

TITLE PAGE

Pest Management Grants Final Report

Contract Number	98-0270
Contract Title	Aerial Release of <i>Trichogramma</i> to Control Codling Moth
Principal Investigator	Russell Stocker
Contractor Organization	ARENA Pesticide Management 3412 Laguna Avenue Davis, CA 95616

Prepared for the 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.

ACKNOWLEDGMENTS

The principal investigator would like to thank the following individuals or groups for their assistance and cooperation during this project:

David Ramos, Walnut Marketing Board

Biological Integrated Orchard Systems Program, Community Alliance with Family Farmers

Carolyn Pickel, University of California Cooperative Extension Farm Advisor

Nick Mills, Entomologist, UC Berkeley, University of California Cooperative Extension Specialist

Sinthya Penn, Beneficial Insectary

This report was submitted in fulfillment of DPR 98-270 "Aerial Release of *Trichogramma* to Control Codling Moth" by Russell Stocker, ARENA Pesticide Management, under the sponsorship of the California Department of Pesticide Regulation. Work was completed as of December 31, 1999.

TABLE OF CONTENTS

Title Page	1
Disclaimer	2
Acknowledgments	3
Table of Contents	4
List of Figures	n/a
List of Tables	5
Abstract	6
Executive Summary	7
Body of Report	8-11
References	12
Appendices	13-14

LIST OF TABLES

Table 1 Participating Orchards, Acreage, Release Dates, and Harvest Data

Table 2 Meetings and Presentations

ABSTRACT

Cydia pomonella, codling moth, is a serious exotic pest in walnuts and other crops in California. From over 200,000 acres in 20 counties, and with an annual crop value of over \$280 million, California produces virtually all the commercial walnuts in the United States. The Food Quality Protection Act will eliminate or reduce the use of products such as Guthion and similar organophosphates that currently control codling moth populations. Therefore, alternative strategies, such as the use of *Trichogramma*, must be developed. Two major challenges to the implementation of *Trichogramma* in walnuts have been 1) how to place the parasitized eggs in the orchard canopy where the codling moths are found, and 2) how to do so economically. Previous work has demonstrated the technical feasibility of metering and applying *Trichogramma* parasitized *Ephestia* eggs from an aircraft, in conjunction with an adhesive to adhere *Trichogramma* parasitoids to the foliage of walnut trees. In addition, *Trichogramma* have been demonstrated, on a limited scale, to provide adequate control of codling moth in walnuts. This project has provided the aerial release of *Trichogramma* parasitoids, under controlled and monitored conditions, in conjunction with the Pest Management Alliance (PMA) Work Plan for California Walnuts and the Biological Integrated Orchard Systems (BIOS) program of the Community Alliance with Family Farmers (CAFF).

The PMA and BIOS programs were independently managed and the principal investigator provided *Trichogramma* releases to both groups. Two reduced-strategies were utilized in both the PMA and BIOS programs. One utilized mating disruption followed by *Trichogramma* releases or the use of "softer" chemicals or other "green" materials. The second strategy utilized Confirm (tebufenozide) followed by *Trichogramma* releases. The results from both strategies are compared to conventional (Conv) pesticide treatments in this report. Overall, the results were encouraging, particularly in orchards demonstrating low pest pressure, where codling moth damage rates were low and very similar to those found in conventionally treated plots. In orchards with high pest pressure, damage rates were unacceptable on a commercial scale and supplemental control measures would have been implemented in a large scale commercial setting.

Monitoring of the pest population is the most important component in the success of these reduced-risk strategies. Without adequate or accurate monitoring, implementation of any reduced-risk strategy is ill-timed and the subsequent pest control rates are inadequate for the method to be accepted on a commercial scale. A second and important component is the ability to apply the reduced-risk strategy (*Trichogramma*, mating disruption with pheromones, etc.) once monitoring has determined the optimum timing for implementation of the strategy. There were difficulties reported by the Walnut PMA with the pheromone emulsion application equipment, which is still in development. In contrast, there were no problems with the *Trichogramma* application/release system. This is an important consideration in the commercial implementation and acceptance of this reduced-risk pest control strategy.

A final component to the implementation of reduced-risk strategies is affordability. Monitoring is costly and reduced-risk strategies presently are more costly per acre than conventional methods of codling moth control. However, the aerial release system did not fail in the field and, as implementation of the use of *Trichogramma* increases, costs per unit should decrease. Also, further research may determine that lower release rates are adequately effective, further reducing cost per acre by as much as 25%, or perhaps more.

