

University of California Sustainable Agriculture Research and Education Program

1993 Progress Report 1995

**UC Sustainable Agriculture Research and Education Program
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LETTER FROM THE DIRECTOR

One of the roles of a land grant university is to provide a forum and develop solutions for the challenges of the day. Maintaining and enhancing our natural resource base is one of the greatest challenges we face. SAREP's existence within the University of California is based on the desire of the state's citizens to keep the agricultural system, which is inextricably linked to our natural resources, sustainable. To do this, it is vitally important to prepare people to carefully manage our resources and production systems, anticipating the long-term as well as short-term repercussions of decisions.

The sustainable approach takes the view that we should use natural systems as the model to achieve our goals. It employs agricultural practices that do not disrupt nature, and indeed, may enhance it. At the same time, the sustainable approach should bring economic stability to both the farmer and the community.

In the last decade, many farmers and researchers have found that they can develop sustainable farming systems by working together using participatory, collaborative approaches to solving problems. Farmers have found that both basic and applied research can be very helpful when used in a whole farm, systems-view context. Researchers have also found value working in a co-learning atmosphere with growers. Concrete approaches to improving sustainability in a collaborative



environment include the Biologically Integrated Orchard Systems (BIOS) and the Biologically Integrated Farming Systems (BIFS) projects. Management teams including SAREP, other UC researchers, non-profit organizations, and farm groups are at the heart of these models. Both projects employ a systems-view of agriculture, using soil management as the key to biological integration. They demonstrate the feasibility of farming using natural systems.

In addition to these special programs, SAREP has funded a diverse group of projects in production agriculture, food systems, and economics and public policy. We see these as examples that demonstrate the integration and interconnectedness between the people who produce and consume our food and fiber, and the natural resources necessary to make this production possible. Our staff is working to encourage collaboration and stewardship throughout the state with UC research and extension personnel, farmers and consumers. To keep California's production systems alive and well, we will continue to encourage practices and policies that enhance our natural resources. We at SAREP are pleased to work with people from different backgrounds and experiences to build cooperative management that is aware of its impact on the future.

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INTRODUCTION

In 1986 the California Legislature passed Senate Bill 872, the Sustainable Agriculture Act, to address some of these complex issues. The Act requested that the University of California establish the Sustainable Agriculture Research and Education Program (SAREP) to promote agricultural production and distribution methods that adopt more resource-conserving, energy efficient systems. SAREP was established in the fall of 1986.

SAREP Goals

The goal of the UC Sustainable Agriculture Research and Education Program is to support scientific research and education required for the development of more economically viable, environmentally sensitive, and socially responsible agricultural practices and policies, and to disseminate this information to farmers, ranchers, researchers, policymakers and other interested parties.

The 1986 Sustainable Agriculture Act defines SAREP's three main responsibilities:

The Administration of Competitive Research Grants

The program has awarded over \$2.6 million to approximately 161 basic and applied research projects, economic and public policy research projects, seminars and field demonstrations, and graduate student grants. These projects include studies of sustainable cropping systems, animal husbandry, habitat enhancement for biological pest management, economic analyses of farming systems, and topics in community development, marketing, public policy and consumer education related to sustainable food systems.

The Development and Distribution of Information

SAREP has collected, organized and distributed information through the program's quarterly newsletter and other publications, videos, and databases, many of which are now accessible on the Internet. The program's World Wide Web Home Page includes links to information about SAREP-funded projects,

newsletter articles, and requests for proposals for competitive grant programs. SAREP has also sponsored, co-sponsored, or supported many workshops, conferences and seminars that share the results of research and extend it to a variety of audiences throughout the state.

The Support of Long-Term Farmland Studies

In 1990, SAREP helped fund the first 100-year, irrigated farmland research site in a Mediterranean climate anywhere in the world. SAREP continues to fund research that addresses long-term issues related to sustaining California agriculture and the natural and human resources upon which it depends.

In the nine years since its inception, SAREP has been a catalyst within California agriculture, in its communities and within the land grant university system nationwide to find solutions to the complex problems we face. This report summarizes SAREP's activities in FY 1993/1994 and FY 1994/1995, beginning where **Progress Report 1990-1993** ends.

Public and Technical Advisory Committees

Public and technical advisory committees advise SAREP on its goals and make recommendations on the award of competitive grants. The Public Advisory Committee includes individuals actively involved in agricultural production (large, medium and small-sized conventional and organic growers), as well as members from government, consumer and environmental organizations. The Technical Advisory Committee is made up of faculty, specialists and farm advisors throughout the state with knowledge and experience in diverse areas related to sustainable agriculture. Individuals on the public and technical advisory committees serve three-year terms with some members rotating off each year. The diverse composition of SAREP's Public and Technical Advisory Committees reflects the breadth of our goals.

1995 Public Advisory Committee Members

ε **CATHERINE BRANDEL**, chef at Chez Panisse, Berkeley, Alameda County

ε **PETER COOEY**, legislative director for California Assemblymember Mike Machado (D-San Joaquin County)

JENNIFER CURTIS, senior research associate, Pesticide Project, Natural Resources Defense Council, San Francisco

FRANK DAWLEY, ranch manager, Big Bluff Ranch, Red Bluff, Tehama County

GAIL GANT, consultant with Weddle, Hansen and Assoc., a private environmental and agricultural consulting firm, Placerville, El Dorado County

MARION KALB, executive director of Southern California's 20-market Southland Farmers' Market Association

RON MANSFIELD, grower, packer and shipper, Goldbud Farms, Placerville, El Dorado County

JOHN ROBERTS, vice-president and director of research, The Center for Living in Harmony, a nonprofit educational and charitable organization and demonstration site, Valley Center, San Diego County

BRYTE STEWART, partner in a family farm in Rio Vista, Solano County and its native grass

seed business

CRAIG UNDERWOOD, partner in a family farming operation, Ventura County

DON VILLAREJO, agriculture policy analyst at the non-profit California Institute for Rural Studies in Davis, Yolo County

ANGUS WRIGHT, professor of environmental studies, California State University, Sacramento

1995 Technical Advisory Committee

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EDITH ALLEN, natural resources extension specialist in the Department of Botany and Plant Sciences at UC Riverside

SCOTT JOHNSON, pomology extension specialist at the UC Kearney Agricultural Center in Parlier, Kern County

DON KLINGBORG, assistant dean for the Office of Public Programs, School of Veterinary Medicine, UC Davis

HOLLY GEORGE, UC Cooperative Extension county director and livestock/youth development advisor in Plumas and Sierra counties

DON NIELSEN, professor of soil and water science, Department of Land, Air and Water Resources, UC Davis

JUAN VICENTE PALERM, professor of anthropology at UC Riverside and director of UC MEXUS, a statewide program on U.S./Mexico issues and research

ELLEN RILLA, UC Cooperative Extension county director in Sonoma and Marin counties

CAROL SHENNAN, associate professor, Department of Vegetable Crops, UC Davis

TOM SHULTZ, UC Cooperative Extension dairy advisor in Tulare County

LUCIA VARELA, UC Cooperative Extension Integrated Pest Management advisor, North Coast

SAREP Staff

The SAREP staff includes 13 individuals, who fill the equivalent of 9.6 full-time positions, of which 1.5 full-time positions are paid for by external sources of funding. All but one staff member is located at UC Davis. The staff administers and manages SAREP's competitive grants program as well as the Biologically Integrated Farming Systems (BIFS) program grants, and also gathers, synthesizes, and distributes a wide variety of information about sustainable food and agricultural systems throughout California. Areas addressed by SAREP staff include annual cropping systems, tree and vine crops, cover crops, pest management, soil quality and management, restoration ecology, economics and public policy, farmworker issues, consumer issues, nutrition and sustainable food systems, and biotechnology and sustainable agriculture.

Staff also focus on education and outreach through the program's quarterly newsletter, SAREP's World

Wide Web server on the Internet, an interactive sustainable agriculture electronic mail network, the production of numerous publications, and participation in various conferences and training events.

After years of being split into offices at two locations, SAREP staff members all moved to the new UC Division of Agriculture and Natural Resources (DANR) building on Hopkins Road in the far west section of the UC Davis campus in December 1994. The program shares the building with the UC Small Farm Center, the Genetic Resources Conservation Program, and the offices of the directors of DANR's North Region and North Central Region.

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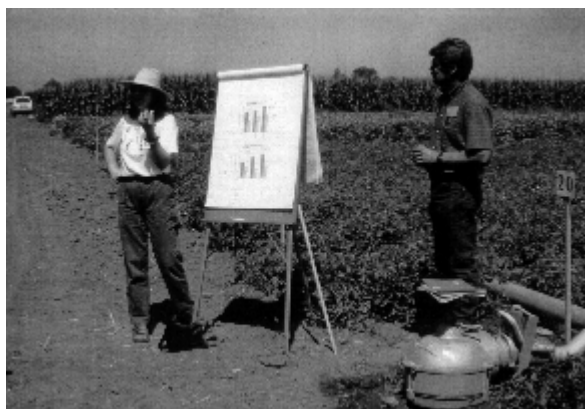
(1) 50 percent funded by USDA

(2) funded primarily by California Energy Commission

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COMPETITIVE GRANTS PROGRAM

A primary function of the program is to offer grant money for research and education projects. SAREP has awarded over \$2.6 million in grant monies for 161 projects over the last nine fiscal years (FY 1986/87 - FY 1994/95). In FY 1993/94 and FY 1994/95, SAREP spent over \$367,000 in new and continuing competitive grants. These projects fall into two general areas: economics and public policy and sustainable agricultural production. SAREP has also funded one cropping systems comparison project for the last seven years. This project will be described first, followed by new and continuing projects funded in FY 1993/94 and FY 1994/95 and older projects that have submitted final reports in the last two years.



Many of the other projects SAREP funded in previous funding cycles have now been completed. SAREP has worked with investigators to publicize results through the program's newsletter, university information channels, conferences, and electronic and print media for the public. These projects are also described in **SAREP's Progress Report 1986-1990** and **Progress Report 1990-1993**.

A COMPARISON OF CONVENTIONAL, LOW-INPUT AND ORGANIC FARMING SYSTEMS: THE TRANSITION PHASE AND LONG-TERM VIABILITY

Budget:

FY 88/89: \$50,000

FY 89/90: \$50,000

FY 90/91: \$50,000

FY 91/92: \$50,000

FY 92/93: \$37,500

FY 93/94: \$37,500

FY 94/95: \$49,753

Investigators:

Howard Ferris, professor, Department of Nematology, UC Davis
Lee Jackson, agronomist, Department of Agronomy and Range Science, UC Davis
Karen Klonsky, specialist, Department of Agricultural Economics, UC Davis
Thomas Lanini, weed ecologist, Department of Vegetable Crops/Weed Science, UC Davis
James Marois, professor, Department of Plant Pathology, UC Davis
Robert Miller, lecturer emeritus, Department of Land, Air and Water Resources, UC Davis
Larry Schwankl, irrigation specialist, Department of Land, Air and Water Resources, UC Davis
Kate Scow, associate professor, Department of Land, Air and Water Resources, UC Davis
Carol Shennan, associate professor, Department of Vegetable Crops/Weed Science, UC Davis
Steve Temple, specialist, Department of Agronomy and Range Science, UC Davis
Ariena van Bruggen, associate professor, Department of Plant Pathology, UC Davis
Frank Zalom, director, Statewide IPM Project/specialist, Department of Entomology, UC Davis

Cooperators, Advisors and Staff:

Jim Durst, farmer, Yolo County
Diana Friedman, research manager, UC Davis
Tom Kearney, UC Cooperative Extension farm advisor, Yolo, Solano and Colusa counties
Julie McNamara, information specialist, UC Davis
Gene Miyao, UC Cooperative Extension farm advisor, Yolo and Solano counties
Bruce Rominger, farmer, Yolo County
Ed Sills, farmer, Sutter County
Don Stewart, crop production manager, UC Davis
Tony Turkovich, farmer, Yolo County
Miriam Volat, research assistant, UC Davis

The goal of this long-term research project is to describe and quantify the environmental, agronomic and economic consequences of the transition from conventional farming systems typical of the southern Sacramento Valley to systems that are less dependent on synthetic fertilizers and pesticides. The research team is multidisciplinary and participating farmers and UC Cooperative Extension farm advisors play a key role in guiding the management decisions applied to the various production systems. By broadening and integrating the scope of investigation, researchers have been able to critically evaluate the success of different farming practices and their effects on the environment, as well as the special requirements for adapting alternative practices to farms in other locations.

Rotations and experimental design

The project was initiated in FY 1988/1989, and is located on 28 acres at the UC Davis Agronomy Farm. The main experiment occupies about 20 acres and compares four cropping systems: 1) a conventional two-year rotation; 2) a conventional four-year rotation; 3) a low-input four-year rotation; and 4) an organic four-year rotation. The four systems are arranged in a split-plot design with four replicates of each system. All the cropping systems include processing tomatoes, a high-value commodity grown on approximately 310,000 acres in California (1990 data). Other cash crops grown include wheat, safflower, field corn, and beans. In addition, winter-spring cover crops are grown in the low-input and organic systems. The specific rotations used in the different management systems are shown in Figure 1. Each replicate of the four systems started the rotation in 1989 with a different entry point in the sequence of crops.

Both conventional systems are managed using practices typical for the southern Sacramento Valley. The two-year conventional system is practiced by farmers when short-term profit must be maximized. **The low-input system** includes a winter cover crop prior to planting tomatoes, safflower, corn and beans.

While trying to reduce dependency on non-renewable resources, synthetic fertilizers or pesticides may be used in the low-input system to maintain the profitability of the operation. **The organic system** is managed according to the certification requirements of California Certified Organic Farmers (CCOF); only approved fertilizers and pesticides are used. "Best farmer" management practices are used in all systems. For example, insect and disease management decisions for all systems are based on periodic monitoring of pest levels, and no pesticides are applied until economic threshold levels are exceeded.

