MISSION STATEMENT

SAREP is a statewide program providing leadership and support for scientific research and education that promotes agricultural and food systems that are economically viable, sustain natural resources and biodiversity, and enhance the quality of life in the state's diverse communities.

The ***UC Sustainable Agriculture Research and Education Program (SAREP)*** was created through the grass roots efforts of organizations and indivduals concerned about the environmental impacts of agriculture, the health of rural communities, and the profitability of family farming operations in California. As a result of a legislative process and with UC leadership, the program was established with three mandates: administer competitive grants for research on sustainable agricultural practices and systems, develop and distribute information through publications and on-farm demonstrations, and support long-term research in sustainable farming systems on UC farmlands.

BASED ON OUR OVERALL MISSION AND THE FOUNDING LEGISLATION, SAREP HAS THREE GOALS:

■ California farmers and ranchers are more able to manage their land and businesses in ways that are economically viable and that protect and enhance both human and natural resources and biodiversity.

■ Consumers have a closer connection to agriculture and California's rural and urban communities are strengthened through participation in sustainable food systems.

■ Government programs and policies encourage and support the development of sustainable farms, ranches and communities in California.

goals

University of California
Division of Agriculture and Natural Resources

Biennial Report

of the UC Sustainable Agriculture Research and Education Program

To the California State Legislature
In response to SB 872 (Chapter 1188, Statutes of 1986)

July 1997 to June 1999

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University of California · Office of the President · January 2000

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture Research and Education Program

www.sarep.ucdavis.edu

SAREP In A New Century

In 1986, the California Legislature requested the formation of SAREP to respond to statewide concerns about public research and education efforts toward the pressing problems of the sustainability of California agriculture. I am happy to report to you that in 1997-1999, the directives of the founding legislation outlined in our mission and goals statements on the previous page were carried out by SAREP in an exemplary fashion.

How will SAREP help lead the effort to increase the sustainability of California agriculture into the next millennium? Looking back over the last two years provides part of the answer; SAREP has awarded more than $1.4 million in sustainable agriculture grants to both university and other applicants. Much of these funds went to support broad research and education partnerships within a particular region or commodity. For example, our Biologically Integrated Farming Systems program awards funds to farmers, farm advisors, and agricultural professionals to create strategic partnerships for agricultural chemical use reduction in winegrapes, walnuts, prunes, rice, citrus, strawberries, apples and other commodities. Our Community Development and Public Policy grants provide resources for food systems research and community-based initiatives that will lead to greater food security for urban residents and simultaneously forge stronger connections with local growers.

Never has the concept and practice of sustainable agriculture been more inclusive and broadly accepted. Sustainable agriculture has emerged as a conceptual tool with a clear research agenda for addressing the challenges confronting agriculture and food systems in California. I look forward to working with you to address the issues of agricultural sustainability in the new millennium and sharing with you, in this biennial report, program accomplishments to meet this challenge.

Sean L. Swezey, director

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

www.sarep.ucdavis.edu

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COMMUNICATION

NEWSLETTER AND WEB SITE

- SAREP publishes a newsletter, ***Sustainable Agriculture,*** three times a year. The newsletter includes reports on research projects, workshops and meetings funded by SAREP, as well as commentaries, updates on research and extension activities, technical reviews, and funding sources. The newsletter is available at the Web site or by contacting the SAREP office.

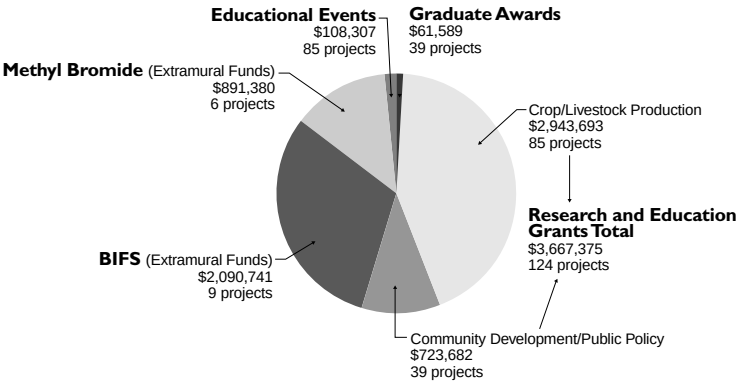
- The nationally recognized SAREP Web site ***(www.sarep.ucdavis.edu)*** provides access to SAREP-funded research and education projects, an interactive events calendar, the most recent biennial report, past and current issues of the newsletter, and extensive information databases on topics such as earthworms, cover crops, and soil quality information.

COMPETITIVE GRANTS

SAREP administers several competitive grants programs for research and education in sustainable agriculture. SAREP has funded 263 research, education and demonstration projects totaling more than $6,800,000 covering a wide range of topics relevant to the state's farmers, ranchers, and communities.

SAREP COMPETITIVE GRANTS 1987-1999

Total Funding: $6,819,392



Grant criteria and requests for proposals are available at the SAREP Web site or by calling SAREP at **(530) 752-7556.**

STAFF RESEARCH AND EDUCATION ACTIVITIES

Since 1987, SAREP has received $1.8 million in extramural funds for research and education projects. Staff members have participated as **speakers, moderators, and organizers** in over 500 workshops, conferences and educational events. Results of their work have been published in over 50 peer-reviewed articles, in addition to a large number of books, bulletins, videotapes, slide presentations and databases. Staff profiles are available on the Web.

PROGRAM AND TECHNICAL ADVISORY COMMITTEES

The **Program Advisory Committee** (PAC) reviews grants for relevance to SAREP's mission and assists in long-range program planning. The **Technical Advisory Committee** (TAC) makes recommendations about the scientific merit of grant applications. Current lists of the PAC and TAC are available at SAREP's Web site.

research

Photo courtesy of Steve Temple

The Sustainable Agriculture Farming Systems (SAFS) Project (Temple 1988-99), *is developing information about the transition from conventional management to low-input and organic practices. Four cropping systems with different rotations of tomatoes, wheat, corn, safflower and/or cover crops have been evaluated: two conventional, a low-input system, and an organic system. Data collected show the low-input system offers significant agronomic and economic advantages. New research is developing reduced-tillage tomato production methods, nonchemical and low-chemical weed control tactics, and cover crop management that improves nitrogen availability following cash crops.*

ENSURING THE LONG-TERM VIABILITY OF CALIFORNIA AGRICULTURE

Many California producers are modifying the way they farm and seeking new ways of managing their businesses to stay both profitable and environmentally sensitive. They are combining information, management skills, and determination with new learning environments and partnerships to develop production systems which meet the demands of society, address concerns for the natural environment, and provide economic security for their families and businesses. This transition is the essence of sustainable agriculture.

Through a yearly competitive grants program, SAREP develops and extends information across a range of topics and production systems in California. The program funds both basic and applied research projects, as well as education and demonstration programs of research-based technologies and systems. Funded projects typically address one or more of the following areas:

- Management of the soil to improve soil quality and reduce the off-site movement of soil, nutrients and pesticides;
- Reduction or elimination of reliance on agricultural chemicals;
- Increased reliance on biological, cultural, and other pest management methods that are environmentally safe and reduce the use of nonrenewable energy;
- Diversification of crops and/or livestock and the surrounding habitat to enhance the biological and economic stability of the farm or ranch;
- Organic farming methods.

With our emphasis on sustainability and environmental quality, many of the projects we support look specifically at the dynamics of organic production systems. An analysis of all agricultural production and Community Development and Public Policy grants funded from 1987 to 1999 shows that 20 percent of the funds went to projects with direct relevance to organic farming and food systems. Another 62 percent was awarded to projects dealing with materials and practices that could be applicable to or adapted to organic systems.

To complement production-oriented research grants, SAREP also offers grants for graduate student research and for educational events. Those eligible to apply for SAREP grants include researchers affiliated with California non-profit, tax-exempt organizations and California public and private institutions of higher education.

Photo by David Pratt

Controlled Grazing on Foothill Rangelands *was a three-year project* (Ingram 1995-98) *investigating management-intensive grazing and spring calving in cow/calf operations on California's annual rangeland. This could potentially allow ranchers to increase the number of animals per acre, reduce production costs by eliminating the need for feeding hay, increase forage cover, reduce herbicide use, and improve water quality without expensive capital improvements or destocking the range. Researchers Roger Ingram and David Pratt have coordinated active educational programs aimed at producers, including an annual Grazing Academy (also supported by SAREP) which attracted hundreds of livestock professionals.*

In 1999, SAREP launched a specialized grants program targeting alternatives to methyl bromide. Methyl bromide has been identified as an ozone-depleting substance, and the U.S. Environmental Protection Agency has prohibited the production and importation of methyl bromide starting January 1, 2005. Although several potential chemical and non-chemical alternatives to methyl bromide have been identified, none have been adequately evaluated for their effectiveness within California farming systems. SAREP is supporting six new biologically based projects aimed at filling that information gap and helping producers prepare for the changes ahead.

In addition to its competitive grants, SAREP works with a variety of organizations to examine critical issues and educate producers, extension professionals, public policy makers and others about sustainable farming and ranching practices. These outreach efforts complement and extend the research projects SAREP is supporting. Educational programs include research symposia, conferences, and numerous workshops and field days on a range of topics related to agricultural sustainability. SAREP is also involved in producing publications and other educational/information resources aimed at producers and extension professionals. Recent topics covered include soil quality and management, cover cropping, biological control, habitat management, eco labeling, weather-driven plant disease models, and crop-specific information on winegrape and apple production. Materials are available in print and electronic form on the World Wide Web.

In 1988, SAREP funded a small project, ***Comparing Organic to Conventional Culture Methods in Commercial Almond Production in Central California*** (Hendricks 1988-91), *comparing two commercial almond operations in Merced County, one managed organically, the other conventionally farmed. The initial project expanded to a larger comparison of eight orchards. The results indicated that organic almonds could be produced economically without insecticides. This project was the impetus for the successful Biologically Integrated Orchard Systems (BIOS) program, jointly developed by SAREP and the Community Alliance with Family Farmers (CAFF). The original Merced County BIOS almond project is now in its sixth year, has expanded to seven counties, and includes walnuts.*

Photo by Robert L. Bugg

demonstration

ENGAGING FARMERS IN AGRICULTURAL RESEARCH THROUGH ON-FARM DEMONSTRATIONS: BIOLOGICALLY INTEGRATED FARMING SYSTEMS (BIFS)

An increasing number of California farmers and livestock producers representing many agricultural commodities are maintaining yields and quality while reducing their reliance on agricultural chemicals through Biologically Integrated Farming Systems (BIFS). BIFS projects typically include:

- On-farm demonstrations of an innovative biologically based farming system;
- A collaborative extension model involving public-private partnerships for sharing technical information about the farming system;
- An organized program of monitoring key biological and economic variables to inform on-farm decision making as well as evaluate project success.

The goal of the BIFS competitive grants program is to demonstrate and expand the use of integrated farming systems that are shown 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 time 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;
- Improving livestock management while protecting natural resources.

Photo by Robert L. Bugg

Growers in the **Winegrape BIFS Project** *farm over 50% (30,000 acres) of the acreage in the Lodi-Woodbridge Winegrape District (*Chandler/Ohmart 1995-98). *Over 70% of the BIFS demonstration vineyards use cover crops, and in-season pest and beneficial species are monitored in all BIFS vineyards. The proportion of BIFS vineyards sprayed for mites or leafhoppers declined from 54% in 1996 to 28% in 1998, and grower use of the pre-emergent herbicide Simazine decreased from 57% to 36% in the same time period. Additionally, 73% of the BIFS acreage has been converted to drip irrigation, which can reduce the use of nitrogen by 50%.*

Photo by Robert L. Bugg

*In the **West Side BIFS On-Farm Demonstration Project*** (Mitchell 1995-98)*, 11 farm managers dedicated at least one field site of 80 acres or more to side-by-side comparison plots of BIFS vs. conventional farming practices. These farm managers were introduced to organic soil health management, integrated weed management to reduce herbicide use, intensive cotton pest and beneficial arthropod monitoring, and the potential of conservation tillage. Three years of physical, chemical and biological data have been collected and analyzed to monitor the impacts of this biologically intensive soil management. Those soil quality measures that showed the most consistent increases in alternatively managed sites included total soil carbon, microbial biomass carbon and nitrogen, and exchangeable potassium and organic matter. All soil quality data collected will be used to develop a soil quality index that can assist growers in making management decisions.*

bifs

Currently BIFS projects are underway in rice (Butte County), walnuts (San Joaquin County), citrus (Fresno County), prunes (throughout the Central Valley), strawberries (Central Coast), dairy/forage crops (San Joaquin Valley), and apples (Contra Costa County).

SAREP staff members regularly undertake programmatic work that shows how biologically integrated farming systems function and how they can be improved. That work includes in-person presentations to farmers, consultants, and scientists interested in BIFS; synopsis and summary of scientific literature; and hands-on research followed by publication of peer-reviewed papers.

For more information on the BIFS program see SAREP's Web site at
http://www.sarep.ucdavis.edu/bifs/

Photo courtesy of Jeff Kositsky

The Park Village Farm Project (Kositsky, 1997–98; Kositsky/Melton 1999-2000) *was designed to provide affordable, culturally appropriate produce to members of the Southeast Asian community in Stockton, Calif. This project has created economic opportunities for residents of Park Village Apartments through a community supported agriculture project.*

LINKING FARMERS, CONSUMERS AND COMMUNITIES IN SUSTAINABLE COMMUNITY FOOD SYSTEMS

SAREP supports the development of "community food systems" through its Community Development and Public Policy program. Farmers, consumers and communities are partnering to create projects that employ sustainable food production, processing, distribution and consumption while enhancing the environmental, economic and social health of a particular place. One of the most important aspects of these community projects is increased resident participation to achieve the following:

- Improved access by all community members to an adequate, affordable, nutritious diet;
- Support of a stable base of family farms that uses less chemical and energy-intensive production practices and emphasizes local inputs;
- Marketing and processing practices that create more direct links between farmers and consumers;
- Development of food and agriculture-related businesses that create jobs and re-circulate financial capital within the community;
- Improved working and living conditions for farm and food system labor; and
- Creation of food and agriculture policies that promote local or sustainable food production, processing and consumption.

farms

community

Through our competitive grants program, SAREP funds research and education projects that support the development of comprehensive community food systems and targeted projects addressing components of community food systems. Projects include innovative marketing strategies for farmers, consumer education about local sustainably produced foods, urban agriculture, the connection of farmers with low-income populations, and linking community economic development and sustainable agriculture.

SAREP also supports connections between agriculture and communities through collaborative research and extension activities. Examples include studies of the economic development potential of urban market gardens, farmers' markets' roles in promoting small business development, and the role of communities in increasing the adoption of sustainable farming practices in the Central Valley.

Students grow and harvest fresh produce for the school cafeteria at the ***Willard Greening Project*** (Huang 1996-98; 1999-2000) *in Berkeley, Calif. The project is an integral part of the Berkeley Food Systems Project, a city-wide project to increase the amount of locally grown produce from area farmers and community and school gardens purchased by the school food service. This effort is helping to initiate a citywide food policy with the goal of ensuring community food security for all residents.*

Photo by Gail Feenstra

Photo by Kent Porter/The Press Democrat

A Geographical Information Systems (GIS) vineyard mapping project, ***A Spatially Explicit Vineyard Expansion Model: Addressing Crop Production, Public Policy, and Environmental Concerns,*** (Merenlender 1996-2000), *is evaluating the conversion of open hardwood oak rangelands to vineyards in Sonoma County. Vineyard expansion can increase habitat fragmentation which can negatively affect the natural resources the land currently supports. The GIS model predicts where undeveloped, potentially productive grape-growing land is located and addresses the habitat and watershed consequences of vineyard expansion. Results will be shared with community land use planners, farmers and others concerned about long-term land use decisions.*

ENABLING POLICIES THAT PROMOTE SUSTAINABLE AGRICULTURE AND FOOD SYSTEMS

SAREP's research and education efforts support the development of food and agriculture policies that address some of the critical issues in California including farmland preservation and land use, water use and quality issues, farm labor, and agricultural chemical use reduction. More generally stated, SAREP supports policies that enable a transition to sustainable farming and food systems.

SAREP's projects contribute both scientific information and a process for bringing diverse community stakeholders together to create policies that promote sustainable food and agricultural practices. Examples of such projects include assessments of water use and water transfers, Geographical Information Systems (GIS) analyses of competing uses for agricultural lands, farmland preservation policies, and assessments of watershed management options among a variety of community stakeholders.

SAREP also supports the emergence and development of city- or countywide food policies that have emerged in California during the last decade. These food policy councils are broad-based community coalitions that have become institutional vehicles for planning local food systems. Most include area government representatives or have become formal parts of local government structure. In addition to coordinating existing state and local government food programs, the councils incorporate food resources such as farmers' markets, community supported agriculture projects, local farm stands, and urban community gardens. SAREP has provided funding and/or technical assistance to the Marin, Berkeley, and Santa Cruz food policy councils.

For many years, state and federal regulations have addressed concerns about the adverse effects of agriculture on the environment by prohibiting or phasing out particular practices or pesticides or restricting development of wildlands. The early 1990s marked the emergence of voluntary agricultural chemical use reduction projects that combine information developed through research with practical farmer-to-farmer information sharing. Based on the success of these programs, several government agencies have since adopted a similar "voluntary approach" to agricultural chemical use reduction.

policy

Ensuring the Long-Term Viability of California Agriculture through Research and Education

UC SAREP

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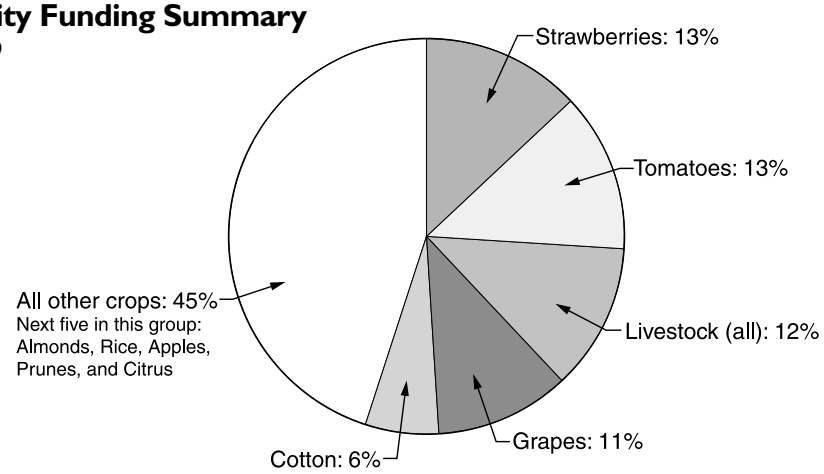
California farmers and ranchers face a tremendous challenge as stewards of the state's land resource. As producers of a wide array of high-quality agricultural commodities, valued at $28 billion in 1998, California farmers are expected to sustain high productivity with minimal environmental impact. However, observers of the environmental and social conditions of agriculture and food systems in California are concerned with the sustainability of these systems. High urban growth rates have led to increased competition for the land, water and air resources necessary for production agriculture. Consumers are increasingly concerned about food security issues and are demanding roles in shaping sustainable food and agricultural systems. Farmers face increasing restrictions and prohibition of farming practices considered commonplace even five years ago. At the same time, production costs are rising and many commodity prices continue to be at low levels.

