Appendix 21

Center for Agricultural Partnerships, Walnut IPM Expansion Project Case Study for CARAT

February 2003

Prepared by: P.W. Weddle, Project Manager

Pest Management Problem

- **Describe the pest management problem (regulatory, resistance, new pest, secondary pest, needs of the IPM system, IPM system not being used). What are/were the consequences of not resolving the problem.**

California produces 99% of U.S. walnuts and 38% of the world production. In 2001, California growers produced over 300,000 tons of walnuts valued at over $346 million. Codling moth, Cydia pomonella, (CM) is the key statewide pest of walnuts, infesting 60% of the more than 200,000 planted acres in California. Uncontrolled codling moth can cause economic damage on up to 40 % of the crop. Organophosphates (OPs) are the primary insecticides used to control codling moth but pending regulatory action under FQPA is likely to further restrict or eliminate one or more of the existing uses. In addition, the pressures from insecticide resistance and the problems associated with secondary pest outbreaks as a result of OP applications have created additional problems and increased pesticide use. Furthermore in its "1998 California 303(d) List and TMDL Priority Schedule", the Central Valley Regional Water Quality Control Board identified the insecticide chlorpyrifos as a high priority for development of a Total Maximum Daily Load on 190 miles of the Merced and San Joaquin Rivers and 480,000 acres in the Delta waterways among the watersheds targeted. Chlorpyrifos has been widely used on walnuts in the Sacramento and San Joaquin valleys.

Use of OP's in walnut pest management is relatively inexpensive. Cooperator surveys show that costs and efficacy concerns are a major barrier to adoption of CMMD.

Solution

- **Describe the solution and how it is/was intended to solve the problem**
- **What is/was the time frame for solving the problem**

The most promising option for resolving the critical regulatory and biological problems in walnut pest management is pheromone mediated mating disruption. This project was a cooperative effort of the Center for Agricultural Partnerships (CAP) with growers and their organizations, crop consultants, researchers and farm advisors to implement a systematic process to further adoption of a sprayable mating disruption system on a wide

scale in commercial walnut production and; 2) Document and communicate economic, biological and decision-making changes in the adoption of sprayable mating disruption at the farm and project levels on a wide scale in commercial walnut production.
In conjunction with the implementation of the sprayable pheromone, the project also implemented and validated the effectiveness of kairomone-based lure as a key component in the use of sprayable mating disruption on a wide scale in commercial walnut production. Since codling moth is a key pest on other crops, which also rely on organophosphates being regulated under FQPA, successful use of this technology in walnuts could also have a dramatic effect on pest management on those key crops.

The most promising option for resolving the problems of cost and uncertainty of transition to new pest management technologies and practices is to provide growers and their pest control advisors a systematic program designed to "failsafe" their on-site adoption experience. The CAP walnut project was designed to provide individual and collective coordination and support for early adopters of the target technologies. In addition, the project has developed a commercial network to enhance the capacity of growers to more efficiently incorporate new technologies into their daily pest management activities.

Implementation of the technologies was to be accomplished during the growing season by cooperating growers with the support of their pest management advisors (PCAs). The foundation of the implementation effort is the involvement of growers and their pest management advisors throughout the project. The involvement of PCAs ensures that results are documented and provides a means for growers to receive the information necessary to make better decisions. By allowing growers and PCAs the opportunity to see this system work in their own orchards, they have the opportunity for direct observation that is essential to the adoption of innovation. PCA involvement also provides the mechanism for sustaining implementation efforts commercially after the project ends.

The project was initially designed to implement sprayables on 25% of the walnut acreage susceptible to codling moth infestation, approximately 25,000 acres by the end of the third year.

Project Development

- **Characterize the nature of the project: basic research, applied research, registration, education, demonstration, and implementation**
- **What is/was the budget and time frame for the project**
- **What are/were the sources of funds for the project**
- **Who led the development of the project**
- **Who are/were the key supporters, participants**
- **Who is/was responsible for securing the funding, writing the proposal**

- **What problems are/were encountered in securing funding**

The CAP walnut project was focused primarily on farm based, site-specific implementation of new technologies and practices.