Together with the Walnut PMA and the BIOS programs, the principal investigator has demonstrated the aerial release of *Trichogramma* to be an effective component of reduced-risk strategies to control codling moth in walnuts. Although further research will be required for industry-wide implementation, the success of these investigations has been disseminated to the walnut industry through various meetings and publications.

EXECUTIVE SUMMARY

Cydia pomonella, codling moth, is a serious exotic pest in walnuts and other crops in California. From over 200,000 acres in 20 counties, and with an annual crop value of over \$280 million, California produces virtually all the commercial walnuts in the United States. The Food Quality Protection Act will eliminate or reduce the use of products such as Guthion and similar organophosphates that currently control codling moth populations. Therefore, alternative strategies, such as the use of *Trichogramma*, must be developed. Two major challenges to the implementation of *Trichogramma* in walnuts have been 1) how to place the parasitized eggs in the orchard canopy where the codling moths are found, and 2) how to do so economically. Previous work has demonstrated the technical feasibility of metering and applying *Trichogramma* parasitized *Ephesttia* eggs from an aircraft, in conjunction with an adhesive to adhere *Trichogramma* parasitoids to the foliage of walnut trees. In addition, *Trichogramma* have been demonstrated, on a limited scale, to provide adequate control of codling moth in walnuts. This project has provided aerial release of *Trichogramma* parasitoids, under controlled and monitored conditions, in conjunction with the Pest Management Alliance (PMA) Work Plan for California Walnuts and the Biological Integrated Orchard Systems project of the California Alliance of Family Farmers (CAFF).

In cooperation with the PMA and BIOS programs, 68 timed releases of *Trichogramma* parasitoids were made over 165 acres of walnuts located in 10 orchards and involving growers in six counties. Two strategies were utilized by the Walnut PMA and BIOS programs. The first utilized mating disruption followed by *Trichogramma* releases and/or the use of "softer" chemicals or other "green" control measures. The second strategy utilized Confirm (tebufenozide) followed by *Trichogramma* releases. Both strategies were then compared to plots managed with conventional pesticide treatments. Overall, the results were encouraging, particularly in orchards demonstrating low pest pressure where codling moth damage rates were low, and very similar to those found in conventionally treated plots. In orchards with high pest pressure, damage rates were unacceptable on a commercial scale and supplemental codling moth control measures would have been implemented in a commercial setting.

Monitoring of the pest population is the most important component in the success of these reduced-risk strategies. Without adequate or accurate monitoring, implementation of any reduced-risk strategy is ill-timed and the subsequent pest control rates are inadequate for the method to be accepted on a commercial scale. A second and important component is the ability to apply the reduced-risk strategy (*Trichogramma*, mating disruption with pheromones, etc.) once monitoring has determined the optimum timing for implementation of the strategy. There were difficulties reported by the Walnut PMA with the pheromone emulsion application equipment, which is still in development. In contrast, there were no problems with the *Trichogramma* application/release system. This is an important consideration in the commercial implementation and acceptance of this reduced-risk pest control strategy.

A final component to the implementation of reduced-risk strategies is affordability. Monitoring is costly and reduced-risk strategies presently are significantly more costly per acre than conventional methods of codling moth control. In these trials, reduced-risk practices were approximately double the cost of conventional methods of codling moth control. However, the aerial release system did not fail in the field and, as implementation of the use of *Trichogramma* increases, costs per unit should decrease. Additional research and experience in the field may determine that lower release rates are effective, further reducing cost per acre by as much as 25% and perhaps more.

Together with the Walnut PMA and BIOS programs, the principal investigator has demonstrated the aerial release of *Trichogramma* to be an effective component of reduced-risk strategies to control codling moth in walnuts. Although further research will be required for industry-wide implementation, the results of these investigations have been disseminated to the walnut industry through various meetings and publications. In all circumstances, the program was well received.