One of SAREP's major goals is to help the state's farmers and ranchers mange their land and businesses in ways that are profitable and protect the environment. The program does that through two means: 1) funding research and education projects that address critical needs and problems in our agricultural systems, and 2) developing and extending information on sustainable farming and ranching practices.

COMPETITIVE GRANTS PROGRAM

SAREP has held closely to its mandate to support research and extension efforts relevant to the state's farmers and ranchers. From 1987 to 1999, SAREP funded 100 projects related to crop or livestock production, for a total of $6 million (Research and Education/Crop/Livestock, BIFS, Methyl Bromide). These projects address issues, problems, and opportunities in a variety of production systems across the state. The top five commodities addressed through our grants from 1987 to 1999 are shown in the following chart.

SAREP Ag Production Grants Commodity Funding Summary 1987-1999



With SAREP's emphasis on sustainability and environmental quality, many of the projects supported look specifically at the dynamics of organic production systems. An analysis of all agricultural production and community development and public policy grants funded from 1987 to 1999 shows that 20 percent of the funds went to projects with direct relevance to organic farming and food systems. Another 62 percent was awarded to projects dealing with materials and practices that could be applicable to or adapted to organic systems.

Projects for the current reporting period (1997-1999) include both basic research as well as projects geared toward the application of new techniques (see SAREP Funded Projects below). Major project categories include soil management, pest management, livestock and dairy production, and cropping systems. The Biologically Integrated Cropping Systems (BIFS) grants program is covered in a separate brochure.

In 1999, SAREP launched a special grants program targeting alternatives to methyl bromide. Methyl bromide has been identified as an ozone-depleting substance, and the U.S. Environmental Protection Agency has prohibited the production and importation of methyl bromide starting January 1, 2005. Although several potential chemical and non-chemical alternatives to methyl bromide have been identified, none have been adequately evaluated for their effectiveness within California farming systems. SAREP is supporting six new biologically based projects aimed at filling that information gap and helping producers prepare for the changes ahead.

Grants for Graduate Students and Educational Events

In addition to grants for production-oriented research, SAREP also provides grants for graduate student research and for educational events.

Sustainable Agriculture Graduate Awards

The Sustainable Agriculture Graduate Awards (SAGA) complement existing graduate support funds within the university and help graduate students address critical issues facing agricultural producers and society. In FY 1997/98 and 1998/99, nine graduate students were awarded a total of $17,925 for sustainable agriculture projects. A list of the SAGA grants funded in this reporting period appears later in this publication.

Educational Events

In FY 1997/98 and 1998/99, SAREP supported 56 educational events by providing a total of $35,591 in grants to Cooperative Extension personnel and non-profit educational organizations. Grants of $1,000 maximum per event support workshops, field days, conferences and other educational activities addressing sustainable farming and ranching and community economic development. Final reports from 1998 show that more than 1,000 individuals participated in the events funded that year. A list of the educational events funded in FY 1997/98 and 1998/99 appears in this publication.

SAREP FUNDED PROJECTS

Projects funded in 1999 are summarized below. Individual fact sheets for projects funded in previous years are available at the SAREP Web site at *www.sarep.ucdavis.edu.*

1999

Alternatives to Methyl Bromide

■ ***Cultural Control and Etiology of Replant Disorder of Prunus spp.,*** Greg Browne, $150,638 (3 years)

Pre-plant applications of methyl bromide (MeBr) are used extensively for control of replant problems on *Prunus* spp. in California. This project will directly concern orchard replacement strategies for almonds, nectarines, peaches, plums, and prunes. The research will attempt to reduce dependence on MeBr by determining possible contributions of pre-plant fallow periods and cover crops to replant disorder (RD) control, by determining the level of specificity of RD between two types of crops that may follow each other on large acreages—*Prunus* spp. and *Vitis* spp.—and by elucidating underlying causes of RD.

■ ***Microbiological Improvement of Root Health, Growth, and Yield of Strawberry,*** John Duniway, $118,780 (3 years)

The objective of this research is to find and effectively deploy microorganisms to improve root health, growth, and yield of strawberry plants without soil fumigation or with less than optimum soil fumigation treatments. This project's approach is to use microorganisms growing in fumigated soils in California which promote growth of strawberry plants in the greenhouse, to inoculate transplants and plants grown for berry production in the field. Methods of field application will be researched and resulting growth and yield responses of strawberry measured relative to those obtained by conventional farming practices with and without fumigation.

■ ***Development of Grape Rootstocks with Multiple Nematode Resistance,*** Howard Ferris, $100,744 (3 years)
The phase-out of methyl bromide will present California grape growers with a critical problem: lack of suitable rootstocks with nematode resistance. This problem will be particularly severe where new vineyards are replanted over a previous vineyard. This research will accelerate the development of grape rootstocks with resistance to a broad range of nematode species and aggressive strains. The project will also provide the grape rootstock breeding program with data on nematode resistance to help produce better crosses.

■ ***Containerized Strawberry Transplants as a Replacement for Methyl Bromide Soil Fumigation in California Strawberry Nurseries,*** Kirk Larson, $107,969 (3 years)
Strawberry nurseries currently fumigate with mixtures of methyl bromide (MeBr) and chloropicrin (CP) to ensure the production of pathogen- and nematode-free transplants. The impending ban on MeBr requires that alternative technologies be developed for continued production of quality strawberry transplants. The use of containerized transplants produced in disease-free, soil-less media would eliminate the need for nursery soil fumigation. This research will determine suitable methods for propagating and conditioning containerized strawberry plants (plugs) and determine plug performance in California's strawberry production regions.

■ ***Alternatives to Methyl Bromide for Control of Soil Borne Fungi, Bacteria and Weeds in Coastal Ornamental Crops,*** James MacDonald, $76,228 (3 years)
Non-chemical alternatives to methyl bromide for field-grown ornamentals (cut flowers, bulbs and greens) grown in the coastal regions of California will be researched. Solarization will be combined with the addition of organic amendments to stimulate the phenomenon of biofumigation. The project will focus on the soil-borne fungus *Fusarium oxysporum,* the soil-borne bacterium *Erwinia carotovora* and several weed species as representative of the pathogens and pests that need to be controlled.

■ ***Acetaldehyde and Carbon Dioxide Fumigation for Postharvest Control of Insects on Strawberry Fruit,*** Elizabeth Mitcham, $75,986 (2 years)
This project will explore fumigation with acetaldehyde and carbon dioxide as an alternative to methyl bromide for postharvest insect and mite control in strawberries. Two-spotted spider mites and western flower thrips will be exposed to 0.5 to 2.5 percent acetaldehyde alone and with 20 to 50 percent carbon dioxide in the laboratory. Mortality of insects and fruit quality will be monitored.

Production Agriculture Research and Education

■ ***Quantifying Pest and Beneficial Insects Associated with Insectary Hedgerow Plantings,*** Rachael Long, $7,000 (1 year)
California farmers are planting hedgerows of insectary plants around their farms to attract beneficial insects for better biocontrol of pests in adjacent crops. Little information exists, however, on the types of insects attracted to hedgerow plants, including both pest and beneficial insects and whether hedgerows serve as an overwintering site for pests such as stinkbugs. This project aims to quantify the diversity, abundance, and distribution of pest and beneficial insects in hedgerow plantings.

■ ***Conservation Tillage Systems for the San Joaquin Valley's West Side,*** Jeff Mitchell, $38,322 (3 years)
Currently, preplant tillage operations account for about 18 to 24 percent of overall production costs for annual crops grown in the West Side of the San Joaquin Valley (SJV). This research and extension project will compare conservation tillage and conventional tillage practices in crop rotations common to the SJV West Side in terms of productivity, key soil properties, pest and crop management requirements, and production costs. Information related to the background, goals and outcomes of this study will be widely disseminated.

1998

■ ***Impact of Dairy Waste and Crop Nutrient Management of Shallow Groundwater Quality,*** Thomas Harter, $44,000 (3 years)

■ ***Effects of Cover Crops on a Vineyard Ecosystem in the Northern San Joaquin Valley,*** Chuck Ingels, $18,272 (3 years)

■ ***Use of Dairy Lagoon Water in Production of Forage Crops,*** Marsha Campbell Mathews, $46,210 (3 years)

■ ***Native Grass Species for Use as Perennial Cover Crops in Central Valley Vineyards,*** Michael Costello, $15,000 (1 year)

■ ***Defining Changes in Soil Organic Matter Quality During the Transition from Conventional to Low Input Organic Systems to Identify Sustainable Farming Practices,*** William Horwath, $46,722 (2 years)

■ ***A Grower-Managed Biorational Management Program for Artichokes on the Northern Central California Coast,*** Mohamed Bari, $43,057 (2 years)

1996

■ ***Alternate Side Irrigation to Control Root Rot in Avocados,*** Gary Bender, $10,000 (1 year)

■ ***Development of a N-Fertilizer Recommendation Model to Improve N-Use Efficiency and to Alleviate Nitrate Pollution to Ground Water from Almond Orchards,*** Patrick Brown, $30,000 (3 years)

■ ***The Impact of a Sustainable Agricultural Practice with Grapes on Pesticide Use in California,*** Lynn Epstein, $8,573 (1 year)

■ ***History of Grazing on the Shasta-Trinity National Forest: Implications for the Future,*** Larry Forero, $5,919 (1 year)

■ ***The Contribution of Ranch Roads, Cattle Trails and Bed Load to the Sediment Budget for a Grazed Watershed in the Central Sierra Foothills,*** Melvin George, $23,508 (3 years)

■ ***Do Soils Suppressive of Phylloxera Exist?,*** Jeffrey Granett, $8,287 (1 year)

■ ***Role of the Soil Microbial Community in Suppression of Rhizoctonia Stem Rot Disease of Cauliflower,*** Joseph Hancock, $18,400 (2 years)

■ ***Farming, Agriculture and Resource Management for Sustainability (FARMS),*** Rich Engel, $15,000 (1 year)

■ ***Environmental Fate and Characterization of Selenium Supplemented to Intensively Grazed Beef Cattle,*** John Maas, $27,100 (2 years)

■ ***Use of Cover Crop Mulches in Processing Tomato Production Systems,*** Jeff Mitchell, $8,800 (2 years)

1995

■ ***Controlled Grazing on Foothill Rangelands,*** Roger Ingram, $48,400 (3 years)

■ ***Assessing the Environmental Risk from Rangeland Cattle Shedding Cryptosporidium parvum in Their Feces,*** Rob Atwill, $7,946 (2 years)

■ ***Ecology of a Group of Generalist Predators, The Green Lacewings, and their Contribution to Biological Control in Almonds and Walnuts,*** Jay Rosenheim, $24,000 (3 years)

■ ***Alternative Postharvest Treatments for Decay and Insect Control,*** Marita Cantwell, $48,405 (3 years)

■ ***Fostering the Transition Toward Balanced Predator/Prey Mite Populations in Vineyards Using Narrow Range Summer Oil,*** Michael Costello, $16,250 (2 years)

1994

■ ***Suppression of Plant-Parasitic Nematodes in Conventional and Organic Farming Systems,*** Bruce Jaffee, $19,155 (3 years)

1988

■ ***Evaluating the Transition from Conventional to More Sustainable and Organic Farming Systems in the Sacramento Valley,*** Steven Temple, $455,626 (10 years)

COLLABORATIVE RESEARCH AND EXTENSION ACTIVITIES

SAREP works with a variety of organizations and groups within and outside the University of California to educate producers, extension professionals, public policy makers and others about sustainable farming and ranching practices. 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, community organizations, and government agencies, to address issues of the sustainability of California's agriculture. These outreach efforts complement and extend SAREP-funded research projects. Activities during the last two years include the following:

Central Coast Farming Systems Research and Extension Program

In cooperation with the University of California, Santa Cruz Center for Agroecology and Sustainable Food Systems, SAREP staff are actively involved in research and extension activities in the Central Coast region. These projects are designed to 1) provide successful reduced-risk and organic farming principles to organic, transitional and conventional farmers considering conversion to sustainable practices and/or production for certified organic markets, and 2) demonstrate the on-going agronomic and economic feasibility of these new production technologies in an on-farm, whole-systems research approach. Practices promoted by the program include: release of insectary-reared natural enemies, conservation of native natural enemies, "farmscaping" for the support of biological control agents, and intensive monitoring and threshold-based decision-making to reduce pesticide applications. Staff-led research includes farm-level conversion from conventional to organic production systems (apples and cotton), biological control and non-crop farmscape vegetation for pesticide use reduction (cotton and strawberries), codling moth mating disruption (apples), biointensive and organic production (strawberries), and a grower-managed reduced-risk key pest control program (artichokes).

Weather-Driven Plant Disease Risk Models

SAREP works with California PestCast, a project of the University of California Statewide Integrated Pest Management Project. PestCast is a regional weather network to support the development, validation and implementation of plant disease models. SAREP is working with PestCast support on the validation of several plant disease risk models. In addition, SAREP is leading the development of PestCast's disease model database on the World Wide Web. This database serves as a clearinghouse of information about models developed for economically important crop and turf diseases in California. A model is included in the database if it uses weather, host and/or pathogen data to predict risk of plant disease outbreak. Available at: *http://www.ipm.ucdavis.edu/DISEASE/california_pestcast.html*

California Environmental Regulations and Vineyard Development

With support from the California Association of Winegrape Growers, SAREP is developing a guide for California winegrape growers, describing important federal, state, and county regulations for vineyard development. The guide will identify necessary steps for complying with existing regulations and provide information on educational resources for growers, including publications and organizational contacts. General environmental issues to be addressed include erosion, hillside development, oak woodlands conservation, vernal pools and wetlands, riparian areas, water quality, air quality, habitat conservation, and endangered species.

Collaboration with Western Region USDA SARE Program

SAREP has maintained a strong connection over the past decade with 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 December 1997, former SAREP Associate Director Jill Shore Auburn was selected to head the national SARE program in Washington D.C. SAREP Director Sean L. Swezey is chair of the USDA-SARE Western Coordinating Committee and program co-chair of the SARE 2000 conference to be held in Portland, Oregon in March 2000.

SAREP also houses 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.

Professional Development Program

With funding from the Western Region USDA-SARE Professional Development Program, SAREP has produced educational resources that advisors and Natural Resources Conservation Service (NRCS) field staff can use in working with their clientele around the state. Initial projects have focused on developing educational materials on cover cropping and soil quality (see Selected Resources and Publications at the end of this brochure). A new project funded in 1999 is aimed at providing educational opportunities for pest control advisors interested in learning more about sustainable agriculture and ecological pest management. SAREP is also providing small grants to support professional development activities that take place through UC workgroups and continuing conferences, and through NRCS channels. Grants funded in FY 1997/98 and 1998/99 included in-service educational activities and workgroups on a range of topics from pest management, cover crops, conservation tillage and soil management, biointensive mini-gardening, floriculture and nursery management, to livestock.

Sustainable Agriculture Educators

SAREP also recognizes the unique contributions of the many other teachers, instructors, and program managers involved in education related to sustainable agriculture. SAREP maintains a list of sustainable agriculture education programs in California (soon to be available on the Web) and works with many of them through grants and collaborative projects. For the last three years SAREP has hosted an annual sustainable agriculture educators meeting for faculty from the California State University System, community colleges, and the University of California. This group has about 30 members who teach a variety of courses related to sustainable agriculture or agricultural ecology. Members benefit through sharing of educational resources and curricula, and discussion of strategies for successful teaching and instruction.

GRANTS AWARDED FOR EDUCATIONAL EVENTS · FY 1998/99

- Sierra Cantor, Sotoyome Resource Conservation District, Sonoma/Marin counties, ***FARMS (Farming, Agriculture and Resource Management for Sustainability),*** $1,000
- Deborah Giraud, UCCE Humboldt County, ***Community Food Security...Access for All,*** $900
- William Huber, Hyampom Valley Growers Association, ***Marketing Your Agricultural Product,*** $947
- Chuck Ingels, UCCE Sacramento County, ***Cover Cropping in Vineyards: Experimental Results and Species Demonstration,*** $500
- Roger Ingram, UCCE Placer/Nevada counties, ***The California Grazing Academy,*** $1,000
- Stephanie Larson, UCCE Sonoma/Marin counties, ***Balancing Agricultural Viability with State and Federal Water and Habitat Regulations,*** $1,000
- Richard Molinar, UCCE Fresno County, ***Annual Strawberry Growers Meeting***, $920
- Katy Pye, Yolo County Resource Conservation District, ***"Bring Farm Edges Back to Life!" Field Day***, $1000
- Judith Redmond, Commmunity Alliance with Family Farmers, ***Food Safety Issues and Their Importance to Small Farms; The Economics of Alternative Production Practices,*** $2,000
- Steve Schwartz, California FarmLink, ***Maintaining Sustainable Communities Through Effective Use of Easements and Estate Planning,*** $1,000
- Lisa Woo Shanks, Foundation for the Advancement of Environmental Education, ***Horses and Water Quality Protection: Outreach to the San Francisco Bay Horse Community,*** $1,000
- Rodney Tripp, California Section of the Society of Range Management, ***California Range and Natural Resources Camp,*** $1000
- Sabrina Walker, Project YE'ES—Youth Economic Educational Sustainability, ***"Digging Towards the Future": Youth Urban Agriculture Conference,*** $1,000
- Lynn Young, Committee for Sustainable Agriculture, ***Five Sustainable Agriculture Conferences and Farm Tours: Best Management Practices for Strawberries, Cool-Season Vegetables, Field Crops, and Livestock and Dairy (2),*** $2,500

GRANTS AWARDED FOR EDUCATIONAL EVENTS · FY 1997/98

- Andrea Sexton, Glenn County, ***Glenn County Workshop Series*** (8 events), $4,000
- Bob Roan, Placer County, ***PlacerGROWN Farm Conference,*** $1,000
- Chuck Ingels, UCCE Sacramento County, ***Codling Moth Biology and Ecological Control,*** $1,000
- Dave Daley and Glenn Nader, CSU Chico, UCCE Sutter/Yuba counties, ***Beef Day,*** $1,000
- Desmond Jolly, UCD Small Farm Center, ***Agriculture and Ethics Symposium,*** $1,000
- Ernest White, Tehama County Resource Conservation District, ***Introduction to Watershed Functions,*** $914
- Chuck Ingels, Bennie Fouche, UCCE Sacramento County, ***Strawberry IPM for Southeast Asian Growers*** (3 events), $2,000
- Jean Saffell, Fresno Resource Conservation District, ***Fresno County RCD Day,*** $1,000
- Lynn Young, Watsonville Committee for Sustainable Agriculture (CSA), ***CSA Soil Fertility Conference*** (6 events), $3,000
- Mel George, UC Davis, ***Annual Grassland Ecosystem Shortcourse,*** $1,000
- Pat Delwiche, CSU Chico, ***Integrating Agriculture with Wildlife (I),*** $960
- Paul Wills, Shasta/Trinity Counties, ***Turning Dirt into Soil,*** $950
- Roger Ingram, UCCE Placer/Nevada counties, ***California Grazing Academy,*** $1,000
- William Oswald, UC Berkeley, ***Integrated Wastewater Ponding for Kehoe Dairy*** (2 events), $2,000

GRANTS AWARDED FOR SAGA · FY 1998/99

- Chris G. Campbell, UC Berkeley Environmental Science, Policy and Management, ***Characterizing Solute Transport in Sloping Soils Using*** *In Situ* ***Measurements and Transfer Functions Modeling,*** $2,000
- Alison J. Eagle, UC Davis International Agricultural Development, ***Nutrient Supply Power of Rice Soils Under Alternative Rice Straw Management Practices,*** $2,000
- Julie Guthman, UC Berkeley Geography, ***Organic Regulation: Codifying Meaning, Structuring Opportunity,*** $2,000
- Donald W. Lotter, UC Davis Entomology, ***Tests of Induced Resistance in Grapevine,*** $1,035
- Benjamin N. Shouse, UC Davis Ecology/Nematology, ***The Place of Microbial Grazers in Reduced-Input Agriculture,*** $2,000

GRANTS AWARDED FOR SAGA · FY 1997/98

- Valerie Eviner, UC Berkeley Integrative Biology, ***Understanding the Influence of Plant Species on Soil Nutrient Dynamics and Soil Properties in California Annual Grasslands,*** $2,000
- Cecilia Jones, UC Davis Plant Pathology, ***Effect of Decomposition of Organic Amendments on the Rhizosphere Bacterial Communities and Suppression of Root Pathogens on Cotton,*** $2,000
- Andreas Westphal, UC Riverside Nematology, ***Field Survey for Suppressiveness Against Heterodera Schachtii,*** $2,000
- Annette Wszelaki, UC Davis Pomology, ***Heat Treatments, Biological Controls and Controlled Atmospheres as Alternatives to Pesticides in Control of Botrytis cinerea in Postharvest Handling of Strawberries and Apples,*** $2,000

SELECTED RESOURCES AND PUBLICATIONS

SAREP Publications

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

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.

