sampling of sentinel scale host plants **has** revealed that the activities of these 2 parasitoids can remove a significant number of the scale population from the orchard.

The CTFA and CCPGAB continue to utilize their communications infrastructures to: sponsor and publicize UC grower education days, publish quarterly newsletters and maintain active websites highlighting progress made on the PMA project. Through this continued effort, hundreds of growers and professional crop care consultants are being exposed to alternative, reduced-risk practices that effectively address the pest complexes of the stone fruit industry.

Finally, successful demonstration of utilizing horticultural oils in dilute dormant applications in combination with pheromone mating disruption, use of new reduced-risk materials and the development of an augmentative parasitoid program in a commercial setting, should increase grower confidence in the efficacy of alternative materials and reduced risk practices.

Appendix

A CLOSER LOOK

CALIFORNIA TREE FRUIT AGREEMENT
Editor: Gary Van Sickle
PO Box 968
Reedley, CA 93654
e-mail: gvansickle@caltreefruit.com
Phone: 559-638-8260
Fax: 559-638-8842

This Newsletter provides information on research supported by the California Tree Fruit Agreement

Preconditioning/Pre-ripening Tips for Peaches, Plums and Nectarines

Contributed by Dr. Carlos Crisosto, University of California Kearney Agricultural Center (carlos@uckac.edu)

Principle Findings

- Controlled delayed cooling can be used to precondition stone fruit susceptible to internal breakdown in order to maintain flavor and extend market life. Delayed cooling can also be used to pre-ripen susceptible and non-susceptible stone fruit varieties in order to deliver a more "ready to eat" product to the consumer. It is important to know what you want to accomplish with each cultivar before changing your program.

    1. In general, a 48-hour cooling delay at 68°F is the most effective preconditioning treatment to extend market life of internal breakdown susceptible peaches and nectarines.

    2. For peaches, nectarines and plums, the use of ethylene during the cooling delays (Preconditioning/Pre-ripening) did not increase market life with respect to internal breakdown symptom development.

    3. To pre-ripen stone fruit, delay cooling at 68°F for the minimum period of time necessary to achieve the desired level of ripeness (up to 6-8 lbf for peaches and nectarines, 5 lbf for plums measured on the weakest position on the fruit).

- Flesh firmness must be monitored on the weakest position on the fruit during the preconditioning/pre-ripening treatment. Peaches and nectarines become very susceptible to vibration injury during transportation when flesh firmness is <5 lbf.

- Peach, nectarine and plum market life is longer when the fruit is stored at 32°F rather than 41°F.

- Rapid cooling after preconditioning is important to stop further fruit flesh softening, senescent breakdown, decay and prevent prolonged exposure to 41°F temperatures. More refrigeration capacity may be needed to execute this system.

- More information can be found at http://www.uckac.edu/postharv/ http://postharvest.ucdavis.edu/, http://fruitsandnuts.ucdavis.edu/ and http://pom.ucdavis.edu/. A full research report will be published in the 2000 CTFA Research Report. A detailed article entitled "Preconditioned/Pre-ripening, A New California Fruit Delivery System Overview" is being prepared for publication as a University of California, DANR Publication Series.

Demonstration Days Planned

Stone fruit growers will have several chances this season to view results of the Pest Management Alliance (PMA) Demonstration Orchards. The test plots have incorporated

reduced risk practices side by side with conventional practices. The project is a partnership with the following sponsors: University of California, CA State University-Agricultural Research Initiative, CA Department of Pesticide Regulation, CA Cling Peach Growers Advisory Board, CA Tree Fruit Agreement, Gowan, Dow AgriSciences, and Exxon. Grower participants this season includes: Daybreak Farms, Deniz Packing Co., Kovacevich & Sons, Pinkham Bros., Quinco Corporation, Rubicon Orchards, Schellenberg Farms, and Tos Farms.

Growers will have an opportunity to view one of the test plots at a PMA Field Day to be held April 25 at Daybreak Farms in Traver, CA. The event will begin at 8:30 a.m. with registration and coffee. Results from the 2000 season research will be presented at 9:00 a.m. Throughout the morning UC researchers will provide information on control of several pests from San Jose Scale to thrips to katydids. Brown rot control will also be discussed. Representatives from the U.S. Environmental Protection Agency and CA Department of Pesticide Regulation will also be present to offer their thoughts on the project. The event will last until noon. Several hours of PCA credits have been requested.