The budget for the feasibility study and design o f the project were was approximately $125,000, about 70% of that dedicated to assessment of the project's feasibility. Actual field implementation efforts were projected to cover three years at about $150K per year. CAP has provided the bulk of the funds. US-EPA Region 9, The Great Valley Foundation and 3M Canada provided approximately 47% of the funds.

Diamond of California provided significant communications support through its newsletter and publications and provided the services of its field staff for the project. The outreach within the industry was conducted through the Diamond of California newsletter, which recognized and reinforced the work of project participants and informed the cooperative's members of the project. The project was publicized to the entire walnut industry through the Walnut Marketing Board's quarterly newsletter. Press relations were also conducted to the general public about the industry's efforts use environmentally sound farming practices.

Patrick Weddle, Senior Consultant to CAP, conducted the feasibility assessment and was the project manager.

Key supporters were Diamond of California, the Walnut Marketing Board, 3M-Canada Corporation, Trece, Inc., Suterra, and Certis. Steve Wulfert, fieldman, Diamond of California; Joe Grant, Extension Pomologist, U.C. Cooperative Extension, San Joaquin, Co.; and Steve Sibbett, Extension Pomologist Emeritis, U.C. Cooperative Extension, Tulare Co. served as coordinators for the project. Steven Welter, U.C Berkeley, Walt Bentley and Carolyn Pickel UC-IPM served as technical advisors and participants. Once the project was started, The Nature Conservancy and Crain Orchards became involved in sharing data and comparing field results.

The key to project success was the intensive involvement of private crop consultants in the project. Since implementation at the field level is a private sector activity their participation along with that of their grower-clients made the field implementation effort possible.

Larry Elworth, Executive Director of the Center for Agricultural Partnerships, led the development of the project and was responsible for securing project funding and writing proposals. There are virtually no funding sources for commercial implementation projects that are farm based and site-specific. Though a number of funding sources propose to include implementation as one of the purposes that are supported, they regularly confuse research and demonstration with commercial implementation. In addition, due to severe budget deficits, California state funding sources, such as the Department of Pesticide Regulations, have drastically reduced or eliminated

implementation project funding programs (e.g. Pest Management Alliance Program). Commodity research boards, such as the Walnut Research Commission traditionally fund research and not implementation. Environmental funders have reduced or eliminated their funding for IPM projects and for site-specific efforts to reduce pesticide risks in conventional agricultural. To the extent that they do have funds for this purpose, the recent drastic decline in the stock market has had a severe impact on non-profit funders reducing their ability to fully fund programs and initiate funding of new projects.

Project Management

- **Describe how the project was initiated; what were its objectives**
- **How was planning done**
- **How was success defined at the beginning**
- **How is/was the project staffed. Who is/was responsible for handling money, coordinating, managing the project.**

The "CAP Process" for project development

Implementation of new technologies and practices in agriculture, especially technologies that are farm-site specific, information intensive and unconventional relative to those being replaced, can be slow to implement commercially on any large scale. For growers to learn of new innovative technologies and practices they initially benefit from access to collective experience, i.e., credible research, extension and regional field demonstration of the innovation. This collective experience is currently provided by traditional research and education sources such as the land grant system and cooperative extension. For growers to ultimately adopt new technologies and practices they need to take the collective experience and incorporate the knowledge to individually experience and observe the relative advantage of the innovation, its trialability in the field, its compatibility with other cultural practices and its complexity relative to older practices (Rogers). In many cases, this individual experience takes place in a context that is dominated by many forces and interests beyond the innovation yet influencing grower decisions to use the target innovation nonetheless. In 2001, CAP initiated a study to determine the feasibility of conducting a large-scale commercial implementation project in California walnuts. Through a systematic decision tree process it was determined that the potential existed within the California walnut industry to have large scale environmental and economic impact by commercially expanding upon successful ongoing efforts of the walnut industry to research, educate and demonstrate new biologically based systems of crop protection (The Walnut Pest Management Alliance Program). As a result, CAP initiated funding of the Walnut IPM Expansion Project (WIPMEP) in 2001. In 2002, the pilot field project component was initiated statewide.