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.**

How to Order

Order SAREP publications directly from:
UC SAREP
University of California
One Shields Avenue
Davis, CA 95616-8716
Phone: (530) 752-7556
Fax: (530) 754-8550
Email: *sarep@ucdavis.edu*
World Wide Web: *http://www.sarep.ucdavis.edu*

DANR Publications

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

Organic Apple Production Manual. Edited by Sean L. Swezey, Paul Vossen, Janet Caprile, and Walt Bentley. Available March 2000. Publication 3403.

Cover Cropping in Vineyards: A Grower's Handbook. Edited by Chuck Ingels, Robert L. Bugg, Glenn McGourty, and Peter Christensen. 1998. Publication 3338. Price: **$20.00.**

How to Find Agricultural Information on the Internet. By Mark Campidonica, edited by Jill Shore Auburn. 1997. Publication 3387. Price: **$12.00.**

Order DANR publications directly from:
Division of Agriculture and Natural Resources (DANR)
Communication Services
6701 San Pablo Avenue
Oakland, CA 94608-1239
Phone: (800) 994-8849
or (510) 642-2431
Fax: (510) 643-5470
World Wide Web: *http://anrcatalog.ucdavis.edu*

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.*

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Progress Report

A Grower-Managed Biorational Pest Management Program for Artichokes on the Northern Central California Coast

Grant Award:
$28,268

Funding Period:
FY 1997–2000

Principal Investigator:
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Cooperating Growers:
Steve Bontadelli, farmer, Pfyffer Brothers Ranch, Santa Cruz, Santa Cruz County

Tim Hudson, farmer, Coastways Ranch, Pescadero, San Mateo County

Jim Cochran, farmer, Swanton Berry Farms, Davenport, Santa Cruz County

Mitchell Torres, farmer, Tierra Farms, Salinas, Monterey County

Objectives

1. Design and demonstrate a grower-managed biorational artichoke pest management program in selected artichoke production sites in coastal Santa Cruz, San Mateo, and Monterey counties, in a farmer-led, participatory management team setting.

2. Apply and monitor critical components of the management program, including conducting mass releases of the locally-reared egg parasitoid *Trichogramma thalense;* monitoring pest abundance through trapping and heat/degree day accumulation; monitoring native beneficial insect abundance; and monitoring artichoke plume moth damage for program fields and matched non-program controls.

3. Evaluate the potential economic profitability of integrating weather and field monitoring, mating disruption, cultural controls, and mass release of *T. thalense* into existing artichoke production procedures.

Summary

A native egg parasite, *Trichogramma thalense* was mass-reared in the laboratory, and released a maximum of 13 times against the eggs of the artichoke plume moth *(Platyptilia carduidactyla)* in three, five-acre biointensive artichoke production fields on the northern coast of Santa Cruz/San Mateo counties in 1998. A biorational grower-managed pest management program for these fields (BIORAPP) was used in the 1998-1999 season and monitored by a management team consisting of three growers (one grower is also an independent pest control advisor), and both an artichoke industry and a university researcher. Mass-released parasites were recovered from artichoke plume moth (APM) eggs collected post-release on only three dates, and in only one of the BIORAPP fields, in 1998; however, APM egg deposition was low in all other fields. Parasites were not recovered from any of the three adjacent, five-acre, non-release conventional artichoke fields.

The impact of BIORAPP management (trichogramma release, pheromone-based mating disruption, double-cut cultural control, and intensive monitoring on APM abundance and artichoke damage) was also monitored in the fields. APM damage to buds, male artichoke plume moth flight, and larval density, were measured from June 1998 (cutback) through May 1999 (double cutback). The BIORAPP combination of pheromone-based mating disruption, release of *Trichogramma thalense,* and intensive weekly monitoring resulted in a six-month insecticide stress-free production period for the BIORAPP fields. Two of the BIORAPP fields and one control field exceeded the action threshold of 4 percent bud damage on individual dates; however, average seasonal bud damage for all fields was below 4 percent through May 1999. Buds were not sampled frequently enough in two fields (one BIORAPP and one control) to accurately assess percent damage. Two organic artichoke growers have recently enrolled new fields and joined the BIORAPP management team for 1999.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Native Grass Species for Use as Perennial Cover Crops in San Joaquin Valley Vineyards

Grant Award:
$15,000

Funding Period:
FY 1997–98

Principal Investigator:
Michael Costello
(former) UC Cooperative Extension farm advisor, Fresno County

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Other Investigators:

Dan Munk, UC Cooperative Extension farm advisor, Fresno County

Kurt Hembree, UC Cooperative Extension farm advisor, Fresno County

Chuck Ingels, UC Cooperative Extension farm advisor, Sacramento County

Objectives

1. Determine the suitability of California native grass species for use as permanent cover crops in vineyards, in terms of cover crop establishment and ability to compete with weeds.

2. Analyze phenology (active growth season, flowering, dormancy period, etc.) and biomass produced for the native grasses studied.

3. Measure effects of native grasses on vineyard water and nitrogen use, water infiltration, weed control, effect on spring frosts, soil quality, vine water/nitrogen status and spider mite populations.

Summary

Perennial native grasses were tested as cover crops in two vineyards at the Kearney Agricultural Center in Parlier, Calif. In a drip-irrigated vineyard of Barbera, the cover crops which established were nodding needlegrass, California barley prostrate and a blend of the two. An attempt to establish oniongrass failed. In a flood-irrigated block of Grenache grapes, the cover crops which established were purple needlegrass, nodding needlegrass, California brome and a blend of California brome and blue wildrye. Meadow barley was seeded but failed to establish. Seasonal monitoring was done for in-row and between-row soil moisture and plant water status, at-harvest yield was measured, and in-winter pruning weights were taken as an estimate of vine vigor.

At the drip-irrigated site, overall soil moisture status was higher in-row for the nodding needlegrass treatment at 1' to 4', but soil moisture levels were higher between-rows for clean cultivation. At the flood-irrigated site, soil moisture in the nodding needlegrass treatment was lower until the first irrigation. With each irrigation (July 10, July 27 and August 25), soil moisture status at the deeper levels was elevated in the needlegrass treatment.

Very few significant differences were found among cover crop treatments in yield or pruning weight. The pattern of average yields at the drip-irrigated site were: highest in the nodding needlegrass and Blando brome treatments; intermediate with clean cultivation, nodding needlegrass/California barley blend and resident vegetation; and lowest with the pure stand of California barley; average pruning weights closely followed this pattern. The pattern of average yields at the flood-irrigated site were: highest in the clean cultivated treatment; intermediate in the blando brome, purple needlegrass and nodding needlegrass treatments; and lowest in the California brome/blue wildrye blend and pure stand of California brome.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Progress Report

Impact of Dairy Waste and Nutrient Management on Shallow Groundwater Quality

Grant Award:
$44,000

Funding Period:
FY 1997–2000

Principal Investigator:

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Other Investigators:

William R. Horwath, Dept. of Land, Air, and Water Resources, UC Davis

Roland D. Meyer, Dept. of Land, Air, and Water Resources, UC Davis

Marsha Campbell Mathews, UC Cooperative Extension, Stanislaus County

Cooperators:

Dairy operators in Merced and Stanislaus County

Turlock Irrigation District

Modesto Irrigation District
Regional Water Quality Control Board

Natural Resources Conservation District, Stanislaus County

Objectives

This integrated farming/groundwater study is using an existing network of monitoring wells on five dairies in Stanislaus and Merced County to:

1. Determine the nature and extent of nitrate groundwater contamination under dairies and provide an improved understanding of the nitrogen pathways from various components of the dairy operation (corrals, ponds, spills, manure application to fields) and how these contribute to the degradation of groundwater quality.

2. Provide baseline data on groundwater quality that can be used to determine future improvements in groundwater quality due to improved nutrient management and dairy operations practices on selected dairies.

3. Demonstrate and evaluate short-term as well as long-term changes in groundwater quality at shallow depths due to improved nutrient management within the dairy operation at selected field sites (in conjunction with a dairy waste management and nutrient management project).

4. Educate dairy operators and the communities in Stanislaus and Merced County, local and state regulatory agencies, and water management agencies on the impact of various nutrient management alternatives on groundwater quality and cooperatively develop sustainable solutions to protect groundwater quality from excessive salt and nutrient loading under dairies.

This proposal was submitted jointly with a proposal on the use of dairy lagoon water in the production of forage crops [see project summary *Use of Dairy Lagoon Water in Production of Forage Crops,* Marsha Campbell Mathews].

Summary

California is the largest dairy producing state in the United States. Environmentally sustainable management of these dairies is critical to the economic health of California's agricultural community. This project focuses on understanding the link between dairy waste management and shallow groundwater quality, and on developing improved dairy waste management methods that will ensure impacts on groundwater quality are minimized. Shallow groundwater quality has been monitored on cooperating dairies in the San Joaquin Valley. Waste management practices on these five dairies are considered to be representative of many dairies, particularly in the northern San Joaquin Valley, where the depth to groundwater is shallow and soils are predominantly sandy. The researchers classified the monitoring wells, to the extent possible, according to the proximity of dairy landuses that are most likely to influence the water quality in a particular well: the corral, pond (or lagoon) where dairy waste is stored, and the field where lagoon water is applied.

Consistent with previous reports, nitrate levels in wells associated with all land uses were found to exceed the maximum contamination level of 10 mg/l. The mean concentrations found in shallow groundwater underneath fields and corrals were much higher than those of upgradient shallow groundwater wells. Within each dairy, nitrate levels varied by up to one order of magnitude between monitoring wells. Additional variation was found in particular wells, where nitrate concentrations sometimes increased or decreased by more than 100 percent over the period the study. Given the high variability over time and between wells, average concentrations must be interpreted carefully. However, the data clearly suggest that nitrogen concentration in shallow groundwater significantly increase as groundwater is recharged across the dairy. On the other hand, it is expected that shallow groundwater moving off the dairies is diluted with recharge from non-manure excess irrigation water. Nitrate may also be subject to denitrification. Both prcoesses reduce nitrogen levels in shallow groundwater.

Besides seasonal changes, no discernable trend was observed in the average nitrate concentration over the three-year observation period. The data suggest that significant amounts of nitrate leaching takes place in fields receiving excess manure water applications. Less is known about potential nutrient leaching from corrals and ponds, although both have been shown to contribute some nitrate to groundwater. Ongoing research includes monitoring groundwater quality responses due to improved manure management in selected fields. Work is considered to be ongoing and results are preliminary.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Progress Report

Effects of Cover Crops on a Vineyard Ecosystem in the Northern San Joaquin Valley

Grant Award:
$18,272

Funding Period:
FY 1997–2000

Principal Investigator:

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Kate Scow, Dept. of Land, Air, and Water Resources, UC Davis

Mahinder Dhaliwal (grower-cooperator), Deer Creek Vineyard, Johas and Associates Inc., Sacramento County

Objectives

1. To determine the effects of several popular cover crop mixes on grapevine shoot growth, water stress, nutrient status, and fruit production and quality.

2. To evaluate the biomass production and nitrogen content of cover crop mixes.

3. To evaluate the effects of cover crops on soil microbial ecology.

4. To determine the economics of using different cover crop systems.

Summary

The cover crops used in this study had minimal effects on the vines in the first year. Vine water stress, although minimal, was greatest in the native grass and clover mixes before the first irrigation only. Petiole nitrate-nitrogen content was somewhat higher in the vetch/bell bean/pea/barley treatment and lower in the native grass treatment. However, yields were similar and juice analyses were not greatly different.

There were substantial differences in biomass of the cover crops. Annual clovers grew little during the winter and did not catch up to the other species one month later. The vetch/bell bean/pea/oat mix produced the greatest biomass by April (67 percent greater than the clover mix). Weed suppression was also slightly greater in this treatment. The biomass of the resident vegetation (control) was about a quarter to a third that of the cover crop treatments.

The total nitrogen content of the vetch/bell bean/pea/oat increased dramatically in March and early April, and was about 50 percent greater than that of the clover mix in April. On a per-acre basis, the vetch mix added just over 100 lbs. of nitrogen; this amount is excessive if continued over time.

Of the four cover crop treatments, annual clovers showed the lowest cost both in terms of establishment ($83.21 per acre in year 1), and in continued maintenance ($18.74 per acre for year 2 and beyond). Native grasses were the most expensive to establish (about $185 per acre in this study) due to the high cost of seed; after establishment costs dropped to about $31 per acre mainly for mowing and extra fertilizer. Overall, planting seeds and disking, when needed, are the costliest operations involved in using cover crops.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Defining Changes in Soil Organic Matter Quality During the Transition from Conventional to Low Input Organic Systems to Identify Sustainable Farming Practices

Grant Award:
$46,722

Funding Period:
FY 1997–99

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Cooperators:

Jeff Mitchell, Dept. of Vegetable Crops, UC Davis

Stu Pettygrove, Dept. of Land, Air and Water Resources, UC Davis

M. Sean Clark, Sustainable Agriculture Farming Systems, (former) research manager, UC Davis

Objectives

1. Determine the change in soil organic matter (SOM) quality during the transition from conventional to low-input organic farming systems.

2. Provide farmers with soil quality criteria to help them implement farming practices that promote SOM maintenance.

3. Demonstrate the critical importance of SOM maintenance in promoting the sustainability of agroecosystems.

Summary

This research has focused on defining the characteristics of soil organic matter (SOM) that contribute to cropping system sustainability. To quantify these characteristics, the researchers have begun to examine and compare soils managed in fundamentally different ways at the UC Davis Sustainable Agriculture Farming Systems (SAFS) project. The management practices examined cover conventional practices to alternative practices designed to increase the level of SOM. It has been difficult to assess soil fertility based on gross measures of SOM, such as total soil carbon and nitrogen. For example, nitrogen budgets in the SAFS project have shown that the “organic” treatment (manure and cover crop) has accumulated the most soil nitrogen, but appear to be the most nitrogen limited treatment. On the other hand, the “low-input” treatment (cover crop and fertilizer nitrogen) has accumulated less soil nitrogen, but has consistently out-produced the “organic” and “conventional” corn rotation treatments. These results indicate that it is not the quantity of SOM, but rather the quality of SOM that may control soil fertility. The researchers believe increased understanding of SOM composition will improve soil health, sustain long-term food production, and will help growers become informed of the value of the alternative cropping system management designed to enhance SOM.

Project results show a significant increase in SOM in alternative system (low-input/organic) vs. conventionally managed plots. The inclusion of additional rotation crops did not effect SOM in the conventional treatment. The addition of partially composted poultry manure and cover crops increased SOM more than any other treatment. However, because of the large amount of carbon and nitrogen added to the organic system, this system lost more carbon and nitrogen through mineralization compared to the conventional system. The low-input system appears to be the least efficient in retaining carbon input, or in other words converting crop residues into SOM. The conventional treatment was the most efficient at converting crop residues into SOM. However, since the conventional system received less carbon and nitrogen inputs than the alternative systems, it produced less SOM than the alternative systems. The low-input treatment, which uses a winter cover crop and reduced fertilizer input, was the least efficient at converting crop residues into SOM. The increase of SOM in the organic treatment shows the importance of recycled agricultural wastes, such as composted poultry manure, in increasing SOM. In contrast, the low-put system was the most efficient at storing nitrogen compared to the conventional and organic systems. These results show that formation of SOM is dependent on both soil management and types and or quality of soil inputs.

The research has shown that the low-input treatment has had comparable or increased yield compared to the conventional system. This, however, was not obvious because assays to predict nitrogen availability showed the low-input treatment had the lowest rate of potentially mineralizable nitrogen (PNM). However, the low-input treatment had the largest active pool of nitrogen compared to the other systems. These results indicate that standard assays of soil fertility are not always applicable and may also not be suitable for soils managed alternatively since these methods were primarily developed for conventionally managed soil. The above results may be explained by the timing of soil nutrient release for plant uptake. Even though the low-input system produced the least available nitrogen it may have supplied the nitrogen it mineralized at the time of maximum plant uptake. These observations are interesting and show that a hybrid system, such as the low-input treatment, has incorporated the positive aspects of the conventional and organic management

philosophies in such a way as to enhance soil fertility. The results also show the importance of designing cropping system practices that influence both the level of SOM and the ability to supply nutrients when crops demand them.

