PROGRESS REPORT
APRIL 15, 1999
ALTERNATIVE PRACTICES FOR REDUCING PESTICIDE IMPACTS ON WATER QUALITY
CONTRACT #B-81609

This report summarizes activities and accomplishments since our last progress report on January 15, 1999. Task Orders for Year 1 of the contract are presented together with "**REPORT**" sections on the status of each task.

TASK ORDERS
October 1, 1998 – September 30, 1999 (Year 1)
Contract No. B81609

TASK 1 – MATRIX OF INFORMATION SYNTHESIS – Year 1

Compile the current knowledge of urban and in-season agricultural (stonefruit and almond production) pest management practices that are alternatives to diazinon and chlorpyrifos. Currently fragmented information on these alternatives will be compiled from scientific journals, research reports, and unpublished (anecdotal) investigations primarily found at the U.C. Cooperative Extension county level of ongoing applied research. From the compiled knowledge, produce an information synthesis document, the Alternative Practices Matrix, that will display a comprehensive set of interactive variables relative to alternative practice economics, efficacy, and environmental impact potentials.

Subtask 1. P.I.s will recruit and hire a research assistant with sufficient technical expertise in pest management and aquatic toxicology and demonstrated writing skills. Estimated duration for this task is 2 months beginning October 1, 1998.
Subtask 2. Research assistant will begin compiling information on urban and in-season agricultural (stonefruit and almond production) uses of chlorpyrifos and diazinon.
Subtask 3. Research assistant and P.I.s will identify the uses that suggest the highest potential for impacting surface waters due to their being consistent with observations of seasonal increases in aquatic areas within the CALFED geographic scope. Estimated duration for this task is 6 months.
Subtask 4. Research assistant will begin compiling the literature that addresses alternatives to chlorpyrifos and diazinon for the uses identified in Subtask #3. This task is estimated to begin April 1, 1999 and continue into Year 2.
Subtask 5. Project manager and P.I.s prepare and submit progress reports.

REPORT: The current knowledge of in-season pest management practices that are alternatives for chlorpyrifos and diazinon are being compiled for possible inclusion in the In-season Alternatives Practices matrix. Approximately 50 new references have been retrieved and reviewed by Pattie Gouveia. In addition, she is reviewing approximately 50 other references which comprised our dormant spray matrix; these may have some relevancy to in-season uses as well.

A very informal survey of lawn care providers in Modesto was conducted to determine which materials (diazinon, chlorpyrifos or other) they most often apply. The intent was not to survey for analytical purposes but to get an idea of what products are actually being recommended for lawn care. Philip Tocco surveyed 43 different lawn care companies. This survey further assisted us in defining the criteria for which pests to include in the urban matrix.

We estimate Task 1 to be 30-40% complete for Year 1.

TASK 2 – ALTERNATIVE PRACTICES EDUCATION AND OUTREACH – Year 1

Programs will be developed to provide agricultural producers (stonefruit and almonds) with a detailed assessment of the current knowledge of water quality problems associated with pesticide use while offering substantive alternatives. For urban users of diazinon and chlorpyrifos, the education and outreach component of the project will define the main urban uses of diazinon and chlorpyrifos, establish the most appropriate priority of audiences to address, and identify the most appropriate means of gaining access to these audiences.

The following subtasks generally describe the approach and sequence of work on behalf of both the agricultural and urban components of this project.

Subtask 1. Recruit and hire a county-based (Cooperative Extension) research assistant and a rural sociologist to interact with the P.I.s and Cooperative Extension personnel in the case study area (Modesto region). Estimated duration for this task is 2 months beginning October 1, 1998.
Subtask 2. CE research assistant will begin developing baseline information on current pesticide use practices within the case study area. Estimated to begin December 1, 1998.
Subtask 3. Sociologist will develop questionnaire materials that will allow for measures of the influence education and outreach efforts have on adoption of alternative practices.
Subtask 4. CE research assistant, P.I.s, and project manager will identify local, regional, and state agencies and organizations that are stakeholders in urban and in-season agricultural uses of chlorpyrifos and diazinon.
Subtask 5. CE research assistant, P.I.s, and project manager will create or interact with existing advisory committees involved with education and outreach to the major urban and in-season users of chlorpyrifos and diazinon.
Subtask 6. CE research assistant, P.I.s, and project manager will establish the most appropriate priority of audiences for directing educational and outreach efforts (e.g. licensed applicators, wholesale/retail nursery distributors, residential users, crop associations). This task is estimated to begin January 1, 1999.
Subtask 7. CE research assistant, sociologist, P.I.s, and project manager will identify the most appropriate means of gaining access to the audiences identified in Subtask #6.
Subtask 8. CE research assistant, P.I.s, and project manager will develop educational materials appropriate for the focal audiences. Sophistication of educational materials will be consistent with the scope of the budget for this project.
Subtask 9. The products of Tasks 6-8 will be submitted to the steering committee and CALFED for review and comment.
Subtask 10. CE research assistant, P.I.s, and project manager will begin implementing education and outreach efforts. This task is estimated to begin February 1, 1999 and continue into Year 2.
Subtask 11. Project manager and P.I.s prepare and submit progress reports.