Growers in the south valley will have an opportunity to hear a condensed version of the presentation in their own area on April 17 from noon to 1:00 p.m. at Kovacevich & Sons Ranch in Wheeler Ridge. Box lunches will be provided at 11:45 a.m. to those who RSVP to Gary Van Sickle @ (800)-636-8260.

Growers in the north valley will have an opportunity to attend the PMA Field Day for cling peaches. The meeting will be held on April 26 from 10:00 a.m. to 11:30 a.m. at the Hundal Ranch, on the south edge of Yuba City. Mating disruption of OFM and PTB will be discussed. Information is available from Heidi Sanders @ (530) 673-8526.

PMA Results From 2000

Extensive monitoring of both the reduced risk and the conventional plots has produced valuable information for future use by the stone fruit industry. Trends between the two programs remain consistent. The data obtained from this past year's demonstration blocks illustrates, in general, higher insect activity in the PMA plots, compared to the conventional plots. However, there were also higher populations of the SJS parasitoids, Aphytis spp. and Encarsia perniciosi.

To gauge the profitability of the program that did not use OPs or carbamates, researchers have used the percentage of fruit "culled" because of insect damage, as an indication of how the reduced risk program performed, compared to the conventional program. The data illustrates that within each variety there was no statistical difference between the two pest management programs. Furthermore, this was also true of the overall performance when both pest control methods were grouped in their respective programs. The PMA orchards averaged a cull rate of 5.69%, while the conventional averaged a cull rate of 4.53%.

The costs of the programs used varied considerably between varieties and between the northern Sacramento Valley cling peaches and the southern San Joaquin Valley plots. Also, the approach to managing pests in the PMA orchards had a bearing on cost. In the San Joaquin Valley, the per acre least costly PMA program was $160 for Grand Rosa plums and the most costly PMA program was $331 for Summer Red nectarines. The conventional program costs, per acre, ranged from $156 for Elegant Lady peaches to $322 for Summer Red nectarines. The average per acre cost of the PMA programs in the southern San Joaquin Valley was $221. The average conventional

program cost was $222.

Results of the cling peach comparison blocks in Yuba County varied more than those in the south. The costs for the 3 PMA plots ranged from $221 to $278. The costs for the conventional programs ranged from $103 to $171. The per acre average cost of the PMA plots was $240, compared to the conventional orchards at $141.

Mark Your Calendar

April 17 - Pest Management Alliance Demonstration Day – Kern County. To be held at the Kovacevich Ranch at Wheeler Ridge, 12 noon to 1:00 p.m. RSVP to Gary Van Sickle for map. (559) 638-8260. A copy of the meeting notice and map is on the internet at http://www.uckac.edu/treefruitipm/PMA_1.htm.

April 25 - Pest Management Alliance Demonstration Day – Traver. To be held at Daybreak Farms, 36060 Burke Drive, Traver, CA, 8:30 a.m. to 12 noon. PCA Credits available. A copy of the meeting notice and map is on the internet at http://www.uckac.edu/treefruitipm/PMA_1.htm.

April 26 – No. Calif. Pest Management Alliance Demonstration Day. To be held at the Hundal Ranch at George Washington and Best Road, south of Yuba City, 10:00 a.m. to 11:30 a.m. Call Heidi Sanders for information @ (530) 673-8526.

May 3 – CTFA Spring Meeting, Visalia Convention Center, Visalia, CA, 7:30 a.m. to 4:30 p.m. Please RSVP to Dovey Plain, (559) 638-8260, if you plan to attend.

PMA Brown Bag Lunch Series. To be held at various grower orchard plots who are cooperators in the PMA program each Wednesday, May 9, 16, 23, and 30. Each session will be held during the lunch hour (12 noon to 1:00 p.m.) and feature an informal opportunity to hear from the researchers as to what the monitoring program is finding, what the current pest pressures are and what could be a potential threat in the near future. Bring your lunch and an appetite for knowledge. Call Gary Van Sickle for dates and maps to each of the sites at (800)-636-8260. A copy of the meeting schedule and maps will be on the internet at http://www.uckac.edu/treefruitipm/PMA_1.htm.