The interest of local farmers in the SAFS project is tremendous and allowed the researchers to disseminate their results to the local farm community through independent presentations and SAFS extension activities. Greater farmer appreciation is expected since the research results generated for SAFS is applicable to other agricultural regions in California, especially the San Joaquin Valley.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Progress Report

Use of Dairy Lagoon Water in Production of Forage Crops

Grant Award:
$46,210

Funding Period:
FY 1997–2000

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Objectives

1. Demonstrate effective use of dairy wastewater for the production of forage crops associated with dairies in Stanislaus and Merced counties to reduce groundwater contamination by nitrates in this area.

2. Develop a method for in-field rapid determination of ammonium (NH_4-N), the primary immediately available nitrogen component of dairy lagoon water, and demonstrate its use in substituting lagoon water nitrogen sources for commercial nitrogen fertilizer.

3. Develop practical procedures for estimating flow of irrigation and lagoon water throughout the course of an irrigation, and demonstrate how these can be used in conjunction with laboratory nutrient analysis or quick test NH_4-N results to calculate the amount of crop nutrients being applied to a field.

4. Confirm that the altered nitrogen management practices will not compromise yield or contribute to excess salt accumulation in the soil.

5. Show how increased pond capacity can improve flexibility in management of lagoon water nutrients, ultimately resulting in an improvement in groundwater quality.

6. Manage a demonstration area large enough to show improvements in groundwater quality as a result of using these sustainable practices. Nitrate under these fields will be monitored under the joint proposal "Impact of Dairy Waste and Crop Nutrient Management on Shallow Groundwater Quality."

7. Educate dairy operators, crop consultants and others on effective, practical methods of managing dairy lagoon water applied to cropland to avoid groundwater contamination.

Summary

A study of 44 monitoring wells on five dairies in the northern San Joaquin Valley has indicated that the largest source of excess nitrate in shallow groundwater on dairies comes from the fields (Harter 1999). In this project, the researchers implemented management practices aimed at improving groundwater quality by 1) minimizing excess pond water nitrogen applications to fields, especially during the winter months, and 2) eliminating the use of commercial nitrogen fertilizer by substituting similar amounts of pond water to supply the nitrogen needs of silage corn.

Despite the rich nutrient content of dairy lagoon water, many corn silage growers in the San Joaquin Valley have considered it unreliable as a primary source of nitrogen for their crops. A major portion of this project, begun in spring 1998, was aimed at developing methods of measuring and metering dairy lagoon water nitrogen in order to use this as a nutrient source for the corn without over- or under-application. Last season, a four-minute quick test for ammonium (the rapidly available form of nitrogen in lagoon water) was developed and used in conjunction with a hand-held flow meter inserted down an irrigation standpipe to adjust lagoon water nitrogen to match target application rates. An outstanding silage crop was produced. On the replicated field, the average yield for the corn silage was 41.6 tons per acre for the anhydrous control and 44.5 tons per acre pond water nitrogen (well above the 1997 Stanislaus County average of 27.2 tons per acre). Based on these results, the cooperating dairy producer is installing $200,000 of improvements to the waste handling system on the dairy to facilitate use of lagoon water nutrients over the entire acreage.

This is a progress report and represents only the first year of what is intended to be a multi-year project.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Alternate Side Irrigation to Control Root Rot in Avocados

Grant Award:
$10,000

Funding Period:
FY 1996–97

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Objectives

1. To establish a small-scale pilot project to establish the efficacy of using alternate side irrigation with and without mulch applications as part of an integrated pest management (IPM) program to control root rot in avocado.

2. To determine the water use requirements of trees infected with avocado root rot.

Summary

Phytophthora root rot of avocado *(Persea americana)* has devastated thousands of acres of trees in California. Without treatment, tree decline and mortality can be rapid. This experiment examined the use of alternate side irrigation and composted green waste mulch applications to control root rot caused by *Phytophthora cinnamomi* in avocados. Four treatments were evaluated: a control irrigated at 30 centibars (cb) of soil tension; alternate side irrigation, irrigated at 60 cb of soil tension; alternate side irrigation with mulch applied, irrigated at 60 cb of soil tension; and standard irrigation with mulch applied, irrigated at 30 cb of soil tension.

Treatments were evaluated by counting new, non-infected root tips on four occasions and by measuring *Phytophthora* propagules per gram of soil once. Prior to the start of the experiment, initial root tip counts showed a virtual absence of non-infected root tips and no significant difference in the number of non-infected root tips among the treatments. As the growing season progressed, alternate side irrigation with mulch produced the fewest non-infected root tips and was significantly lower than the other three treatments in July and October. Standard irrigation with no mulch (control) produced the most non-infected root tips, but overall, was not significantly different than alternate side irrigation with no mulch and standard irrigation with mulch. Standard irrigation with mulch produced the fewest *Phytophthora* propagules per gram of soil, while alternate side irrigation with no mulch produced the highest number of propagules per gram of soil. However, there was no significant difference in the number of propagules per gram of soil between any of the four treatments. Based on this experiment, it did not appear that alternate side irrigation is a viable control strategy for avocado root rot.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Development of a N-Fertilizer Recommendation Model to Improve N-Use Efficiency and to Alleviate Nitrate Pollution to Ground Water from Almond Orchards

Grant Award:
$30,000

Funding Period:
FY 1996–99

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Objectives

1. Conduct field validation of leaf nitrate analysis in almond orchards.
2. Develop an “on-site” test of tissue nitrate concentration throughout the growth season.
3. Determine almond tree seasonal and total nitrogen (N) demand for optimum yield.
4. Develop a grower-used computer-based site-specific N management program.

Summary

Overfertilization in almond orchards is attributed to the lack of reliable tools for measuring tree N status, tree N demand and soil N availability. The purpose of this project was to provide better tools for distinguishing between fertilizer applications that are essential and those that are excessive, and provide growers guidance on when and how much N fertilizer should be applied to obtain optimum yield while minimizing the potential pollution to the environment.

Previous research suggested the potential value of leaf NO_3-N as an indicator of N status in almond orchards. Contrary to earlier results, studies conducted here demonstrated that leaf nitrate analysis is an unreliable indicator of tree N status due to large variations in tree nitrate concentrations over time and a strong interdependence on plant water status.

The second aim of this research was to determine the seasonal patterns of N demand in mature almond orchards. To this end sequential whole tree excavations were conducted at January 21, March 20, and May 20, 1997 at the Delta college orchard, Manteca, Calif., and there was one excavation at harvest and in the spring of 1998. Weight of individual trees excavated range from 570 kg to 799 kg dry, with corresponding total N content of 4 to 6 kg N. The highest proportion of total N was present in root and root stock in January and March. Fruit and canopy had the largest proportion of total N in May. Nitrate and total soluble N represented only a small proportion of total N presented in the whole tree.

The researchers have completed analysis of seasonal N uptake dynamics and total yearly N demand. This information has now been integrated into a user-friendly interactive computer program that is available for distribution. In summary, the determination of N fluxes in almond orchards demonstrates that the majority of N uptake and demand occurs from late February through to early September and that the primary demand for N is for nut fill and nut development. N demands can therefore be predicted by estimating yield and can be applied during the periods of greatest N uptake from the soil which occurs during nut development.

By timing N applications with periods of greatest demand, and matching N application rates with crop load this research provides growers with a tool that will encourage maximum efficiency of use of N fertilizers. Maximum efficiency of use will result in a minimization of N loss from the orchard system.

The complete report of this project is available on SAREP’s Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

The Impact of a Sustainable Agricultural Practice with Grapes on Pesticide Use in California

Grant Award:
$8,573

Funding Period:
FY 1996–97

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Objectives

1. To determine the progress California has made towards reducing fungicides on grapes, fungicide use will be measured using the California Department of Pesticide Regulation's (DPR) Pesticide Use Reports between 1990 and 1995.

2. To assess to what extent grape canopy management (e.g. leaf removal) has contributed and could contribute to future reductions in fungicide use on grapes.

Summary

California's unique Pesticide Use Reports (PUR) provide an opportunity to analyze grower chemical control practices. Individual applicator records submitted to the state were electronically cleaned of some of the errors in the database. Then, applicable records were converted into output that described California vineyard chemical control programs for bunch rot of wine and table grapes between 1992 and 1995. The data indicated that overall in California, only 21 percent and 11 percent of the wine and table grape vineyards, respectively, applied fungicides for bunch rot to their grapes per year, and of those, the median vineyard made only one application per field. The amount of fungicides used to control bunch rot of grapes remained fairly constant between 1992 and 1995; there was no evidence from the PUR that usage of leaf removal to control bunch rot resulted in decreased fungicide use between 1992 and 1995. In contrast to the comparatively stable use of the fungicides used on grapes to specifically control bunch rot, the percentage of growers using inorganic copper, and the percentage of hectares treated with inorganic copper, increased between 1992 and 1995.

Major conclusions from this study include:

1. Although use of leaf removal on wine grapes in the North Coast probably increased during the study period, there is no evidence from the Pesticide Use Reports that there was a decrease in fungicide use.

2. The frequency of use of fungicides used to control bunch rot is less than might be expected from reading the IPM literature.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Progress Report

The Contribution of Ranch Roads, Cattle Trails and Bed Load to the Sediment Budget for a Grazed Watershed in the Central Sierra Foothills

Grant Award:
$23,508

Funding Period:
FY 1996–99

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Objectives

1. Estimate sediment delivery to a stream channel from roads and cattle trails in a grazed watershed.

2. Estimate stream channel bedload sediment transport in a grazed watershed.

3. Test the utility of sediment traps for rapid cost-effective monitoring of sediment delivery to stream channels.

4. Extend the results of this information to community watershed groups, rangeland owners, range management professionals, and land management and regulatory agency staff.

The Rangeland Watershed Program (RWP) expects to develop a sediment budget for a grazed watershed. This project supports the addition of sediment budget components that were not previously being measured. The RWP was able to develop a grazed watershed research site beginning in 1993 with funding from the US Environmental Protection Agency (EPA). The primary objective of this three-state EPA-funded project ($500,000) was to evaluate the effectiveness of range management practices for controlling or preventing grazing-induced sediment. The sediment budget components that have been measured since 1994 were funded by this EPA project. Funding from the Integrated Hardwood Range Management Program ($200,000) will support continued measurement of these existing components through 2001, as well as development of new research watersheds at the Sierra Foothills Research and Extension Center.

Summary

Sediment transport was significantly greater in the cattle trails than the vegetated areas in the rainfall years ending in 1997 and 1998. There was no significant difference in 1999. In 1997 and 1998 there was sufficient rainfall to generate measurable runoff and the intermittent streams began flowing in January of those two rainfall years. Rainfall in 1998-99 was low resulting in little runoff and no stream flow

These sediment traps are easy to install and to clean on each sampling date with minimum error. By frequently checking and cleaning the traps we have reduced the losses due to overfilling. While cattle rarely damage one of the traps they do tend to walk around them establishing a new trail. Therefore, we must move the traps each year to keep them in active trails. The Alameda Resource Conservation District used our sediment traps as a model to build traps for use in measuring sediment from roads, trails and bare areas in the Alameda Creek watershed near Livermore.

Due to the low rainfall in the 1998-99 rainfall year, no bedload measurements were taken. In the 1997-98 rainfall year bedload was estimated from a series of storms at the end of January and during the first week of February. The means of three hourly samples were plotted against flow (cfs) to develop a linear model for predicting bedload from flow. Flow accounted for 79 percent of the variation in bedload. This study will be continued for at least one more year. The results will be added to the 1998-99 results to develop a bedload prediction equation for the research watershed at San Joaquin Experimental Range.

This study shows that cattle trails are an important conduit of sediment from the uplands to stream channels. Practices that reduce trailing across stream channels or provide ground cover along cattle trails immediately adjacent to stream channels will help to reduce this source of sediment from grazed watersheds. The bedload study requires additional data before it will be useful in addressing sediment sources.

The results of the trail and bedload studies have been used in 24 Ranch Water Quality Planning Short Courses since September 1997. During this short course various nonpoint sources of pollution associated with livestock grazing and ranching, including sediment, are covered with participating landowners. During these short courses more than 300 ranchers have completed water quality plans for nearly 1 million acres of privately owned rangeland. These plans follow the California Rangeland Water Quality Management Plan approved by the State Water Resources Control Board in 1995.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Do Soils Suppressive of Phylloxera Exist?

Grant Award:
$8,287

Funding Period:
FY 1996–97

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Objectives

Long-term:

1. To develop a substantive hypothesis of the mechanisms of the vineyard soils which suppress phylloxera damage.

2. To determine vineyard management methods to make practical use of the knowledge of which soils suppress phylloxera to control damage.

Short-term:

1. To test the hypothesis that vineyard soils exist which are suppressive or tolerant of phylloxera growth in areas where the decline of the vineyard would be expected.

2. To determine whether suppressiveness is due to increased vine tolerance, inhibition of phylloxera population growth, or inhibition of secondary pathogen infection of wound sites.

Summary

Root samples were taken from organically and conventionally managed phylloxera-infested vineyards in northern California. Roots infested with phylloxera from organically managed vineyards showed significantly less root rot (11.8%) than phylloxerated roots from conventionally managed vineyards (27.1%). Incidence of fungal rot was significantly correlated with phylloxera populations in conventionally managed vineyards, whereas it was not in organically managed vineyards. Fungal cultures of necrotic feeding sites on roots showed no differences in pathogen species composition, however, occurrence of the pathogen antagonist *Trichoderm*a was more prevalent in the cultures from roots from organically managed vineyards.

The importance of "feeding the soil" with organic matter is underscored in this research. Organic matter is important not only in nutrient retention and release but in the regulation of microbial populations for optimal root health as well. Damage from phylloxera feeding is less severe in soils managed with high organic matter inputs, possibly due to the facilitation of growth of pathogen antagonist microbes such as *Trichoderma.* The decoupling of phylloxera numbers and root damage, possibly mediated by pathogen antagonists in the rhizosphere, may be a fruitful area of study in other crop/pest systems.

Phylloxera infested vineyards have a soil ecosystem that is characterized by continual wounding of perennial plant roots. This creates an ongoing and long term dynamic between 1) root pathogens, 2) pathogen antagonists, if present, 3) soil organic matter serving as a microbe energy and plant nutrient source, and 4) the plant.

Recently discovered susceptibility to phylloxera of current "resistant" rootstocks in Germany, the 5C rootstock in particular, lends urgency to the task of developing alternative strategies for phylloxera. While no major rootstock with 100 percent North American heritage has been shown to be susceptible to phylloxera damage in California despite extensive testing, there is no guarantee of rootstock invincibility. California may be at the stage of phylloxera infestation Germany was 40 years ago, with "resistant" rootstocks such as 5C beginning to show nodosities but lacking damage (Porten 1997). German vines have developed phylloxera damage in the last two decades on these rootstocks, which are currently being used as phylloxera-resistant replanting stock in California. However we should note that the climate in Germany favors midsummer nodosities which seem to be the cause of their damage, while these would not occur in California as readily. Some systems of replanting vineyards in California are optimal for selection for phylloxera virulence; if growers continue to replant into infested vineyards where infested roots intertwine with the newly planted roots, virulence may become more common.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

Resources

Lotter, D.W., Granett, J., and Omer, A.P. 1999. Differences in Grape Phylloxera Relation, Grapevine Root Damage in Organic and Conventional Managed Vineyards in California. *Hort Science* 34:1108-1111.

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Role of Soil Microbial Community in Suppression of Rhizoctonia Stem Rot of Cauliflower

Grant Award:
$18,400

Funding Period:
FY 1996–98

Principal Investigator:

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Objectives

1. To establish microbial community profiles or "signatures" of soils conducive or suppressive of Rhizoctonia stem rot/wirestem disease (RWS) in fields sites at the West Side Research and Extension Center, Fresno County.

2. To determine changes in the microbial community profiles associated with loss of RWS suppressiveness associated with mild heat treatments.

3. To construct microbiological media selective for microbes present in RWS suppressive soils but not in RWS conducive soils (natural soils and in those where suppressiveness is lost with mild heat treatments) for the isolation of these microbes and for measuring the quantitative and qualitative differences in individual microbes between suppressive and conducive soils.

4. To measure RWS in soils (sterilized soil, conductive soil, and potting mixes) amended with microbes most affected by mild heat treatment of Rhizoctonia suppressive soils.

Summary

Soils from sample sites 100 feet apart in a field at the West Side Research and Extension Center (Fresno Co.) were consistently either suppressive (DS) or conducive (DC) to Rhizoctonia wirestem disease of cauliflower (RWS) in September 1996 and March and June 1997. Populations of general bacteria and fluorscent pseudomonads were similar in magnitude in the DS and DC soil samples in both September 1996 and March 1997 when the differences in suppressiveness were greatest between the two sites. Actinomycetes were up to eight-fold higher in the DS soil than in the DC soil. Microbial "metabolic fingerprints" of DS and DC soils were similar.

When seedlings of cauliflower were grown in transplant-plug trays, RWS was less severe when transplants grown in DS soil were planted into Rhizoctonia infested UC mix (very disease conducive) then transplants grown in DC or heat-treated DS soil. Protection against RWS by plug-transplants did not seem to be a consequence of physical interference with the pathogen.

The degree of disease suppressiveness of soil from the suppressive site declined progressively over the course of the year from September 1996 to September 1997. In September 1997 the soils were conducive at both sites. Disease suppressiveness was destroyed when soil was heated at 40º C or higher for an hour, which suggested that suppressivness had a biological basis. When soil was washed from roots of plug-transplants, plants grown in DS soil were as susceptible to RWS as those grown in DC soil. This indicated that suppressiveness was protective rather than an enhancement of plant resistance to RWS. In support of this interpretation, we found that protection against RWS was lost when efficacious biological control agents isolated from DS soil were washed out of the UC mix plugs to which they had been applied.

Screening of a large number of isolates of actinomycetes from DS soils resulted in the recovery of a few isolates of Streptomyces species that protected cauliflower seedlings from RWS when seedlings had been grown in plug trays in UC mix drenched with inoculum of these microbes. In the plug-transplant system some commercial and locally formulated potting mixes suppressed RWS without amendment. Results of this work showed that the suppressiveness of certain soils to RWS is transferrable to plug-transplants, that certain actinomycetes from DS soils can infer suppressiveness to RWS, and that potting mixes that are DS could offer a practical means of avoiding seedling diseases after transplanting into pathogen infested soils.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Grant Award:
$8,880

Funding Period:
FY 1996–98

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Evaluation of Cover Crop Mulches in No-till Processing Tomato Production Systems

Objective

1. To evaluate the effectiveness of surface organic mulches in reduced-tillage processing tomato production systems for:

   a. suppressing weeds;

   b. improving production efficiencies in terms of nutrient inputs;

   c. providing optimal soil temperature regimes for crop growth; and

   d. conserving soil moisture.

Summary

A two-year field study was conducted in Five Points, Calif., to evaluate and refine the potential of using surface organic mulches in no-till transplanted processing tomato production systems. The winter cover crops rye/vetch, triticale/vetch, Sava and Sephi medic were grown and converted to surface mulches and compared with conventional fallow production systems.