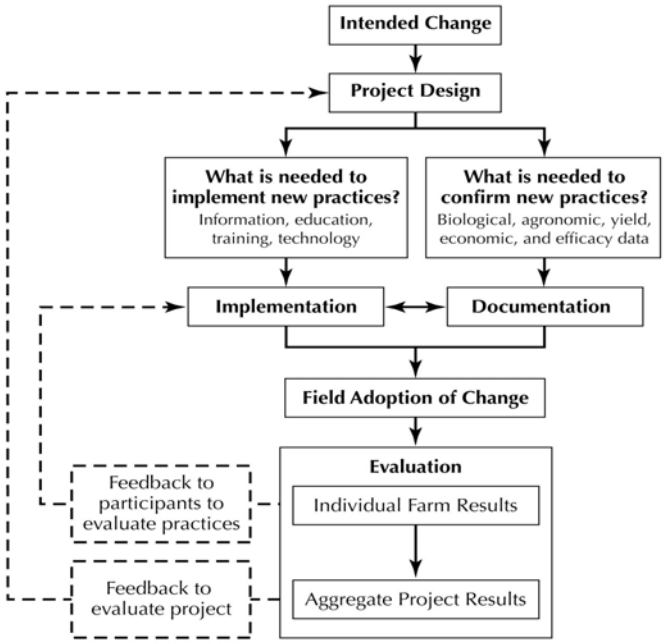
Project Objectives

The project has the following objectives:
1) To implement a systematic process for further adoption of a sprayable pheromone-

mediated mating disruption system on 1000 acres of commercial walnut production.
2) To measure, document, evaluate and communicate economic, biological, and decision-making changes in the adoption of sprayable mating disruption at the farm, project, and industry levels.

Project Design and Planning

The diagram below shows the integrated process used by CAP in this project:



A planning meeting with the project's core participants including the Walnut Research Commission research coordinator, the three regional coordinators and the four cooperating consultants was held in February to develop a work plan for the 2002 field season. In the meeting, which was conducted by a facilitator, the participants were prompted to provide their views of what needed to be done to accomplish project objectives. These results were then transcribed into a work plan format. The work plan was used throughout the season as the road map for project activities. Thus, project core participants designed and took immediate ownership of their work plans for the project year

Success was defined in keeping with the integrated process. First of all, success was defined as the efficacious use of sprayable pheromones and kairomones in the field and the ability to assess that efficacy at the grower and aggregate project level. In addition success was defined in terms of the project's ability to effectively provide the information and support necessary for the implementation and evaluation.

Pat Weddle was project manager. Larry Elworth, Executive Director of the Center for Agricultural Partnerships and CAP staff handled all of the administration, oversight and press relations.

Project Work

- **What are/were the main activities - what are people doing**
- **What are/were the milestones and chief accomplishments of the project**

Project management in collaboration with CAP and project cooperators conducted the following work in 2002:

Project Organization & Planning

- Developed project field budgets, January
- Designed survey and interview instruments, February
- Conducted project planning meeting and focus group with core technical cooperators, March 14

Education & Outreach

- Formal Presentation introducing the project to the Western Orchard Pest and Disease Management Conference, Portland, OR (Jan 10)
- Formal Presentation introducing the project to the Walnut Research Committee Annual Conference, Bodega Bay, CA (Jan 24)
- Co-sponsored mating disruption technical seminar, AAIE Annual Conference, Berkeley, CA (Feb 5)
- Formal presentation on the project to Cal-EPA, Dept. of Pesticide Regulations, Pest Management Alliance Annual Workshop, Sacramento, CA (March 12)
- Formal presentation introducing project to Tulare Co. growers at UCCE grower meeting, Hanford, CA (April 2)
- Formal presentation on mating disruption in walnuts and the CAP project to Diamond Walnut Technical Staff Meeting, Stockton, CA (May 30)
- Two meetings with UC-IPM Area IPM specialists, one in Yuba City and one in Parlier to review project and statewide UC-IPM pheromone data (June)
- Conducted industry education meeting for project stakeholders to report project results (November)

Establishment of Cooperators

- Established three Regional Coordinators (January)
- Established three Regional Consultants (January)
- Established 8 grower cooperators with 9 orchards representing 900 acres (February, March)
- Secured sprayable pheromone donations from 3M Canada and Suterra LTD
- Secured trap and lure donations from Trece, Inc. (April)
- Field trapping by cooperators was initiated (March-April)