Name	Title	Affiliation
Jonathan Field	P.I., Manager	California Tree Fruit Agreement 30 years agricultural experience
Gary Van Sickle	Research Director	California Tree Fruit Agreement 36 years agricultural experience
Heidi Sanders	Research Coordinator	California Cling Peach Growers Advisory Board *10 years agricultural experience*
Dr. Beth Grafton-Cardwell	Entomologist	UC Riverside – Kearney Ag Center Extensive experience with scale
Dr. Kent Daane	Entomologist	UC Berkley - Kearney Ag Center Researches and implements biological control practices
Walt Bentley	IPM Advisor	UCCE - Kearney Ag Center Researches and implements reduced risk practices
Janine Hasey	Farm Advisor	UCCE - Sutter and Yuba Counties Researches and implements reduced risk practices
Carolyn Pickel	IPM Advisor	UCCE - Sacramento Valley Researches and implements reduced risk practices
Kevin Day	Farm Advisor	UCCE - Tulare County *Pomologist for stone fruit*
Dr. Brent Holtz	Farm Advisor	UCCE - Madera County
Bob Beede	Farm Advisor	UCCE – Kings County Researcher for stone fruits
Harry Andris	Farm Advisor	UCCE – Fresno County Stone and pome fruits
Shawn Steffan	Staff Research Associate	Kearney Ag Center Coordinates field activities
Steve Strong	Grower Participant / PCA	CTFA Research Subcommittee Venida Packing
Bill Green	PCA/Grower Relations	CTFA Research Subcommittee, LVR Corp.
Rod Milton	Grower	CTFA Research Subcommittee
John Tos	Grower	CTFA Peach Administrative Committee, Tos Farms, Inc.
Bill Tos	Grower Participant / Chairman	Tos Farms, Inc. / CTFA Research Subcommittee
Rick Schellenberg	Grower Participant	CTFA Nectarine Administration Committee, Schellenberg Farms
Norman Kline	Grower Participant	CCPGAB Research Chairman
Sarb Johl	Grower	CCPGAB Committee

Table 1.

Summary Data and Discussion, to-date (August, 2001)

FINAL FRUIT COUNTS	Fruit Damage Counts (units: # damaged/ 100 fruit; N = 700 for Bright Pearl, Fire Pearl; N = 500 for remainder)									
County/Variety	OFM	PTB	OLR	SJS	Katydid	Cukebeetle	NOW	Thrips	Total	Bird
Fresno/Elegant Lady										
PMA	0.2	0	0	0.2	0.6	0	0	0	1	0
Standard	0.6	0	0	0	0.4	0	0	0.2	1.2	0.8
Fresno/Summer Red										
PMA	0.2	0	1	0	0.6	0	2	2.6	6.4	1
Standard	0	0	2.2	0	0.2	0	0.4	6	8.8	0.2
Fresno/Sweet September										
PMA										
Standard										
Kings/Red Jim										
PMA	0	0	0.2	0.2	0.2	0	0	4.8	5.4	0
Standard	0.6	0	0	1.4	0.2	0	0	2	4.2	1.6
Tulare/Bright Pearl										
PMA	0	0	0.43	0.71	6.4	3.7	0	4	15.3	0.14
Standard	0	0	0.71	0.43	2.7	1.6	0	4.4	9.9	0.14
Tulare/Fire Pearl										
PMA	0	0	0	1.4	4.9	5	0	2.9	14.1	0.14
Standard	0	0	0	1	7.9	3.3	0	3.4	15.5	0
Tulare/Fortune										
PMA	0	0	0.4	5.6	0	0	0	10.2	16.2	0
Tulare/Autumn Beaut										
PMA										
Tulare/Zee Lady										
PMA	0.4	0	0	0.2	0.4	0	0	0	1	0
Tulare/Arctic Snow										
PMA										
Madera/Angelino										
PMA	0	0	0.4	0	0.8	0	0.6	3	4.8	1.2
Standard	0	0	0.6	0	0.4	0	0	4.6	5.6	0.6
Sutter-Yuba/Ross										
PMA										
Standard										
Sutter-Yuba/Starn-Hesse										
PMA										
Standard										
Kern/Kovacevich										
PMA										
Standard										
Average (totals divided by 6--b/c 6 comparison-blocks)										
PMA	0.067	0	0.338	0.418	2.25	1.45	0.433	2.88	7.83	0.413
Standard	0.2	0	0.585	0.472	1.97	0.817	0.067	3.43	7.53	0.557