REPORT: As stated in our previous report, the CE research assistant, the P.I.s and the project manager are continuing to identify local, regional and state agencies who are stakeholders in major uses of chlorpyriphos and diazinon. We continue to interact with existing advisory committees involved with education and outreach to major users of chlorpyriphos and diazinon.

Our most disappointing setback occurred in March when Phillip Tocco was unexpectedly offered a promising career opportunity back East and couldn't afford to turn it down. This leaves us once more searching for someone to fill the position of CE research assistant. Finding a replacement as capable and productive as Phillip will be a considerable challenge.

Subtasks 8 through 10 are still scheduled to be addressed later in the project. Dr. Zalom did make eight presentations this last quarter to a variety of commodity groups. His presentations addressed multiple issues related to the use of organophosphates relative to water quality and identifying alternative practices for their use.

We estimate Task 2 to be 30-35% complete for Year 1.

TASK 3 – FIELD STUDIES OF ALTERNATIVE PRACTICES – Year 1

Develop a master protocol for monitoring studies that will clearly identify the criteria for selecting a site to simultaneously study the efficacy of an alternative practice relative to pest control and improving water quality. Year 1 efforts will focus primarily on alternatives to dormant sprays. Select study sites and initiate field studies. Water quality monitoring will determine whether reduction of offsite pesticide movement follows adoption of alternative practices, and whether toxicity to test organisms is also diminished. Pest control monitoring will compare efficacy of diazinon and chlorpyrifos with alternative treatments for control of peach twig borer and scale insects in replicated field trials where the toxicology monitoring will also be conducted. Additionally, develop resident species bioassays as alternatives to the standard EPA test organisms.

Subtask 1. CE research assistant and P.I.s will prepare a draft master protocol that identifies the criteria for selecting sites for studying dormant spray alternative practices relative to pest management efficacy and impacts on surface water quality (e.g. type of irrigation supply, mode of water application, crop, design of hydrology of field for irrigation purposes, slope of land, soil type, surrounding vegetation, and relationship to surface waters). Additionally, the protocol will define the parameters to be controlled, parameters to be measured or described, the methodology of measurement, and the analytical processes for data production and evaluation. This task is estimated to begin October 1, 1998 and reach full refinement by July 31, 1999 following peer reviews as described below.
Subtask 2. CE research assistant and P.I.s will meet with Cooperative Extension advisors and growers to identify and select areas with history of appropriate pest incidence and consistent with the master protocol criteria for field studies. This task is estimated to begin December 1, 1998 and be finalized with the completion of task #3 by January 1, 1999 for dormant alternative studies.
Subtask 3. Submit draft master protocol and proposed study sites to project steering committee and the CALFED monitoring group for review.
Subtask 4. CE research assistant and P.I.s will refine draft master protocol and site selections according to recommendations of steering committee. The draft master protocol and site selections will also be given to the CALFED monitoring group for their review. This task is estimated to be completed by January 1, 1999.
Subtask 5. Survey proposed sites pre-treatment to establish initial presence of target pests as the final site selection criteria.
Subtask 6. For the purpose of establishing baseline data, CE research assistant and toxicology lab personnel collect water samples from proposed study sites and perform bioassays and chemical detection for definition of pre-alternative pesticide status. Siting and replication of sampling will be consistent with the master protocol. Two of the standardized US EPA test organisms will be used: the fathead minnow (*Pimephales promelas)* and the water flea (*Ceriodaphnia dubia*). In addition, highly selective analytical chemistry and toxicology endpoints will be used to determine presence and concentration of specific agents. To establish number of toxic units present in the sample, dilution tests will be used.
Subtask 7. CE research assistant and growers initiate treatment of field study sites. Replicated treatments may consist of the target organophosphates, alternative conventional pesticides (carbamates, pyrethroids including Ambush and Asana), microbial or other biologically-based pesticides that are generally regarded as "safe" (for example *Bacillus thuringiensis,* Spinosad and pheromones), in season (rather than dormant season) applications of these materials, and reduced rates of application.
Subtask 8. CE research assistant and P.I. begin monitoring pest incidence and damage in each treatment replicate after treatments have been established. Monitor peach twig borer shoot strikes and fruit damage at harvest. Monitor San Jose scale males with pheromone traps and scale populations on wood and fruit.
Subtask 9. CE research assistant and toxicology lab personnel collect water samples from study sites according to master protocol and perform bioassays and chemical detection for pesticide levels.
Subtask 10. Recognizing that chronic bioassays need to be developed which will use indigenous species that can ultimately be related to the three US EPA standard organisms, toxicology lab personnel will select candidate organisms on the basis of their role in the food web of CALFED-identified, endangered, and/or listed fish species. They will collect organisms and establish cultures of 4 resident food web organisms. Estimated to begin August 1, 1998 and be completed by February 1, 1999.
Subtask 11. Toxicology lab personnel will conduct bioassays with native food web organisms (a. benthic midge *Chironomus sp.*; b. cyclopoid copepod; c. cladoceran *Bosmina sp.*; and, d. amphipod (*Corophium sp.)*. Rank order