Project Evaluation

- Collaborated with UC-SAREP on walnut industry survey to be conducted in 2002
- Conducted interviews and surveys of Regional Consultants (April)
- Conducted interviews and surveys of grower cooperators (May-June)
- Conducted interim project field evaluation to determine effectiveness of new trapping technologies, sprayable pheromones and project communications with Regional Coordinators and Consultants (June 5-6)
- Conducted monthly visits with cooperators to periodically assess cooperator perceptions of target technologies
- Conducted an end of season project wrap-up meeting with regional coordinators and consultants to document project outcomes (November)

Field Data Management

- Initiated on-line field data management system with UC-IPM (April)
- Established and verified field trapping methodology with Regional Coordinators and Regional Consultants (April-May)
- Established data management coordination with DJS Consulting (May)
- Provided updated summaries to Regional Coordinators, Consultants and other key project cooperators (June)
- Initiated economic analysis data collection (June)
- Supported Certis' design and execution of comprehensive harvest sample damage analysis (September)
- Summarized field data for industry presentations (October)

Industry and General Public Communications

- Published industry solicited article on project description, goals and objectives in Diamond Walnut Newsletter, January. This newsletter is sent to approximately 50% of California walnut growers
- Published industry solicited article on project history, design, goals and objectives in Walnut Marketing Board Newsletter, June. This newsletter is received by all California Walnut Growers
- Field meeting with Sacramento Bee to develop a newspaper article highlighting the CAP walnut project, Marysville, CA, May 21
- Sac Bee newspaper article "Pheromones are in the air" published June 9

<u>Implementation of Sprayable Pheromone and other CM Treatments</u>

Approximately 832 of the 900 project acres were treated with label rates of sprayable pheromones (the remaining acreage was used as comparison blocks). Approximately 663 project acres were treated with 3M MEC-CM® and 226 acres with Suterra's Checkmate® CM-F. In Tulare County only, sixty project acres were designated "conventional" and not treated with pheromones. These blocks were used as a comparison with nearby pheromone treated blocks. Pheromone treatments were initiated soon after materials were available and, in all but the Southern Region, prior to peak flight of overwintering moths. Due to the early

flights in the Southern Region, Lorsban was applied in the spring prior to application of pheromones.

In the South Region, supplemental chemical sprays were applied to two blocks. Confirm (tebufenozide) was applied to 20 acres (Vina variety) where May-June dropped nut counts averaged more than 12 nuts per tree. Lorsban (chlorpyriphos) was applied to a second orchard where the grower feared another potential worm pest (redhumped caterpillar, Schizura cocinna).

There were no attempts to determine differences between the two sprayable pheromone products and none can be inferred from the results of this year's field experience.

Cooperating growers and consultants agreed that the incorporation of sprayable pheromones into their pest management program in 2002 was technically feasible though prohibitively expensive in terms of out of pocket costs relative to their conventional pesticide program. Based on their use of sprayables in 2002, all consultants and all but one grower stated willingness to examine sprayables in 2003. These cooperators stated that the expansion in use of sprayables would be a function of the cost of the sprayable product in 2003 and the willingness of their clients to incur added costs of purchasing sprayables.