Table 2.

FINAL FRUIT COUNTS		
Variety	PMA	CON
Elegant Lady peaches	1	1.2
Summer Red nectarines	6.4	8.8
Fire Pearl nectarines	14.1	15.5
Bright Pearl nectarines	15.3	9.9
Red Jim nectarines	5.4	4.2
Angelino plums	4.8	5.6
AVERAGE:	7.833333	7.533333
Zee Lady peaches	1.4	
Fortune plums	16.2	

Table 3.

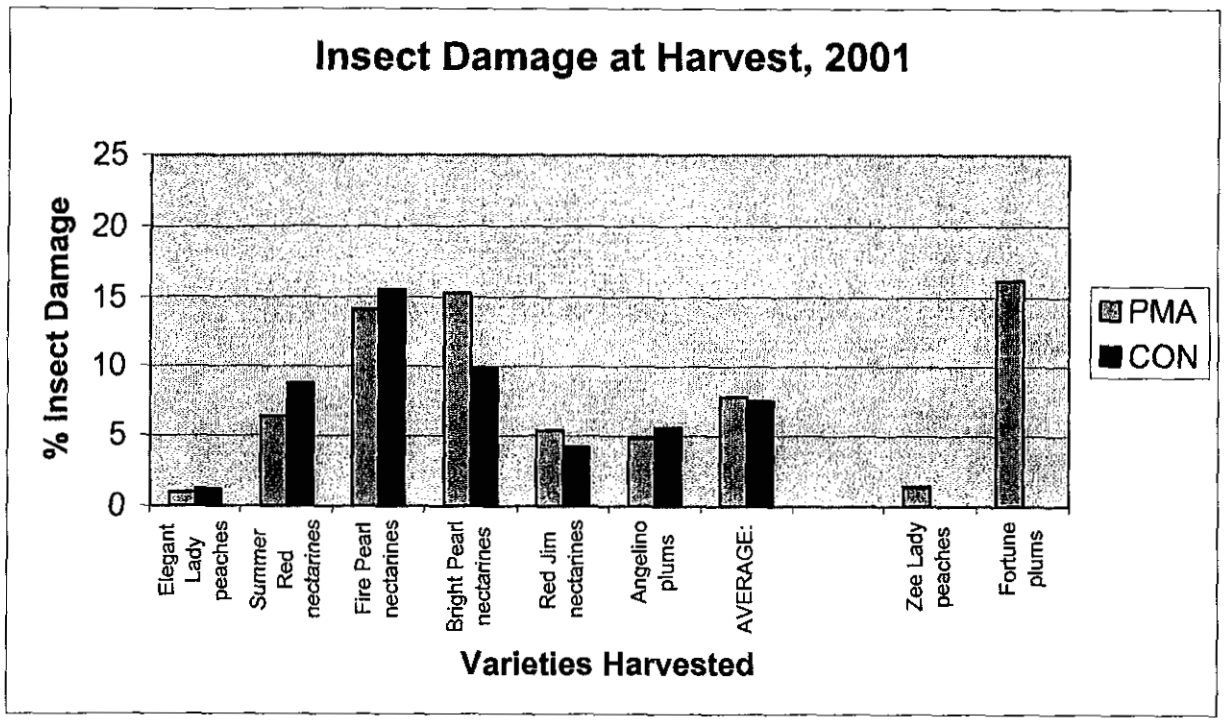


Table 4. Paraffin Emulsion Trial

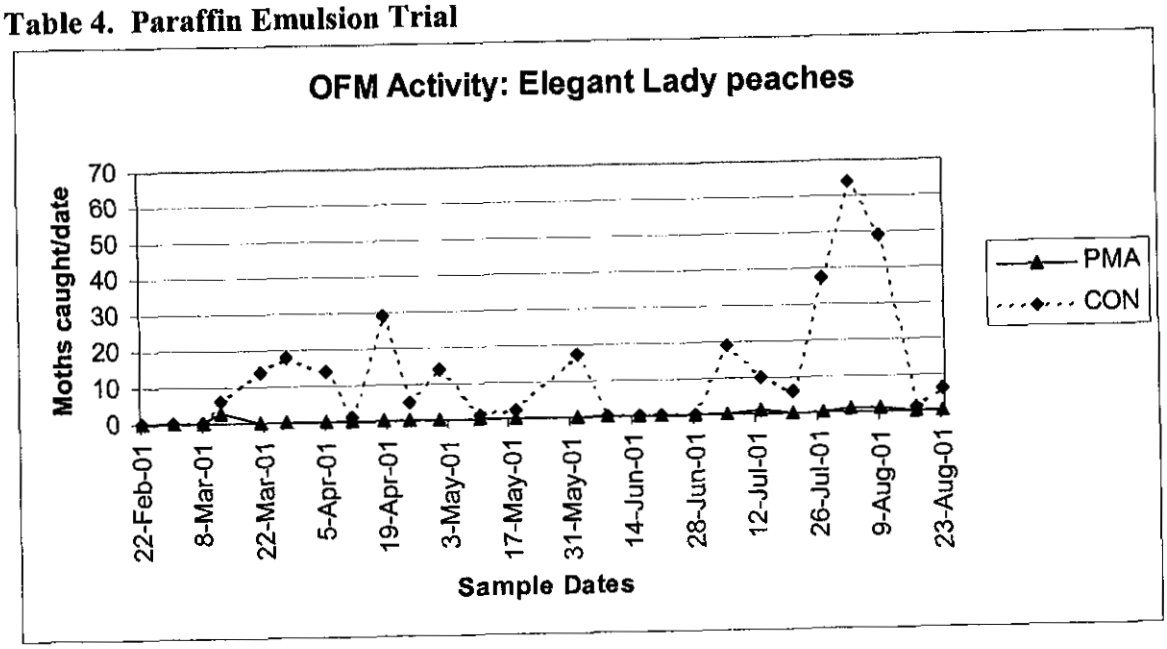


Table 5. Paraffin Emulsion Trial