Preliminary findings of this work include:

1. Transplanting and harvesting processing tomatoes in surface cover crop mulches is feasible.

2. Cover crop mulches may actually contribute more favorably to annual water balances than previously thought. Soil water content (0 to 9 feet depth) was generally higher under cover crop mulches from May through August relative to conventional tillage bare surfaces.

3. Earthworm populations tended to be higher under cover crop mulch surfaces than under fallow surfaces at the beginning of the second year of the study.

4. Soil carbon content was increased by mulch surfaces relative to fallows.

Economic analyses comparing production costs between conservation tillage and conventional tillage systems are needed as are in-season, post-transplant weed control by appropriate bed shoulder cultivation or chemical materials to make conservation tillage production more farm-ready. These modifications are the focus of our ongoing 1999 studies at a number of sites.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

FARMS (Farming, Agriculture and Resource Management for Sustainability)

Grant Award:
$15,000

Funding Period:
FY 1996–97

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John Weatherford, Natural Resources Conservation Service, Yolo County
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Objectives

1. Provide an opportunity for a diverse group of high school students, teachers, college faculty and farmers and ranchers to work together. Participants will learn about proven agricultural practices and technologies through farm demonstrations, best management practices through experiments and research, and the relationships among soil, water, food and the environment through observation and experience. An advisory committee will establish guidelines and select students for the project.

2. Provide participating FARMS teachers and students with California Foundation for Agriculture in the Classroom lesson plans to provide in-class training and interdepartmental information programs to teach every teacher and student in participating schools about sustainable agricultural practices.

3. Encourage participants, over the course of one school year, to work with their teachers, local agriculturalists and mentors from UC Davis to develop and conduct research projects related to progressive agricultural practices. This project will be presented both in writing and orally to the FARMS committee, related businesses, local growers, and the students' peers.

4. Conduct farm workshops throughout the year where students learn by seeing and doing first-hand. An overnight stay with a farm family culminates the students' exposure to a diminishing way of life and a changing culture.

5. Introduce students to a college campus and university faculty to help them learn about potential careers in agriculture and the environmental sciences. Motivate students to become responsible adults and challenge them to make a difference with their lives by continuing their education.

6. Develop an outreach model program that can be adopted in other areas of the state.

7. Conduct an evaluation of the FARMS program to ascertain changes in knowledge regarding sustainable practices and assess student interest in agriculture as a result of the FARMS program. In addition, local grower supporters, student and teacher participants and steering committee members will be surveyed to determine the effectiveness of the program.

Summary

The 1996-97 and 1997-98 Farming, Agriculture and Resource Management for Sustainability (FARMS) programs effectively increased the skill level and appreciation for sustainable agricultural practices among the 60 high school participants (30 each year), 12 teachers and numerous farmers involved in the project. In addition, sustainable agriculture and science concepts were shared with more than 120 elementary school students through cross-age tutoring activities, and representatives from the Natural Resources Conservation Service (NRCS), Yolo County Resource Conservation District (RCD) and University of California interacted with students on a mentor-student basis.

The 30 students from Winters, Florin, Armijo (Fairfield) and Terra Linda (San Rafael) high schools participated in five workshops and one evening introductory activity over the course of the 1996-97 school year. Thirty students from Davis, Luther Burbank, Winters, Armijo and Terra Linda high schools participated in seven workshops during the 1997-98 school year in addition to the evening introductory activity. In these workshops, students studied soil microbiology and soil characteristics and a variety of sustainable practices, including: use of raptors for rodent control, beneficial and detrimental insect identification, use of cover crops in orchard systems, use of earthworms for soil and organic matter modifications, and the use of native plants for beneficial insect habitats. Past participants have also studied the economics of organic, low-input and conventional farming systems.

Each student or team of students developed and conducted a research project relating to sustainable agricultural practices utilizing the expertise of the mentors from UC Cooperative Extension, Natural Resources Conservation Service, UC Davis and other organizations. These research projects were presented to their peers, teachers and mentors at the final FARMS event of the year.

A highlight for the 1996-97 FARMS students was the coordinated workshop with the Sustainable Agricultural Farming Systems (SAFS) staff at UC Davis. Through this workshop, high school students were able to observe and participate in on-going university research projects. This reinforced student interest in post-secondary education and further study of sustainable agricultural practices.

Through the 1996-97 FARMS program, 30 students received extensive experience in sustainable agricultural practices, reinforced their science skills and were introduced to a university environment. In addition, numerous elementary students were provided with information on the balance between agriculture and the environment and the conservation practices which are used in progressive farming systems. All objectives of the 1996-97 SAREP grant proposal for the FARMS program were completed. These objectives have also been met, or surpassed, during the first half of the 1997-98 FARMS program, which is partially funded through support from SAREP.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Environmental Fate and Characterization of Selenium Supplemented to Intensively Grazed Beef Cattle

Grant Award:
$27,100

Funding Period:
FY 1996–98

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Objectives

1. Characterize the environmental fate of selenium (Se) supplemented to beef cattle and Se used to fertilize pastures on which beef cattle were intensively grazed.

2. Quantify Se concentrations in pasture soils and plants, comparing control and Se treatments in pastures.

3. Measure the nutritional Se status of the grazing cattle in the four treatment groups.

4. Measure the Se concentration in cattle excreta (feces and urine) at steady state, in the control and treatment groups.

5. Evaluate the Se uptake by plants from cattle excreta in a greenhouse experiment to estimate Se bioavailability.

6. Characterize the chemical species of Se in the excreta and water (water from pasture run-off) and to characterize the chemical species of Se in the soil-water-plant fractions collected in the greenhouse study.

All of the above objectives, which were listed in the original proposal, were accomplished except Objective 6. The amount of Se in the water leaving these pastures was below the method detection limit (2 micrograms/liter) in most specimens from the first series of samples, so valid comparisons of data were not possible and collections were discontinued. Also, attempts to speciate the various Se compounds in cattle excreta were not successful due to the organic matter matrix. Also, the Se concentration in the excreta of all groups was very low, which did not allow for characterizing these chemical species of Se in the greenhouse studies. Future research will need to focus on speciation of Se in these various organic materials, to further understand possible interactions.

Summary

Selenium deficiency is the number one cattle disease problem diagnosed by the University of California's Veterinary Diagnostic Laboratory. Three methods were used to supplement selenium (Se) to cattle in an intensive pasture grazing system: subcutaneous injection of a commercial Se product, Se fertilization of the pastures, and a rumen Se bolus. Selenium-deficient control animals were maintained in these studies.

The Se status of the cattle was significantly influenced by treatment, and control cattle remained Se deficient. The Se injection cattle showed a slight increase in Se status versus controls for one or two months before returning to control levels. The Se status of both the rumen bolus cattle and the Se fertilizer cattle was greatly increased above the control group. The Se rumen bolus group status was higher and more consistent than the Se fertilizer group. The Se status of the cattle in the Se fertilizer group was correlated with pasture Se concentration. There was no difference in the Se concentration of the excreta of the control group, injection group, and fertilizer group at the end of the 4 month periods (10 to 20 ppb); however, the bolus group had higher Se concentrations in the excreta (170 ppb). When the excreta was studied in the greenhouse experiments, there was no differences observed in the Se concentrations of the various plants species due to Se treatment of the cattle. This indicates that Se bioavailability in the feces and urine of cattle is not affected by Se supplementation methods and remains very low.

Two methods of Se supplementation for cattle look particularly promising from this study. The use of a rumen Se bolus and Se fertilization of pastures for grazing and perhaps forage production appear to be potentially beneficial in preventing Se deficiency. Selenium in the excreta of cattle is not biologically available according to our data and Se supplemented to cattle does not appear to accumulate in pastures or soils. These methods (Se bolus and Se fertilization) appear to be both safe and efficacious for the cattle as well as for the environment.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Assessing the Environmental Risk from Rangeland Cattle Shedding Cryptosporidium parvum in Their Feces

Grant Award:
$7,946

Funding Period:
FY 1995–97

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Objectives

Determine if C. *parvum* oocysts excreted in the feces of livestock can survive ambient temperatures typical of California rangeland from spring through fall.

1. Acquire internal thermal profiles of fecal patties from April through September, stratified by location (exposed to sun or under a tree in the shade).
2. Determine the effect of diurnal temperature on the viability of *C. parvum* oocysts.

Summary

This project's specific goal was to determine if temperatures occurring on California rangeland from spring through fall would inactivate (kill) bovine-derived oocysts (eggs) of the parasite, *Cryptosporidium parvum*. The project's two aims were to acquire thermal profiles of fecal patties from April through September, stratified by sunny or shady locations, and then determine the effect of these diurnal temperatures on the viability of *C. parvum* oocysts.

Sun-exposed manure commonly exceeded 50°C while shaded manure ranged from 40 to 50°C. The researchers found that one 24-hour cycle of a 40°C profile mimicking shaded manure resulted in an 18 to 22 percent loss of oocyst viability. One 24-hour cycle of a 50°C and 60°C profile for manure on open range resulted in 50 to 70 percent loss of viability. Four days of the 24-hour 40°C profile resulted in 82 percent loss of oocyst viability. Four days of the 24-hour 50°C profile resulted in a 95 percent loss of oocyst viability, or only 5 percent remaining viable. These data suggest that manure containing oocysts may serve as a source of infection for a few days, but that five days or more of 350°C will likely kill nearly all oocysts. The fecal deposits which accumulate underneath shade trees may, during summer thunderstorms, serve as a source of viable oocysts if the oaks are located near water and the oocysts are capable of traveling sufficiently far in overland or subsurface flow. Furthermore, shaded manure may serve as a source of infection for newborn calves.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Fostering Transition toward Balanced Predator/Prey Mite Populations in Vineyards Using Narrow Range Summer Oil

Funding Period:
FY 1995–97

Grant Award:
$16,250

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Objectives

1. Evaluate effects of narrow range summer oil on predator/prey seasonal dynamics when applied on Pacific mite populations in outbreak phase.

2. Foster a transition from reliance on chemical miticides to a balanced predator mite/spider mite population.

3. Estimate yields and quality of harvested grapes for the different treatments.

Summary

Spider mites are consistent and economically important arthropod pests of grapes in Calfornia. Two species of spider mites can reach pest status, Pacific mite (*Tetranychus pacificus* McGregor) and Willamette mite (*Eotetranychus willametti* [McGregor]). Dusty conditions and vine water stress, which are common in much of the raisin producing area of the central San Joaquin Valley, encourage mite outbreaks. Propargite (Omite) is most frequently applied because of its effectiveness on the Pacific mite and low toxicity to predatory arthropods, but has a 30-day re-entry period and is scheduled for cancellation due to the Delaney Clause. Narrow range summer oils have a very short re-entry period (12 hours) and resistance has never been reported.

This study was designed to test two factors simultaneously on the populations of Pacific mite and western predatory mite. These were 1) the maintenance of in-season vineyard ground cover and 2) the use of horticultural oil against Pacific mite. Two experiments were established in vineyards designed as a randomized complete block/split plot, with four replications. The main plot factor was the presence or absence of a cover crop and the subplot factor was the type of spray applied (1.5 percent narrow range oil, propargite, and a no spray control).

Results of the study suggest that oil has the potential to both exacerbate spider mite populations as well as be an effective miticide. In addition, for an increasing spider mite population, oil has a very short-lived effect. However, for a decreasing population, oil can accelerate the decline. Compare the two years of the study in which the oil/Omite treatments were applied, Jameson in 1996 and Easton in 1997. The treatments were applied at different points in the population growth cycle. In 1996, treatments were first applied when spider mites density was on the upswing. The oil treatment resulted in a decline in Pacific mite, but this was short lived (curiously, the control treatment declined at this point too, probably because of a cool, wet weather front that passed through at this time). Two weeks after treatment, mite density in the oil plots was higher than the control plots, and remained so until the second spray application three weeks later. At that point, Pacific mite density began to decline naturally, and the oil treatment had the effect of accelerating the decline. At the Easton site, the first and only oil treatment was applied relatively late in the season, also just before the natural decline of the Pacific mite population, and again, this had the effect of accelerating the decline. It appears, then, that for a rapidly increasing Pacific mite population, only about one to two weeks of control could be expected with oil. Therefore, in order to achieve the same amount of control compared to Omite, at least two, but more likely three to four oil sprays would be needed. The oil treatment did have the effect of preserving predator mites, but this had little practical value given the low predator/prey ratios at the critical Pacific mite buildup period.

Agroecological theory suggests that a cover crop will lesson the risk of a spider mite outbreak, but this effect was not seen in this study. The cover crop in this study had no effect on the buildup or final density of Pacific mite, nor did it affect vine growth and yield parameters.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Alternative Postharvest Treatments for Decay and Insect Control

Grant Award:
$48,405

Funding Period:
FY 1995–98

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Cooperating Growers-Shippers:
Tomato, pepper, specialty leafy greens and grape operations

Objectives

1. Demonstrate the effectiveness of heat treatments (hot water) for decay control on peppers and tomatoes in laboratory and commercial scale testing.

2. Demonstrate the dual-purpose treatment of high CO_2 atmospheres for control of *Botrytis* rot and insects in Thompson Seedless table grapes during storage or transport.

3. Demonstrate the effectiveness of short-term high CO_2 treatments at lower temperatures for control of insects on a diversity of leafy greens.

4. Demonstrate the effectiveness of the combination treatment of high CO_2 and heat for control of codling moth in Bartlett pears.

Summary

Heat treatments have potential to provide an alternative control measure for postharvest decay. The researchers have developed a solid database of effective hot water treatment regimes for postharvest decay control on peppers and tomatoes. *Botrytis* is the main test organism. Based on decay control scores, heat injury scores and overall pepper quality, the following hot water treatments were potentially useful: 55°C (131°F) for four to six minutes, 58°C (136°F) for three to four minutes, and 60°C (140°F) for two minutes. These treatment regimes are similar to those found effective for decay control on mature-green and pink tomatoes. Firmness and color quality of pink tomatoes can be reduced by these treatments; heat-treated mature-green tomatoes ripened normally. These treatments can work well as batch treatments, but are not feasible for current continuous water flume systems. Short hot water dips are potentially useful for control of microorganisms on the surface of products used for minimal processing. These results were discussed in numerous meetings with vegetable industry members.

The effects under this project supported development of a 45 percent carbon dioxide treatment to control three pests of table grapes, western flower thrips, Pacific spider mite and omnivorous leafroller. Probit 9 mortality for the three pests was achieved within 13 days at 2°C. Grape quality studies indicated that tolerance to this treatment for ten days was excellent; however, quality after 15 days was slightly reduced due to berry softening and rachis browning. Sensory studies indicated no detrimental effect on consumer acceptability. The researchers also evaluated the effect of the 45 percent CO_2 atmosphere on *Botrytis cinerea,* the cause of gray mold of grapes. These results indicated that shipment under the 45 percent CO_2 quarantine atmosphere may allow for a reduction in the use of sulfur dioxide fumigation for decay control of grapes. Continued work on grape mealybug, another pest of grapes, indicates it is not controlled by the carbon dioxide treatment. A sulfur dioxide/carbon dioxide pre-treatment in combination with the 13-day carbon dioxide treatment showed promise for adults and crawlers; however, eggs appear more difficult to kill. Additional work is needed before a workable treatment is developed for grapes; however, these treatments may have application for other commodities.

The researchers used various carbon dioxide concentrations, combination atmosphere treatments, heat treatments and storage periods to control Western flower thrips and Green peach aphids, common insects occurring on a wide range of green vegetables. The researchers tested the tolerance of asparagus, broccoli, celery, a wide range of specialty salad greens, and iceberg lettuce to some of the potentially useful treatment combinations. In the current protocols, insects are allowed a 24-hour recovery period at 20°C (68°F). Effective treatment periods of 36 to 48 hours at 0° to 5°C (32 to 41°F) are required for complete kill with 93 to 100 percent CO_2 atmospheres. Some green vegetables will tolerate exposures up to 24 hours, but lettuce did not tolerate more than eight hours. An eight-hour exposure weakened the insects and substantially increased mortality levels, but must be followed by some other control measure. Another interesting alternative treatment the research documented was a

short-term “shock” treatment (none or extremely low O_2 at ambient temperature) followed by low temperature storage; high mortality rates were observed. Depending on temperature, lettuce can tolerate periods of 24 to 72 hours under nitrogen without a decrease in storage quality. We also evaluated short-term high CO_2 treatments at 42°C (136°F) since higher temperatures increase the efficacy of the insecticidal atmospheres; broccoli and celery, but not lettuce, tolerated two hours under these conditions.

A high temperature (46°C [115°F]) controlled atmosphere (1% O_2 /15% CO_2) treatment was tested for two years on Bartlett pears for control of codling moth. In both years, the treatments slowed the rate of fruit ripening, even after several weeks in cold storage. This could be considered a benefit for exported fruit that are often marketed without cold storage. The rate of fruit heating appeared to influence the effect of the treatment, with the more rapid rate of heating having a bigger influence on the rate of fruit ripening (1996 work). Additional testing is necessary to test this theory. Nevertheless, this appears to be a promising quarantine treatment for pears.

The complete report of this project is available on SAREP’s Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Grant Award:
$10,919

Funding Period:
FY 1995–97

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History of Grazing on the Shasta-Trinity National Forest: Implications for the Future

Objectives

The objective of this project is to reconstruct the history of grazing on the Shasta-Trinity National Forest, determine the cause for the tenfold reduction of grazing activity on it, and analyze the relationship between federal grazing policy as implemented at the allotment level and changes in the use and management of base properties. This information will provide valuable insight into causes of land use change over the last 100 years. The information developed from this study could be used to demonstrate how reduction in livestock grazing on public land translates to private land use decisions. In addition to collecting information on animal numbers, the US Forest Service (USFS) has periodically collected vegetation information on some of its lands grazed by livestock.

Summary

This project looked at the history of grazing on the Shasta-Trinity National Forest and impacts on related private land. The researchers looked specifically at: changes in animal numbers, season of use, and livestock management methods, range condition, and any communications between the Forest Service and the tenant related to resource quality or policy changes. Data sources included historic USFS documents, archival level research, and interviews of current and past grazing tenants, and was cross referenced with digitized maps of the area.

The information compiled from this study has helped explain how and why livestock grazing has changed on the Shasta-Trinity National Forest across time. The Shasta National Forest was reserved in 1905, the Trinity in 1906. The USFS began to limit grazing access in 1907 (on both forests). Early grazing permits specified the number, kind and class of stock grazed as well as season of use and grazing boundaries. Livestock grazing decreased on the Shasta-Trinity National Forest for a variety of reasons that included economics, vegetation management policy and land development.