A companion research area of eight acres is being used to test alternative grain and cover crop legumes that could be used as cash crops, as winter and summer cover crops, or in intercropping systems in California. Along with this effort, investigators are evaluating various kinds of agricultural equipment for use in reduced tillage operations and innovative cover crop management.

Figure 1. Summary of Crop Rotations Used in Four Management Systems.								
	Year 1		Year 2		Year 3		Year 4	
Management System	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Summer
Conventional (2 yr)	fallow	tomato	wheat		fallow	tomato	wheat	
Conventional (4 yr)	fallow	tomato	fallow	safflwr	fallow	cover	corn	beans
Low-Input	cover**	tomato	cover	safflwr	cover	corn	oat+vetch	beans
Organic	cover	tomato	cover	safflwr	cover	corn	oat+vetch	beans
<i>** Cover crops used have included vetch, oats, and cowpeas, solely or in mixtures. Other species are currently being</i>								

Observations and results

Researchers have been collecting data on: crop growth, yield and quality; soil biology; soil fertility; soil organic matter levels; soil water infiltration rates; weeds, pest and beneficial insect populations, and disease levels; and economic performance. Some of the key findings and questions for future research are summarized below.

Crop growth and yield. Soil fertility and weed management have been identified as the most important factors limiting yields in the organic and low-input systems. Project managers have altered production practices to address these constraints. Organic and low-input tomatoes, for example, are now transplanted instead of direct seeded. This practice leaves more time for cover crop growth, gives tomatoes a head start in competing against weeds and allows for the use of efficient mechanical cultivation techniques. Manure fertilizers and foliar sprays have also improved yields in the organic systems. Nonetheless, it has been difficult to obtain the high quality transplants necessary for optimal growth and yield. In the 1994 growing season, for example, researchers found that transplants in the organic and low-input systems were infected with a virus. Symptoms became apparent four to six weeks after transplanting, and yields in the organic and low-input systems were lower than in the conventional systems.

Soil biology and fertility. Nitrogen availability appears to be an important factor determining tomato yields during the transition to organic production. Prior to 1992, tomato plants in the organic system were stunted and yellow early in the season, did not compete well with weeds, and had yields lower than

tomatoes grown under conventional methods. These results were despite the fact that soil nitrate levels in the organic tomatoes in 1990 and 1991 were actually higher than or equivalent to levels in the conventional system. The reason for this phenomenon is probably related to the importance of microbial activity in an organic system. Unlike the conventional system where plants obtain nutrients from highly soluble chemical sources, the organic and low-input systems rely on microorganisms to make nutrients available for plant uptake. Through the first four years of the rotation, it has been determined that the low-input and organic systems derived 85 percent of their nitrogen from the vetch cover crop that was incorporated into the soil and broken down by microbes.

To measure the importance of soil microbial activity, researchers looked closely at changes in microbial biomass carbon over the growing season. Microbial biomass carbon is an estimate of both the size of the total microbial community and the mass of potential plant nutrients contained within the cells of the microorganisms. This variable was measured in tomato plots four times between March and September in both 1990 and 1992. Levels of microbial biomass carbon fluctuated similarly in all systems over the growing season. In 1990 the only significant differences among the four farming systems occurred following the early April incorporation of the cover crop, at which time the microbial biomass carbon was higher in the organic and low-input systems. In 1992 microbial biomass carbon was higher in the organic and low-input systems throughout the growing season.

Related studies have shown some interesting differences in nematode populations among the four farming systems. Nematodes can be classified by what they feed on: bacteria, fungi, plants, or other nematodes. In the two conventional systems, the total numbers of all nematodes in the soil (to 30 cm depth) did not change significantly between 1988 and 1992. In contrast, during the same period, there were significant decreases in the total number of nematodes in the low-input and organic systems. Bacterial feeding nematodes are of particular interest because of their role in mineralizing nitrogen. Thirteen of these species have been identified in this research site. The proportion of all nematodes that are bacterial feeders declined over the four years in the two conventional systems, increased in the low-input system and declined in the organic system. The decline in the organic system is surprising given the high levels of microbial biomass measured in those plots. Researchers suggest that the late sampling date for nematodes may have been responsible for this discrepancy.

Insects, Weeds and Diseases. The shift from conventional to low-input or organic pest control did not result in large increases in relative abundance of most pest species over the period of this study. However, there were some significant short-term problems in individual farming systems. Significantly greater damage occurred in organic and low-input plots due to tomato fruitworm in 1989 and stink bugs in 1992, while insecticides prevented damage to conventional plots. Similarly, the cover crop residue appeared to increase damage by seed corn maggot to safflower and corn in two consecutive years. *Verticillium* increased in soils on the conventional two-year plots, probably because of the increased frequency of tomato plantings in this system. The presence of the disease organism, however, does not seem to have affected yields in those plots. Bacterial spot of processing tomato was severe in the spring of 1993, due to rain and a hailstorm. Aerial treatments were not practical for the small plots in this study, but by the time the fields had dried sufficiently for ground application, the weather was hot and dry, stopping the epidemic. Rust occurred every year on all safflower plots. However, it was not observed to cause yield loss. Corn smut was observed in all plots, but the level of its incidence remained below the treatment threshold.

Weeds were a problem in all systems, but the different control methods employed in each system favored the growth of several key species. In the low-input and organic systems, barnyardgrass has become a significant problem. In the conventional systems, field bindweed and nightshade have been more problematic. The shift to these weed species has resulted in modifications to the control strategies, including herbicide changes or increased cultivation frequency, but there has been little or no change in

total weed cover. The vagaries of the weather presented an added challenge in low-input and organic systems. For example, the wet spring in 1993 prevented timely cultivation and resulted in increased weed competition in the organic corn where herbicides were not used.

Economics. Results to date suggest that similar crop yields may be obtained when "best farmer" management practices are used in each of the different systems. Similar yields, however, do not necessarily translate into similar profits. The yields and organic price premiums of tomatoes, and year-to-year variation in production costs for each system were the most important factors determining relative whole-farm profit (Figure 2). During the 1991 growing season, for example, gross returns, per acre operating costs, and net returns above total costs were all highest in the conventional two-year rotation (all crops combined). The 1992 season, by contrast showed that the organic systems had the highest figures in each of these same categories. Reduced whole-farm profits per acre in the 1993 and 1994 seasons can be attributed to problems with tomato transplants as described earlier.

Results of this study support what other studies have found: The transition period (as evidenced by the performance of the low-input system) carries significant risk. There are no price premiums for "transitional commodities," costs of production may be high, growers are generally on the steep part of the learning curve, and the new production system can be ecologically unstable for a time.

Conclusions

From the standpoint of crop performance and yield, it appears that a rotation of processing tomatoes, safflower, field corn and wheat or winter legume, followed by double-cropped dry beans, is a good crop rotation on which to make systems comparisons. The use of nitrogen-fixing winter cover crops for green manure and as seed crops has merit, but also resulted in crop management challenges that required "best farmer" experience and flexibility to work within the constraints imposed by time and weather. The late winter, early spring management of cover crops, including residue management, seedbed preparation, supplemental manuring and the retention of sufficient soil moisture to germinate tomatoes, corn and safflower has become a central research theme for continuing studies in the large companion plots adjacent to the main experiment. The interdisciplinary group is focusing on several key issues as the project continues its second rotation cycle. These include identifying the best cover crops for each system/season combination and observing phenomena that have an impact on soil fertility and plant nutrition, particularly the season-long monitoring of cover crop nitrogen, crop growth and yield. The long-term implications of weed control, as well as the related demand for creative management and appropriate equipment, are critical.

Conclusions about the preferable crop with which to enter the rotation are still premature. The attractive premiums offered for organically grown tomatoes, and regulations that specify a minimum of three years without pesticides prior to certification, suggest that field corn would be the best starting point of the rotation, but pest control (and especially weed management) implications of this choice must be considered. Choices will also depend on the grower's economic situation and a consideration of the wide range of costs and returns for the five cash crops in the rotation. The challenges of managing winter cover and grain legume cash crops without herbicides (organic), or with short-lived, post-emergence herbicides (low-input), are at least partially offset by the opportunities to plant or replant catch crops, such as spring barley after lupine and pink beans after safflower in this study.

This research summary is based in part on a series of articles featured in California Agriculture, Volume 48, Number 5, 1994, University of California, Division of Agriculture and Natural Resources, Oakland, CA. This project is supported primarily by the USDA's National Sustainable Agriculture Research and Education (SARE) program. Additional funds have also come from the Fertilizer Research and Education Program and the H.J. Heinz Foundation. For more information, contact the SAFS project at: Department

SUSTAINING AGRICULTURE IN SANTA CRUZ COUNTY: DEVELOPING COMMUNITY NETWORKS TO PROMOTE COMMUNITY AND ENVIRONMENT-RESPONSIBLE AGRICULTURE

Budget:

FY 91/92: \$7,787

FY 92/93: \$8,809

Investigators:

Stephen Gliessman, professor, Center for Agroecology and Sustainable Food Systems/ Environmental Studies Board, UC Santa Cruz

James Pepper, associate professor, Environmental Studies Board, UC Santa Cruz

One of the critical issues facing California agriculture is its interaction with nearby communities. Regions are being forced to come to terms with preserving agriculture in the face of increasing market, development and population pressures. Realizing that addressing these issues would need to be a community process, individuals formed a coalition in Santa Cruz County in the fall of 1991 with funding from SAREP. The goal of this Agriculture and Community Project (AgComm) coalition was to examine the status of agriculture in Santa Cruz County and collaborate with the local community to ensure its long-term viability. Principal investigators Steve Gliessman and Jim Pepper organized and directed the initial planning committee which was composed of representatives of a broad base of community interests. After meeting for a year (May 1992-May 1993), the planning committee defined topics which provided the foundation for specific areas of research and became the basis of the agenda for a communitywide forum held November 20, 1993 in Aptos. At this forum, participants examined ways in which the entire community is connected to agriculture and explored strategies to broaden and strengthen this connection. Local residents were particularly interested in community education, encouraging the community to buy locally grown foods and find common ground between urban and agricultural interests.

Concurrently, the planning committee's work led to directed research by the AgComm staff about land use, farmland preservation and farmworker housing. Exploration of policy options by the AgComm staff included research on agriculture elements that have been drafted or approved under General Plan law in 11 counties in California. As a result of their work on land preservation, the Agricultural Policy Advisory Commission to the local Board of Supervisors asked the AgComm group to advise them on issues such as agriculture at the urban edge. Should the Board of Supervisors and the County Planning Department decide to pursue an agricultural element, work on the General Plan elements will be compiled along with recommendations for proceeding.

In the fall of 1994, the continuing interest in land preservation policies led the AgComm group to conduct a "mobile workshop" or bus tour for local agriculture leaders, planning officials and policymakers on "Preserving Agricultural Land on the Edge: Ag Land Preservation Techniques." A workbook with articles describing the tools and techniques for preserving agricultural land was produced for this mobile workshop and is available for purchase from the AgComm Project. For more information, contact: Kerstin Ohlander, AgComm Project, UCSC College Eight, Rm. 214, Santa Cruz, CA 95064; (408) 459-

OPPORTUNITIES AND BARRIERS TO PROVIDE SUSTAINABLY PRODUCED FOOD TO ALAMEDA COUNTY CONSUMERS

Budget:

FY 91/92: \$ 6,347

FY 92/93: \$13,225

Investigators:

Valerie (Pelto) Frances, executive director (former), Alameda County Food Action Council

Cooperators:

Helen Ullrich, food/nutrition policy consultant, Berkeley

Janet Savage, field program supervisor/instructor, nutrition, School of Public Health, UC Berkeley

This project surveyed retail produce buyers in order to: 1) gather demographic data on the availability of fresh fruits and vegetables in Alameda County food markets; 2) determine produce buyer criteria for selecting fresh produce; 3) assess buyers' attitudes toward sustainably produced food; and 4) identify characteristics of consumers who shop where fresh fruits and vegetables are available. The study found that only 27 percent of the 819 markets in Alameda County eligible to accept food stamps handle any significant amount of fruits and vegetables. When selecting produce, buyers listed quality and appearance first with variety, price, and consumer needs ranking lower. Wholesale terminals or distributor/brokers were about evenly used. Buyers had very little knowledge of sustainable agriculture and only one fourth had heard of sustainable or organic agriculture. Despite this, they ranked the values of sustainable agriculture as being very important. An Advisory Task Force connected with the project recommended that strategies to develop relationships with small/medium scale grocers should be emphasized as a way of expanding the market for sustainably produced food. For more information, contact: Janet Savage, School of Public Health, 317 Warren Hall, University of California, Berkeley, CA 94702; (510) 642-2414.

FROM FARMWORKER TO SMALL FARMER

Budget:

FY 92/93: \$10,750

Investigators:

Ann Baier, director (former), Rural Development Center, Salinas

Jos, Montenegro, director, Rural Development Center, Salinas

Cooperators:

James Grieshop, consumer education specialist, Department of Human and Community Development (formerly called "Department of Applied Behavioral Sciences"), UC Davis

Barbara Goldman, lecturer, Department of Human and Community Development, UC Davis

Richard Smith, UC Cooperative Extension farm advisor, San Benito County

The Rural Development Center (RDC) is a community-based agricultural training and resource center which offers educational programs and practical experience opportunities to farmers and low-income people in the Salinas Valley. In this project, the RDC conducted a follow-up study of former students to assess the impact of the program on them and the extent to which program goals were met. Interviews with former students sought information about the motivations, difficulties and barriers to becoming a small-scale farmer in the Salinas Valley; the implications of adopting and using sustainable practices; and the skills, knowledge, and personal characteristics that contribute to the development of successful and sustainable farms by former farmworkers. The study found that participants in RDC programs have gained: 1) practical farming and business skills and experience; 2) confidence in their abilities to realize objectives and achieve goals; 3) exposure to sustainable agricultural methods which they had not seen or heard about in California agriculture as they had previously experienced it; and 4) a network of support for farmer-to-farmer information exchange and assistance, family integration and involvement of children. The study found that networks of community support and interaction are key factors in the success of Spanish-speaking beginning farmers. For more information, contact: Jos, Montenegro, Director, Rural Development Center, P.O. Box 5415, Salinas, CA 93915; (408) 758-1469.