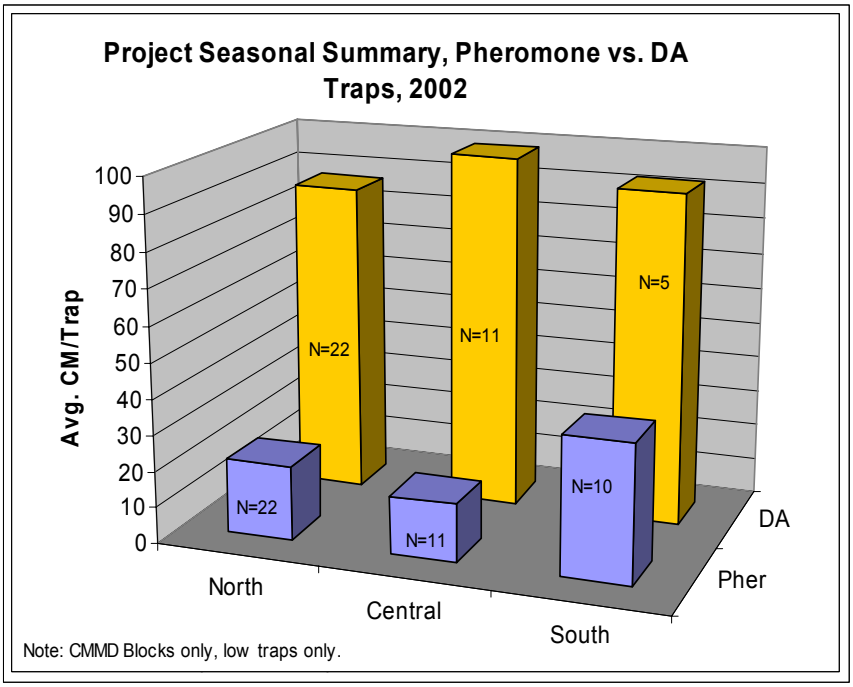
Codling moth trapping results

Field results represent the springtime period through the end of the codling moth flight in September.

Project orchards were all trapped with both 1X pheromone baited and kairomone baited traps donated by Trece, Inc. Most blocks received pheromone applications aimed to disrupt mating of the overwintering adults that emerged this spring and/or their offspring.

By the end of September, project cooperators had completed trapping of the codling moth populations, dropped nut evaluations and canopy nut count evaluations for codling moth damage. Certis sponsored harvest "wind row" nut samples of those project orchards that utilized 3M's CM-MEC sprayable pheromone.

Each cooperating orchard (with the exception of the "comparison blocks in the south region) received one or more sprayable pheromone applications and was trapped with both pheromone baited and kairomone (a.k.a. DA lure) baited traps. The purpose of this lure comparison was to evaluate the potential of the DA lure as a potential tool for monitoring codling moth adults in pheromone disrupted environments where pheromone traps are "masked" by the mating disruption treatment. Results of the trap counts are summarized in Fig. 1.



Pheromone vs. DA

Seasonal Flight	Avg/trap	
	Pher	DA
North	20.77	87
Central	16.09	98.81
South	38.3	92.4

Figure 1. CAP walnut project statewide seasonal summary of codling moth trap count averages in DA baited traps compared to pheromone-baited traps.

In most project orchards, once sprayable pheromones were applied, pheromone baited trap counts declined relative to DA traps. Through the end of the overwintering flight, DA trap captures, on average, exceeded pheromone traps by a ration of at least 4:1, 6:1 and 2.4:1 in the North, Central and South regions, respectively. Cooperating consultants expressed strong interest in the ability of DA traps to capture moths when pheromone traps were effectively shut down.

Dropped nut damage evaluations

Dropped nut counts were taken in six participating orchards as the overwintering flight neared its end in late May and early June. Results generally demonstrated acceptable suppression of the overwintering CM flight. Average dropped nut counts ranged from 0 to 5 nuts per tree. The higher averages generally occurred in later samples.

Consultants were uncertain as to the ultimate benefit of dropped nut assessments. Because dropped nuts represent damage after the fact, they are valuable as an indication of past control failure and as an indication of the potential for increased damage risk in subsequent CM generations.

Canopy count damage evaluations

Systematic canopy count evaluations were conducted in the South and Central Regions. Results showed no substantial differences in CM damage levels between pheromone blocks

and comparison blocks. CM infestations remaining on the trees at the end of the overwintering flight were generally less than 1%, well within acceptable damage levels. One Central Region orchard exhibited 4% infested nuts in a small area within a 25-acre block. Consequently, the crop consultant treated this area with chlorpyriphos in early July. Consultants agreed that, even though no direct correlation with harvest damage exists, canopy counts are, nonetheless, important in the assessment of harvest damage potential.

Harvest damage evaluations

Commercial harvest grading methodologies typically do not discriminate species-specific insect damage. In order to better determine the effectiveness of the 3M sprayable pheromone, Certis, in cooperation with project participants, conducted a series of windrow samples at commercial harvest to determine the species of Lepidoptera insects infesting harvested nuts.

