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From the Director

New Leadership for SAREP

I am pleased to tell you that **Sean Swezey** has agreed to become the new director of the Sustainable Agriculture Research and Education Program. Dr. Swezey, an entomologist who currently serves as associate director of the Center for Agroecology and Sustainable Food Systems at UC Santa Cruz, assumed his duties on Feb. 1, 1999. Dr. Swezey has built a distinguished career of research and outreach on a broad array of topics related to sustainable agriculture. He received A.B. and M.A. degrees in anthropology, a B.S. in conservation and resource studies, and a Ph.D. in entomological sciences, all from UC Berkeley. Dr. Swezey has held teaching and research appointments at UC Berkeley, Cornell University and UC Santa Cruz. He has served as Consulting Entomologist with the Organization of American States and with the Food and Agriculture Organization of the United Nations.

Dr. Swezey emerged from a prolonged search for a new SAREP director as the top candidate. We are extremely fortunate to have identified a person of his experience to lead SAREP into the 21st century. He is an accomplished field researcher and has developed a reputation as a consensus builder among the major commodity growers on the Central Coast. He has studied the conversion from conventional to organic cotton farming in the San Joaquin Valley. He works well and easily with people and his considerable interpersonal skills should serve him well in his new position. I expect that SAREP will grow and prosper under his leadership.

Dr. Swezey and I have agreed that the SAREP offices should remain at Davis during this first transition year. As the transition progresses, I expect that Dr. Swezey may wish to move the office headquarters to a location on the Central Coast. Again, I would not expect such a move to occur until after the first transition year is over. Vice President Gomes and I are delighted that Sean has agreed to join us and we look forward to working with him in the coming years. I hope that all of you will have an early opportunity to meet Dr. Swezey and to welcome him to his new position.

On this occasion, I wish also to offer my profound thanks to **Dr. Robert Reginato** for his service as Interim Director of SAREP. Bob has provided steady and experienced leadership to the program during the last seven months. He has been instrumental in guiding the development of the new initiative on methyl bromide alternatives as well as the on-going Biologically Integrated Farming Systems (BIFS) programs. I am deeply appreciative for his willingness to postpone his retirement activities in order to serve the Division of Agriculture and Natural Resources and the University of California.—Henry J. Vaux, Jr., Associate Vice President, Programs, UC Division of Agriculture and Natural Resources.

SAREP Funds Graduate Student, Meeting Grants

Five graduate students and 27 meetings have been granted a total of \$25,767 by UC SAREP in the latest funding cycle, according to **Bev Ransom**, SAREP grants manager.

Titles of graduate student projects and brief descriptions of meetings, including principal investigators, contact information and amounts awarded follow.

Graduate Student Awards (5 projects; \$10,000)

- **Chris Campbell**, "Characterizing Solute Transport in Sloping Soils Using *In Situ* Measurements and Transfer Function Modeling," \$2,000. Department of Environmental Science Policy and Management, UC Berkeley. (510) 643-5142, ccampbel@nature.berkeley.edu
- **Julie Guthman**, "Organic Regulation: Codifying Meaning, Structuring Opportunity," \$2,000. Department of Geography, UC Berkeley. (510)549-2297, jguthman@uclink4.berkeley.edu
- **Alison Eagle**, "Nutrient Supply Power of Rice Soils Under Alternative Rice Straw Management Practices," \$2,000. International Agricultural Development (Department of Agronomy and Range Science), UC Davis. (530) 754-7537, ajeagle@ucdavis.edu
- **Donald Lotter**, "Tests of Induced Resistance in Grapevine," \$2,000. Department of Entomology (Graduate Group in Ecology), UC Davis. dwlatter@dcn.davis.ca.us
- **Benjamin Shouse**, "The Place of Microbial Grazers in Reduced-Input Agriculture," \$2,000. Department of Nematology (Graduate Group in Ecology), UC Davis. (530) 752-2124, bnshouse@ucdavis.edu

Grants for Educational Events [14 grants (27 events); \$15,767]

Educational grants are awarded to individuals and organizations to conduct workshops, field days, and other instructional events related to sustainable agriculture. Fourteen grants were awarded to support 27 different events or programs around the state. For more information about a particular event call the telephone

number listed or use the email listed. To learn more about SAREP's educational grants program, call **David Chaney** at (530) 754-8551, dechaney@ucdavis.edu