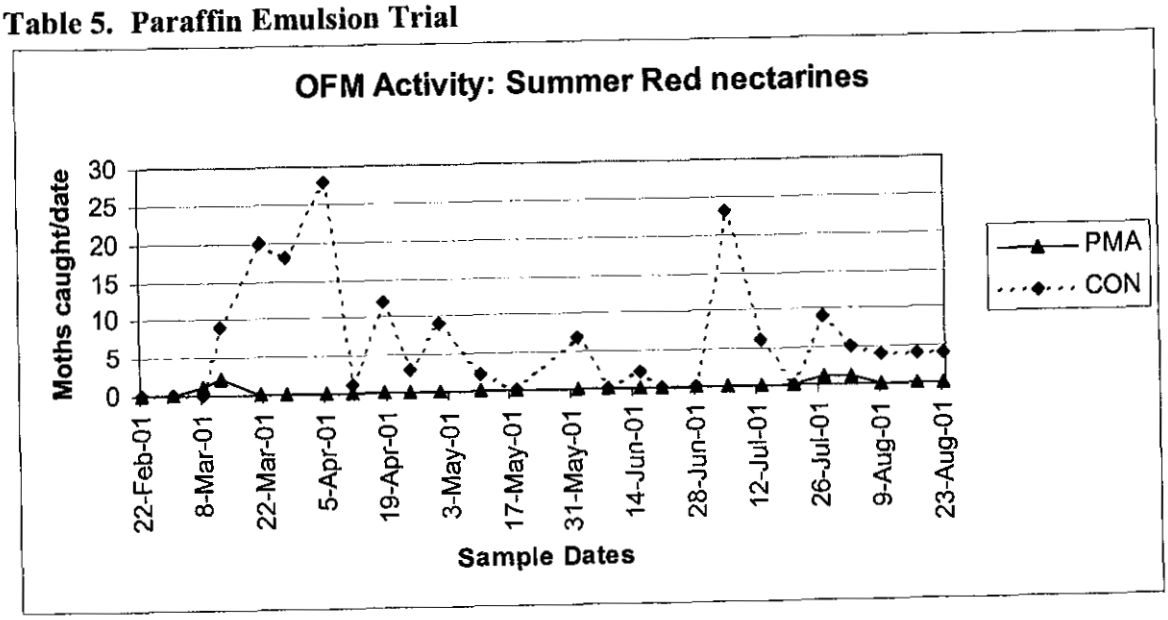


Table 6. Puffer Trial Data - Hanford

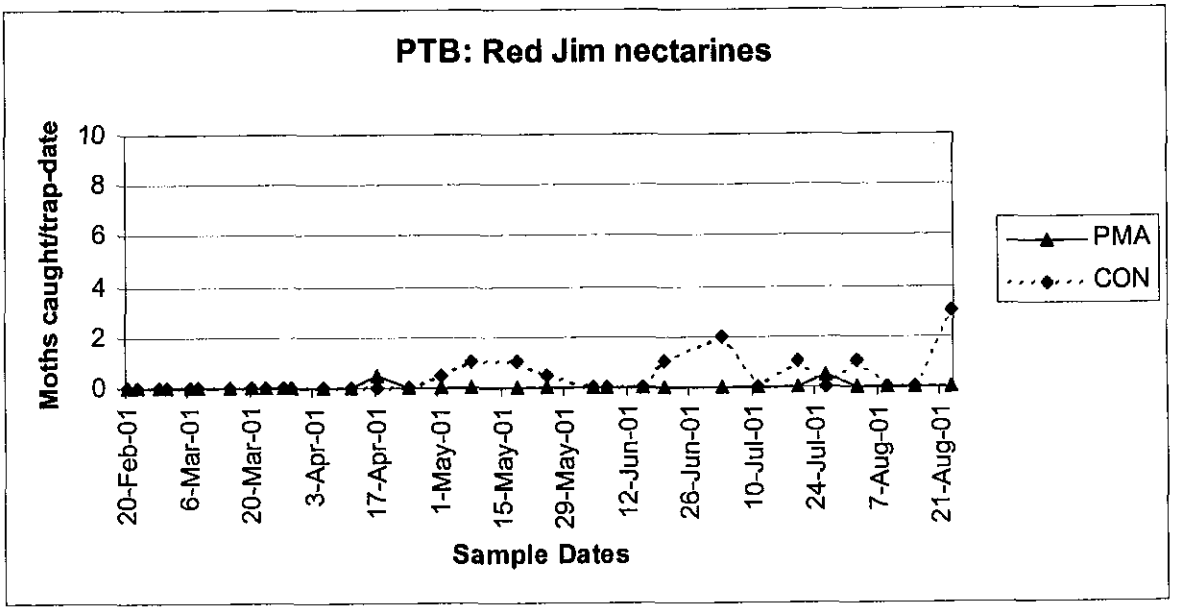
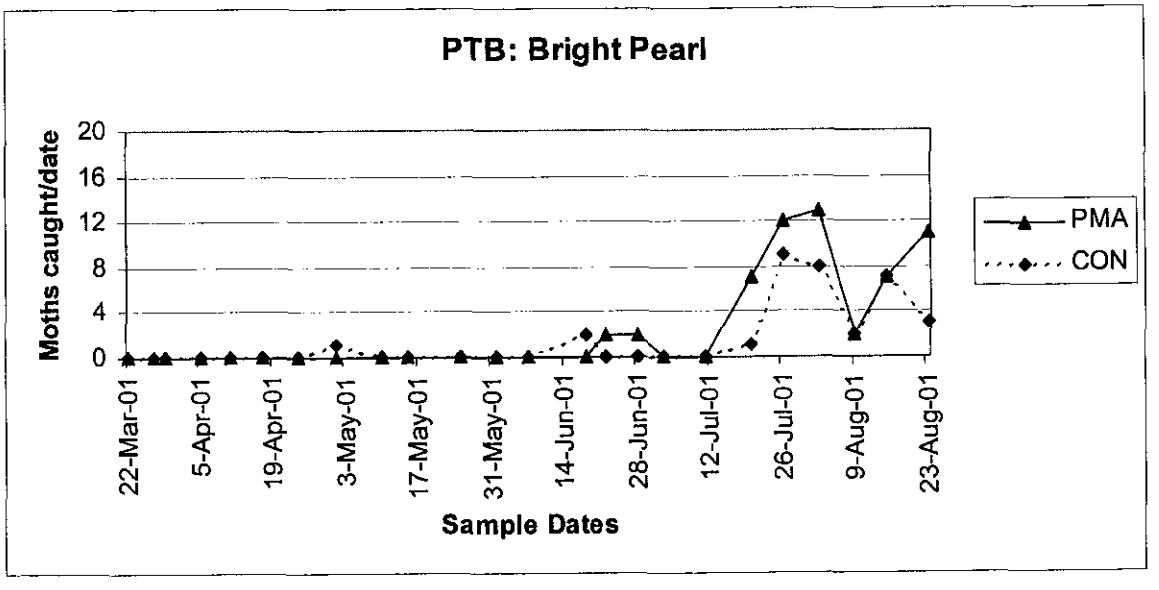
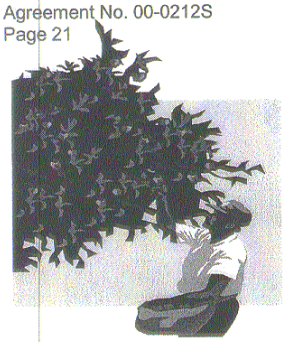