In each of the 5 orchards where 3M pheromone was used, a series of four samples were collected, one sample each in the north, south, east, and west directions from the second tree away from DA baited codling moth traps. For each sample, two opposite swaths at 45º angles to the tree row were raked and a minimum of 100 nuts per sample were collected, hulled and immediately delivered to the Dried Fruit Association in Fresno, CA. From these collections, 100 nuts per sample evaluated for the number of "blows" (i.e. dried and/or shriveled nut meats), codling moth damaged nuts, codling moth larvae present, Navel Orange Worm (NOW) Amylois transitella damaged nuts and NOW larvae present. A total of 130 samples were taken from the 5 cooperating orchards.

The results of this survey demonstrated low infestation levels of CM and NOW in all harvest samples. Most insect damage resulted from NOW. There was no apparent correlation of harvest damage to earlier canopy or dropped nut damage assessments.

Economics

- Input Costs

3M-Canada and Suterra have made significant contributions of their sprayable pheromone products to grower cooperators in 2002. Trece, Inc. has contributed all the DA trapping supplies. These contributions reduced the participation costs to growers and were favorable incentives for cooperators to be involved in the CAP project.

At the March planning meeting, the core participants determined that, during this initial project field year, they were primarily interested in tracking costs of materials and applications. Consequently, these costs to the grower have been calculated from their pesticide use in cooperating orchards. Input costs are calculated from the commercial price for products and applications reported by PCA cooperators. To compensate for the value of contributed pheromone product, the list cost (including estimated cost of sprayable pheromone) and the actual costs (excluding the value of contributed pheromone) are compared.

Where data allowed comparisons of the CMMD blocks with non-pheromone treated blocks (South Region only), list vs. actual costs of the pheromone program were substantially higher than the comparison blocks (Figures 3 & 4). On average, these cooperating growers actually spent $116 per acre more than their comparison blocks. Were it not for donated product, they would have spent $193 per acre more.

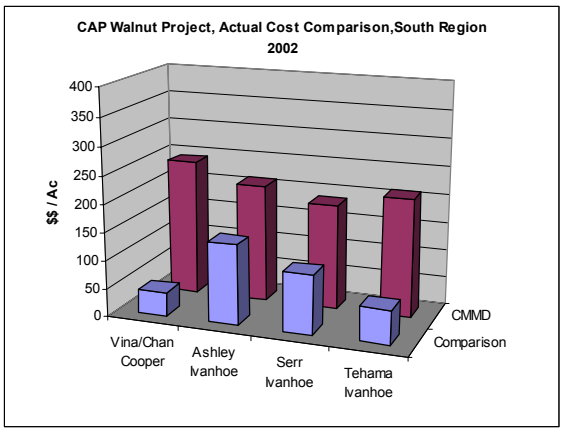


Figure 3. Comparison of *list* costs in the pheromone treated blocks vs. the comparison blocks in Tulare Co.

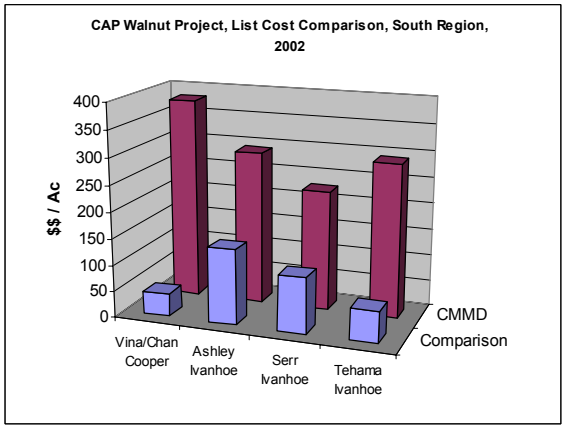


Figure 4. Comparison of *actual* costs in the pheromone treated blocks vs. the comparison blocks in Tulare Co.

Overall, CMMD potential (i.e. list) costs to growers averaged $ 283, $170 and $118 per acre in the south, central and north regions respectively. Because of product contributions, cooperators actually spent $207, $61 and $52 per acre, respectively (Fig.5).