BODY OF REPORT

A. Introduction

Codling moth, *Cydia pomonella*, is a major exotic pest of walnuts, apples and pears in California and elsewhere in the United States. It was introduced from Eurasia, and has spread rapidly, becoming a major problem in three quarters of the California counties where walnuts are grown. California produces virtually all the commercially produced walnuts in the United States with over 205,000 acres in 20 counties dedicated to walnut production. Annual crop value is \$280 million, placing walnuts among the top five in California's fruit and nut crops (Statistics of Fruits, Nut Trees and Horticultural Specialties, 1988; IPM for Walnuts, 1987; Maintaining the Competitive Edge in California's Walnut Industry). Pheromone-based mating disruption is one Integrated Pest Management (IPM) strategy for codling moth control (Vickers & Rothchild, 1991; Barnes, et al., 1992) that has worked well in apples and pears. Unfortunately, this alternative management strategy has not been as successful in walnuts due to the size of the trees and large volume of air which must be permeated with pheromone. Current practices for the release of *Trichogramma* involve the refrigerated shipment of pupae, known as parasitoids, which are glued to perforated cards. The cards are broken into squares on-site and distributed by hand in orchards by stapling the squares to leaves or by incubating the parasitized eggs in paper wedge cups, which are then set out after the adults emerge. Both the card and cup practices are highly labor intensive and not feasible on a commercial scale.

Previous work by the principal investigator has shown the feasibility of releasing *the Trichogramma* parasitoids (at a predetermined rate) by air, in conjunction with an adhesive, to facilitate placement of the parasitoids in the upper walnut canopy where the codling moths are found. The primary goal of this proposal was to demonstrate the feasibility of this release process on a larger scale, utilizing the Walnut Pest Management Alliance (PMA) and Biological Integrated Orchard Systems (BIOS) programs' networks of growers and specialists to facilitate grower cooperation, orchard identification and monitoring, and, finally, accurate data collection. The second goal of this proposal was to provide cost comparisons between this reduced-risk pest control strategy and conventional practices. Finally, the third goal of this proposal was to communicate the success of this reduced-risk strategy to the walnut industry.

B. Materials and Methods

The primary work plan task was to coordinate the availability of the aircraft, a Cessna Ag Wagon (C-188), and beneficial insect release system (developed by R. Stocker) with the release needs in trial orchards identified by the PMA work plan and the BIOS program. Ten orchards, located from Butte County in the north to Tulare/Kings County in the south were identified with plots covering 5 to 23 acres planned for *Trichogramma* release at each site (See Table 1). These plots were significantly larger than those previously available to the investigator, which improves the significance of the results, and served as larger scale test sites for the aerial release system. Both the PMA and BIOS orchards were managed in conjunction with either "softer" pesticides (such as Confirm) or pheromone-based mating disruption protocols for the first generation of codling moth, followed by the release of *Trichogramma* for control during the second and third codling moth generations. The specific protocols are detailed in the reports of the PMA and BIOS groups.

An extensive monitoring program was present in the PMA Work Plan and there was collaboration with the BIOS participants. Field scouts monitored the orchards weekly for degree days and codling moth flights, communicating their findings to Carolyn Pickel and Dr. N. Mills, who recommended *Trichogramma* release dates. Release dates were given by phone to R. Stocker. He then carried out the release protocol, releasing *Trichogramma* parasitoids (at a minimum rate of 200,000 per acre) in conjunction with an adhesive to facilitate placement of the parasitoids in the upper canopy of the walnut orchards. The orchards were monitored for damage and various modifications were made to the original protocols by the staff to keep pest populations within reasonable limits in heavy pest pressure orchards.

The best overall assessment of the success or failure of this reduced-risk pest control strategy is the evaluation of the nuts at harvest, and these data are presented in this report. To ensure random samples, all collections were taken after the trees were shaken for harvest. For plots in the BIOS protocol, 60 nuts from 10 random trees were collected. For plots in the PMA protocol, 50 nuts from 10 random trees were collected. Nuts were evaluated for both codling moth and naval orange worm damage because naval orange worm follows codling moth or other physical damage. Naval orange worm is unable to penetrate the walnut husk, but obtains access either through a hole bored by the codling moth larvae or through weakened areas damaged by sunburn, etc. The two types of insect damage are distinct. Codling moth damage presents a nut with a small worm and very little frass or webbing inside the shell, whereas naval orange worm damage demonstrates a nut filled with frass and webbing. Harvest data are presented in Table 1 and are discussed in the Results, below.

