



UNIVERSITY OF CALIFORNIA

Sustainable Agriculture Research and Education Program

www.sarep.ucdavis.edu

Engaging Farmers in Agricultural Research through On-Farm Demonstrations: Biologically Integrated Farming Systems (BIFS)

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With a \$3,650 grant from SAREP in 1988, UC farm advisor Lonnie Hendricks began monitoring two Merced County almond orchards farmed by brothers Glenn and Ron Anderson. Glenn farmed organically, while Ron used herbicides and insecticides on his almonds right across the road. Hendricks' project, expanded to include eight other orchards in additional studies funded by SAREP, showed that organic almond orchards compare favorably to orchards farmed conventionally. Data from the project inspired the Community Alliance with Family Farmers (CAFF), in collaboration with SAREP staff, to launch demonstration projects aimed at agricultural chemical use reduction. These projects became known as the Biologically Integrated Orchard Systems (BIOS) program.

Initial success with the BIOS project in almonds, characterized by a collaborative and interdisciplinary management team, voluntary participation of interested growers and the use of financial incentives such as free cover crop seed, led the California Legislature to create the Biologically Integrated Farming Systems (BIFS) program to extend this approach. Assembly Bill 3383 (Bornstein, Brown, and Snyder) was signed into law in September 1994 establishing BIFS. The bill requested the University of California to establish a pilot demonstration program to provide extension services, training, and financial incentives for farmers who voluntarily participate in pilot projects to reduce their use of agricultural chemicals. Since 1994, funds have been provided by the California Department of Pesticide Regulation's Food Safety Account, the U.S. Environmental Protection Agency (US-EPA), and the UC Division of Agriculture and Natural Resources. New legislation (AB 1998, Thomson) signed in September 1998 expanded the goals and extended the time frame of the existing program and allocated additional state funding. Two large-scale, multi-year projects were chosen for funding in 1995; five additional projects were funded at the end of 1998, and two were funded in 1999.

The goal of BIFS is to demonstrate and expand the use of integrated farming systems that have been proven to economically reduce the use of farm chemicals. Farmers involved in BIFS projects are:

- integrating biological and cultural control of pests into their production systems;
- using pest monitoring and economic action thresholds to advise the timing of chemical applications;
- emphasizing soil-building practices such as the use of cover crops to provide all or part of the nitrogen needed by crops, increase water infiltration of the soil, and decrease erosion and flooding;
- creating on-farm habitat and restoring riparian areas to encourage beneficial insect populations and improve habitat for fish, migrant birds and game species; and
- improving livestock management while protecting natural resources.

COMPETITIVE GRANTS PROGRAM

These on-farm demonstration projects are selected for funding through the BIFS competitive grants program. Projects are selected based on clearly defined criteria outlined in a Request for Proposals. A 13-member advisory board reviews proposals and makes recommendations for funding to the SAREP director. Renewal of funding for subsequent years is based on demonstrated progress.

SAREP FUNDED PROJECTS

The first projects selected for funding in 1995, in winegrapes and in cotton and rotational row crops, completed their third and final year in 1998. Separate fact sheets are available from the SAREP Web site (www.sarep.ucdavis.edu) for these two projects: *Implementing a Biologically Integrated Farming System for Winegrapes in the Lodi-Woodbridge Winegrape District*, or "Winegrape BIFS," and *Extending Biologically Integrated Farming Practices within the San Joaquin Valley's West Side*, or "Westside BIFS." Projects funded in 1998 and 1999 are summarized below.

1999

■ ***Integrating Forage Production with Dairy Manure Management in the San Joaquin Valley***, Stuart Pettygrove, \$300,484 (3 years)

Many dairies in the state use lagoons to store waste manure in liquid form. Demonstration farms will accurately time the pumping of dilute, nutrient-containing water from the lagoons to adjoining cropland to coincide with the nutrient demands of the forage crop. The forage grown is used in the same dairy, which closes the nutrient cycling loop and reduces environmental pollution. This project is trying to work pro-actively to prepare dairies for the enforcement of existing federal and state regulations, and for future manure management regulations.

■ ***Integrated Pome Fruit Production in Contra Costa County***, Janet Caprile, \$140,000 (3 years)

Rapid urbanization around apple orchards in Contra Costa County has led to agricultural-urban interface problems, with the use of pesticides being the primary concern. This project focuses on reducing the use of broad-spectrum insecticides in apple orchards. A key component of the project is the use of mating disruption (MD) for codling moth control. But MD is expensive, and this BIFS project would reduce cost and risk barriers to the adoption of MD by providing cost share and monitoring assistance. In project orchards, the use of organophosphates, carbamates and other broad spectrum, ecologically disruptive materials should be reduced by 70 to 80 percent in the first year and by 80 to 90 percent in the second and third years. After the third year, total pest control costs for project orchards are expected to be comparable to conventional orchards. Growers should then be able to afford to integrate the program into their own management practices.