Rural

Development Center (RDC) director Jos, Montenegro meets with students in RDC's training program and their families.

EXAMINATION OF THE INTERACTION OF AGRICULTURAL VARIABLES AND RURAL COMMUNITY CONDITIONS USING MACROSOCIAL ACCOUNTING METHODS

Budget:

FY 92/93: \$14,500

Investigator:

Dean Macannell, professor, Department of Human and Community Development, UC Davis (now with the Landscape Architecture Program, Department of Environmental Design, UC Davis)

Cooperator:

Don Villarejo, executive director, California Institute for Rural Studies, Davis

This study examines the interaction of agricultural variables and rural community conditions in 75 communities in the Central Valley of California. The following hypotheses will be tested:

- ε Larger farms are associated with lower quality of community life;
- ε Separation of farm management from ownership is associated with lower quality of community life;
- ε Crop diversity is associated with higher quality of community life; and
- ε The rate of pesticide permit applications is negatively associated with quality of community life.

Although these hypotheses are framed within the same general theoretical perspective as previous

macrosocial accounting projects, this project uses current and much better data provided by the California Institute for Rural Studies (CIRS). These data were originally coded by CIRS from mandated pesticide application permit forms and include information about the crop(s), field sizes, address of applicant, location of the fields, etc. The availability of this data and the quality of measurements will allow a much better focus on agricultural issues than was previously possible. On the social variables, the project will continue to improve measures of community quality especially in the area of ethnic relations (availability of quality schooling for minority children, income differentials between white and non-white holders of the same occupational positions, etc.). In addition, the project will continue to run the full battery of standard tests of community life quality: family income levels, employment rates, and poverty indices. These two data sets will then be merged to find out which agricultural variables significantly affect the social variables in these 75 communities. An analysis of variance and several correlation matrices have been completed preparatory to the regression analysis. The results of these preliminary tests suggest that improvements in the quality of the data bases will have a noticeable impact on the results and that strong regression models can be built of the relationship between agricultural structure and community conditions. For more information, contact: Dean MacCannell, Landscape Architecture Program, Department of Environmental Design, University of California, Davis, CA 95616; (916) 752-3907, 752-6437.

PRODUCING AND MARKETING AN EDUCATIONAL CURRICULUM ON ETHICS AND AGRICULTURAL PRACTICES

Budget:

FY 92/93: \$8,770

FY 93/94: \$7,340

Investigators:

Desmond Jolly, specialist, Department of Agricultural Economics, UC Davis

Stan Dundon, professor, Department of Philosophy, California State University, Sacramento

This project has produced a curriculum to empower producers, marketers and professionals involved in the food and fiber system to more explicitly incorporate ethics into their decisions and practices. The curriculum uses written case studies that include a narrative description of the case, as well as questions and discussion topics that provoke participants to measure the case against their ethical criteria or their notions of socially shared values. The cases include Saltwater Intrusion in the Central Valley; Selling Small Fruit Illegally; Levi Strauss: Selling Jeans, Promoting Ethics; General Mills Cereal Contamination and others. These materials have been tested on a variety of audiences: workshops at farm conferences, farm advisor and specialist workgroup meetings, and university classes. The tests indicate that the material as well as the pedagogical approach are very successful in stimulating thought and dialogue about ethics as it relates to the food and fiber system. The curriculum is available as an integrated package including a handbook, facilitator's manual, and case studies. For more information, contact: Desmond Jolly, Dept. of Agricultural Economics, University of California, Davis, CA 95616; (916) 752-3562.

PESTICIDE USE REDUCTION IN THE STATE OF

CALIFORNIA

Budget:

FY 92/93: \$13,555

FY 93/94: \$ 9,500

Investigators:

Monica Moore, regional coordinator, Pesticide Action Network North America, San Francisco

Angus Wright, professor, Department of Environmental Studies, California State University, Sacramento (Year 1)

Bruce Jennings, assistant professor (former), Department of Environmental Studies, University of Montana, Missoula (Year 2); currently visiting scholar, Department of Environmental Science, Policy and Management, UC Berkeley

Project Associate:

Doreen Stabinsky, Pesticide Action Network North America, San Francisco

This project has provided a forum for the development of new and creative pesticide reduction policy options tailored to California's specific situation. During Year 1, the Pesticide Action Network of North America (PANNA) consulted with 46 leaders in California agriculture to discuss pesticide use reduction policy options. These discussions led to a draft pesticide use reduction plan for California. The plan, to be used in ongoing policy discussions, calls on policy makers to: 1) establish a numerical use reduction goal that is voluntary and ambitious, at least 50 percent reduction of use in the state by the year 2000 measured against a base year of 1992; 2) establish specific reduction strategies by sector by consulting with all affected parties and communities; 3) phase out high-hazard pesticides according to specific criteria based on impacts to human health and the environment; 4) increase funding for alternative agriculture research through competitive grant programs; 5) develop a program of financial incentives for growers in transition to alternative agricultural practices; and 6) develop a pesticide fee-based mechanism for funding both research and extension alternatives and financial incentive programs.

During Year 2 the researchers produced a report *Financial Incentives and Their Potential to Reduce Pesticide Use in Three California Crops: Cotton, Oranges, and Strawberries*. The report was based upon direct interviews with farmers, pest control advisors and Cooperative Extension personnel, supplemented by meetings and other communication with participants in PANNA's pesticide use reduction work. The study identifies a variety of financial incentive options, and analyzes their potential utility in ongoing policy discussions. The financial incentives considered include: cost-share, tax credits, modified price support programs, crop insurance, technical assistance, specially licensed pest control advisors, increased regulation of high hazard pesticides and pesticide use, and agricultural land preservation. For more information, contact: Monica Moore, Pesticide Action Network of North America, 116 New Montgomery, #810, San Francisco, CA 94105; (415) 541-9140; e-mail: panna@igc.apc.org.

ARCATA FARM AND EDUCATION PROJECT

Budget:

FY 92/93: \$11,730

FY 93/94: \$19,843

FY 94/95: \$8,683



Investigator:

Peter Lehman, professor, Department of Engineering and International Development Technology, Humboldt State University, Arcata

Cooperators:

*Deborah Giraud, UC Cooperative Extension farm advisor, Humboldt and Del Norte counties
Susan Ornelas, UC Cooperative Extension youth development advisor (interim), Hoopa; Arcata Educational Farm, Arcata*

Janet Czarnecki, project associate, Arcata Educational Farm, Arcata

Jen McNally, intern, Arcata Educational Farm, Arcata

Andrew Rahn, farm manager, Arcata Educational Farm, Arcata

Greg Ennes, teacher, Sunnybrae Middle School, Arcata

Michael Shaddix, teacher, Sunnybrae Middle School, Arcata

Cindy Kettner, teacher, Equinox School, Arcata

The Arcata Farm and Education Project demonstrates how a small project can spark creative connections that promote a more sustainable community food system. The two-acre, student-run community farm is the result of cooperation between Humboldt State University, Cooperative Extension, the City of Arcata, and local farmers and educators. The project has five major objectives: to use the farm as an educational facility to teach university students about sustainable small farm management skills; to operate the farm using community supported agriculture (CSA) principles and to assess the feasibility of the CSA in the region; to develop and incorporate curriculum for local elementary and high schools; to facilitate communication about agriculture in the community by involving local farmers, refugee farmers and community members in classes and activities at the farm; and to give community youth groups access to the facility as a place to experiment with animal husbandry and sustainable agriculture projects. A manual, a slide set, and possibly a video are being developed that will describe the farm's activities, how it has overcome problems, and lessons for other communities. For more information, contact: Peter Lehman, Humboldt State University, Arcata, CA 95521; (707) 826-4231.

CALIFORNIA SUSTAINABLE AGRICULTURE WORKING GROUP MEETING

Budget:

FY 93-94: \$10,631

Investigators:

Kai Siedenburg, coordinator, California SAWG, Santa Cruz

Judith Redmond, executive director, Community Alliance with Family Farmers Foundation, Davis

With support from the Kellogg-funded California Alliance for Sustainable Agriculture, California formed a Sustainable Agriculture Working Group (SAWG) in 1993, which held its initial meeting on October 8-9, 1994 to gather a broad cross-section of individuals and groups with interests related to sustainable agriculture for the purpose of: 1) identifying key SAWG objectives and purposes; 2) identifying opportunities for collaboration and cooperation among the groups; 3) educating one another about needed policies to support sustainable agriculture in the state; and 4) learning about local, state and national policy processes. This meeting was the first statewide public forum for information exchange and strategic thinking around state and national sustainable agriculture policy issues. As a result of the meeting, a Community Food Security Committee was formed. The committee began meeting in the fall

of 1994 and has organized a project which is attempting to link local farmers with low-income residential treatment facilities. For more information, contact: Kai Siedenburg, California SAWG, P.O. Box 1599, Santa Cruz, CA 95061; (408) 458-5304; e-mail: casawg@igc.apc.org.

EXPANDING DIRECT MARKETING OPPORTUNITIES FOR COMMUNITY FOOD SECURITY AND TO REDUCE PESTICIDE USE

Budget:

FY 94/95: \$10,615

Investigator:

Robert Gottlieb, lecturer, Department of Urban Planning, UCLA

Cooperators:

Marion Kalb, executive director, Southland Farmers' Market Association, Los Angeles

Carolyn Olney, associate director, Southern California Interfaith Hunger Coalition, Los Angeles

This project explores direct marketing opportunities for reducing pesticide use and developing community food security in poor and low-income areas. Researchers will conduct a feasibility study for developing a community supported agriculture (CSAs or subscription farms) structure with farmers who sell at the Gardena farmers' market, located in a mixed low- and middle-income neighborhood in southwest Los Angeles. The results of the research will be made available to other farmers' market associations and growers as well as community groups and food security advocates. Based on research results, a program will be developed to encourage farmers' market CSAs throughout California and to work with sustainable agriculture groups to highlight such programs as an effective strategy for linking sustainable agriculture concerns with community food security. For more information, contact: Robert Gottlieb, Department of Urban Planning, UCLA, Los Angeles, CA 90024-1467; (310) 825-1067.

IMPACTS OF LOCAL FOOD SYSTEMS ON COMMUNITIES AND AGRICULTURE/REASON FOR THE SEASON

Budget:

FY 94/95: \$12,000

Investigators:

Roger Ingram, farm advisor, UC Cooperative Extension, Placer County

Sharon Junge, county director, UC Cooperative Extension, Placer County

Garth Veerkamp, farm advisor, UC Cooperative Extension farm advisor, Placer County

Cooperators:

This project is providing important educational strategies to support the PlacerGROWN Ag Marketing Program that is encouraging greater purchasing and production of local agricultural products to create a more stable and sustainable community. The project is attempting to increase consumer awareness and responsibility for their role in creating sustainable communities. Through the development of a regional food guide, consumers will be educated about the benefits of purchasing locally produced, processed and distributed food that is geared to seasonal availability. Emphasis will be placed on developing baseline data that will assist in measuring the impacts of the PlacerGROWN program over the next three years. For more information, contact either Roger Ingram, Sharon Junge, or Garth Veerkamp, UCCE Placer County, 11477 E Avenue, Auburn, CA 95603; (916) 889-7385.

SHARING THE COSTS OF LAND TENURE AND STEWARDSHIP

Budget:

FY 94/95: \$5,000

Investigator:

Jered Lawson, Center for Agroecology and Sustainable Food Systems, UC Santa Cruz

Cooperators:

Steve and Gloria Decatur, Live Power Community Farm, Covelo

This project is producing a manual describing an innovative model for ag land preservation known as "shared-equity." This land-saving action has the farmer own the productive agricultural value of the land and a non-profit organization own all additional speculative or market value of the land, thereby creating access to permanently affordable farms. The manual will provide a rationale for why such joint tenure arrangements are a new and needed model for maintaining farms with sustainable production methods. It will also provide practical "how-to" information and resources for those wishing to adopt this land preservation model. For more information, contact: Jered Lawson, University of California, Center for Agroecology and Sustainable Food Systems, 1156 High Street, Santa Cruz, CA 95064; (408) 459-3964.

VIABILITY OF SMALL AND MEDIUM SCALE FARMS IN CALIFORNIA: CASE STUDY OF FRESNO AND MONTEREY COUNTIES

Budget:

FY 94/95: \$15,000

Investigator:

Don Villarejo, executive director, California Institute for Rural Studies, Davis

This project is quantitatively determining current crop farm operator turnover both farms going out of business and new farms entering the business in representative California counties for the purpose of

informing public discussion about the viability of California farms. The research is examining farm survival in Fresno and Monterey counties over a five-year period from 1990-94. CIRS is pinpointing specific categories of farms, by farm size, by commodities produced, and by ethnicity (focusing on Hispanic strawberry growers in Monterey and Hmong farm operators in Fresno). In addition, preliminary information from the CIRS Pesticide Use Report data base will be used to report on the pattern of pesticide use among different farm sizes and within specific commodities to determine the relation, if any, to viability. Special attention is being devoted to a region of western Fresno County where recent water cutbacks have idled as much as 175,000 acres of crop land during the period 1987-92. For more information, contact Don Villarejo, CIRS, P.O. Box 2143, Davis, CA 95617; (916) 756-6555.