A second goal of this proposal was to evaluate the costs of reduced-risk pest control practices compared to costs of conventional control methods. The investigator utilized his extensive experience as a conventional pesticide applicator and local, established retail vendors to determine comparison per acre costs for the application of conventional materials (see Table 1). Costs of materials applied by ground were estimated at \$20/acre plus material and those applied by air were estimated at \$10/acre plus material. Costs for *Trichogramma* parasitized eggs were borne by the growers at the wholesale rate (\$8.20/100,000 eggs; applied at 200,000/acre) and aerial application was charged at a flat rate of \$5/acre. It should be noted that proper orchard monitoring is time consuming and, therefore, an additional cost to the grower. In these trials, the monitoring expenses were not borne by the growers.

A final focus of this proposal was to communicate the feasibility and success of the beneficial insect release system and the use of *Trichogramma* as an alternative pest control strategy to the walnut industry. Table 2 details the forums visited and presentations given by the principal investigator to accomplish this goal. At the various meetings, the beneficial insect release system was well received and there was audience interest in the use of *Trichogramma* as a component of alternative pest control strategies. In addition, this strategy received coverage on local television (KCRA, Channel 3) and in the press (Sacramento Bee and other newspapers), raising public awareness of this and perhaps other reduced risk pest control strategies.

C. Results

All of the 68 scheduled releases (either four or eight per orchard) were made on the target dates according to the proposal, with the exception of two that were delayed a day or two by high winds. The aircraft and beneficial insect release system performed without difficulty. In contrast, the Walnut PMA reported repeated difficulty with the application of a paraffin emulsion product, which is in development for mating disruption.

Data from harvest evaluation (crack-out) at 10 orchards utilizing conventional and either BIOS or PMA alternative control methods are presented in Table 1.

The five orchards managed by the BIOS team were all located in San Joaquin County where pest pressure (determined by codling moth populations) was low during the 1999 season. Two blocks (John Eilers and Tom McGurk) demonstrated lower rates of codling moth and naval orange worm damage (gross % at harvest) with *Trichogramma* than blocks managed with conventional methods. Two orchards were dedicated to reduced-risk control practices and provided no conventional blocks for comparison. Of these, the Chris Locke orchard provided data from two varieties (Vina and Serr) interplanted in the same orchard and both demonstrated low damage percentages (0.2 and 0.3 vs 0.0 and 0.3%, respectively). The Jack Radavero orchard reported the highest damage rate (1.8 and 0.8%, respectively) of the BIOS blocks, although this rate was lower than several of the blocks in the PMA managed orchards (see below). The fifth BIOS orchard (Anderson Barngrover) demonstrated low codling moth and naval orange worm damage (1.3 and 0.3 %, respectively), but this rate was higher than that seen in conventional blocks.

Of the five orchards managed by the Walnut PMA, two orchards (Bob Saak and Paul Stanfield) reported worm damage less than blocks managed with conventional methods and a third (Bob Saak) reported damage equal to that observed in the conventionally managed block. All of these results are encouraging. The remaining two orchards experienced codling moth and naval orange worm damage in reduced-risk blocks that was approximately twice that observed in the conventionally managed blocks. The Jerry Tennant/Houston Ranch experienced the heaviest codling moth and naval orange worm damage in reduced risk blocks, reporting 7.6 and 1.8%, respectively, compared to 4.7 and 0.6%, respectively, in conventionally managed blocks.

D. Discussion

The reduced-risk pest management strategies employed by the Walnut PMA and BIOS groups have met the primary objective of this proposal, demonstrating that reduced-risk pest control strategies, including the aerial release of *Trichogramma*, can be successful and provide adequate codling moth control in walnuts. The larger scale of this demonstration has shown individual growers, as well as local farm advisors and industry personnel, the feasibility of the aerial release of *Trichogramma* as a component of reduced-risk pest control strategies. It must be noted that the 1999 season was determined to be a low pest pressure year and, as such, these data must be applied with a degree of caution. A heavy pest pressure season likely would have given different results - perhaps similar between reduced-risk strategies and conventional methods, perhaps not. This remains to be seen. Regardless, the results obtained during the 1999 walnut season are encouraging. The ongoing efforts of the Walnut PMA and BIOS groups, as well as further refinement of both monitoring practices and strategy protocols, will improve the likelihood of the aerial release of *Trichogramma* becoming an integral part of accepted reduced-risk pest management programs.