1998

■ ***Biologically Integrated Farming System in Rice***, Randall Mutters, \$286,200 (3 years)

Priorities in the rice project include summer water depth management, winter flooding, drill seeding, and the use of winter cover crops. Project collaborators include a UC Cooperative Extension farm advisor, UC Davis faculty and extension researchers, an agronomist/pest control advisor for the Butte County Rice Growers Association, and eight rice farmers. Rice farmers have expressed interest in improving water quality, and in addressing the issue of increased weed resistance to herbicides and more regulations, which have increased production costs.

■ ***Expansion of the Biologically Integrated Orchard Systems Model to Northern San Joaquin Valley Walnut Orchards***, Joseph Grant, \$154,160 (3 years)

The project will extend practices from the similarly designed Biologically Integrated Orchard Systems (BIOS) project to walnut farmers in the San Joaquin Valley. The use of less disruptive pesticides in combination with pheromone mating disruption (MD) and biological control with *Trichogramma* wasps is expected to help the project effectively control codling moth while reducing the use of chemical pesticides. At the same time, the project is working to incorporate cover crops and intensive monitoring into the farming practices of BIFS participants. Outreach to area farmers, including a newsletter and field days, will be coordinated through a collaboration with the Community Alliance with Family Farmers. Ten farmers have enrolled 230 acres in the first year of the walnut BIFS project.

■ ***Citrus Orchard Management—Economic, Environmental, and "Knowledge Access" Considerations***, Mark Freeman, \$238,700 (3 years)

The project is working with citrus growers on the eastern side of the San Joaquin Valley. Responding to regulatory interests in further protecting ground water, it is focusing on careful monitoring and the use of economic action thresholds to guide pesticide and fertilizer applications. Another project focus is in economics, with private industry and UC Cooperative Extension cooperating to develop customized cost studies and evaluate risk management. In addition, water management tools will be customized for use in citrus. Six farmers have enrolled in the first year of the citrus BIFS project.

■ ***Proposal to Develop and Implement a Biologically Integrated Production System for Prunes***, Gary Obenauf, \$270,000 (3 years)

The prune BIFS project is a part of the larger Integrated Prune Farming Practices Program working with 22 prune growers in 10 counties in the Sacramento and San Joaquin valleys. The project focuses on reducing the use of dormant season organophosphate pesticides, increasing orchard monitoring activities, and reducing applications of synthetic nitrogen fertilizers. Demonstration orchards will be established in each county, and the orchards will be split to compare the conventionally managed and biologically based production systems.

■ **BASIS (Biological Agriculture Systems in Strawberries): A Biointensive Production Methods Innovators Group in the Monterey Bay Region**, Carolee Bull, \$300,000 (3 years)

This project works with growers in Santa Cruz and Monterey counties, a region that produces 50 percent of California's strawberries. Working with eight strawberry growers, the project focuses on testing and demonstrating alternatives to the soil fumigant methyl bromide by introducing or augmenting through cultural practices beneficial organisms such as soil microbes and arthropods. The strawberry BIFS project also examines non-chemical weed control methods, including the use of hot water treatments to kill seeds and seedlings, and the application of different mulches.

1995

■ **Implementing a Biologically Integrated Farming System for Winegrapes in the Lodi-Woodbridge Winegrape District**, Cliff Ohmart, \$312,616 (3 years)

■ **Extending Biologically Integrated Farming Practices within the San Joaquin Valley's West Side**, Jeff Mitchell, \$278,324 (3 years)

COLLABORATIVE RESEARCH AND EXTENSION ACTIVITIES

Since BIFS projects emphasize a collaborative and interdisciplinary approach, SAREP staff work closely with them, assisting with project outreach efforts and providing natural and social science technical support in their areas of expertise. Staff also provide technical assistance by presenting at field days, assisting with customized farm plans, and reviewing and editing publications.

The BIFS Workgroup

SAREP is a Statewide Special Program of the University of California Division of Agriculture and Natural Resources (DANR). DANR provides funding and institutional support for workgroups in high priority areas of research and extension. Workgroups bring together Agricultural Experiment Station (AES) and Cooperative Extension (CE) personnel along with non-DANR partners to work on emerging and continuing priority issues in DANR program areas. SAREP staff will administer a new BIFS Workgroup, which will provide a forum for BIFS and other similar projects (not funded by SAREP) to share ideas, resources, and experience. Possible actions by the Workgroup include sharing information management databases and survey instruments, developing a BIFS "how-to" manual, coordinating data collection between projects, and planning workshops and a symposium.

Biologically Integrated Orchard Systems (BIOS) Partnerships

The Biologically Integrated Orchard Systems, or BIOS, is a technical assistance program coordinated by the Community Alliance with Family Farmers (CAFF). It was the model for the BIFS program and continues throughout the state. BIOS demonstrates the viability of farming systems that rely on reduced chemical inputs, and the power of linking agricultural institutions to work toward a common goal. BIOS projects for almonds and walnuts, the second and ninth biggest food crop users of pesticides in California, are established in seven counties. SAREP staff members have served on the management teams of BIOS projects in Merced, Colusa, Yolo, and San Joaquin counties, and continue to present at field days and assist with pesticide use analysis.