- **Sierra Cantor**, Sotoyome Resource Conservation District, Mary Kimball, Yolo Resource Conservation District.\$1,000. "Sonoma/Marin County Farming, Agriculture and Resource Management for Sustainability (FARMS) Program." Dates: Seven field days/meetings, January-May 1999. Location: Farms TBA. (707) 569-1448(Cantor), sotorcd@sonic.net ; (530) 662-2037 ext. 121(Kimball), mckimball@ucdavis.edu
- **Deborah Giraud**, UC Cooperative Extension Humboldt County, Cynthia Chason, Food for People, Inc. \$900."Community Food Security...Access for All." Date: 1-day workshop Apr. 23, 1999. Location: Humboldt County Agricultural Center, Eureka.(707) 445-7351 (Giraud), ddgiraud@ucdavis.edu ; (707) 445-3166(Chason).
- **William Huber**, Hyampom Valley Growers Association, Trinity County Resource Conversation and Development. \$947. "Marketing Your Agricultural Product." Date: 1-day workshop on a Saturday in early March 1999 TBA. Location: Hyampom Community Center. (530) 628-5128(Huber).
- **Chuck Ingels**, UC Cooperative Extension Sacramento County.\$500. "Cover Cropping in Vineyards: Experimental Results and Species Demonstration." Date: 1-day workshop Apr. 14, 1999. Location: Deer Creek Vineyard, Sacramento County. (916) 875-6913(Ingels), caingels@ucdavis.edu
- **Roger Ingram**, UC Cooperative Extension, Placer/Nevada counties, David Pratt, UC Cooperative Extension Napa/Solano counties. \$1000. "The California Grazing Academy." Date: 3-dayworkshop, late April-early May 1999. Location: UC Sierra Foothill Research and Extension Center. (530) 889-7385 (Ingram), rsingram@ucdavis.edu ;(707) 421-6790 #7, dwpratt@ucdavis.edu
- **Stephanie Larson**, UC Cooperative Extension Sonoma/Marin counties, Dayna Ghiradelli, UC Cooperative Extension, Sonoma/Marin counties. \$1000. "Balancing Agricultural Viability with State and Federal Water and Habitat Regulations." Date: 1-day meeting, January or February 1999, TBA. Location: Petaluma. (707) 527-2621 (both),slarson@ucdavis.edu , dgwilson@ucdavis.edu
- **Richard Molinar, Michael Yang**, UC Cooperative Extension Fresno County. \$920. "Annual Strawberry Growers Meeting." Date:1-day meeting, Feb. 28, 1999. Location: UC Cooperative Extension office, Fresno. (209) 456-7555 (both), rhmolinar@ucdavis.edu
- **Katy Pye**, Yolo County Resource Conservation District,

Paul Robins, Yolo County Resource Conservation District, Community Alliance with Family Farmers. \$1,000. "Bring Farm Edges Back to Life!" Dates: Five 2-hour field workshops in January, February, March, November, December 1999 TBA. Locations: Yolo County and surrounding areas. (530)662-2037 ext. 3 (both), topquail@yolorcd.ca.gov (Pye), rednatives@hotmail.com (Robins). [Funds contributed by International Tree Crops Institute.]

- **Judith Redmond, Reggie Knox** Community Alliance with Family Farmers (CAFF). \$2,000. Lighthouse Farm Network Education Events. Dates: Two 2-hour meetings: "The Economics of Alternative Production Practices," Woodland, February 1999 TBA; "Food Safety Issues and Small Farms," Rancho Grande Restaurant, Watsonville, Sept. 21, 1999. (530)756-8518 ext. 13 (Redmond), caff@caff.org ; (831) 457-1007 (Knox), reggie@cruzio.com

- **Steve Schwartz**, California FarmLink; Community Alliance with Family Farmers. \$1,000. "Maintaining Sustainable Communities Through Effective Use of Easements and Estate Planning." Date: May 1999 TBA. Location: Santa Rosa. (916) 443-4225 (Schwartz), farmlink@tomatoweb.com

- **Lisa Woo Shanks**, USDA Natural Resources Conservation Service, **Maxine Durney**, Foundation for the Advancement of Environmental Education, Council of Bay Area Resource Conservation Districts. \$1,000. "Horses and Water Quality Protection: Outreach to the San Francisco Bay Area Horse Community." Dates: Three seminars in November 1999 TBA. Locations: North Bay (Petaluma/Novato/Nicasio), East Bay (Livermore/Walnut Creek), South Bay (Woodside/Half Moon Bay) TBA. (707) 794-8692 ext. 123 (Shanks), Lisa. Shanks@ca.usda.gov ; (707) 762-2983 (Durney).