as to sensitivity and select one sensitive and one moderately sensitive species for bioassays. Estimated to begin January 1, 1999 and continue into the early part of year 2.
Subtask 12. Toxicology lab personnel will initiate studies and evaluate resident species for use in Toxicant Identification Evaluations. Estimated to begin June 1, 1999 continue into year two as necessary.

REPORT: In our previous report, we commented on the limitations inherent in development of the master protocol portion of this task. However, we chose to rethink this limitation and proceeded to develop the protocol based on our current and best knowledge. Refinement of the protocol will occur as we learn from our current and future field studies. Development of the protocol was primarily accomplished by Phillip Tocco's diligence in pulling together the methodologies and the thinking of the various disciplines involved in this project. Once compiled and reviewed "in-house", the draft was submitted to nine other individuals (primarily CE Farm Advisors) considered to have expertise in orchard management and pest control. The revised protocol is now ready to be submitted to the CALFED monitoring committee (Jeff Phipps).

Water (runoff) samples were collected from our two field study sites. At the first site, in Merced County, which involved three replicates of four pesticide treatments (an OP, a pyrethroid, Spinosad, and control), we collected 12 runoff samples during each of two major rainfall events. At the second site, in Glenn County, which involved three replicates of three pesticide treatments (an OP, a pyrethroid, and control) combined with four treatments of ground cover vegetation, we also collected runoff samples as well as made measurements of estimated total runoff from multiple rainfall events. In our next quarterly report we anticipate being able to provide a summary of total numbers and types of samples collected along with the results of toxicity assays already done (approximately 50) as well as analyses still pending (approximately 200). That summary will also address a couple of pitfalls encountered in one of our trials and the lessons learned which will surely enhance our data collections during the next dormant season.

Dr. Wilson's laboratory has received the water samples (approximately 200) from Dr. Hinton's Aquatic Toxicology Laboratory. The samples are being stored frozen pending the anticipated validation of analytical methodologies. Methodologies for Solid Phase Extraction (SPE) of diazinon from water and GC analysis are in hand. Pilot experiments with esfenvalerate and SPE have been carried out; there appears to be excellent recovery. GC conditions for esfenvalerate analysis are being worked out. The lab expects to receive their new Electron Capture Detector (ECD) by the end of April. This will give them greater sensitivity in detecting esfenvalerate. They have given aliquots of some earlier runoff samples to Dr. Hammock's laboratory; his group performed a comparison of ELISA and GC/MS analyses of esfenvalerate and found good correspondence between the methods.

Field sampling for incidence of pest species is scheduled to begin soon. (subtask 8)

Development of alternative test organisms continues with adjustments being made to refine culture techniques for the candidate organisms. (subtasks 10-12)

We estimate Task 3 to be 35-45% complete for Year 1.