Regional Initiatives in Sustainable Vineyard Management

SAREP has worked with the Central Coast Vineyard Team (CCVT) since 1995. The CCVT is a tri-county grower group whose mission is to promote sustainable vineyard practices along California's Central Coast. CCVT members own or manage over 30,000 acres of Central Coast winegrapes. The CCVT has developed the Positive Points System (PPS) — a 1,000-point protocol for evaluating adoption of sustainable farming practices for a single farm or region and over time. The PPS, through a series of questions, outlines a model vineyard that integrates soil, water, pest, and viticultural practices. The model vineyard is designed to be less dependent on chemical inputs and relies on biological systems. This integrated production system could eventually be used as the basis for a regional eco label for winegrapes. For more information see the Web site at <http://www.vineyardteam.org/index.html>

Alternative Farming Systems and the Food Quality Protection Act of 1996

With funding from the U.S. Environmental Protection Agency, SAREP is coordinating a diverse team made up of winegrape, table, and raisin grape industry representatives, as well as federal and state regulators, other University of California researchers, and environmental groups to support a Food Quality Protection Act (FQPA) transition process for the California grape industry. This process analyzes the grape industry's pest management system for winegrape, raisin and table grapes. Such analysis is a first step in the larger description of an alternative whole farming system (like a BIFS project) that can reduce reliance on the most toxic agricultural chemicals. Three crop-pest profiles are being developed and include information on statewide and/or regional pesticide use for all major and many minor pests. They describe the cultural, biological and chemical control methods currently available and highlight where additional research is needed or where non-FQPA impacted alternatives do exist and greater effort into actual on-farm implementation is needed.

Nitrogen Dynamics in Sprinkler-irrigated Cover-cropped Organic Almond Orchards

This study was conducted in part in an organic almond orchard by the UC Davis Department of Environmental Horticulture, in collaboration with SAREP. The study concerned nitrogen availability from cover crops and showed that vetch hay left on the soil surface decomposed rapidly, releasing nitrogen to the soil. Over 90 percent of the nitrogen originally contained in the vetch hay was released during the first six weeks, with less than five percent loss of nitrogen to the atmosphere as volatile ammonia. This work strongly implies that leguminous cover crops can be an important source of nitrogen in untilled, sprinkler-irrigated Biologically Integrated Orchard Systems (BIOS).

The Role of Nightcrawler Earthworm (*Lumbricus terrestris*) in Residues of Leguminous Cover Crops

SAREP collaborated with the Swedish Agricultural University in Uppsala on a study that included laboratory and field components. The data indicated that the addition of *L. terrestris* to the resident complex of earthworms significantly increased the rate of disappearance of woollypod vetch (*Vicia villosa* ssp. *dasycarpa*) litter. Other decomposers that feed on vetch litter included various isopod Crustacea and European earwig.

Increasing the Adoption of Sustainable Agriculture in the Central Valley

SAREP staff are collaborating with the Community Alliance with Family Farmers, the Lodi-Woodbridge Winegrape Commission and UC researchers to study why farmers adopt sustainable agriculture practices and how community links might be strengthened to support adoption. With funding from the USDA Fund for Rural America, farmers in the Biologically Integrated Farming System (BIOS) program and community stakeholders in Stanislaus and Merced counties have been interviewed to identify current and potential collaborations in the areas of farmland preservation and local marketing.

SELECTED RESOURCES AND PUBLICATIONS

How to Order

SAREP Publications

A complete list of all SAREP publications is available on the Web at www.sarep.ucdavis.edu.

Biologically Integrated Farming Systems (BIFS) Progress Report: January 1999. Available on the SAREP Web site. Price: **Free**.

Exploring Eco Labeling for California Winegrapes: Conference Proceedings. Edited by Janet C. Broome, Clifford Ohmart, Angela Moskow, and Jennifer Waddel. 1999. Available on the SAREP Web site. Price: **Free**.

Soil Quality Topics: A Selection of Resources for Education and Extension. Edited by David Chaney and Ann Mayse. 1999. Price: **\$30.00**.

Cover Crops: Resources for Education and Extension. Edited by David Chaney and Ann Mayse. 1998. Price: **\$20.00**.

Sustainable Farming Systems: A Guide to the Transition. By Ann Mayse. 1997. Price: **\$6.50**.

Sustainable Agriculture. Three-times per year newsletter from SAREP. **Free** in U.S.; foreign subscribers are asked to make a donation of \$10.00 or more annually to cover postage. Available in print and on the SAREP Web site.

DANR Publications

DANR publications can be ordered by phone, Fax, mail, or Internet directly from UC DANR Communication Services.

Cover Cropping in Vineyards: A Grower's Handbook. Edited by Chuck Ingels, Robert L. Bugg, Glenn McGourty, and Peter Christensen. 1998. Price: **\$20.00**.

Related Publications

Enhancing Biological Control: Habitat Management to Promote Natural Enemies of Agricultural Pests. Edited by Charles H. Pickett and Robert L. Bugg. 1998. Price: **\$50.00**. Available from UC Press. Phone: (800) 777-4726; World Wide Web: <http://www.ucpress.edu>

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