- **Rodney Tripp**, Society of Range Management (Calif. section), **Sheila Barry**, Alameda County Resource Conservation District, **Joyce James**, UC Elkus Youth Ranch. \$1,000. "California Range and Natural Resources Camp." Date: 6-day camp, June 14-19, 1999. Location: UC Elkus Youth Ranch, Half Moon Bay. (510) 287-2022 (Tripp), (925-371-0154 ext. 41 (Barry).

- **Sabrina Walker**, Project YE'ES (Youth Economic Education Stability) Community Education Center, **Ann Marie Kennedy**, YE'ES Urban Garden Program. \$1,000. "Digging Toward the Future: Youth Urban Agriculture Conference." Date: Apr. 3, 1999. Location: Grant High School, Sacramento. Community Education Center (530)752-7956.

- **Lynn Young, Ken Dickerson**, Committee for Sustainable Agriculture, Natural Resources Conservation Service, CALFED Bay-Delta Program, CAL/EPA IWMB. \$2,500. "1999 Regional Sustainable Agriculture Conferences and Farm Tours."

Dates/Locations: Modesto/Field Crops/Orchards/Vineyards, Feb. 26-27, 1999; Watsonville/Strawberries, March 3, 1999; Salinas/Cool-Season Vegetables, March 17, 1999; Sonoma, Modesto/Livestock/Dairy, Spring 1999. (831) 763-2111, csaefc@csa-efc.org

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Citrus is focus of New Biologically Integrated Farming Systems Project

by Lyra Halprin, SAREP

Citrus growers, researchers and ag consultants in the eastern side of the San Joaquin Valley are the latest group of agriculturists to be awarded money to demonstrate "biologically integrated farming systems" (BIFS) on local farms to reduce pesticide and fertilizer use, and share that information with other growers.

Mark Freeman, a Fresno County farm advisor and the principal investigator for the citrus BIFS project administered by UCSAREP, says the project will provide more information to address the "tougher economic and environmental concerns that affect citrus clientele."

"The current problem-solving model of citrus professionals working with growers focuses mostly on issue identification," Freeman says. "It doesn't allow adequate time and resources for education, consideration of alternatives, and the encouragement needed to adopt alternative practices."

Motivation to Reduce Pesticides

Freeman notes that one of the major motivations for citrus growers to reduce the use of broad-spectrum pesticides are the plans presented recently by the California Department of Food and Agriculture's Department of Pesticide Regulation (DPR) to further protect groundwater.

"DPR's plans will be implemented in the year 2000 and will profoundly affect the citrus industry," Freeman says. "The new regulations will affect both growers and pest control advisors. Water management plans will be required before certain chemicals can be applied, both to reduce surface runoff from the fields and deep percolation of chemicals through the soils."

"Our goals are to emphasize careful monitoring, using validated threshold values before applying pesticides or fertilizers, and the reduction of broad-spectrum chemicals," he says. "Growers will be searching for ways to cut costs and maintain quality and yields after the devastating 1998 freeze. We plan to supply information and knowledge that will help them accomplish that goal."

The citrus BIFS project has been awarded \$80,000 for the first year of a three-year project. It will use a farmer-to-farmer approach to information and technology exchange, emphasize science-based information, and will monitor key biological and economic variables.

Freeman is excited about one of the tools the citrus BIFS project will use. "We're looking forward to using the Geographical Information Systems (GIS) database organized by Fresno County. It's already set up, and the county agricultural commissioner has pesticide usage reports for the last three years entered. It will be easy for us to use that template and build upon it," he says. GIS measures and compares aspects of geographic phenomena and processes. In agriculture, variables that occur within particular fields can be noted and entered into a computer database. These data can be compared with data collected about other variables and/or other fields; these can be integrated to discover new relationships.

Freeman says the citrus growers involved in the BIFS project will be able to use the GIS to compare multiple factors based upon a geographic location. For example, the GIS will allow them to compare insect damage by geographic location. "We'll be able to see if certain locations are more susceptible to insect damage and yield and quality of fruit. We can enter all the data we collect on insect damage at particular locations and once it is in the GIS, it will be accessible for analysis and discussion with farmers," Freeman says.