POSTHARVEST HEAT TREATMENTS AS A NON-CHEMICAL ALTERNATIVE FOR CONTROL OF DECAY AND PHYSIOLOGICAL DISORDERS OF CALIFORNIA FRUIT CROPS

Budget:

FY 92-93: \$10,000

FY 93-94: \$11,730

Investigator:

Elizabeth Mitcham, assistant specialist, Department of Pomology, UC Davis

Most apples are treated with the antioxidant diphenylamine (DPA) before cold storage to prevent the development of storage scald. This project examined the effects of hot water dips before cold storage on Granny Smith apples in an effort to find an alternative means of scald control. The hot water treatments were compared to controlled atmosphere, DPA, and hot air treatments.

In this project, the apples were immersed for varying lengths of time in 46ø, 48ø, 50ø, and 52ø C water before storage at 0.5ø C for three and six months. While scald development and severity were reduced, no treatment provided 100 percent control. Higher temperatures or longer immersion times were more effective at reducing scald. Most heat treatments resulted in increased firmness of apples after storage, particularly after six months, compared with non-heated apples. Controlled atmosphere and DPA treatments gave the best scald control, followed by the hot air treatment of 38ø C for four days. The best hot water treatments were 50ø C for five minutes and 48ø C for 15 minutes. It does not appear that hot water dips will be a commercially feasible treatment for the apple industry because of the lack of adequate scald control and the risk of fruit injury.

Hot water dips were also tested on pomegranates and kiwifruit. Treatments of pomegranates with hot water were not successful in preventing chilling injury or controlling decay. Kiwifruit decay control experiments were also unsuccessful primarily due to lack of Botrytis rot development in inoculated fruit. For more information, contact: Elizabeth Mitcham, Department of Pomology, University of California, Davis, CA 95616; (916) 752-7512.

RELEASE OF NITROGEN FROM A LEGUMINOUS COVER CROP AND THE SUBSEQUENT UTILIZATION BY BELL PEPPER

Budget:

FY 92-93: \$1,554

Investigator:

Richard Smith, UC Cooperative Extension farm advisor, San Benito County

Other investigator:

Louise Jackson, associate professor, Department of Vegetable Crops, UC Davis

Leguminous cover crops begin to release nitrogen to the soil once they are incorporated into the soil if adequate water is available for microbial decomposition of the plant tissue. The amount of nitrogen that is released from a productive cover crop can be substantial, however the rate of release of nitrogen and the duration of the release is not well understood. In this study, researchers investigated the rate of release of nitrogen from Lana vetch and its subsequent utilization by bell peppers a long-season, high-nitrogen demanding vegetable. They also treated some plots with superimposed applications of a slow-release fertilizer (feather meal) to determine if the additional nitrogen, supplemental to the cover crop, provided season-long nitrogen to the crop.

In 1992, there was a steady increase in the nitrate-nitrogen levels of the soil solution up to 74 days following incorporation of vetch residue into moist soil. This release of nitrogen from the vetch followed an earlier trend observed in 1991 in a sweet corn field. The release curve of nitrogen by vetch fit the growth pattern nicely for some vegetables such as sweet corn and melons. These crops have their peak demand for nitrogen at the time when the cover crop is releasing a maximum amount of nitrogen.

For bell pepper, the 1992 data indicates that the nitrogen supplied by the cover crop alone did not keep the petiole nitrate-N levels as high as plots that were amended with slow release fertilizer, which supplied late season nitrogen to the pepper crop. However, there was no significant improvement in yield from any of the fertilizer treatments, possibly because of a late-season disease outbreak. In 1993 the petiole nitrate-N levels again increased later in the growing season in the fertilized plots and the yield in the plot fertilized with 160 pounds of nitrogen as feather meal had a significantly higher yield.

These results indicate that the nitrogen released from a leguminous cover crop such as vetch can provide significant amounts of nitrogen for subsequent vegetable crop production. However, long-season, high-nitrogen demanding crops such as bell peppers may need supplemental applications of late season fertilizer for optimal growth. For more information, contact: Richard Smith, UCCE San Benito County, 649-A San Benito Street, Hollister, CA 95023-3952; (408) 637-5346.

EVALUATING DRYLAND LEGUMES AND NATIVE PERENNIAL GRASSES AS PLANT MATERIALS FOR USE IN SUSTAINABLE AGRICULTURE SYSTEMS

Budget:

FY 92-93: \$8,700

FY 93-94: \$8,700

Investigator:

William A. Williams, professor emeritus, Department of Agronomy and Range Science, UC Davis

Other investigators:

Craig Thomsen, staff research associate, Department of Agronomy and Range Science, UC Davis

Walter Graves, UC Cooperative Extension farm advisor emeritus, San Bernardino County

In this project, researchers evaluated dryland legumes and native perennial grasses for use in pasture, range, vineyard, and other farming systems in northern California. The plants were evaluated for adaptability, persistence, weed suppression, and management requirements. Specific components of this project included: field trials with dryland legumes; establishment and maintenance of a demonstration nursery; curating a large collection of cultivars, experimental lines, and wildland species (California natives); increasing seed of material for future trials; and providing seed to researchers, farm advisors, and producers.

The researchers planted 71 accessions of annual medics (*Medicago* spp.) comprising 15 species. Many of these accessions performed poorly. In general, performance of many of the medics was excellent in the first year and poor the second year for a number of reasons. Overall, bur medic (*Medicago polymorpha*) appears to be the most promising annual medic for California. Some of the 48 accessions of subterranean clover (*Trifolium subterraneum*) performed quite well. As a group, the short season accessions of subterranean clover produced less cover than mid- or long-season lines, but they may be among the most persistent because they finish their life cycle before soil moisture is depleted. Another important factor relating to long-term persistence is hard-seededness, a characteristic that most subclovers do not have.

Some of the practical implications from this research are: 1) seeding recommendations should rarely if ever be made that are based on short-term data; 2) long-term performance of dryland legumes is very site-specific; for this reason, large-scale seedings should be preceded by variety trials, or at least variety trials should be included along with the plantings; 3) the seed mixes that are assembled by most companies and sold as dryland mixes will usually contain a large percentage of seed that is of little long-term value on the site where it is planted; and 4) many of the cultivars developed in Australia that apparently perform well there may not show an equivalent response here. For more information, contact Craig Thomsen, Department of Agronomy and Range Science, University of California, Davis, CA 95616; (916) 752-8810.

Competitive Grants Program

SOIL-BUILDING WITH COVER CROPS IN CALIFORNIA ALMOND ORCHARDS

Budget:

FY 92-93: \$5,000

FY 93-94: \$5,750

Investigator:

Lonnie Hendricks, UC Cooperative Extension farm advisor, Merced County

There is a growing trend in the California almond industry toward noncultivation and cover cropping. The majority of cover crops used are resident weed species, but almond growers need to know if certain planted cover crops may have advantages over resident vegetation. In this project, ten cover crop mixes were planted in an almond orchard in November 1992. In addition, almond orchards of five innovative growers were monitored in a previously funded SAREP project. The project compared the effects of cover crops on soil and tree nutrition, insect populations, mowing frequency, and orchard floor preparation at harvest.

Leaf nitrogen levels in all plots and on all orchard comparisons remained adequate during the experiments. In the cover crop treatments, ladybird beetles were highest in the Beneficial Blend, Insectary mix, vetch and clovers; they were low in the resident vegetation, Blando brome, Zorro fescue, and bur medic. In the orchard comparisons, ladybird beetles were high in the established vetch/clover mixes and in the tall resident vegetation. The numbers of parasitic wasps were highly variable, but there was a trend toward higher numbers in the planted cover crops and fewer in the resident vegetation. Plant feeding and beneficial mites varied among the comparison orchards. However, in measurements taken over seven years, two-spotted spider mites have very seldom been an economic problem in heavily cover-cropped, unsprayed almond orchards. Almond rejects caused by peach twig borer and navel orangeworm were usually quite low in the comparison orchards.

The extension of the results of this research were as impressive as the actual results. In addition to the six field tours held from 1993 to 1995, dozens of almond growers in Merced and Stanislaus counties benefited directly from this research in the Biologically Integrated Orchard Systems (BIOS) project. BIOS was coordinated by the Community Alliance with Family Farmers (CAFF) Foundation, with extensive input from SAREP. The project was also featured in the January/February 1995 issue of UC's California Agriculture magazine. For more information, contact: Lonnie Hendricks, UCCE Merced County, 2145 W Wardrobe Avenue, Merced, CA 95340-6496; (209) 385-7403.

DETERMINATION OF THE EFFECT OF COVER CROPS ON LETTUCE DROP DISEASE

Budget:

FY 92-93: \$3,850

FY 93-94: \$4,530

FY 94-95: \$3,640

Investigator:

Steven Koike, UC Cooperative Extension farm advisor, Monterey County

Other investigators:

Richard Smith, UC Cooperative Extension farm advisor, San Benito County

Louise Jackson, associate professor, Department of Vegetable Crops, UC Davis

John Inman, UC Cooperative Extension farm advisor, Monterey County

Lettuce drop is a widespread soilborne disease of lettuce in the Salinas Valley and other coastal lettuce growing regions. The disease causes substantial economic loss when sclerotia, the resting structures of the pathogen, build up in the soil. Resistant cultivars are not available, and growers rely on synthetic fungicides for managing the disease. Cover crops may influence sclerotial levels by either acting as host plants or as organic substrates; in both cases, sclerotia may increase in the soil. Conversely, cover crops

may increase soil microbial diversity and actually help reduce disease incidence or severity. This study, now in its third year, is evaluating selected cover crops to see whether lettuce drop is increased or decreased.

Two years of the study indicate that Phacelia, two species of vetch, and Austrian pea became significantly infected by this pathogen. Cover crops were incorporated in March, allowed to decompose for a period of time, and followed with a lettuce crop (planted early June). In early August, the investigators began to evaluate the lettuce crop for disease. At this time, Phacelia and purple vetch plots had significantly more disease than the fallow control. The data collected during the first and second years of this study indicate that some of these cover crops can support the pathogen, resulting in increased lettuce drop. It should be noted that this is a small plot study that used high inoculum density to induce disease.

In the third year of the study, sudangrass is being investigated for suppressing lettuce drop. Broccoli residues and manure/yard waste compost will also be evaluated for disease suppression. For more information, contact: Steven Koike, UCCE Monterey County, 1432 Abbott Street, Salinas, CA 93901; (408) 759-7356.

Competitive Grants Program

MONITORING SOIL FLAVONOIDS TO ENHANCE GROWTH OF DESIRABLE MICROBES

Budget:

FY 92-93: \$10,000

FY 93-94: \$15,000

FY 94-95: \$15,000

Investigator:

Donald Phillips, professor, Department of Agronomy and Range Science, UC Davis

Other investigators:

Penny Hirsch, principal scientific officer, Soil Science Department, Rothamsted Experiment Station, England

R. Ford Denison, associate professor, Department of Agronomy and Range Science, UC Davis

Steve Temple, specialist, Department of Agronomy and Range Science, UC Davis

Richard Smiley, professor/superintendent, Columbia Basin Agricultural Research Center, Oregon State University, Pendleton, OR

Paul Rasmussen, soil scientist, Columbia Plateau Conservation Research Center, USDA-ARS, Pendleton, OR

Increasing soil organic matter favors growth of desirable bacteria and fungi, but little is known about the mechanisms by which living plants, crop residues, and green manures promote growth of soil microbes. This project is identifying and quantifying small organic molecules that move from plant material to soil microorganisms. The goal is to discover natural products that trigger growth of beneficial, as opposed to detrimental, soil bacteria and fungi. Measurements developed on this project eventually may complement other commonly used parameters of soil quality.

During the first two years of this project, the researchers developed extraction and analytical protocols for isolating signature compounds from soil, and identified one signature compound, the isoflavonoid medicarpin, in many soil samples. The most striking advance from the third year was the identification of nucleosides as major soil compounds that are affected by agronomic management. Elevated amounts of these molecules were found in manured (vs. unfertilized) treatments in long-term wheat plots at Rothamsted, England, and in organic (vs. conventional) management treatments in tomato plots from the USDA-SARE experiment at Davis. Soil extracts prepared from the USDA-SARE plots containing tomato, bean, and an oat-vetch mixture suggested that sampling date, rather than crop species, had a greater effect on the amount of small organic molecules and indicated a new group of potential signal compounds that deserves future attention in this study. For more information, contact: Donald Phillips, Department of Agronomy and Range Science, University of California, Davis, CA 95616; (916) 752-1891.

THE EFFECTS OF COVER CROPS, TIME OF COVER CROP PLOWDOWN AND TRELLIS SYSTEM ON SPIDERS AND OTHER PREDATORS OF THE VARIEGATED LEAFHOPPER (ERYTHRONEURA VARIABILIS)

Budget:

FY 92-93: \$14,487

FY 93-94: \$14,487

FY 94-95: \$12,500

Investigator:

Kent Daane, associate specialist, Division of Biological Control (Department of Environmental Science, Policy and Management, UC Berkeley), Kearney Agricultural Center, Parlier

Other investigator:

Michael Costello, UC Cooperative Extension farm advisor, Fresno County

The variegated leafhopper is the most important insect pest in Central Valley vineyards. This insect causes chlorotic spotting and defoliation if damage is severe; also, its excretions attract sooty molds, which reduce photosynthesis and cause table grape bunches to be culled. This project, now in its third and final year, involves large replicated experiments which were established in commercial table and raisin grape vineyards. The researchers are testing the hypothesis that ground covers influence leafhopper population levels, and, if so, that this is because of higher predation. They also sought to better determine the role of three groupings of predators (spiders, predatory flies, and predaceous mites) that are common in vineyards but have been little studied. Temperatures and humidity are also being monitored in cover and no-cover treatments to assess the influence of microclimate on predators.