Economics. The market value of livestock (wool, lamb and beef) was converted to real dollars and plotted. The value for all three commodities peaked in 1920 (just post WWI) correlating with peak grazing numbers on the forest. Numbers slid as the value of livestock decreased through the depression and picked up slightly during WWII. Since WWII the increasing value of livestock did not result in a corresponding increase on the number of livestock accessing forage on the Shasta-Trinity National Forest. Interviews with former permittees on the Shasta-Trinity National Forest stopped grazing the forest because it was no longer economical to do so.

Vegetation Change. Prior to being reserved, many stockmen on the forest had used fire to limit brush. When the USFS began managing the forest, they enacted a no burn policy. One permittee (Stillwater Land and Cattle) eventually lost their grazing permit for failing to comply with this policy. Consider this telegram from a district ranger in Mt. Shasta to his superior in San Francisco (Dec. 22, 1917):

> *Forty-seven fires set by stockmen now burning Squaw Creek district doing little damage at present. Some circumstantial but no direct evidence. All local stockman favor burning results on public sentiment bad will spend no money fighting fires but something must be done about whole situation. See previous correspondence Stillwater Land and Cattle Company. Present circumstances similar. Can you suggest anything?*

The USFS was managing for timber early in their tenure. The Summary of Grazing Condition on the Trinity National Forest (1910) notes:

> *The grazing areas on the Trinity are gradually coming to a timber growth and in some situations very rapidly. This is more noticeable at from 3,000-5,000 foot altitudes. At lower elevations on south and west slopes the young pines are, in a great many places, filling up the thinly wooded slopes. At higher elevations, the brush ranges remain about the same, as the timber seems to encroach on these areas very slowly. The forage crop throughout the Forest is improving but grazing land is on the decrease.*

Land Development. Landscape level changes have occurred over the last 90 years. Shasta and Trinity dams were built, lumbering increased, wilderness designated and development of an extensive road system has been developed. Lands that once served as base property for ranches dependent upon public land for grazing have been subdivided. The impact of this development is difficult to establish. At least five ranches dependent upon public forage were flooded with the construction of Trinity Dam (1962). Our data did not indicate a large percentage reduction in grazing on the forest.

Conclusion

It is clear livestock grazing pressure has decreased nearly 20 fold since the lands of the Shasta-Trinity National Forest were removed from the public domain. When management of these lands fell to the USFS, they began to actively manage these lands with the best information available. Clearly, reduction in season of use and limited access to the forage on the forest, management toward timber (and away from grazing) and no-burn policy all contributed to reduced forage harvest on the forest. When past permittees were interviewed, the majority recognized changes in vegetation made it difficult (if not impossible) for the forest to carry as much stock as it did historically. Most permittees also cited personal circumstances and the economic of the livestock industry as reasons for giving up grazing on public lands.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Controlled Grazing on Foothill Rangelands

Grant Award:
$48,500

Funding Period:
FY 1995–98

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Objectives

The goals of the Sustainable Ranching Research and Education Project are:

1. Develop, demonstrate, and extend research-based management strategies to optimize economic and environmental sustainability of ranching.

2. Develop a facility to foster controlled grazing and sustainable livestock production research and education.

These goals are supported by the following objectives: a) Demonstrate controlled grazing on foothill range/annual grassland and irrigated pasture; b) Demonstrate monitoring procedures to assess range condition and trend and livestock performance; c) Teach research-based controlled grazing practices to livestock producers; d) Compare the effects of controlled grazing to conventional grazing management in livestock production and economic performance; e) Compare the effects of controlled grazing to grazing exclusion and conventional grazing management on plant communities; f) Determine the effects of controlled grazing on trace mineral nutrition of cattle; g) Determine the effects of controlled grazing on parasitation of cattle.

Summary

The project developed a 250-acre watershed into 23 rangeland and two irrigated pasture paddocks. Water was developed to every paddock using both permanent and portable water points. Innovative technologies were demonstrated fencing, water development, and pumping. Grazing planning was used to ensure rest periods of 30 to 45 days during fast growth and 90 to 120 days during slow growth. The project herd of fall calving cows was established. Calving season was switched to spring to match the animal's greatest demand with nature's largest supply, eliminating the need to purchase costly energy off the farm (hay) and feed to the animals. Forage samples were collected on a monthly basis for the purpose of developing a supplement that made up for all deficiencies except for energy—which would come from the land.

Three years of data show that it is possible, and may be more profitable, to eliminate hay feeding from a year 'round cow/calf operation on California's annual rangeland. To eliminate hay feeding, however, ranches must be restructured so the cow's production cycle matches the forage cycle. Although more research is needed before specific management recommendations can be made, there are a number of significant findings that can be used to improve or refine current management systems:

1. Cows can be bred during the heat of the summer. The project had 100 percent conception rates on cows during the two years they calved in the spring (1998 and 1999, breeding in July).
2. The calving interval between spring calving cows of 1998 and 1999 was 357 days. (The usual average is more than one year.) Calving season (when calves are born) lasted 42 days in 1998 and 19 days in 1999. The shorter the calving season, the more uniform the calves and the easier the management. Calving seasons were short because cows were in adequate body condition with BCS at 7.9 in 1998 and 6.6 in 1999. The single most important indicator for a cow is adequate body condition at calving which shortens the postpartum period and increases the potential success of getting cows re-bred quickly.
3. Heifers (young breeding female under age three) had an 80 percent conception rate and calved at BCS 4.7. The combined demands of growth, gestation, and lactation typically make it challenging to get heifers in adequate body condition.
4. Fall calving cows were used in the project's first year; the transition was then made to spring calvers. Comparing the calf weights of fall- and spring-born calves at similar ages revealed a 53-pound advantage for six-month-old fall calves. By 11 months of age, there was no difference. This suggests the need for a stocker phase (an intermediary stage after weaning and before entering the feedlot) for spring-born calves.

5. Keeping cows and calves together for as long as possible improved weight gain on the calves. Calves weaned at six months of age were 30 pounds lighter at selling than calves weaned at nine months of age. Body condition was the indicator for weaning. Cows with calves were weaned when cows reached a BCS 5; they must be weaned one to two months before they calve again, even if their body condition is adequate.
6. Cows were weighed and body condition scored on a monthly basis. It is possible for cows to use their body condition (stored fat) as an energy source during times when feed quantity is low, as long as an adequate feed period occurs prior to calving to allow them to gain back the condition they lost.
7. Forage samples were taken on a monthly basis for 36 months. Two mineral supplements were formulated based on the results: one for the green season and one for the dry season. The dry season supplement contained urea to make up for forage protein deficiencies in late summer and fall. The mix was primarily salt with trace minerals and urea and was fed in a loose form.
8. Crude protein reached a peak of over 20 percent in late winter and declined to less than six percent by August. This continued to decline to less than four percent in October.
9. Forage energy (mega-calories) levels peaked in February/March and declined 40 percent by mid-summer.
10. The projected gross margin per cow for calves born in 1999 was $214 or $18.82 per acre.
11. No mastitis or other udder problems were encountered. Calves did not have pneumonia. Eye problems were typical for the area; most were caused by seedheads penetrating the eye.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

Resources

A project Web site was established and includes several dozen papers on grazing, ecology, nutrition, fencing, and low-stress livestock handling. It also includes information about project events and links to other useful Web sites. The address for the Web site is http://www.foothill.net/~ringram.

Four audio-tape programs were developed to provide follow-up support for Grazing Academy alumni and to introduce other ranchers to controlled grazing principles. Each set of tapes includes a small workbook. Information about purchasing these tapes is available at the project Web site or by calling the principal investigator.

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Ecology of a Group of Generalist Predators, the Green Lacewings, and their Contribution to Biological Control in Almonds and Walnuts

Grant Award:
$24,000

Funding Period:
FY 1995–98

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George Kresa,
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Russell Lester,
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Objectives

1. To measure the seasonal patterns of abundance of green lacewings in almond and walnut orchards and quantify lacewing survivorship through egg, larval, and pupal stages.

2. To quantify the abundance of other dominant species of generalist predators in almond and walnut orchards.

3. To determine the diet of predatory green lacewings, including their rate of consumption of key almond and walnut pests, through detailed observations of foraging lacewings.

Summary

Pesticide resistance evolution and the environmental costs of insecticide use are motivating almond and walnut growers to seek non-chemical methods of pest control. One such method is biological control, which uses predators and parasitoids to control insect and mite pests. The ecology of generalist predators is, however, very poorly understood, making it difficult to manipulate predators for pest control. This project's goal is to develop an understanding of the ecology of a key group of generalist predators, the green lacewings (family Chrysopidae).

This project studied predatory green lacewings and other key groups of generalist predators in six crops in Yolo and Solano counties: almonds, walnuts, grapes, tomatoes, alfalfa, and cotton. The researchers first addressed the question of whether lacewing populations occur naturally in agroecosystems at densities as high or higher than those recommended in augmentative releases. Lacewing egg populations were found to peak early in the season in grapes for 1996 only (reaching 11,000 per acre), alfalfa (reaching 58,800 per acre in 1996 and 72,000 per acre in 1997), almonds (reaching 23,000 per acre in 1996 and 36,000 per acre in 1997), and walnuts both years (reaching 7,000 and 19,000 per acre in 1996 and 1997, respectively). In cotton the highest numbers (26,000 per acre in 1996 and 51,000 per acre in 1997) were reached during the late summer. No lacewings were recorded in tomatoes in 1996 and densities were very low during 1997 (maximum density of 2,000 per acre). Lacewings occurred in crops despite the presence of very low densities of prey species (aphids, mites, and thrips). Variation in lacewing densities between crops, between sites within a crop, and seasonally underscore the importance of sampling fields before recommending augmentative releases; however, in many cases augmentative releases can produce meaningful increases in lacewing densities.

Lacewing survivorship through the egg stage, which can be attacked by parasitoids or predators, was generally high (approximately 60 to 80 percent). In contrast, only 30 percent of lacewings survived through the pupal stage, which was also attacked by parasitoids and predators. Other dominant predators included spiders, *Orius tristicolor,* predatory mites, and ants. Direct observations of foraging lacewing larvae showed that lacewings feed on mites and thrips in almonds, and also consumed extrafloral nectar. In walnuts, lacewings consumed aphids and mites.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

Resources

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UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Suppression of Plant-Parasitic Nematodes in Conventional and Organic Farming Systems

Grant Award:
$19,155

Funding Period:
FY 1994–97

Principal Investigator:

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Kate Scow,
Dept. of Land Air and Water Resources, UC Davis

Objectives

1. To determine whether suppressiveness of soil to root-knot nematode differs in conventional and organic cropping systems.

2. To determine whether species and abundance of fungal enemies of plant-parasitic nematodes differ in conventional and organic cropping systems.

Summary

Suppression of the root-knot nematode *(Meloidogyne javanica)* and numbers of nematode-trapping fungi were compared in conventionally- and organically managed plots in the Sustainable Agriculture Farming Systems (SAFS) Project at the University of California, Davis. Soil samples were collected three times per year for two years. Suppression of root-knot nematode by organisms was measured in the laboratory. There were three combinations of soil/nematode inoculation: natural soil with added M. javanica, natural soil without added M. javanica, and heat-treated soil. Soil was placed in containers; appropriate treatments were subjected to heat to kill natural enemies of nematodes. Fourteen days later, containers assigned to appropriate treatments were inoculated with known numbers of M. javanica (infective stage). After an additional 66 hours had elapsed, cabbage seedlings were introduced to the containers. An additional five days were allowed to elapse, at which time seedling roots were inspected and scored for incidence of M. javanica infection. Suppression was substantial, was not affected by management system, but was correlated with general microbial activity.

Numbers of species of nematode-trapping fungi were slightly but significantly greater in organically-managed plots. Two fungi, *Arthrobotrys dactyloides* and *Nematoctonus leiosporus,* were more abundant in organically-managed plots, whereas two others, *A. haptotyla* and *A. thaumasia,* were more abundant in conventionally-managed plots. Suppression of root-knot nematode was not correlated with numbers of nematode-trapping fungi.

When formulated as hyphae in alginate pellets and added to field soil, *A. haptotyla* substantially suppressed the root-knot nematode but not the cyst nematode in pot experiments; suppression in pot experiments was associated with much greater fungus population densities than detected in the field.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

Resources

Jaffee, B.A., H. Ferris, and K.M. Scow. 1998. Nematode-trapping fungi in organic and conventional cropping systems. *Phytopathology* 88:344-350.

Jaffee, B. A. 1998. Susceptibility of a cyst and a root-knot nematode to three nematode-trapping fungi. *Fundamental and Applied Nematology* 21:695-703.

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Ten Year Progress Report

The Transition from Conventional to Low-Input or Organic Farming Systems: Soil Biology, Soil Chemistry, Soil Physics, Energy Utilization, Economics, and Risk

Grant Award:
$526,690

Funding Period:
FY 1988–99

Principal Investigator:

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Howard Ferris, Dept. of Nematology, UC Davis

Ariena van Bruggen, (formerly) Dept. of Plant Pathology, UC Davis

Kate Scow, Dept. of Land, Air, and Water Resources, UC Davis

William Horwath, Dept. of Land, Air, and Water Resources, UC Davis

Tom Lanini, Dept. of Vegetable Crops, UC Davis

Jeff Mitchell, Dept. of Vegetable Crops, UC Davis

Peter Livingston, Dept. of Agriculture & Resource Economics, UC Davis

Durga D. Poudel,
SAFS research manager

Peter Brostrom, crop production manager

Tom Kearney, UC Cooperative Extension farm advisor, Yolo/Solano counties

Gene Miyao, UC Cooperative Extension farm advisor, Yolo/Solano counties

Jim Durst, farmer, Yolo County

Bruce Rominger, farmer, Yolo County

Ed Sills, farmer, Yolo County

Carol Shennan, Dept. of Vegetable Crops, UC Davis

Objectives

1. Over a 12-year period encompassing three, four-year rotation cycles, compare four farming systems with different levels of reliance on non-renewable resources with regard to:

   a. Crop growth, yield, and quality as influenced by different pest management, agronomic and rotational schemes of the four farming systems.

   b. Abundance and diversity of weed, pathogen, arthropod, and nematode populations and their impact on crop growth, yield, and quality.

   c. Changes in soil biology, physics, chemistry, and water relations and their impact on soil quality and productivity.

   d. Cost of production inputs, value of production, economic risk, energy budgets for agricultural production under the four farming systems.

2. Compare and evaluate existing and/or novel low-input and organic farming tactics, with emphasis on innovations that correct deficiencies, enhance profitability or decrease risk in each farming system.

3. Distribute and facilitate adoption of information generated by this project to all interested parties as it becomes available.

Summary

The Sustainable Agriculture Farming Systems (SAFS) project was established to study the transition from conventional to low-input and organic practices. Treatments include three, four-year rotations under conventional (conv-4), low-input, and organic management and a conventionally-managed, two-year rotation (conv-2). Comparing 1996 values with base line data taken in 1988, the organic system showed a greater increase in selected soil fertility variables than the other systems. In 1996, the organic system, on average, had 91 percent greater soluble phosphorous (P), 21.5 percent greater soluble potassium (K), and 14.1 percent greater soil organic matter (SOM) than in 1988. Additional positive effects on soil quality resulting from low-input and organic management include higher microbial biomass and activity, increase in mobile humic acids, increased water infiltration rates, and soil water-holding capacity. Pesticide use in the low-input cropping system is less than 50 percent of that used in the conventional systems.

The most profitable farming system continues to be the conv-2 system due to the greater frequency of tomato in that rotation. Among the four-year rotations, the organic system with price premiums is the most profitable while the organic system without premiums is the least profitable. New research efforts are underway to quantify the contribution of cover crop nitrogen (N) to the following cash crop in the low-input and organic systems and to measure the impact of farming system management on soil biota and the associated effects on soil fertility and pest management.

Information generated from SAFS research has been disseminated through a video highlighting the project results, workshops, annual field days, field tours, educational materials, peer-reviewed articles, and an Internet homepage. The project was the host site for AgTech98, the annual UC Davis showcase of important research and technology. Interest in the findings of the SAFS project by farmers, industry, researchers, and the general public continues to increase, and the SAFS plots serve as a living laboratory for graduate and undergraduate students, and provide samples for a number of soil and agronomic courses on campus.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

Selected Resources

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Cavero, J., R.E. Plant, C. Shennan and D.B. Friedman. 1997. The effect of nitrogen source and crop rotation on the growth and yield of processing tomatoes. *Nutrient Cycling in Agroecosystems* 47:271-282.

Clark, M.S. 1999.Ground beetle abundance and community composition in conventional and organic tomato systems of California's Central Valley. *Applied Soil Ecology,* 11:199-206.

Clark, M. S., W. R. Horwath, C. Shennan, K. M. Scow. 1998. Changes in soil chemical properties resulting from organic and low-input farming practices. *Agronomy Journal.* 90:662-671.

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Ferris, H., R.C. Venette, H.R. van der Meulen, S.S. Lau. 1998. Nitrogen mineralization by bacterial-feeding nematodes: Verification and measurement. Plant and Soil 203:159-171

Ferris, H., R. C. Venette and S. S. Lau. 1996. Dynamics of nematode communities in tomatoes grown in conventional and organic farming systems, and their impact on soil fertility. *Applied Soil Ecology* 3:161-175.

Gunapala, N. and K.M. Scow. 1998. Dynamics of soil microbial biomass and activity in conventional and organic farming systems. *Soil Biology and Biochemistry* 30:805-816.

Gunapala, N., R.C. Venette, H. Ferris, and K.M. Scow. 1998. Effects of soil management history on the rate of organic matter decomposition. Soil Biology and Biochemistry 30:1917-1927.

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Klonsky, K. and P. Livingston. 1994. Alternative systems aim to reduce inputs, maintain profits. *California Agriculture.* 48(5):34-42.

Lanini, W.T., F. Zalom, J.J. Marois, and H. Ferris. 1994. Researchers find short-term insect problems, long-term weed problems. *California Agriculture* 48(5):27-33.

Scow, K.M., O. Somasco, N. Gunapala, S. Lau, R. Venette, H. Ferris, R. Miller, and C. Shennan. 1994. Transition from conventional to low-input agriculture changes soil fertility and biology. *California Agriculture* 48(5):20-26.

Temple S.R., O.A. Somasco, M. Kirk and D. Friedman. 1994. Conventional, low-input, and organic farming systems compared. *California Agriculture.* 48(5):14-19.

Temple, S.R., D.B. Friedman, O. Somasco, H. Ferris, K. Scow, and K. Klonsky. 1994. An interdisciplinary, experiment station-based participatory comparison of alternative crop management systems for California's Sacramento Valley. *American Journal of Alternative Agriculture* 9:64-71.

van Bruggen, A.H.C., and A.M. Semenov. 1999. A new approach to the search for indicators of root disease suppression. *Australian Plant Pathology,* 28(1):4-10.

van Bruggen, A.H.C. 1995. Plant disease severity in high-input compared to reduced input and organic farming systems. *Plant Disease* 79:976-984.