Table 7. Puffer Trial Data - Farmersville





Tree Fruit Pest Management Meeting

Sponsored by the University of California, CTFA, CCPGAB, CSU-Agricultural Research Initiative, CA Dept. of Pesticide Regulation, U.S. EPA, Gowan, Dow AgriSciences, and Exxon

Thursday August 9, 2001
9:00 am to 12:15 p.m.

Kearney Ag Center
9240 S. Riverbend
Parlier, Ca
2.5 Hours PCA Credits Applied For

Agenda

8:45 – 9:00 Registration

Moderator - Gary Van Sickle, Research Director, CTFA

9:00 a.m.	PBS Documentary Film of Prior PMA Day	Marilyn Dolan, CTFA
9:30 a.m.	Break	
9:45 a.m.	Katydid Biology; Electrostatic Sprayers	Walt Bentley, UC IPM Advisor
10:05 a.m.	San Jose Scale Susceptibility to Dormant Oil	Beth Grafton-Cardwell, Entomologist
10:30 a.m.	Ants and Earwigs as Possible Stone Fruit Pests	Rich Coviello, UCCE Fresno Co. Advisor
10:45 a.m.	Management of Nematodes Without Methyl Bromide	Michael McKenry, Nematologist
11:10 a.m.	Native Gray Ant as a Top Predator	Kent Daane, UCCE Bio-Control Specialist
11:35 a.m.	PMA Project Status; Paraffin Emulsion for OFM Disruption	Shawn Steffan, UC Research Associate
11:50 a.m.	Q&A with Personnel & Growers	
12:15 p.m.	Lunch	

Lunch will be provided by the California Tree Fruit Agreement at 12:15 p.m.
Lunch will be provided only to those who register prior to August 1, 2001. Space is limited to the first 200 registrants. Please send or fax the form below to:

Attn: Amy Chelgren
California Tree Fruit Agreement
PO Box 968
Reedley, CA 93654
ph: 559-638-8260
fax: 559-638-8842

Names: _____ _____

_____ _____

Company Name and Address: _____

Phone/Fax/E-mail: _____

2001 Grower Participants: Daybreak Farms, Deniz Packing Co., Kovacevich & Sons, Pinkham Bros., Quinco Corporation, Rubicon Orchards, Schellenberg Farms, and Tos Farms.