Although much of the data have not been analyzed, some preliminary observations can be made. Trends of lower leafhopper numbers in cover-cropped plots in the table grape vineyard are evident; however, the

data do not indicate any increase in the numbers of beneficial arthropods monitored. There is little evidence so far that ground covers have more than a minor effect on vine canopy temperature. For more information, contact: Kent Daane, Kearney Agricultural Center, 9240 S Riverbend Avenue, Parlier, CA 93468; (209) 891-2500; or Michael Costello, UCCE Fresno County, 1720 S Maple Avenue, Fresno, CA 93702; (209) 456-7567.

Competitive Grants Program

SURVEY OF ANNUAL CROP GROWERS REGARDING COVER CROPS

Budget:

FY 93-94: \$2,885

Investigators:

Mark Van Horn, manager, Student Experimental Farm, UC Davis

Ann Marie Ridgely, researcher, Student Experimental Farm, UC Davis

This survey was designed to collect information from annual crop growers that would help focus future research and extension efforts regarding the use of cover crops in field and vegetable crop systems. UC SAREP funding was added to this USDA-SARE program funded project, to further target growers *not* using cover crops in order to examine barriers. Survey participants included a random sample of 200 tomato and safflower growers in five counties (Yolo, Solano, Sutter, San Joaquin and Colusa) plus a targeted list of 48 producers in the same five counties who were thought to be using cover crops. Participants were asked about their usage of cover crops and their perceptions of the benefits and drawbacks of cover crops. The drawbacks to cover crops mentioned by cover crop users and non-users were similar: 1) the cover crop could not be incorporated in time for spring planting; 2) a cash crop with a direct economic benefit could be planted instead; and 3) the overall cost of growing the cover crop was too high (including seed, labor, equipment, fuel and water costs). Farmers also mentioned increases in harmful insect populations, and tillage complications due to cover crop residue. The perceived benefits most often mentioned by farmers not currently growing cover crops were increases in soil organic matter and the addition of nitrogen to the soil, benefits that can be obtained through means other than cover cropping. Many other potential benefits of cover cropping, mentioned by the cover crop growers, were apparently unknown or unappreciated by those who did not grow cover crops. These benefits include: increased beneficial insects, reduced weed problems, increased water holding capacity, increased nutrient availability to the following crop, and reduced soil compaction. The greatest research and education needs were identified as: 1) new or existing cover crop varieties with particular characteristics (e.g. fit rotation, soil or weather; produce high biomass, fast growth, extensive root system, or high N content); and 2) the effects of cover crops on various aspects of the farming system, such as soil structure, fertility, insects and weeds. For more information, contact: Mark Van Horn, Student Experimental Farm, University of California, Davis, CA 95616; (916) 752-7645; e-mail: mxvanhorn@ucdavis.edu

THE IMPACT OF DUST DEPOSITS ON INSECTARY REARED AND RELEASED PARASITES IN TRANSITIONAL AND ORGANIC CITRUS ORCHARDS USING PERENNIAL

VS. ANNUAL, TILLED COVER CROPS

Budget:

FY 94-95: \$9,500

Investigator:

Phil Phillips, UC Cooperative Extension area IPM advisor, Ventura County

As a critical component to the sustainability of both transitioning and organic citrus orchards, it is important to understand the impact of foliar dust deposits on the survival of insectary-reared *Aphytis melinus* and *Metaphycus helvolus* used respectively for the biological control of California red scale and black scale. This experiment will determine the effects on these two species from the following factors: ambient dust, dust generated by orchard operations, and water-washing trees once during the season. This project should assist citrus growers in their conversion to sustainable or organic production. For more information, contact: Phil Phillips, UCCE Ventura County, 669 County Square Drive, Ventura, CA 93003-5401; (805) 645-1457.



SUPPRESSION OF PLANT-PARASITIC NEMATODES IN CONVENTIONAL AND ORGANIC FARMING SYSTEMS

Budget:

FY 94-95: \$5,155

Investigator:

Bruce Jaffee, associate professor, Department of Nematology, UC Davis

Other investigator:

Ann Muldoon, staff research associate, Department of Nematology, UC Davis

This project is being conducted at the Sustainable Agriculture Farming Systems Project at UC Davis. Soils from conventional and organic farming systems are being examined for their ability to suppress plant-parasitic nematodes. Also, the identity and population density of beneficial fungi that attack nematodes are being compared between the systems. Samples will be collected and processed three times per year for two years. *For more information, contact: Bruce Jaffee, Department of Nematology, University of California, Davis, CA 95616; (916) 752-0862.*

ROTATION LENGTH AND ORGANIC TRANSITIONS

Budget:

FY 94-95: \$10,000

Investigator:

R. Ford Denison, associate professor, Department of Agronomy and Range Science, UC Davis

An additional four-year organic rotation was added to the 100-year long-term farmland research experiment at UC Davis. The new organic rotation is being preceded by two years of conventionally managed processing tomatoes and corn. This treatment allows subsequent comparisons between crops under identical organic management but at different stages of the "organic transition" (first vs. fourth year). Expected results include a determination of optimum rotation length, and assessment of the relative contributions of soil quality and human factors in transitions to organic farming. *For more information, contact: R. Ford Denison, Department of Agronomy and Range Science, University of California, Davis, CA 95616; (916) 752-9688.*

NITROGEN FERTILITY MONITORING IN ORGANIC AND CONVENTIONAL VEGETABLE SYSTEMS

Budget:

FY 94-95: \$2,744

Investigator:

Richard Smith, UC Cooperative Extension farm advisor, San Benito County

Other investigator:

Robert Miller, lecturer emeritus, Department of Land, Water and Air Resources, UC Davis

There is increasing interest in improving the efficiency of nitrogen use in vegetable crop production in order to decrease contamination of ground water with nitrate. To this end, there has been a great deal of research and interest in the use of "quick tests" for nitrate for plant and soil analysis. In conventional farming systems, monitoring nitrate using quick tests has proven to be a reliable measure of the crop nitrogen status and the need for nitrogen fertilizer applications. In organic farming systems, however, preliminary evidence indicates that nitrate may not be a good indicator of crop nitrogen status and that the new quick test technology may not be as applicable.

This study proposes to monitor nitrogen in four farms that are producing onions: two organic farms that are using compost, cover crops and feather meal (a slow release fertilizer), and two conventional farms. Soil nitrate and ammonium will be monitored, as well as nitrate levels in the fresh sap of root tissue and the total nitrogen in the onion tops. The data will confirm if quick tests for nitrate are useful on organic farms and will provide further information on the nitrate levels in soils of organic farms. Both of these issues may have broad and important implications for nitrogen leaching and groundwater contamination. For more information, contact: Richard Smith, UCCE San Benito County, 649-A San Benito Street, Hollister, CA 95023-3952; (408) 637-5346.

SUBSURFACE DRIP IRRIGATION FOR SOILBORNE DISEASE MANAGEMENT IN LETTUCE

Budget:

FY 94-95: \$11,000

Investigator:

Krishna Subbarao, specialist, Department of Plant Pathology, UC Davis

Many vegetable crop growers in the Salinas Valley are converting to subsurface drip irrigation because of the benefits that it offers. These benefits include greater water use efficiency, incremental and steady application of nitrogen and water, and reduced drainage and nitrate leaching. In addition, previous research by this investigator has shown that subsurface drip irrigation reduces corky root and lettuce drop, two serious soilborne diseases. This project will further confirm the effects of subsurface drip and furrow irrigations on diseases of lettuce, and will include a grower field day. Implementation of this irrigation technology would improve the sustainability of vegetable production systems in the Salinas Valley and contribute to reduced use of fungicides. For more information, contact: Krishna Subbarao, U.S. Agricultural Research Station, 1636 E. Alisal Street, Salinas, CA 93905; (408) 755-2890.
Competitive Grants Program

BIOS ECONOMIC IMPACT STUDY: QUANTIFYING THE TRANSITION TO SUSTAINABLE PRODUCTION

Budget:

FY 94-95: \$9,194

Investigator:

Karen Klonsky, specialist, Department of Agricultural Economics, UC Davis

Other investigator:

Gerry Cohn, researcher, Department of Agricultural Economics, UC Davis

The Biologically Integrated Orchard Systems (BIOS) program, administered by the Community Alliance with Family Farmers (CAFF) Foundation, offers farmers support in making the transition to sustainable agriculture by providing technical assistance and training on how to use techniques already proven to be effective. The impacts on income and expenses will be determined for farms enrolled in the Merced County almond BIOS program. This project will also evaluate the economic viability of the BIOS production method over a three-year transition period. For more information, contact: Karen Klonsky, Department of Agricultural Economics, University of California, Davis, CA 95616; (916) 752-3563.

Sustainable Agricultural Graduate Awards

In 1992, SAREP began awarding small grants to graduate students pursuing research in sustainable agriculture. The Sustainable Agriculture Graduate Awards (SAGA) have been a good way for SAREP to use scarce resources because they complement already existing money within the university and help graduate students address critical issues facing agricultural producers and society. In FY 1993/94, seven graduate students were awarded a total of \$6,960 for sustainable agriculture projects:

- **Gerald Cohn**, Department of Agricultural Economics, UC Davis, \$1,000 for "Community Supported Agriculture: Survey and Analysis of Consumer Motivations."

Polly Goldman, Center for Agroecology and Sustainable Food Systems, UC Santa Cruz, \$1,000 for "Use of Agricultural Borders for Sustainable Arthropod Pest Management in Organic Cotton."

Cynthia Havstad, International Agricultural Development, UC Davis, \$1,000 for "Compost Use and Research Needs of Central Valley Vegetable Farmers."

George Heimpel, Department of Entomology, UC Davis, \$1,000 for "Improving Biological Control of San Jose Scale Using Flowering Cover Crops."

Rachel O'Malley, Environmental Studies and Biology, UC Santa Cruz, \$960 for "Managing Rice for a Sustainable Future: Winter Flooding, Organic Production and Pest Food Webs."

Laura Tourte, Department of Vegetable Crops, UC Davis, \$1,000 for "The Effect of Kelp (Seaweed) Extract and Fish Powder Sprays on Organically Grown Processing Tomatoes: Plant Growth, Yield and Economics."

Kathleen Walker, Department of Environmental Science, Policy and Management, UC Berkeley, \$1,000 for "An Analysis of Apple Growers' Access to IPM Information in Kern and Santa Cruz Counties."

In FY 1994/95, five more graduate students were awarded a total of \$7,973. The students and the titles of their projects are:

- ε **Heinrich Schweizer**, Department of Entomology, UC Davis, \$2,000 for "Identification of Non-Pesticidal Mortality Factors of *Scirtothrips citri* Moulton Which Might be Enhanced by Cultural Manipulations in Order to Reduce Economic Damage."

Robert Venette, Department of Nematology, UC Davis, \$1,000 for "Soil Bacteria: Carbon and Nitrogen Ratios, Attractiveness to Bacterial-Feeding Nematodes, and Potential Role in Terrestrial Nitrogen Cycles."

Brian Correiar, Graduate Group in Plant Protection and Pest Management, UC Davis, \$1,250 for "Determination of Sampling Methods and Effectiveness of Variable Rates of Trifluralin for Layby Weed Control in Tomatoes."

Jennifer Katcher, Department of Pomology, UC Davis, \$2,000 for "Reducing Nitrogen Fertilization and Irrigation May Improve Almond Trees' Defense Against Hull Rot Infection."

Colehour Arden, Department of Human and Community Development, UC Davis, \$1,723 for "Effects and Prospects of Direct Marketing on Sustainability: Survey of Farmer Perspectives."

In 1994 and 1995, SAREP continued its program of small grants for educational events. For the two funding cycles covered in this progress report, SAREP awarded \$26,224 to support 31 different educational events around California. Grants were awarded to Cooperative Extension personnel and non-profit educational organizations, and helped disseminate a wealth of practical information about sustainable farming and ranching practices and community economic development. Final reports from 1994 showed that more than 800 individuals participated in the events funded through these grants. Attendance figures for 1995 were not available at the time this report was written. The specific meetings funded in each year are listed below.