The second goal of this proposal was to compare the costs per acre (including both material and application expenses) of reduced-risk and conventional pest control programs. Costs for each block in each orchard are provided in Table 1. The reduced-risk protocols implemented by the BIOS group resulted in a cost per acre of \$207 compared to \$99 in conventionally managed blocks. The reduced-risk protocols implemented by the Walnut PMA group resulted in a cost per acre of \$222 compared to \$111 in conventionally managed blocks, although it should be noted that the Bob Saak orchard received double treatments with both conventional and reduced-risk materials at each application. The reason for this management decision is unknown. Thus, if the costs for the Saak blocks are halved, the resulting costs per acre for the Walnut PMA blocks are \$203 and \$83 for the conventionally managed blocks. These are likely to be more accurate figures. It was expected that cost per acre in the reduced-risk managed orchards would be higher than in conventionally managed orchards due to the labor intensive nature of reduced-risk practices. It is unfortunate that the costs for the reduced-risk control strategies are approximately double those for conventional practices. But, it is likely that costs will decrease as the demand for and availability of biological controls, such as *Trichogramma*, and other reduced-risk strategies increases. If conventional products are removed from the market, growers simply will have no choice but to convert to reduced-risk practices, regardless of the cost. However, plain and simple experience as well as further refinement of monitoring techniques and application practices will help reduce the costs of these reduced-risk strategies.

The final objective of this proposal was to communicate the success of the beneficial insect release system and the use of *Trichogramma* as a reduced-risk strategy for the control of codling moth to the walnut-growing community. Several meetings have been attended and presentations have been given (see Table 2). The positive reception the principal investigator received at these meetings was encouraging and has sparked discussion between the meeting participants of other avenues of reduced risk pest control.

E. Summary and Conclusions

The primary objective of this proposal was to demonstrate the larger scale feasibility and cost effectiveness of the beneficial insect release system as a reduced-risk pest management option. The successful use of *Trichogramma* as part of a reduced-risk strategy to control codling moth has been demonstrated. In the past, one of the problems hindering the use of *Trichogramma* on a larger scale has been the highly labor-intensive and time-critical release protocols. The development of the beneficial insect release system has solved both the labor and time-critical components. Demonstration of its successful use from an aircraft and its use in field trials are an important step in the development of this reduced-risk pest control methodology. The continuing importance of careful and accurate monitoring of pest populations must be recognized for this and other reduced-risk strategies to be successful.

Although currently more costly per acre (approximately double), this pest control method remains a viable component of reduced-risk codling moth control programs. With wider industry implementation, costs to growers should be reduced. Regardless of cost, when conventional materials are no longer available, this strategy will be available.

REFERENCES

Statistics of Fruits, Nut Trees and Horticultural Specialties. National Agricultural Statistics Service, 1988.

Integrated Pest Management for Walnuts. University of California Statewide Integrated Pest Management Project, Division of Agriculture and Natural Resources, Second Edition, M.L. Flint, ed., University of California, Oakland, CA, publication #3270, pp 36-41, 1987.

Maintaining the Competitive Edge in California's Walnut Industry. University of California, Agricultural Issues Center, R. Coppock, ed., University of California, Davis, 1994.

Vickers R.A., Rothschild G.H.L. Use of sex pheromones for control of the codling moth. In: Tortricid Pests. Elsevier, Amsterdam, pp 339-354, 1991.

Barnes M.M., Millar J.G., Kirsch P.A., Hawks D.C. Codling moth (Lepidoptera:Tortricidae) control by dissemination of synthetic female sex pheromone. *Journal of Economic Entomology* 85:1274-1277, 1992.