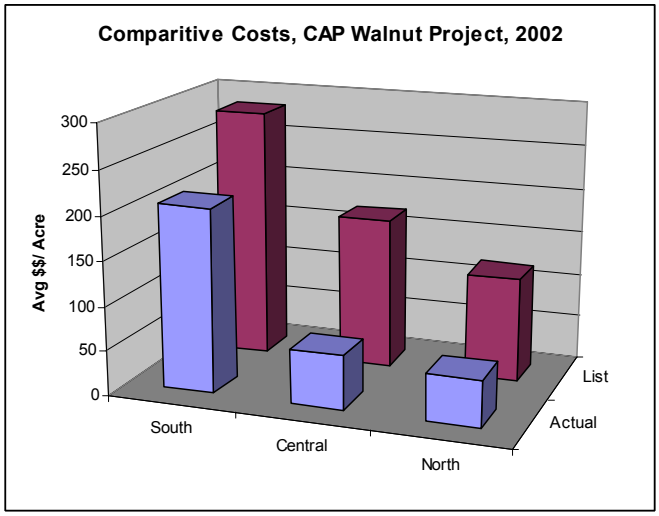


Figure 5. Regional comparison of average list costs vs. actual costs for sprayable pheromone treatments

As a result of the actual or potential costs to growers realized with sprayable pheromone this season, cooperators have determined that, for sprayable pheromones to be adopted, a more targeted approach to pheromone use will be required to minimize costs.

Core participants gathered for a facilitated evaluation session after the field season. The project was evaluated for its effectiveness in providing the information and support necessary for conducting field efforts. Participants indicated that the network created between and among PCAs and industry suppliers was a particularly valuable outcome. In evaluating the process, participants commented that the amount of work and clarity of direction achieved during the year far exceeded their previous experience in similar project efforts.

Accomplishments
Project Evaluation

- **Is/did the project succeed(ing) in solving the problem**
- **How can you tell**
- **What are/were the critical factors in its success/failure**
- **What are/were the key problems that were encountered**
- **What unforeseen events shaped the project**
- **If you were to start the project over again, what would you do differently**
- **What has happened since the project ended**

Evaluation of the project was conducted through an analysis of field data at the grower level and then aggregated to determine the overall project impacts.

Key factors in the success of the project were the time and effort spent in determining the feasibility of the project, its design and in the creation of an implementation network. A network of stakeholders including growers, crop consultants, Diamond of California field staff, a large independent processor, industry consultants, product manufacturers, product distributors, commodity group personnel and university and cooperative extension personnel were brought together to focus on project objectives. Project coordinators and consultants designed field evaluation methodologies and protocols and conducted the agreed upon tasks. These cooperators began building an experience base relative to project objectives and CAP methodologies. Biological, economic and decision-making data collection occurred in a planned and timely manner. Cooperators individually and collectively developed a sense what was and was not working with the project. Systematic efforts were made to expand the number of acres and cooperators for the 2003 growing season.

The key problems encountered were the expense of the pheromones and the availability of three inexpensive OP alternatives for codling moth control in walnut production. The

newness of the kairomones and the lack of historical data to assess the results from the DA lures were anticipated. This first year was considered a beginning step in using the kairomone-baited traps. However the ambiguity of results from the use of sprayables was not anticipated and tempered the desires of cooperators to greatly expand 2003 implementation of sprayable pheromones.

The end-of-season project evaluation meeting provided the opportunity for participants to determine the next course for implementation. Participants indicated that they would use sprayables at roughly the same levels in the 2003 growing season. However, it also became clear that at this point on the implementation curve an alternative approach to implementation would be more effective. Instead of relying on sprayables as a wholesale substitute for OP's and thereby essentially using them prophylacticly, it was suggested that they be introduced into a system at low rates in combinations with OPs or other controls. Limited research has suggested that the addition of low rates of sprayable pheromone may reduce codling moth populations below levels achieved by an insecticide alone. That reduction in population and the resulting reduction in damage below 5% would qualify the crop for a series of premiums if delivered to Diamond. The price premiums could offset any additional expenses from the inclusion of pheromone. In this way, the use of the pheromones could be introduced and its value demonstrated more easily to the grower while additional experience was gained in the wider use of the materials.

Thus, while the problem of codling moth was not completely solved by the project, the problem of effective implementation of reduced risk technology was significantly advanced. The industry collectively gained the experience that can only be derived form commercial implementation by field practitioners on a wide scale. By having a systematic process and network for conducting that work, knowledge was gained that will serve as the foundation for subsequent efforts.

The unforeseen lack of funding terminated the CAP's involvement in the project. Because of the nature of farm-based implementation projects, substantial funding over a period of as many as 5 years is probably necessary to sustain project integrity leading to a significant, measurable and lasting project legacy. That sustained funding was not available for this project.