1994 GRANTS FOR EDUCATIONAL EVENTS

• **Integrated Crop Management Grower Meeting.** Catherine Baranek, North Delta Conservancy (Walnut Grove). \$530

Sustainable Agriculture Conference and Farm Tour Series. Mariposa Guido, Committee for Sustainable Agriculture. \$2,000 to support the following meetings:

- Sustainable Grape Production (Santa Rosa)
- Floriculture and Nursery Production (Watsonville)
- Cover Crops in the Central Coast (Salinas)

Alternative Agriculture for Sierra County Area. Kim Joos, Sierra County Economic Council. \$1,000

Producing Organic Wool for the Sustainability of the Sheep Industry. Stephanie Larson, UC Cooperative Extension, Marin County. \$550

Waterfowl Production in Sustainable Agricultural Environments. Robert McLandress, California Waterfowl Association, Sacramento. \$550

Innovative Cropping Systems Options for Westside Growers: Potential Roles for Cover Crops. Jeff Mitchell, Department of Vegetable Crops, UC Davis. \$197

Rangeland and Environmental Monitoring Meeting Series. Glenn Nader, UC Cooperative Extension, Lassen County. \$2,000

California Grazing Academy. David Pratt, UC Cooperative Extension, Napa, Solano, Yolo counties; Roger Ingram, UC Cooperative Extension, Placer/Nevada counties. \$1,000

Rotational Grazing Field Day/Tour/Workshop for Dairy Producers. Barbara Reed, UC Cooperative Extension, Glenn County. \$500

Controlling Brown Rot in Organic Peach Orchards: An Update on Two Years of Field Research. Robert Scowcroft, Organic Farming Research Foundation; Carl Rosato, Woodleaf Farm, Oroville. \$1,000

Cover Crops in Annual Rotations: A Facilitated Discussion. Mark Van Horn, Student Experimental Farm, UC Davis. \$440

West County Sustainable Land Management. Paul Vossen, UC Cooperative Extension, Sonoma County. \$1,000

Synergy from Solar Energy. Bill Weitkamp, UC Cooperative Extension, San Luis Obispo County; George Work, Work Ranch, San Miguel. \$1,000

1995 GRANTS FOR EDUCATIONAL EVENTS

• **Thistle Management in California.** Michael Smith, UC Cooperative Extension, San Luis Obispo County. \$1,000

Agroforestry Technology Course. Miles Merwin, International Tree Crops Institute, Davis. \$1,000

Development of Comparative Crop Systems Research Projects in the Central San Joaquin Valley: Farmer/Scientist Focus Session to Identify Research Priorities and Appropriate Cropping Systems Research Options. Jeff Mitchell, Department of Vegetable Crops, UC Davis. \$424

Demonstrating Improved Rangeland Management for Improving Water Quality. Stephanie Larson, UC Cooperative Extension, Marin County. \$1,000

The California Grazing Academy. David Pratt, UC Cooperative Extension, Napa, Solano and Yolo counties. \$1,000

New Challenges in Production Techniques: Sustainable Agriculture Meeting and Farm Tour Series. Mariposa Guido, Committee for Sustainable Agriculture. \$5,000 to support the following meetings:

- **Citrus and Avocado** (Ventura)
- **Strawberries** (Ventura)
- **Livestock** (Santa Rosa)
- **Vegetables** (Santa Rosa)
- **Gardening and Landscaping** (Davis)

The Lighthouse Farm Network Educational Events. Jill Klein, Community Alliance with Family Farmers. \$4,000 to support the following meetings:

- **Greenhouse Production** (Watsonville)
- **Apple Production** (Watsonville)
- **On-Farm Composting** (Hollister)
- **Bats** (Woodland)

Oak Woodland Management in the Northern Sacramento Valley. Sheila Gaertner, UC Cooperative Extension, Tehama and Glenn counties. \$1,000
Competitive Grants Program

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INFORMATION, EDUCATION AND OUTREACH

SAREP is working with a variety of organizations and groups within and outside the University of California to educate farmers, students, extension professionals and others about sustainable farming and ranching practices, community economic development, food systems, and other topics related to sustainable agriculture. SAREP staff have put a high priority on working collaboratively with colleagues in the UC Division of Agriculture and Natural Resources as well as farmers and community organizations to address issues of concern to California's agriculture. These outreach efforts complement and extend the research projects SAREP is supporting.

Conferences and Workshops

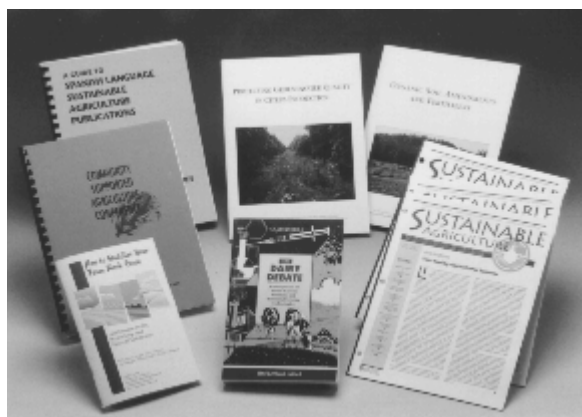
Current scientific research and practical information are shared in conferences, workshops, symposia and meetings. In the last two years, SAREP has collaborated with other university and non-profit groups in planning numerous meetings, symposia, tours and workshops for farm advisors, researchers, policymakers, and community members. SAREP has been a major participant in the following conferences:

- ε Farm Conference, February 26-28, 1995, Sacramento, CA. SAREP participated on the planning committee for this conference along with other co-sponsors.
- ε Integrated Farming Systems (IFS) Networking Conference, February 20-24, 1995, Santa Cruz, CA. SAREP worked with the California Alliance for Sustainable Agriculture (CASA) to bring together over 100 sustainable agriculture leaders from around the country as part of the Kellogg Foundation's IFS initiative.
- ε Exploring our Common Ground: Sustainable Agriculture Into the 21st Century, October 8-9, 1994, Modesto, CA. SAREP worked with the California SAWG to organize the first statewide meeting of the California Sustainable Agriculture Working Group (SAWG).
- ε Community Supported Agriculture Conference, December 6, 1993, UC Davis. SAREP co-sponsored this event with the California Alliance with Family Farmers, the Small Farm Center, Solano/Yolo County Cooperative Extension and Fiddlers' Green Farm.

In addition to the above meetings, SAREP staff have participated as speakers, moderators and organizers in more than 150 workshops primarily in California, but also throughout the United States, Mexico, Australia, New Zealand and Japan. SAREP also facilitates direct outreach to farmers through its grants for sustainable agriculture, meetings, tours and field days (see Competitive Grants section).

Publications

In the last two years, SAREP has continued to develop educational materials to help interested farmers, farm advisors, policy makers and others learn more about sustainable farming techniques and policies. The written materials and videos currently available are listed below. Free and unnumbered publications are available from SAREP. Write to: UC Sustainable Agriculture Research and Education Program, University of California, Davis, CA 95616-8716; (916)752-7556; e-mail: sarep@ucdavis.edu. Numbered publications and videos are available through UC DANR Communications Services, within California (800) 994-8849; elsewhere (510) 642-2431; Fax: (510) 643-5470; e-mail: anrpubs@ucdavis.edu.



SAREP Quarterly Report

Sustainable Agriculture, SAREP's quarterly newsletter, is now in its eighth year of publication. It is the program's main venue for communicating with SAREP's constituency: the agricultural community and

the general public. The newsletter includes reports on research projects, workshops, and meetings funded by SAREP. It previews sections from forthcoming SAREP publications, presents commentaries on sustainable agriculture issues, and includes updates on selected research and extension activities of UC Cooperative Extension and other organizations. It also lists information on funding sources and relevant publications, videos, and Internet resources; and features stories on significant individuals, commodity groups or organizations. The publication contains a section titled Technical Reviews which includes abstracts of scientific articles, and original reviews of research on specific topics.

The newsletter is sent free to anyone who requests it, and has a broad audience of farmers, farm advisors, researchers, and consumers. Reader response indicates that this publication is valued as a source for technical information as well as for its coverage of current developments. The circulation is approximately 3,000.

What is Sustainable Agriculture? 1991

This paper identifies ideas, practices, and policies that make up the broader definition of sustainable agriculture. Animal and plant production systems and the role of consumers are addressed, and the entire food system is examined within the context of California's economic, social, and political environments. 6 pages. SAREP authors [Gail Feenstra](#), Chuck Ingels and David Campbell. Free.

How to Stabilize Your Farm Work Force (and Increase Profits, Productivity, and Personal Satisfaction) Publication SA-004, 1995

This UC SAREP-funded handbook shows farmers how to diversify their operations to keep employees busy throughout the year. It brings together the strategies, benefits and challenges encountered by farmers who keep workers employed year-round. Interviews were conducted with 35 California farmers who shared some of the underlying principles that make their systems work, including crop diversification and rotation, staggered planting, saving work for off-season, labor sharing with other farmers and selective mechanization. Although no easy formula for year-round cropping systems can be given, details and charts are included for three farms from different areas of California. Written by a team of UC Cooperative Extension farm advisors and independent agricultural economists. 44 pages. Authors: Suzanne Vaupel, Gary Johnston, Franz Kegel, Gregory Billikopf, and Melissa Cadet. Cost: \$6.

A Guide to Spanish Language Sustainable Agriculture Publications Publication SA-003, 1995

This UC SAREP-funded publication is a collection of English abstracts of 74 Spanish-language documents about sustainable farming practices for farmworkers and entry level farmers. The abstracts cover a wide range of topics, from the principles of sustainability to practical information about soil and water management, agricultural machinery, field safety and learning English as a second language. Each abstract includes the author of the original publication, a summary, its availability, cost, and its level of readability. Most of the publications were chosen so that individuals with primary or secondary education can read them. Farm advisors and others who work with Spanish-speaking farmers and farmworkers will be able to use these resources to do outreach and educational programs about sustainable farming practices with their clientele. Libraries for the original Spanish documents have been established at five strategic sites in California including the farm advisors' offices in San Diego and Fresno, at UC Santa Barbara, at the Rural Development Center in Salinas, and at the Small Farm Center at UC Davis. 90 pages. Editor: Beatriz Cabezon. Cost: \$10.00.

Community Supported Agriculture Conference Publication SA-002, 1994

In "community supported agriculture" (CSA) arrangements, consumers buy "subscriptions" to local farms, and farmers are able to plan ahead with prepaid customers. Four farmers experienced in operating CSAs discuss their farms and the history and philosophy behind the community supported agriculture concept in these proceedings from a 1993 conference co-sponsored by SAREP at UC Davis. Includes bibliography and resource guide. 37 pp. Editor: Gerry Cohn. Price: \$8.00.

Protecting Groundwater Quality in Citrus Production Publication 21521, 1994

Protecting groundwater from pesticide and nitrate contamination has become one of the most pressing environmental problems in agriculture. The three main herbicides used in citrus production have been found in hundreds of wells in the San Joaquin Valley, and fertilizers used in citrus production can lead to nitrate leaching. This book offers practical and economical methods for reducing the movement of agricultural chemicals to groundwater. 40 pages. Author: Chuck Ingels, SAREP. Price \$5.00.

The Dairy Debate: Consequences of Bovine Growth Hormone and Rotational Grazing Technologies Publication SA-001, 1993

This book examines two contrasting dairy technologies: bovine growth hormone (bGH) and rotational grazing. A multidisciplinary team of researchers from across the U.S. compares the potential impacts of these technologies on animal and human health, consumers, farm families, the economics of dairying, the environment, and rural communities. The book addresses agricultural technology development, government policies, and the research agenda of land grant universities. 372 pages. Editor: William C. Liebhardt, SAREP, and nine co-authors. Price \$28.00.

Organic Soil Amendments and Fertilizers Publication 21505, 1992

Organic soil amendments and fertilizers are used to enhance soil quality and promote plant growth. This publication includes a practical summary of the benefits and value of organic matter, provides some guidelines for evaluating organic materials, and describes many of the organic materials currently available in California. It is aimed at farmers, agricultural advisors, waste management specialists, and home gardeners. Specific materials are listed alphabetically in the index, and a glossary at the end of the publication defines important terms and concepts. 36 pages. Authors: David Chaney, SAREP; Laurie Drinkwater, and Stuart Pettygrove. Price: \$5.00.

Proceedings. Sustainable Agriculture in California: A Research Symposium Publication 3348, 1991

More than 150 researchers, agricultural advisors and farmers gathered for this symposium held in Sacramento, March 15-16, 1990. The proceedings include papers from featured speakers Charles Hess, then the Assistant Secretary of Science and Education at the USDA, and Garth Youngberg, executive director of the Henry A. Wallace Institute for Alternative Agriculture. Additionally, it includes 19 research papers exploring a range of topics including production systems comparisons, pest management, and soil and water management, and abstracts from 40 poster presentations. Analysis, comments, and questions of the concluding farmer panel discussion are also provided. 226 pages. Editor: [David Chaney](#),

SAREP. Price: \$15.00.

Sustainable Agriculture for California: A Guide to Information Publication 3349, 1991

Sustainable Agriculture for California: A Guide to Information refers readers to libraries, organizations, books, journals, and indexes that contain information on a wide variety of subjects related to sustainable agriculture. More than 60 topics are covered in the Guide, which includes a highly organized table of contents and index. If you farm, advise farmers, are a planner or an agricultural researcher, this publication will be very useful. 198 pages. Authors: Steve Mitchell and David Bainbridge. Price: \$12.00.

Videos

Creative Cover Cropping in Perennial Farming Systems Video V93W, 27 minutes, 1993

Cover cropping is especially useful in orchards and vineyards. Through this colorful and informative video, learn how to use cover crops to protect and improve soil fertility, enhance pest control, and provide other benefits. Producer: [Robert Bugg](#), SAREP. Price: \$20.00.

Creative Cover Cropping in Annual Farming Systems Video V93V, 24 minutes, 1993

Cover cropping is a key tool in sustainable agriculture, but presents special challenges when used in row and field crop systems. This video depicts the opportunities and constraints in using cover crops to protect and improve soil fertility, enhance pest control, and provide other benefits. Producer: [Robert Bugg](#), SAREP. Price \$20.00.

Cultural Weed Control in Vegetable Crops Video V93E, 18 minutes, 1993

This SAREP-funded video examines non-chemical weed control practices used by California organic row crop growers. Weed control techniques throughout the entire growing season are covered. The video is aimed at growers interested in reducing herbicide use, but is also suitable for a general audience. Producer: Tom Lanini. Price: \$40.00.

Alive and Well: Sustainable Soil Management Video V92-D, 35 minutes, 1992

Taped on location in Northern California, this SAREP-funded introductory video on sustainable agriculture techniques features five different farming operations where sustainable practices have been successfully implemented. It communicates sound scientific principles, and demonstrates technically accurate procedures. Producers: Jan McGourty, Glenn McGourty, Oleg Harencar. Price: \$40.00.

In early 1995 SAREP launched a World Wide Web server on the Internet (URL=<http://www.sarep.ucdavis.edu/>) which allows users to view program information from locations all over the world. Currently the SAREP Web pages include program publications, summaries of grants previously funded, requests for proposals for the SAREP and Biologically Integrated Farming Systems

(BIFS) grants programs, a calendar of events, and computer applications. Information is provided on topics such as cover crops as a production option for soil improvement, attracting barn owls as a possible component in rodent population controls, and a comparison of bovine growth hormone with rotational grazing. Consumer and policy issues are addressed as well, covering topics such as direct marketing, community supported agriculture, and agricultural land preservation. When complete, the SAREP Web pages will comprise an outstanding database of scientific, technical and practical information, including over 300 newsletter articles from seven years of SAREP's quarterly newsletters, and more than 100 summaries of research and education projects funded by SAREP.