Table 1 - Participating Orchards, Locations, Release Dates, and Harvest Data

Orchard or Orchard Owner	County	Release Dates	Block / Acres / Variety	Harvest Date	# Nuts Sampled	Gross Damage (%)		Cost per Acre
						CM	NOW	
Anderson Bamgrover Ranch	San Joaquin	July 1, 8, 15, 22	BIOS / 16 / Vina	9/22/99	600	1.3	0.3	\$138.00
			Conv / 47 / Vina	9/23/99	600	0.2	0.0	46.43
John Eilers	San Joaquin	July 1, 8, 15, 22 Aug. 9, 16, 23, 30	BIOS / 20 / Serr	10/4/99	600	0.0	0.0	217.20
			Conv / 20 / Serr	10/4/99	600	0.8	0.2	118.43
Chris Locke	San Joaquin	July 1, 8, 15, 22 Aug. 9, 16, 23 Sept. 1	BIOS / 23 / Vina : Serr	10/5/99	600 : 600	0.2 : 0.3	0.0 : 0.3	220.40*
Orchard totally dedicated to biological control; no conventional measures used.								
Tom McGurk	San Joaquin	July 1, 8, 15, 22 Aug. 9, 16, 23, 30	BIOS / 13 / Vina	10/14/99	600	0.5	0.0	256.70
			Conv / 5 / Vina	9/30/99	600	0.7	0.7	132.00
Jack Radavero	San Joaquin	July 1, 8, 15, 22 Aug. 9, 16, 23, Sept. 1	BIOS / 20 / Hartley	10/12/99	600	1.8	0.8	237.20
			Orchard totally dedicated to biological control; no conventional measures used.					
Jim Bremner	Butte	July 2, 9, 16, 23, 30 Aug. 6, 13, 19	PMA / 5 / Vina	9/10/99	500	1.7	0.2	285.00
			Conv / 5 / Vina	9/10/99	500	0.9	0.1	116.00
Jerry Tennant Houston Ranch	Contra Costa	June 18, 25 July 13, 20, 27 Aug. 3, 24, Sept. 1	PMA / 14 / Payne	n/a	500	7.6	1.8	228.00
			Conv / 20 / Payne	n/a	500	4.7	0.6	55.60
Paul Stanfield	Kings	June 22, 29 July 12, 19	PMA / 4.2 / Serr	n/a	500	2.6	3.0	218.80
			Conv / 15.8 / Serr	n/a	500	2.7	5.3	46.43
Jack Gilbert	Sutter	July 21, 28 Aug. 3, 10, 17, 24 Sept. 2, 7	PMA / 15 / Chandler	10/25/99	500	0.0	0.0	171.20
			Conv / 15 / Chandler	10/26/99	500	0.1	0.0	0**
Bob Saak	Tulare	June 22, 29 July 12, 19	PMA / 20 / Serr	n/a	500	0	0.2	232.00+
			Conv / 20 / Serr	n/a	500	0	0.2	228.28++
Totals	six counties represented	68 releases	298 acres / 5 varieties					

BIOS, Biological Integrated Orchard Systems; **PMA**, Pest Management Alliance for California Walnuts

Conv, Conventional pest management practices; **CM**, Codling moth; **NOW**, Naval orange worm

* Vina and Serr varieties interplanted within the 23 acres, treated as one unit for pest control purposes, nuts harvested separately (varieties separated with :).

** No conventional pesticides used; low pest pressure, no need.

+ Alternative control products applied from both air and ground (i.e., double treatment) with each treatment.

++ Conventional pesticides applied from both air and ground (i.e., double treatment) with each treatment.

Table 2 - Meetings Attended and Presentations Given

Date	Location	Audience / Forum
November 3, 1998	Woodland, CA	CAPCA Meeting Slide presentation
March 9, 1999	Yuba City, CA	Walnut Pest Management Alliance Regional Team Meeting Slide presentation and equipment
March 10, 1999	Modesto, CA	Walnut Pest Management Alliance Regional Team Meeting Slide presentation and equipment
March 11, 1999	Parlier, CA	Walnut Pest Management Alliance Regional Team Meeting Slide presentation and equipment
April 23, 1999	Ripon, CA	Community Alliance with Family Farmers (CAFF) Farm Tour Presentation on aerial <i>Trichogramma</i> releases Equipment demonstration
June, 22, 1999	Hanford, CA	Walnut Pest Management Alliance Regional Field Meeting Presentation using release equipment
June 22, 1999	Sacramento, CA	Featured article on KCRA - TV's Morning Show
August 16, 1999	Sacramento, CA and vicinity	Featured in an article in the Sacramento Bee and other smaller local area newspapers "Pitting good bugs against bad" by Edie Lau
August 19, 1999	Chico, CA	Walnut Pest Management Alliance Regional Field Meeting Presentation using release equipment and Demonstration of aerial release
March 9, 2000	Winters, CA	Community Alliance with Family Farmers (CAFF) Field Day Managing Codling Moth in Walnuts without Organophosphates Presentation "Aerial <i>Trichogramma</i> releases"