Venette, R.C., F.A. M. Mostafa, and H. Ferris. 1997. Trophic interactions between bacterial feeding nematodes and the nematophagous fungus Hirsutella rhossiliensis in plant rhizospheres to supress Heterodera schachtii. Plant and soil 191:213-223.

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Scott River Basin Water Balance: Phase I (Year I)

Grant Award:
$14,850

Funding Period:
FY 1997–98

Principal Investigator:

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Objectives

1. Develop a water balance of the Scott River system in order to help local farmers address the problem of the low streamflows in the Scott River while maintaining sustainable agriculture in the Scott Valley.

2. Develop an holistic management tool that will help anticipate the benefits, costs, and political feasibility of policy/project alternatives that are presented by the local Coordinated Resources Management Planning (CRMP) Council.

Summary

This is a final report on Phase I (Year 1) for a water balance of the Scott River basin. Phase I included the collection and inventory of data necessary for developing a water balance and a computer model of the Scott River basin. Phases II and III were funded by the California Department of Fish and Game. (A report will be forwarded to UC SAREP when Phase III is completed in 2000.) Below is a brief summary of Phase I.

Farming and ranching provide the economic base for the people living in the Scott River basin. Historically, surface water ditches provided most of the irrigation and stock water needs for crops and livestock. However, during the summer and late fall there is little or no stream flow. For those that can afford it, large irrigation wells are installed to ensure an adequate water supply during the low-flow, fall months.

In addition, low surface flows in the fall are identified as a primary limiting factor to the survival/success of the local fisheries. These fish migrate upstream to spawn and need an adequate amount of water to allow for migration. Local areas of dewatered streams can cut off miles of potential spawning habitat. Many local agricultural producers recognize the need to improve streamflows to maintain a sustainable agriculture business and a viable community. This water balance was recommended as a way to better understand the hydrology of the basin.

A water balance is really an accounting system of the hydrology of a basin. Hydrology is the collection, occurrence, and distribution of water. In order to develop a water balance, all of the inputs and outputs of water in a watershed need to be identified and the data gathered.

Using basic hydrologic concepts, the inputs were identified as precipitation; the outputs were identified as evapotranspiration and streamflow. These parameters are sufficient for an annual water balance. However, for a monthly or seasonal water balance, changes in soil moisture and groundwater storage are also necessary to capture the deficit of water in the summer and the excess in the winter.

Precipitation and streamflow are directly measurable and can be spatially interpolated with some confidence. However, evapotranspiration requires crop information, air temperature, relative humidity, and soil moisture. In addition to the hydrologic inputs and outputs, the land in the basin needed to be described accurately so that a computer model (named MODFLOW, written in Fortran77) could be developed and used to predict land and resource management impacts. Therefore, information on soils, geology, land use, roads, groundwater use, surface diversions, and urban lands were collected.

The end result of this project is to provide local resource managers with a tool that can be used to identify projects of benefit both to the local fisheries and to the agriculture community. A specific project of interest is conversion of brush lands to grazable grass lands. A physical model will help people visualize the results of such an action. The model will process a scenario where a piece of land is converted from brush land to grass land. The predicted results will then be visually presented to a group. If favorable, a proposal would be written to fund such a project. A visual representation of the scenario could be presented with the proposal for impact and support.

However, the long-term success of this model depends on adequate maintenance. Changes in topography, water use, and land use must be reflected in the model to ensure accurate results. In addition, only projects that have the support of willing landowners will be pursued.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Grant Award:
$5,520

Funding Period:
FY 1997–98

Principal Investigators:

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Market Cooking for Kids: Facilitating Field Trips to Sustainable Agriculture Farms

Objectives

1. Develop a Farmers' Guide to Hosting School Farm Field Trips during the course of 20 farm trips with selected school classes and farmers. This guide will then be widely disseminated to farmers.

2. Develop a complementary Teachers' Resource Guide to Visiting Farms, which will be field-tested with the same teachers.

Summary

This grant provided funding to research and develop *A Farmers' Guide to Hosting Farm Visits for Children*, which has been produced for distribution to Bay Area farmers practicing sustainable agriculture. The purpose of the Guide is to encourage more farmers to host field trips to their farms and to provide the most meaningful educational experiences possible. The Guide offers suggestions for activities, group management, safety and logistics – everything a farmer needs to know to host a group of children. The grant which funded the Guide also helped support farm field trips for 376 Bay Area school children, grades pre-Kindergarten through Grade 5 in the spring of 1998. Outcomes and feedback from the farm field trips were incorporated and inform the Guide's content.

A separate Teachers' Resource Guide has not been developed. Instead, the farmers' guide was designed to serve as a supplemental resource for teachers. In addition, the farmers' guide is being incorporated into the *Market Cooking for Kids Activities Guide*, in which further information on farm field trips for teachers (e.g., list of local farms to visit and bus company information) will be included.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

Resources

A Farmers' Guide to Hosting Farm Visits for Children, Center for Urban Education about Sustainable Agriculture, Berkeley, CA, 1998.

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Park Village Community Supported Agriculture Research Project

Grant Award:
$10,000

Funding Period:
FY 1997–98

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Benny Fouche,
UC Cooperative Extension farm advisor, San Joaquin County

Joanne Cutter,
Countryside Farms, San Joaquin County

Gillian Murphy,
Small Business Development Center, San Joaquin County

Don Bennett,
Stockton Emergency Food Bank, San Joaquin County

Objectives

The Park Village Community Supported Agriculture (CSA) Project was funded by SAREP to support research and educational activities for the Park Village Farm Project. The grant from SAREP was used to examine the feasibility of the Park Village Farm Project, provide potential participants with training and technical assistance, and develop a project plan. [The second phase of this project, to implement the CSA, was funded by SAREP for fiscal year 1999-2000 (Kositsky/Melton).]

The specific objectives of the Park Village CSA Research Project were as follows:

1. Determine how farm land can best be used by Park Village Farms and what improvements must be made to the land.

2. Develop a business plan for Park Village Farms that will ensure the food needs of the community are met while creating economic opportunities for participants.

3. Provide residents of Park Village with training on operating a farm and develop an organizational structure for Park Village Farms.

4. Develop a project design, budget and timeline for the Park Village Farm Project. Raise funds through grants and/or loans for the Park Village Farm Project.

5. Write and disseminate a report that demonstrates the feasibility of the Park Village Farm Project for use by organizations interested in implementing similar projects.

Summary

Park Village Apartments is an affordable apartment complex co-owned by the Rural California Housing Corporation (RCHC) and the Asian Pacific Self-Development and Residential Association (APSARA). RCHC is a regional nonprofit housing and community development agency. APSARA is an association of the residents of Park Village. Residents are primarily refugees from war-torn Cambodia. They formed APSARA in 1989 in response to terrible living conditions in their community. As a result of their efforts, APSARA and RCHC purchased and rehabilitated Park Village. Today, the complex is an affordable, safe place to live that offers services to help families achieve self-sufficiency. Due to language and cultural barriers, however, many families face challenges to economic independence.

In 1996 RCHC staff began meeting with Park Village residents to discuss their interest in agriculture as a means for self-sufficiency. Many of the residents farmed in Cambodia and had informally discussed a desire to continue farming in the United States. During these meetings, residents stated that they believed farming might help them achieve self-sufficiency and food security. RCHC committed to helping residents pursue this goal.

Initially, the Park Village Farm Project was to be sited on 20 acres of land in Acampo, Calif. Under an agreement with the Northern California Land Trust (NCLT), the Park Village Farm Project would farm the land rent-free and pay NCLT for their cost of ownership (property tax and insurance). Through the grant from SAREP, RCHC hired a farming consultant to evaluate the soil, capital improvement requirements and equipment needs for the project, and to determine what crops would be most successful using sustainable farming methods at the NCLT site. In addition, the consultant was to develop a budget for capital improvements and equipment. During this project the consultant worked closely with Benny Fouche, a Small Farm Advisor at the UC Cooperative Extension in San Joaquin County (UCCE). Jeff Kositsky, RCHC's Principal Investigator, worked with the cooperators to develop a feasibility study for the Park Village Farm Project.

This research concluded with a report on the donated land, a list of potential crops, an equipment list and a description of the improvements needed to make the land farmable. Data was gathered through a soil test, interviews with local farmers, a survey of the land, estimates from contractors, interviews with participants, meetings with wholesalers and other potential marketing sources, a review of crop studies and bids from suppliers.

The work was completed in a timely, effective and efficient manner and the report prepared was comprehensive. After the feasibility study was completed, however, NCLT determined that they needed to charge RCHC $6,000 to prepare a new lease. NCLT also determined that they would require rent at 75 percent of the market rate for agricultural land. Since this fee was much greater than the original agreement with NCLT and the land required major improvements, RCHC decided to find another site for the project.

Although the land studied for this research project will not be used by the Park Village Farm Project, conducting the feasibility study provided a significant beneficial impact. First, it prompted the creation of a start-up budget, equipment list and crop plan that was useful regardless of the location of Park Village Farms. Additionally, it allowed RCHC to determine the quality of NCLT's land as it decided if the project should be sited there, educated the participants on agricultural issues, and provided RCHC with increased institutional knowledge on the subject of setting up a farming operation that was used to determine the feasibility of the project and for grant writing purposes.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

www.sarep.ucdavis.edu

Design Plan and Monitoring Program Development for a Straw Bale Produce Cooler Demonstration Unit at the Rural Development Center in Salinas, California

Grant Award:
$4,700

Funding Period:
FY 1997–98

Project Investigator:

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Cooperator:

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Central Coast Resource Conservation and Development Council

Objectives

1. To develop plans for a strawbale produce cooler facility large enough to accommodate the projected volume of produce harvested by the Rural Development Center (RDC) program participants. The Center anticipates growing this produce on demonstration plots in connection with a possible commercial venture.

2. To develop facility plans which will have cooling and storage features to accommodate the physiological requirements of a range of commercial crops (over 40 varieties) grown at the RDC.

3. To develop facility plans with features and instrumentation, which will accommodate a monitoring program to assess efficiency, cost effectiveness, and long term feasibility.

4. To determine the total project cost of the demonstration unit to include labor, materials, and support costs. This information will provide the basic framework for the construction phase of the project (funds will be solicited from available sources).

Summary

The primary purpose of the project was to enhance the prospects of family farmers associated with the RDC to market their own crops in a way that would give them more options, maximize profits, and provide them with greater control over the process of marketing. The construction of a cooling facility on the property would provide participating farmers with a marketing advantage by allowing them to store and cool their harvest and "play the market" to get the optimum price. The cooler would also provide opportunities for collaboration among family farmers in the region, partly through joint marketing arrangements.

Of primary importance in this project is the use of the straw bale produce cooler for educational and demonstration purposes. The project's Technical Advisory Committee (TAC) has been fully supportive of this concept which supports the construction of a cooler unit that will be appropriate to a small family operation, can be built (as much as possible) by the farmer(s) themselves, and is financially affordable. In addition, if the cooler appears feasible, the project participants will develop a guidebook and training materials.

The TAC met all of the stated goals of this project by 1) developing a design for the strawbale cooling unit that can accommodate a wide range of crops and be monitored to assess energy efficiency, cost effectiveness, and long-term feasibility; and 2) developing a timeline and budget for its construction. The TAC also made plans for a covered entrance, which will serve as a space for washing and packing vegetables and as a space for large trucks to load/unload vegetables into the cooler. The second phase of the project will be built after the cooling unit is complete.

With the design and timeline now complete, the TAC is working on two immediate priorities: funding and the permit process. Construction is expected to begin in February 2000 with a completion date of March 2000. Throughout construction, videotaping will occur to create a documentary that will serve as a manual for others constructing their own strawbale coolers.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Progress Report

Evaluating Farmers' Markets in Low-Income Areas

Grant Award:
$9,540

Funding Period:
FY 1996–97

Principal Investigator:

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Mark Wall,
Southland Farmers'
Market Association,
Los Angeles County

Zy Weinberg,
National Association
of Farmers' Market
Nutrition Programs,
Virginia

Objectives

1. To determine the factors that have made farmers' markets in low-income urban communities across the country successful.

2. To determine the factors that have resulted in the failure or stagnation of farmers' markets in low-income communities in California.

3. To determine public policies that affect the success of farmers' markets in low-income communities.

4. To educate farmers' market organizers, farmers, and other relevant individuals about developing farmers' markets in low-income communities and the steps needed to make them successful.

Summary

This research project has explored issues surrounding farmers' markets in low-income communities. It examined policy opportunities and barriers at the federal and state levels, and conducted a literature review of low-income consumers' cooking and shopping habits, and their implications for farmers' markets. It also examined nine markets on the East and West coasts to determine common criteria for operating and starting a successful low-income farmers' market.

A report of our findings, *Hot Peppers and Parking Lot Peaches: Evaluating Farmers' Markets in Low-Income Communities,* includes general guidelines for farmers' market operation, such as developing a community sense of ownership, following solid market organizing and operational principles, cultivating a culturally appropriate mix of products at low prices, developing strong links with farmers, cultivating political connections with City Hall, and gaining some form of subsidy, either through Farmers' Market Nutrition Program coupons, the presence of middle-income shoppers, or through subsidies from middle-income markets.

With regard to policy issues, the report details a lack of coordination within USDA on farmers' markets and low-income food access. USDA has not yet developed a system to allow farmers' markets to continue accepting food stamps once states have converted them to a debit card system. Some California farmers' markets will suffer dramatically if such a system is not developed within the next few years. In other policy issues, the report concludes that the state of California should provide a minimum of $400,000 per year for participation in the Farmers' Market Nutrition Program, and allow for off-farm stands in low-income areas to be exempt from standard pack regulations.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

Resources

Hot Peppers and Parking Lot Peaches: Evaluating Farmers' Markets in Low-Income Communities, Andy Fisher, Community Food Security Coalition, Venice, CA, 1999.

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Grant Award:
$37,707

Funding Period:
FY 1996-98

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Collaboration Between Willard Greening Project & BOSS (Building Opportunities for Self-Sufficiency)

Objectives

1. To develop urban, inner city agriculture by utilizing unused public lands for food production.

2. To demonstrate the applicability and economic sustainability of intensive farming methods such as those promoted by John Jeavons for small plot urban situations.

3. To train homeless people in intensive farming methods.

4. To develop a community food system by:

- Developing and expanding local markets for urban produced foods.
- Developing the Berkeley Unified School District's Food Services as a market for local farmers and gardeners.
- Developing more efficient use and less waste of existing urban-produced foods.
- Promoting mutual understanding and political cooperation between the community and food producers through community education and outreach.
- Educating consumers on the benefits of locally produced, organic foods.
- Demonstrating that contrary to popular beliefs, school children want to and will eat vegetables, and are viable consumers of locally produced, organic foods.

Summary

In 1998, the Willard Greening Project expanded its production with the removal of 2,200 square feet of asphalt and the installation of raised beds at Willard Middle School. As a result, beginning in September 1998, the Willard Greening Project began and continues to produce 15 to 30 pounds of lettuce and salad greens per week. The primary destination for the greens is the school lunch programs at two schools, Willard Middle School and Jefferson Elementary, which use five to six pounds of greens per week. The remainder of the greens is sold at the local farmers' market, or donated to Harrison House, a homeless shelter for families. The successful model of school garden produce supplying the school lunch has prompted other schools to request assistance in implementing this model. The goal is to have all children in Berkeley eating fresh, organic salads in their school lunch. The Greening Project has also actively participated in the formation of the Berkeley Food Systems Project with the goal of developing links between the school and local farmers for the rest of the fresh vegetables and fruits used in school lunches, and for the development of a food security policy to be presented to the City of Berkeley. [The Willard Greening Project received additional funding from SAREP for fiscal year 1999-2000.]

The original objectives of the project have changed. One major change in the objectives involves the termination of the job-training program for the homeless, which then necessitated ending the collaboration between the Willard Greening Project and Building Opportunities for Self-Sufficiency (BOSS). The reasons for ending the homeless job-training program are many. Primarily, BOSS, after evaluating the efficacy of its training program, chose to change the gardening program from job training and food production to rehabilitation. BOSS, within the last year, purchased a piece of property which has been developed into an ornamental and herb garden.

The second major change was the researchers' appreciation of the importance and significance of improving the quality of food served in school lunches. Schools are a major market for food. Berkeley Unified School District (BUSD) has an enrollment of 9,283 students, and approximately one-third of these students are eligible for federal meal subsidies. In the course of a school year, the Food Services department will serve over 463,000 lunches and 106,000 breakfasts. For many students, school meals provide a significant portion of their nutritional intake. Currently the meals served by Berkeley's Food Services department, consistent with the industry standard, contains little or no fresh vegetables and fruits. The bulk of the items served are reheated, prepackaged frozen foods.

California Department of Education, Nutrition Education and Training Section recently concluded that "fruits and vegetables are the most under-consumed of the five food groups," and that in fact "fruit and vegetable intake by kids may be falling." Fruits and vegetables are not just healthy choices; studies have shown that students who eat the recommended amounts of fruit and vegetables actually have improved academic performance. One way to increase fruit and vegetable consumption by children is to involve them in gardening.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Market Cooking for Kids: In Season Cooking and Science for School Children

Grant Award:
$10,000

Funding Period:
FY 1996–97

Principal Investigator:

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Bill Wilkinson,
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Objectives

1. Present the MCK program in the same schools, with the same teachers, as last year.

2. Expand our program, based on suggestions from teachers, to include: activities in school gardens; school visits from local farmers who grow the featured produce; field trips to local farmers' markets; wholesalers; and urban market garden projects; and lessons through the summer in year-round schools.

3. Use the program to test lessons for a Reference Guide about the cooking and science of seasonal foods. With teacher involvement and feedback, further develop lessons, recipes, and pre- and post-lesson classroom activities.

4. Increase teacher and family involvement by providing take-home activities, such as recipes, and soliciting teachers' and parents' input for the reference guide.

5. Make the classroom programs self-sustaining by training teachers and by creating "Rolling Kitchens" for each school.

Summary

This grant supported the development and testing of the Market Cooking for Kids *Activities Guide.* This guide is organized into 18 chapters based on a series of seasonal crops and provides a compilation of recipes, activities, background information, and tips for conducting simple cooking activities in the classroom. Each chapter of the guide also includes a farm profile – a brief article about a local, family-owned, organic farm where each crop is grown. The *Activities Guide* will be used by elementary school teachers to introduce their students to issues of food production, sustainability, and nutrition through hands-on experience.

Market Cooking for Kids has made considerable progress toward meeting each of these objectives since they were originally submitted for this proposal. However, the implementation of this grant has focused primarily on meeting the third objective, to develop and test what was referred to as a "Reference Guide" and has evolved into the Market Cooking for Kids *Activities Guide.*

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Rethinking Direct-Marketing Approaches Appropriate to Low- and Moderate-Income Communities and Urban Market Gardens

Grant Award:
$15,000

Funding Period:
FY 1996–98

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UC Berkeley

Objectives

The intent of this research was to identify viable direct-marketing approaches that could sustain a small market garden in low- and moderate-income urban communities. Once a 'fit' between consumer and producer needs was identified, a pilot project would be developed that was both economically viable and neighborhood-appropriate. The original research objectives included:

1. Eating and Purchasing Habits. Collect data on available food distribution systems, eating habits, and direct marketing participation of a low- and moderate-income community.