In addition to its own information, SAREP's Web pages provide a home for, and links to, other bodies of closely related information. For example, our Web server includes pages from the California Energy Commission's Agricultural Energy Assistance Program (AEAP), whose publications on energy management, pest management, and irrigation management are searchable along with SAREP's own, providing the public with "one-stop shopping" for information from the two programs. SAREP's Web page also links to other Internet sites that feature sustainable agriculture information, such as the National Agricultural Library's Alternative Farming Systems Information Center, the Western Region Sustainable Agriculture Research and Education (SARE) program, the Sustainable Agriculture Network (SAN), and sites that maintain comprehensive indexes of agricultural information such as the University of Florida's AgriGator. In addition, many of SAREP's staff are active participants in SAN's electronic mail group, SANET-MG, and other Internet discussion groups.

Other Staff Activities

BIOS

Three years ago, the Charles Stewart Mott Foundation, the Pew Charitable Trust, and the U.S. Environmental Protection Agency cooperatively provided funding for the Community Alliance with Family Farmers (CAFF) Foundation to undertake a project called the Biologically Integrated Orchard Systems (BIOS). This project enables almond growers in Merced and Stanislaus counties to learn about biologically based farming while reducing reliance on synthetic pesticides and fertilizers. The almond BIOS program involves a group of 30 to 50 participating farmers and a team of educators, including mentor farmers experienced in biologically integrated methods, private agricultural consultants, and University of California scientists and farm advisors. All participating farmers are provided with a package of technical and financial assistance. The BIOS approach thus represents an intensification of traditional extension techniques. The almond BIOS project emphasizes:

- ε Biological and cultural control of pests;
- ε On-farm habitats for beneficial insects, mites, and spiders;
- ε A strong emphasis on soil-building practices, often including biological nitrogen fixation to supply all or part of the nitrogen needed by crop plants; and
- ε Reduced reliance on agricultural chemicals.

SAREP's [Robert Bugg](#) and Chuck Ingels serve as management team members on Biologically Integrated Orchard Systems (BIOS) projects. In BIOS, growers and their pest control advisors work closely with the management team to implement practices which reduce their use of pesticides and/or synthetic fertilizers. The almond BIOS project is currently underway in Merced and Stanislaus counties (20 to 30 growers each), while a walnut BIOS project is operating in Yolo and Solano counties (18 growers). Bugg is on the management team of both the almond BIOS project and the walnut BIOS project; Ingels is on the management team of the walnut BIOS project. Early returns from BIOS have been impressive, with high rates of farmer participation and adoption of the biologically integrated approach. The BIOS projects provide the model upon which the new Biologically Integrated Farming Systems (BIFS) initiative is

based (See BIFS section for more information, p. 56).

ATTRACTING BARN OWLS TO FARMS

SAREP's Chuck Ingels has gathered and developed information on attracting barn owls to farms. The barn owl is often called the most beneficial bird in the world because its diet consists primarily of voles, gophers, mice, and rats. Each adult barn owl may consume about one or two rodents per night; some studies show that a nesting pair and their offspring may eat more than 1,000 rodents per year. Although no research has yet been conducted in California to show an effect on rodent abundance by installing nest boxes on farms, some growers report substantial reductions in gophers. In order to increase our understanding of barn owls, Ingels will be working with other UC researchers on two projects: 1) an experiment to evaluate the effects of installing nest boxes on gopher abundance; and 2) a survey of farmers who have built nest boxes. The goal of the survey is to gather information on the structures farmers have built, trends in nest box occupancy by barn owls, and the perceived effects of installing nest boxes on rodent pest problems.

CALIFORNIA ALLIANCE FOR SUSTAINABLE AGRICULTURE

SAREP's David Campbell is serving on the steering committee of the California Alliance for Sustainable Agriculture (CASA). CASA is a coalition of university programs and non-profit community organizations funded by a three-year, \$2 million dollar grant from the Kellogg Foundation. It is the largest of the 18 Integrated Farming Systems projects Kellogg has funded across the United States. Joining SAREP in the collaboration are the Bio-Integral Resource Center, the California Adolescent Nutrition and Fitness Program, the Center for Agroecology and Sustainable Food Systems of UC Santa Cruz, the Community Alliance with Family Farmers, the Lodi-Woodbridge Winegrape Commission, the Rural Development Center, and the Sustainable Cotton Project. CASA's collaborative projects include a database on agricultural sustainability, a series of workshops on sustainable alternatives to methyl bromide, a media outreach effort to educate the public about sustainable agriculture, outreach to farmworkers in the Salinas Valley, and start-up support for the California Sustainable Agriculture Working Group. Other CASA activities include creating guides for reducing farm chemical use, introducing IPM practices to winegrape and tomato growers, a leadership training program, and a community planning process in Santa Cruz County for sustaining agriculture in the face of environmental threats and urban development.

Campbell's work for the coalition is focused on developing a working paper to identify concrete strategies for implementing sustainable agriculture in ways that enhance local and regional economic and social development. During Year One of the Kellogg grant, a background paper presenting a rationale for sustainable agriculture as an economic development strategy was prepared. During Year Two, consultations with community food systems groups and presentations at sustainable agriculture meetings were made to disseminate these ideas, and case study material from a variety of California locations was collected. Recent developments, including local marketing campaigns in Sonoma, Placer, and Humboldt counties, indicate a renewed interest in fostering positive links between agriculture and communities and present a ripe opportunity for comparative analysis and information sharing. During Year Three of the grant, the earlier working paper was revised through the development of in-depth case studies. This revised paper was presented at the October 1995 "Politics of Sustainable Agriculture" conference in Eugene, Oregon. Campbell will continue to work directly with grass roots community groups in California to develop and evaluate community food systems projects which enhance local economic development. Already, working relationships have been established with representatives of Sonoma Select, Humboldt Harvest, and PlacerGROWN.

Campbell also produced a fact sheet highlighting key trends and contradictions in California agriculture.

The fact sheet addresses a diverse range of issues, including agricultural productivity, pesticide use, farm concentration, hunger and poverty, labor wages and conditions, farmland conversion, water issues, organic production, and farmers' markets. The fact sheet was distributed at the February 1995 networking meeting of the Kellogg IFS initiative to a national audience of leaders in sustainable agriculture.

DEVELOPING COMMUNITY FOOD SYSTEMS

SAREP analysts [Gail Feenstra](#) and David Campbell are engaged in research and outreach activities designed to promote development of community food systems. These systems integrate ecologically sound distribution and consumption patterns with sustainable production to enhance the economic and social life of particular regions. Among the activities to date are: creation of a new section in SAREP's Request for Proposals on community food systems, development of an extensive bibliography, preparation of a flyer on "Ten Things You Can Do To Develop a Community Food System," developing links between farmers and agencies that use the Alameda County Community Food Bank, and consultation with county advisors and community groups interested in starting local food system projects in their cities, counties, or regions. Feenstra has written a review of local food systems in the United States with a critical analysis of their strengths and weaknesses, and identified strategies that might be most effective in developing additional community food systems. This paper was presented at the October 1995 "Politics of Sustainable Agriculture" conference in Eugene, Oregon.

LINKING LOCAL FARMERS WITH SCHOOL FOOD SERVICES

[Gail Feenstra](#) has been collaborating with the UC Small Farm Center, the California Alliance with Family Farmers, the California Federation of Certified Farmers' Markets and the California Association of School Business Officials to facilitate partnerships between local farmers and school food service buyers. A presentation (and pamphlet) titled "How to Buy from Local Farmers" was given at the statewide meeting of school food service directors in April 1995. A research project that would conduct case studies of participating and nonparticipating school districts and several pilot projects is now being developed. Information from the case studies and experiences from the pilot projects will be the basis of a guide for school food service buyers and farmers about how such partnerships might successfully be formed. It will also include local contacts by crop and region. The guide will be disseminated widely through Cooperative Extension and the California Department of Education.

SUSTAINABLE FOOD SYSTEMS CONCEPTS IN LOCAL GOVERNMENT CLASS

For several years, David Campbell and [Gail Feenstra](#) have created assignments and course curricula related to agricultural sustainability, regional food systems, and community economic development for government classes at UC Davis. Students in the classes have done field research projects to identify the possibilities of substituting locally grown foods for imported foods into the greater Davis community food system, and the university campus food service.

COVER CROPS WORKGROUP

Chuck Ingels organized and now chairs the UC Cover Crops Workgroup. The workgroup has nearly 100 members, mostly UC personnel. The purpose of the workgroup is to provide a forum for Cooperative Extension farm advisors and specialists, UC faculty, and others to share information, determine the highest priority research and extension needs, and to coordinate activities to fulfill these needs. Two meetings have been held, at which researchers presented results of cover crop-related experiments. Abstracts of these projects are available from Ingels either by mail (\$5.00, checks payable to UC Regents) or e-mail (free; caingels@ucdavis.edu).

COMMUNITY DEVELOPMENT AND PUBLIC ISSUES WORKGROUP

David Campbell is participating in DANR's Community Development and Public Issues (CDPI) Workgroup. The workgroup was recently formed from the merger of the Community Development and Public Policy workgroups. Its members are working to promote DANR's effective involvement in policy issues and in partnerships with California communities. At a May 1995 CDPI-sponsored workshop Campbell presented a matrix for comparative analysis of "community interventions" by DANR personnel. The matrix and analysis will be available in a forthcoming proceedings of the conference to be published by DANR. He is also on the planning committee for a CDPI workshop which will train county advisors in effective methods for becoming involved in public issues.

WESTERN REGION SARE

UC SAREP carries out several activities with support from its national counterpart, the U.S. Department of Agriculture's Sustainable Agriculture Research and Education (SARE) program, which is managed for the western states by the Western Region SARE program located at Utah State University. In June of 1994, UC SAREP Associate Director Jill Shore Auburn was selected via a competitive process to coordinate the Western SARE Consortium/Network for implementation of the Professional Development/In-Service Education program for Cooperative Extension, Natural Resource Conservation Service, and other agricultural professionals. The program is a coordinated effort of competitive grants and state-level strategic planning and implementation grants in the 13 western states and four Pacific Island affiliates in the region.

UC SAREP also houses the Western SARE Communications Specialist, Kristen Kelleher, who provides public information and outreach for the entire Western SARE program of research and education grants, Agriculture in Concert with the Environment grants (a partnership between USDA and U.S. Environmental Protection Agency), and the SARE Farmer/Rancher Research Grants.

SUSTAINABLE AGRICULTURE NETWORK

Jill Shore Auburn continues to serve on the Executive Committee of the national Sustainable Agriculture Network, a USDA SARE-funded effort of information exchange which she helped to develop as chair of the SAN Committee from its inception through 1993. SAN provides information in printed publications and electronic databases (on diskette and on the Internet) and sponsors an Internet electronic mail discussion group, SANET-MG, with more than 700 participants.

AGRICULTURAL PRODUCTION EDUCATION PROGRAM

SAREP analysts [Robert Bugg](#) and Chuck Ingels are participating as mentors in the Agricultural Production and Education Program, which was started by Winters walnut grower Craig McNamara. This is a pilot program designed to offer high school students firsthand experience in sustainable agriculture and on-farm research. The program, which began in 1994, is being coordinated by Sandy Creighton and Mark Linder of the California Foundation for Agriculture in the Classroom. In the first year, it involved six students from each of four high schools from Northern California. Students worked on projects with the assistance of four UC Davis mentors, including Mike Singer, soil scientist in the UCD land, air and water resources department, Frank Zalom, director of the Statewide Integrated Pest Management Project, and Bugg and Ingels. Students participated in walnut harvest, planted cover crops, attached cardboard bands to trees for codling moth control, and built and installed barn owl boxes. Students also conducted research projects and toured UCD research facilities. In 1995, the project expanded to two additional schools. The program is being evaluated and promoted by Linda Whent, lecturer in the agronomy and range science department.

SUSTAINABLE AGRICULTURE IN SPANISH

Spanish language materials about sustainable agriculture farming practices are now available at five California sites: the UC Davis Small Farm Center, the Rural Development Center in Salinas, the UC Cooperative Extension offices in Fresno and San Diego, and at the Center for Chicano Studies at UC Santa Barbara. Seventy-four Spanish documents at each site describe practical information about alternative agriculture practices appropriate for small-scale, entry-level Hispanic farmers, farm advisors or others who work with this population. All of these documents have been summarized in English and appear in A Guide to Spanish Language Sustainable Agriculture Publications (see Publications section, p. 44).

MEDIA OUTREACH

In addition to direct outreach via meetings, workshops or program publications, SAREP gets information to farmers, researchers, agricultural professionals, policy makers and consumers through the popular press (newspapers, magazines, radio and television), the agricultural trade press, professional journals and postings to the Internet. Press releases about research projects, specific farming practices, workshops, symposia and other program activities sent out via mail, electronic mail and Internet discussion group postings have prompted numerous print and broadcast news stories in California, the nation and the world.

Between July 1993 and July 1995 articles have appeared in the Los Angeles Times, the Washington Post, the Hokkaido Shimbun Press (Sapporo, Japan), the Chicago Tribune, the Sacramento Bee, the San Francisco Examiner, the Topeka Kansas Capital-Journal, the San Francisco Bay-Guardian, Organic Gardening, Sunset Magazine, Business Week, and numerous smaller state and local newspapers and magazines. Other major media contacts resulting in stories have been made with CNN, the MacNeil/Lehrer News Hour, National Public Radio (Morning Edition and Living on Earth), 48 Hours/CBS; KGO-TV San Francisco; KRON-TV San Francisco; KCRA-TV Sacramento; KPFA-Radio Berkeley; KMJ-Radio Fresno; WILL-Radio Urbana, IL; WIBW-Radio Topeka, KS. Additionally, articles have appeared in wire service feeds from the Associated Press, Copley News Service, McClatchy News Service and the Bay City News Service.