In retrospect, the in-season data collection and dissemination effort was not feasible or necessary. PCAs indicated that they did not have the time to submit data or the time to look at it during the season. Indeed, they said that "after the fact" data was of little use in real time, on the spot decision making. They suggested that a more informal network by which PCAs share their observations with each other in real time would have been a better means for communication and coordination.

Recommendations

What additional resources would be/have been particularly useful?

- **Are/were USDA resources used in this project - why or why not**
- **If USDA resources are/were available for this effort how could they be/have been more useful**
- **What outstanding needs would you look to USDA to fill? How should USDA programs be structured and managed to meet those needs.**
- **What EPA actions would/would have contributed to the success of the project**
- **How can successes and barrier reduction/elimination be applied to other transition efforts**

The availability of multi-year implementation funds is critical. It is hard to enough to find and keep skilled staff for a few years of soft funding. It is impossible to retain good staff when funding is from year to year. Having the funds to conduct a feasibility assessment and to effectively design the project was particularly important. Those funds are also largely non-existent. Funds directly available for wide-scale, commercial implementation efforts are virtually non-existent.

CAP applied to USDA – PMAP but was turned down in large part due to the term of the project and the amount of money requested. USDA staff indicated that CAP should, instead, apply for funding from CAR or RAMP – programs for which CAP was not eligible to apply since it is not a land grant university. While we could have applied to those programs under the auspices of a land grant, $50,000 to $80,000 of the money requested for work in the field would have been taken by a university for overhead. CAP declined to make application.

USDA funds were not directly used in this effort but the contribution of individuals who received USDA funds were important. The work of Dr. Steve Welter served as the basis for the protocols used in the project. His research was supported by an IFAFS grant – USDA no longer makes those grants available for pest management activities – and a RAMP grant. The development of the DA lure and the protocols for using it were supported by USDA ARS in California and Washington. In addition, UC-IPM extension specialists participated in the project and provided expert assistance.

As valuable as those research, education and demonstration programs are they do not directly further implementation. The dividends from USDA's investment in research, demonstration and education accrue to farmers only to the extent that they can put the results to use in their own operations.

USDA needs to establish a program specifically dedicated to supporting the commercial field implementation of new practices. A systematic process for conducting implementation efforts should be adopted that all program participants use in creating field results. This sort of program would result in real benefits for farmers, advancing their production practices. It would also provide measurable benefits for human health

and the environment. Finally, it would capitalize on the valuable investments in research, education and the registration of new pest management technologies.

IN order to ensure implementation results, the program should be targeted toward working with the private sector. Non-land grants should be eligible and land grants participating the in program should share funding with private sector entities. PMAP is the only program open to non-land grants. Originally intended to support implementation efforts with growers, it has now been designated as a research program by USDA.

Making the program open to non land grants is very important. CAP and other private sector organizations have encountered resistance, bordering on hostility, as the land grant system has apparently viewed the private sector as a competitor. Ignoring the irony of taxpayers being criticized by public employees as competing for their own money, the resistance of the land grant system is unfounded. Over the last six years, CAP has brought $1.2 million of new money directly to the universities with which it has worked. The reality is that implementation is a private sector effort that uses both private and public information. By definition the private sector must be at the center of the implementation process.

The conservation programs, EQIP and CSP, may provide the means for creating a dedicated implementation effort, even without changes in the other USDA programs. Given their objective of on the ground changes, they are well suited for use in implementation efforts. Additional work will need to be done with EQIP, its Conservation Innovation Grants program, and CSP, to ensure that they can effectively address the problems encountered in the adoption of reduced risk practices.

Delays in the registration of sprayable pheromones on walnuts by EPA almost prevented the project from taking place. This was due in part to the review of inert ingredients. That process needs to be improved so that pheromone registrants are able to refine their formulation and increase the longevity of the pheromones in the field without unduly restricting the commercial use of pheromones in the field. In addition EPA funds intended to aid reduced risk efforts need to focus on the tasks necessary to get newly registered alternatives used in the field.

CAP's experience can have application to a wide range of crop/pest/pesticide combinations. The overall process works and the engagement of the private sector makes field results possible.