2. Bringing Locals to Market. Determine feasible direct-marketing approaches to integrate urban market garden projects into low- and moderate-income neighborhood food consumption and consumer purchases.

3. Pilot Project. Develop an alternative direct-marketing pilot project that addresses the needs and preferences voiced through a survey of the local community.

4. Research Report. Provide a report to UC SAREP and targeted research and community practitioners summarizing results of the study and the justification for the proposed pilot project.

5. Funding Proposal. Approach UC SAREP and other funders to initiate a pilot project that reflects the research findings and test it as a viable case study in urban sustainable agriculture and community food systems.

At the outset the research team believed that the Garden Patch's remaining unmet goal was economic viability which could be achieved through better marketing. As the work progressed it became clear that the research objectives needed to include an assessment of both opportunities and barriers to the self-sufficiency of a non-profit program of this sort:

6. Realities of Non-market Agendas. Assess the ability of an urban, social-agenda farm to be financially viable.

7. Social-Agenda Marketing. Determine economically feasible market approaches for small-scale urban market garden projects that capitalize on the project's social agenda.

Summary

Berkeley Youth Alternatives' (BYA) Garden Patch is a half-acre site providing multiple services to youth and community while striving for financial self-sufficiency. Of particular interest to this study is the Garden Patch's Youth Market Garden Program (Market Garden) which trains and employs at-risk youth to grow and sell organic produce at farmers' markets and elsewhere.

The intent of the research was to improve the Garden Patch's economic viability through analysis of potential market niches and development of a pilot project. The research focused on two areas – food purchasing patterns in the surrounding neighborhood and the economic feasibility of a small urban garden. Data collected through surveys, focus groups, and interviews showed that BYA neighbors enjoy ready-access to fresh produce and have complex shopping patterns motivated by the search for quality, affordability, and convenience.

An internal audit and expert input revealed cost inefficiencies in operating the socially motivated Market Garden, specifically time spent on youth training, non-garden BYA activities, and community outreach. Yet experts and survey participants placed more importance on the Market Garden's role in youth training than as a for-profit venture. Further, many of those surveyed indicated they would support the youth programming by purchasing Market Garden products as long as they were high quality and fairly priced.

These findings informed the design of a pilot project that incorporated small business learning experiences for youth in direct marketing pursuits. However, it remains unclear if such an educationally based program can sustain itself financially in the long term.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Progress Report

A Spatially Explicit Vineyard Expansion Model: Addressing Crop Production, Public Policy, and Environmental Concerns

Grant Award:
$80,200

Funding Period:
FY 1996–1998
FY 1999–2000

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Objectives

The goal of this project was to provide an assessment of where vineyards have been planted, where they are likely to be developed, and address the natural resource and environmental policies that are associated with agricultural expansion in Sonoma County. The specific objectives of the research were to:

1. Integrate vineyard maps with physical and habitat data for Sonoma County into a Geographic Information System (GIS) to assess patterns of vineyard development.

2. Make a model of areas suitable for future vineyard development.

3. Use the GIS to evaluate proposed and adopted regulations and habitat loss and fragmentation.

Summary

Vineyards are expanding rapidly in California's north coast due to a booming wine market. In Sonoma County, much of this expansion is occurring on hillsides that harbor California's remaining oak woodlands. These natural areas support a majority of the region's biodiversity, provide ecosystem goods and services and scenery valued by residents. This project was designed to provide an assessment of where vineyards have been planted, where they are likely to be developed, and address the natural resource and environmental policies that are associated with agricultural expansion in Sonoma County.

The specific objectives of our research were to 1) integrate vineyard maps with physical and habitat data for Sonoma County in a GIS to assess patterns of vineyard development; 2) make a model of areas suitable for future vineyard development; 3) use the GIS to evaluate proposed and adopted regulations; and 4) evaluate the risk of habitat loss and fragmentation. This research project provided analysis that is designed to promote sustainable agriculture at the landscape scale. Also, this information is incorporated into a planning tool that is being used by Sonoma County for planning purposes thereby meeting SAREP's priority to integrate crop production issues with public policy issues and community development.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Natural Beef: Consumer Acceptability, Market Development and Economics

Grant Award:
$14,948

Funding Period:
FY 1996–97

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Red Bluff Bull Sale,
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Objectives

1. Determine the consumer acceptability of natural, forage-fed, blade-tenderized beef, developed on California rangelands without exogeous anabolic steroids or subclinical use of antibiotics.

2. Characterize the demographics of the potential market in Northern California.

3. Determine the economic feasibility of the development of a natural beef market, emphasizing costs and returns to producers in contrast to current marketing systems.

4. Develop a rancher-to-consumer marketing plan for Natural Grass Fed Beef.

Summary

This project provided insight into the viability of grass-fed beef marketing in California. Findings from consumer surveys and focus groups indicated an interest in beef products that were not implanted with hormones or given antibiotics. Restaurant purveyors were interested in increased links between production ranches and restaurant products, and were concerned about the leanness of ranch products and the ability of producers to deliver the consistent quality required for their businesses. A sample marketing plan was developed to provide strategies for potential product development for Northern California.

Four case studies were developed to provide insight into actual market development through past rancher activities. These case studies underscored the issues that need to be addressed prior to considering a marketing plan. A flow chart was developed to visually illustrate the different marketing outlets and the issues that arise trying to access them. Based on these actual experiences, a review document was developed to highlight the issues that need to be addressed with suggestions on how to approach them in a systematic fashion. A business plan model was developed to provide potential ranchers with a framework to help think through the business side of producing grass-fed beef. A sample budget was included to help analyze individual operations. Because of the small economy of scale, transportation was the most sensitive item in the expenditures. The major consideration in grass-fed beef is location: the location of the nearest USDA-inspected processing plant, and the location of the target market. Thus, strategically locating the grass-fattening operations near a processing plant and the target market greatly reduces the operational costs. Ranchers also need to define their product's yield of retail cuts, and its quality in both tenderness and flavor under their existing management systems.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Socio-Economic Analysis of Rotational Management of Wetlands and Cropland in Tulelake Basin

Grant Award:
$14,440

Funding Period:
FY 1996–97

Principal Investigator:

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Objectives

The overall goal of this multidisciplinary and participatory project is to assess the feasibility of wetland/cropland rotations as a long-term management option for sustainable coexistence of irrigated agriculture and wetland reserves for the Tulelake Basin. The primary goal of the proposal was to initiate development of an assessment modeling framework combining GIS (Geographic Information System)-based economic, hydrologic, and environmental models for estimating the effects on farm profitability and overall economic activity, and the environmental changes for different management options.

Specifically, the research objectives were:

1. Document the various positions and values of the many parties concerned about agriculture and wildlife in the Tulelake basin, and to determine what constitutes acceptable resolutions to those involved.

2. Develop a spatial GIS database with a digital map which will include information on topography, infrastructure, cropping history, crop management, water flows, soil characteristics, vegetation patterns, and all data generated from the pilot study sites.

3. Develop and implement innovative cost/benefit assessment frameworks that incorporate spatial and temporal aspects of potential trade-offs and threshold boundaries for decision-making. This will involve:

- Creation of a GIS-based economic model to estimate crop production budgets and drainage and flooding costs.
- Expansion of the model to incorporate ecosystem health indices such as habitat diversity, water quality, water consumption, nutrient cycling and measures of refuge desirability for hunting and wildlife recreation activities.

Summary

This report is part of a multi-disciplinary, and community-based research project underway to assess the feasibility of wetland/cropland rotations as long-term management options for sustainable coexistence of productive irrigated agriculture and wetland reserves in the Tulelake Basin. The proposal requested supplemental support to develop frameworks to assess relative merits and costs of different management scenarios that are acceptable to all the major stakeholders.

Specifically with respect to our proposal's objectives:

The researchers were unable to complete semi-structured interviews as planned due to some highly controversial issues impacting both agriculture and refuge management. Outreach and continued interaction with involved parties has intensified.

Researchers will expand development of a GIS database and digital map for the region that already includes information on topography, climate, infrastructure, crop and wetland history, crop management inputs, water flows, soil characteristics, and vegetation patterns. The researchers will add data on water use, nutrient cycling, pest population dynamics etc. as they are generated from ongoing pilot studies.

The researchers began creation of an innovative cost/benefit framework that will incorporate spatial and temporal aspects for management decision-making. Agency personnel and advisory groups representing farming, environmental, and hunting interests have been involved in all stages of the project.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Market Cooking for Kids: Developing Children's Consciousness of Regional Sustainability

Grant Award:
$7,000

Funding Period:
FY 1995–96

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Bill Wilkinson,
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Objectives

1. To introduce children to the pleasures of flavorful, local produce.

2. To use this enjoyment as a basis for building an understanding about regional sustainable agriculture and for developing good nutritional habits.

Summary

The purpose of this program is basic and vital: to introduce urban children to the experience of tasting, preparing, and learning about the most flavorful, freshest produce. The researchers believe that if children are exposed to this kind of food, they are going to want to eat it. This motivation provides the basis for the fulfillment of the program's objectives.

During the 1995-96 school year, Market Cooking for Kids (MCK) was implemented in two classrooms in each of five San Francisco and five Oakland public elementary schools. We presented five lessons over the course of the school year, each lesson featuring a particular seasonal fruit or vegetable. The lessons were divided into two half-hour segments, one on cooking and one on science. The classes were organized and physically laid out to encourage maximum interaction between the presenters and the children and to facilitate hands-on activities.

The cooking segments, taught by chefs from local restaurants, included comparative tastings of different varieties of the featured fruit or vegetable. After the tastings, each chef worked with the children to prepare a simple recipe based on the same fruit or vegetable.

The science segment focused on helping children understand the fruit or vegetable as part of an ecosystem and to develop a sense of season and place. Using resources provided by local farmers, such as whole, rooted plants, the children learned about the biology of food plants. They also located the primary growing areas for each crop on a California topographical relief map, and several times planted seeds or starts to take home.

Each class (except one) went on a field trip to a local farm to reinforce the children's sense of connection to their regional agriculture. For teachers and students alike, this was one of the highlights of the program.

The program was enthusiastically received by all cooperators and participants. All the schools where it was presented last year have asked the researchers to come back.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

Participating Chefs and Restaurants: **Patricia Unterman, Michael Sparks,** Hayes Street Grill, San Francisco, **Reed Hearon, Jody Denton,** Restaurant LuLu, San Francisco, **Judy Rogers,** Ristorante Ecco, San Francisco, **Anne and David Gingrass,** Hawthorne Lane, San Francisco, **Esther Cook,** RSVP Catering, San Francisco, **Scott Miller,** The Pasta Shop, Oakland, **Maggie Klein,** Oliveto's, Oakland, **Larry Goldman,** Bay Wolf, Oakland, **Jim Shepard,** Oakland Museum Café, Oakland

Participating Classroom Teachers and Schools: ***San Francisco*** — **Larry Allegre, Marta Estrella,** Cesar Chavez Elementary School, **Sandra Berger, Michelle Wong,** Lafayette Elementary School, **Patrick Milkeen, Darci Chan,** Jefferson Elementary School, **Julie Dixon, Anne Allen,** Treasure Island Elementary School, **Mrs. Jamison, Mrs. Chang,** Argonne Elementary School ***Oakland*** — **Esther Tidwell, Meg Engelhardt,** Bella Vista School
Monica Rock, Patrick Urbi, Whittier Elementary School, **David Kumamoto, Loreto Ariztia,** Lafayette Elementary School, **Dana Madison, Kay Carter,** Golden Gate Elementary School, **Anne Larsen, Elizabeth Bandy,** Peralta Year-Round School

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Grant Award:
$20,000

Funding Period:
FY 1995–98

Principal Investigator:

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Pomona-Inland Valley Council of Churches' Food Security Project

Objectives

1. Through the outreach of the Services Developer, who provides training, nutrition education and advocacy via the Beta Center Hunger Program in Pomona, the project will address the nutritional needs of impoverished families with direct food distribution, nutrition education, and classes.

2. Through Pomona-Inland Valley Council of Churches' Pomona Valley Certified Farmers' Market, the project will expand the accessibility of fresh, locally grown, low-cost, nutritious food to low-income communities.

3. Through collaboration with other community gardens in the Pomona area, the project will assist in developing and sustaining neighborhood-based, community-sponsored agriculture.

Summary

The Pomona-Inland Valley Council of Churches (PIVCC), organized in 1967, is an ecumenical organization composed of 83 member churches throughout the Pomona Valley/Inland Empire Region. The Council acts as an advocate for those on the margins of society, and facilitates their empowerment. In particular, the Council responds to the needs of the hungry and homeless in area communities with direct services such as food and shelter, and identifies the root causes of these problems as members work toward systemic change. The Food Security Project is linked to a broader effort to build local food security so that low-income individuals and families can obtain a nutritionally adequate, culturally acceptable diet through local non-emergency sources. The project's goal is to increase the capacity of a neighborhood to produce its own food, increase knowledge and practice of good nutrition, and expand accessibility of fresh, locally grown food.

The Food Security Project experienced some major successes and some setbacks in its third year of operation. Although it was not able to continue the Horticulture Training Program and the Community Garden was not a total success, the Farmers' Market reached approximately 1,000 shoppers per weekend. The accessibility of fresh, locally grown, low-cost nutritious food through the Farmers' Market has expanded to reach considerably more low-income individuals.

The goal of supporting small family farmers through PIVCC's Farmers' Market has been accomplished. The community and the clients have taken advantage of fresh, locally grown, low-cost and nutritious food.

The key staff position, the Hunger Services Developer at the Beta Center Hunger Program, is partially funded by the SAREP grant and continues to be a vital piece in the food security effort, working with impoverished families to help them meet their nutritional needs.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

UNIVERSITY OF CALIFORNIA
Sustainable Agriculture
Research and Education Program

Final Report

Impacts of Local Food Systems on Communities and Agriculture: Reason for the Seasons… Increasing Sustainable Practices Among Consumers

Grant Award:
$30,000

Funding Period:
FY 1994–97

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Cooperators:

PlacerGROWN Agricultural Marketing Program

Objectives

The overall goal of the project has been to encourage greater agricultural production and consumer purchasing of local agricultural products in a manner that creates more sustainable communities.

This goal is supported by the following objectives:

1. Develop a Regional Food Guide that emphasizes availability and consumption of locally produced foods and seasonal variation in diet.
2. Develop an educational strategy to increase consumer demand for locally produced and processed foods around a Reason for the Seasons campaign.
3. Increase consumer awareness of environmental quality, resource use, and social equity information in food shopping decisions.
4. Adoption of more harvest extension practices by local producers.
5. Develop direct marketing of livestock products to the consumer.
6. Develop baseline data on Placer County's present food system.
7. Develop an historical and social profile of agricultural production, practices, and trends in Placer County.
8. Track data over the next three years to determine the extent of impact of PlacerGROWN and related efforts.

These objectives relate specifically to sustainability issues in the area of community food systems, community economic development, land use, and the urban/rural interface.

Summary

The project developed educational strategies and gathered baseline data in support of a newly developed grass-roots agricultural marketing organization called PlacerGROWN. Overall, the project has encouraged greater purchasing and production of local agricultural products to create a more stable and sustainable community. The project has increased consumer awareness and responsibility for their role in creating sustainable communities.

Through the *Reason for the Seasons* campaign, consumers were educated about the benefits of purchasing locally produced, processed, and distributed food that is geared to seasonal availability. Harvest extension practices and information were extended to producers through various workshops and newsletters to increase economic opportunities and farm sustainability. These efforts culminated in the development of an 80-page season extension manual entitled *Growing Across the Seasons.* Direct-marketing of livestock efforts were the focus of a series of 12 workshops which provided detailed information on direct marketing, nutrition, carcass quality, and alternative livestock enterprises.

A survey of bulk food buyers was conducted to gather information on their awareness, attitudes, current use of local agricultural products, and their willingness to increase purchases. Survey respondents indicated support for local agriculture and a willingness to use agricultural produce and products. Placer County has experienced rapid population growth and rapid loss of farmland over the last 20 years. These two trends mean agriculture must adapt and innovate to survive. PlacerGROWN has spent the last three years developing an organization that is positioned to assist farmers to adapt and innovate in today's marketplace.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

Resources

Growing Across the Seasons: A Season and Harvest Extension Guide for the Small-Acreage Farmer, Garth Veerkamp, University of California Cooperative Extension, Placer and Nevada Counties, Publication 31-101, 1996, $10.

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Sustainable Agriculture Research and Education Program

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Selected SAREP Staff Peer-Reviewed Publications 1994-1999

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SAREP Financial Information, FY 1997-1999

INCOME	FY 97/98	FY 98/99
Permanent State and UC Funding*	$649,493	$539,133
Temporary Budgetary Savings	-$28,589	-$28,480
Temporary C.E. Specialist Funds	$0	$67,451
Total Income	**$620,904**	**$578,104**
EXPENSES		
Grants	$179,252	$147,265
Information Development and Dissemination	$317,259	$267,439
Program Expenses	$124,393	$163,400
Total Expenses	**$620,904**	**$578,104**
EXTRAMURAL FUNDING		
SARE (Professional Development State Grant)	$9,500	$9,700
Wallace Genetic Foundation	$21,000	$0
SARE (Western Region Professional Development Curriculum)	$55,239	$43,738
U.S. Environmental Protection Agency (Pollution Prevention Incentives for States)	$0	$109,663
U.S. Environmental Protection Agency (Region 9 Food Quality Protection Act Funds)	$0	$242,000
U.S. Environmental Protection Agency (Region 9 Agricultural Initiative)	$0	$25,000
U.S. Environmental Protection Agency (Pesticide Environmental Stewardship Program)	$0	$40,000
Hartford Food Systems	$2,623	$0
USDA-CSREES Regional Research	$13,400	$13,400
Cornell University/USDA (Fund for Rural America)	$0	$99,543
International Tree Crop Institute, Inc.	$0	$20,000
Center for Ecoliteracy	$0	$14,000
UC Davis/USDA (Fund for Rural America)	$0	$108,754
California Department of Pesticide Regulation (Biologically Integrated Farming Systems)	$0	$980,000
California Department of Pesticide Regulation (Methyl Bromide Alternatives)	$0	$1,000,000
Total Extramural Funding	**$101,762**	**$2,705,798**
OTHER FUNDING		
Sales of Publications and Other Misc Income	$2,002	$1,322

*FY98/99 Permanent State and UC Funding reduction consists of a transfer to UCD Department of Agronomy related to the transfer of the former SAREP Director (.80 Academic FTE), support ($32,000) and related budgetary savings (about 4.5% or $4,500).