Agricultural trade publications and professional journals that have carried stories about SAREP activities in the last two years include AGWEEK, New Farm, California Farmer, California-Arizona Farm Press, Ag Alert, The Packer, Dairyman Magazine, The Cheese Reporter, American Journal of Alternative Agriculture, HortScience and many others.

Additionally, SAREP has made use of PROFNET, an Internet electronic mail discussion group for the news media and university professionals. Through PROFNET, the program has been able to reach news outlets throughout the world with information about SAREP activities and individual experts. There have been numerous other Internet postings in the last year to scientific and agricultural interest groups throughout the world. For example, postings have been made about SAREP publications and research to SANET-MG, a 700-member sustainable agriculture electronic mail discussion group, which have resulted in articles in sustainable agriculture publications.

LINKS TO OTHER PROGRAMS THROUGH ADVISORY BOARDS

SAREP Director Bill Liebhardt and Associate Director Jill Shore Auburn have served on the advisory boards and advisory committees of numerous sustainable agriculture organizations and government agencies including the California Department of Food and Agriculture's Pest Management Advisory Committee and Fertilizer Research and Education Program, the Organic Farming Research Foundation,

the Henry A. Wallace Institute for Alternative Agriculture, and the World Sustainable Agriculture Association. [Gail Feenstra](#) serves on the boards of the statewide California Sustainable Agriculture Working Group, the Center for Urban Education about Sustainable Agriculture and the Agriculture, Food and Human Values Society.

EDUCATION FOR EXTENSION PROFESSIONALS

A new USDA program for professional education in sustainable agriculture was initiated in 1994. Funding was made available under the 1990 Farm Bill (Title XVI, Subtitle B, Chapter 3) for each state to develop a statewide strategic plan for professional development, targeting Cooperative Extension (CE) advisors, Natural Resources Conservation Service (NRCS) field staff, and other agricultural consultants. SAREP coordinated this activity in California.

Our planning process centered around three focus groups, which were held in November and December of 1994 in Merced, Riverside and Davis. The purposes of these meetings were to better define the educational needs and interests of the target

Activities

audiences, and identify the methods and strategies that would be most successful in meeting those needs. More than 60 individuals participated in the focus groups including CE advisors and county directors from each of its four regions, NRCS field staff, farmers, and representatives of several UC programs and non-profit organizations involved in sustainable agriculture education.

Since the target audiences for the Chapter 3 program are initially CE and the NRCS, the participation of advisors and field staff from these organizations was especially important. The plan builds on the considerable expertise and ongoing work of California's CE and NRCS personnel in extending information about sustainable agriculture, and aims to enhance their work with farms, ranches and communities across the state.

Much of the discussion that took place during the planning meetings focused on enriching the educational efforts that are already underway and strengthening the programs of the many organizations and groups in California involved in sustainable agriculture education. In summary, the planning groups recommended a three-part approach that:

- ε builds on existing educational programs;
- ε provides focused programs and farm tours on high priority topics and issues; and
- ε strengthens extension teams and networks addressing related problems and issues.

These components and the assessment of educational needs and interests of the target audiences are described in detail in the planning document which is available from SAREP.

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LONG-TERM RESEARCH ON AGRICULTURAL SYSTEMS

In addition to funding competitive research grants and distributing information, the UC Sustainable Agriculture Research and Education Program is charged by the California Legislature to

answer questions about the long-term effects of agricultural practices. Most of the chemical, biological and physical processes that define the sustainability and environmental impacts of agricultural practices occur over long time periods ranging from ten to 100 years. Many scientists agree that the answers to the questions about long-term impacts can only be obtained through extended field experiments. Long-term farmland research sites are field laboratories for on-going studies of fundamental processes and mechanisms that influence the sustainability of agricultural systems. While the emphasis of long-term studies is on research and data collection over a long period, information can be gathered and distributed continuously.

In fiscal year 1989/90, SAREP provided \$150,000 to a project entitled, "Long-term Research on Agricultural Systems: Crop Diversity and Input Level as Determinants of Function and Evolution of the Agroecosystem" (LTRAS), involving a team of 18 researchers at UC Davis. This one-time award was given to help establish the first long-term research facility in irrigated agriculture in a Mediterranean climate anywhere in the world. LTRAS is located on 300 acres in Yolo County and is directed by R. Ford Denison, agronomy and range science department, UC Davis. LTRAS represents a major commitment of University of California partners to the sustainability of California agriculture. The LTRAS project addresses questions about the appropriate level and nature of inputs to define a sustainable agricultural system that meets our requirement for food and for the environment. The UC Davis College of Agriculture and Environmental Sciences committed almost \$550,000 in matching resources to this site from 1990-1993, and \$155,000 for FY 1993/94. The project continues to receive major support from the college. It also recently received a \$275,000 National Research Initiative (NRI) grant from USDA.

The first experiment on the site, which was started in late 1993, is a 60-acre comparison of annual cropping systems that include rotations with wheat, corn, tomatoes, and winter legume cover crops. Initially, the experiment included ten cropping systems that differ in reliance on external inputs of irrigation water and nitrogen, and included a two-year organic corn/tomato rotation. Long-term trends in key soil properties, such as organic matter, weed seeds, pH, and salinity, are being monitored. Resulting differences in yield, resource use efficiency, profitability, and environmental impact (such as leaching of nitrate or pesticides) will be used to evaluate the sustainability of these cropping systems. LTRAS is expected to make important contributions to agricultural science within a few years, as well as over the long-term. In FY 1993/94, SAREP paid for pest management consulting services provided by Kerry Beane, an expert in IPM and organic methods. In FY 1994/95, SAREP awarded \$10,000 to Denison to establish a new four-year organic rotation (*see Sustainable Agricultural Production Grants, p. 36*).

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BIOLOGICALLY INTEGRATED FARMING SYSTEMS (BIFS)

Field Crops Row Crops Orchards Vineyards

Results from successful Biologically Integrated Orchard Systems (BIOS) projects inspired new enabling legislation (Assembly Bill 3383), which was passed unanimously by both houses of the California legislature and signed into law by Governor Pete Wilson in late 1994. Under AB 3383, UC SAREP awards grants through a competitive process for pilot demonstration projects to help farmers learn about "biologically integrated farming systems" (BIFS). Projects were proposed for wine grapes, cotton, various field and vegetable crops, citrus, and pears. Proposals were evaluated by the Program Advisory Review Board, as designated in AB 3383.

The California Department of Pesticide Regulation and the U.S. Environmental Protection Agency have provided funding of \$670,000 for projects to begin in FY 1995/1996 and beyond. Additional funding will be needed to fully fund the five pilot projects that are specified in the legislation.

In early August 1995, the first two projects were funded and are described below. These projects are not covered in the financial report. We will be reporting on these and other BIFS projects in future progress reports.

EXTENDING BIOLOGICALLY INTEGRATED FARMING PRACTICES WITHIN THE SAN JOAQUIN VALLEY'S WEST SIDE

Budget:

FY 95-96: \$91,912

Project Leaders:

Jeff Mitchell, UC Cooperative Extension, vegetable crops specialist, Kearney Agricultural Center

Pete Goodell, regional IPM advisor, Kearney Agricultural Center

Tim O'Neill, manager, O'Neill Farming, Fresno County

John Diener, manager, Red Rock Ranch, Fresno County

Don May, UC Cooperative Extension farm advisor, Fresno County

Project Support Team:

Tim Prather, regional IPM advisor, Kearney Agricultural Center

Rich Coviello, UC Cooperative Extension farm advisor, Fresno County

Kurt Hembree, UC Cooperative Extension farm advisor, Fresno County

Carol Shennan, associate professor, Department of Vegetable Crop/Weed Science, UC Davis

Project Technical Advisors:

Walt Bentley, regional IPM advisor, Kearney Agricultural Center

Jim Stapleton, regional IPM advisor, Kearney Agricultural Center

Stu Pettygrove, specialist, Department of Land, Air and Water Resources, UC Davis

Kate Scow, associate professor, Department of Land, Air and Water Resources, UC Davis

Frank Menezes, district conservationist, Natural Resource Conservation Service, USDA, Fresno

Fred Thomas, consultant, Cerus Consulting, Richvale

Charlie Summers, associate entomologist, Department of Entomology, UC Berkeley/Kearney Agricultural Center

This participatory extension and research project is designed to facilitate information exchange among farmers, consultants and researchers on biologically integrated farming practices within the West Side of the San Joaquin Valley (SJV). It is modeled on the Biologically Integrated Orchard Systems (BIOS) projects, which have been developed primarily for a single, permanent crop. In this project, participating farmer, university and private and public agency members have embraced the BIOS spirit, but modified the approach to best match the rotational cropping patterns of Central Valley row crop farmers. The project will monitor and evaluate on-farm demonstrations of soil-building practices and options for reduced reliance on agrichemicals, determine the extent to which integrated pest management practices are used in row crops on the West Side, and identify problems preventing further adoption. It will provide community demonstrations of technologies while making use of participatory research teams to develop

and refine additional information. The project will provide technical assistance to farmers and their consultants, and intensive pest management monitoring of fields enrolled in the project. Side-by-side comparisons between conventionally managed and biologically-based production systems will be established on the 13 cooperator farms. In each of the biologically integrated parcels, cover crops and composted organic materials will be integrated into rotations wherever appropriate, while in the conventionally managed parcels, mineral fertilizer applications will be made. A common West Side crop rotation of tomatoes/cotton/onions-garlic will be followed at most sites. Pest management practices will be evaluated and alternatives will be developed through a participatory process. On-farm pest management demonstrations, hands-on training, and field workshops will provide invaluable links with work groups and task forces. While this program focuses primarily on annual cropping systems of the Huron/Five Points area, the findings and results of these activities will be applicable to the entire western side of the SJV which is 200 miles long and 20 miles wide and extends from Los Banos to Bakersfield.

IMPLEMENTING A BIOLOGICALLY INTEGRATED FARMING SYSTEM FOR WINE GRAPES IN THE LODI-WOODBRIDGE WINEGRAPE DISTRICT

Budget:

FY 95-96: \$100,000

Investigators:

Mark Chandler, executive director, Lodi-Woodbridge Winegrape Commission

Clifford Ohmart, consultant, Scientific Methods, Inc., Durham

Cooperators:

Frank Zalom, director, Statewide IPM Project/specialist, Department of Entomology, UC Davis

Paul Verdegaal, UC Cooperative Extension farm advisor, San Joaquin County

Kenneth Hagen, professor emeritus, Division of Biological Control, Department of Entomological Sciences, UC Berkeley

Grapes are the leading economic crop grown in California, with a total value of over \$1.6 billion (CDFA, 1994). In 1988 more than 1 million pounds of insecticides and one-quarter million pounds of miticides were applied to vineyards to control pests. The Lodi-Woodbridge Winegrape Commission includes 650 growers on 46,000 acres of vineyards. The BIFS wine grape project is based on biologically integrated farming methods that the Commission began developing in 1992 to reduce chemical pesticide use, promote effective and rapid adoption of sustainable wine grape production practices, and promote economic development in San Joaquin County by cultivating a market niche for wine grapes produced with more environmentally sensitive practices. Prototype vineyards have dramatically reduced the use of pesticides and synthetic fertilizers while maintaining crop yield and quality through the use of cover crops and composts, weed management using more environmentally sensitive cultural practices, careful monitoring of mite and insect populations, mite management through release of mite predators, encouraging natural enemies by establishing refuges, and the conversion of some vineyards to drip irrigation. With the cooperation of district growers the Commission is implementing BIFS on 30 vineyards comprising 1,921 acres. To ensure the success of the program the commission has assembled cooperators and a management team made up of the Statewide IPM Project director, a University of California scientist pivotal in the development of IPM, a University of California Cooperative Extension

viticulture farm advisor, consultants experienced in implementing BIFS technologies, pest control advisors, and growers. Participating farms were evaluated by the BIFS team at the onset of the project and will be monitored seasonally. The Commission is conducting ongoing side-by-side comparisons of yields and pesticide use between the BIFS-farmed blocks and conventionally farmed blocks on the farms of cooperating growers. The results of the comparisons will be made available with other project data at monthly grower meetings, field days, smaller neighborhood grower meetings, seminars, and in monthly newsletters.

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FINANCIAL INFORMATION

	FY93/94	FY94/95
INCOME		
Permanent state and UC funding	\$633,139	\$639,869
Temporary budgetary savings	\$(25,326)	\$(25,595)
Temporary state funding	\$ 33,900	\$ 3,000
Total Income	\$641,713	\$617,274
EXPENSES		
Grants	\$199,946	\$167,460
Information development and dissemination	\$288,565	\$279,131
Program expenses	\$153,202	\$170,683 (1)
Total Expenses	\$641,713	\$617,274
EXTRAMURAL FUNDING		
California Energy Commission (2)	\$26,937	\$19,586
Community Alliance with Family Farmers Foundation	\$6,500	\$10,000
Kellogg-California Alliance for Sustainable Agriculture	\$25,284	\$17,164
SARE (Statewide Strategic Plan)	\$ -	\$10,000
SARE (Western Region-Extension Training)	\$ -	\$94,000
Other funding (3)	\$6,653	\$10,117
Total Extramural Funding	\$65,374	\$160,867

1 Includes nonrecurring expenses associated with moving our offices.

2 SAREP work authorization under contract to UC Davis Department of Biological and Agricultural Engineering.

3 Includes sales of publications and other miscellaneous income.