"We can look at citrus orchards that release Aphytis wasps to control California red scale versus using a broad-spectrum insecticide and record that data," Freeman says. "We can then compile data on red scale infestations in different locations and see how the remedies compared."

"GIS is such a new tool not many are using it in agriculture yet, but the potential is tremendous," he said. "Our citrus BIFS is going to take full advantage of GIS."

Farmers Look at Alternatives

Kevin Severns, a Sanger-area grower and a member of the citrus BIFS management team, is very interested in exploring alternative farming practices.

"I think we're going to have to get serious about the fact that some of the herbicides and insecticides we've been using will go by the wayside, whether because of regulations or resistance problems," he says. "The reality is that we're going to lose some of those tools. The sooner we gear-up and look for alternatives for weed and pest management, the better off we'll be."

Severns, who farms 40 acres of navel and Valencia oranges and works in grower relations for Orange Cove/Sanger Packing, says the broadly damaging late-1998 freeze highlights another reason to look at farming alternatives.

"The freeze underscores the uncertainty we face in farming," he says. "It's the same uncertainty we face regarding pesticides and herbicides; we want to look strongly at alternatives."

Severns says the opportunity to work with the citrus BIFS project is bound to help growers in their efforts to stay in business. "The market reality is that I'm going to have to ship fruit with high yield, good size and high quality in the next few years if I want to stay in business. I've experienced pesticide resistance; things I've used no longer work. When that happens, a guy's got

to start asking the question, 'Why is this happening and what can I do to mitigate the problem?' Maybe the BIFS projects will help us find some answers."

Sharing information with other growers and hearing what they have to say is the reason **Shawn Stevenson**, a Clovis-area grower, is participating in the management team.

"You might be trying something on your place that someone already tried, and failed or succeeded at, and it's useful to hear that," Stevenson says. "The thing about agriculture is that it's about art as much as it is about science. Things that work or don't work vary. You can't write a cookbook or a manual on farming. Talking about it helps."

Stevenson farms 1,350 acres of citrus and has been using cover crops on much of his land for more than 15 years. "Our use of cover crops evolved from using them on hillside acreage with erosion problems," he says. "The cover crops were effective in reducing the erosion, and it seemed to me there were other benefits, too, including the reduction of compaction. It started me thinking about the soil itself, and how the cover crops might help with the water penetration problems we have around here."

Stevenson says he also began to think about the impact of more than 30 years use of the herbicide simazine in his orchards, including its effect on tree root health. "Because of resistance and regulations, it's useful to learn to farm with fewer chemicals," he says.

Doug Reese, a Fresno County crop consultant and a member of the citrus management team, is interested in the mutual benefits of the BIFS approach.

"My clients have been using cover crops for soil fertility and beneficial insect releases to combat California red scale, and they customize fertility programs for each block of trees," he says. "It will be nice to compare notes with others who have been doing similar practices, and to hear about other management practices that are helping to increase crop quality and reduce inputs."

Stan Xavier, an independent appraiser at Correia-Xavier agricultural appraisers in Fresno, is working with the citrus BIFS farm management team to help farmers, pest control advisors and lenders learn how to use the Internet to get useful information.

Xavier and the Agricultural Lenders Society put together an "Ag and the Internet" training session that offers basic and customized lessons in using the World Wide Web. Xavier has made some of Freeman's cost studies available on the Web.

"The Internet has made it easier and more cost effective to disseminate cost studies and other critical information to growers," Xavier says. "This is one of the areas where I can help."

He notes that citrus growers will be especially interested in having access to cost studies. "These cost studies will help growers educate lenders as they prepare budgets to borrow money to recover from the 1998 freeze," he says. "We know growers incurred additional cultural costs to redevelop citrus trees after the last big freeze in 1990."

Joint Funding

Funding for the citrus project comes from a 1998 budget augmentation by the California State Legislature made possible by Assembly Bill 1998, sponsored by Assembly member **Helen Thomson** of Yolo County. Additional funds for the citrus project and the 1998-funded walnut prune and rice BIFS projects have been provided by the U.S. Environmental Protection Agency and the University of California Division of Agriculture and Natural Resources.

Farmers involved in the BIFS projects are integrating biological and cultural control of pests into their production systems; providing on-farm habitats for beneficial insects, mites and spiders; and emphasizing soil-building practices such as using cover crops to provide all or part of the nitrogen needed by crops. The intended result, according to **Jenny Broome**, SAREP BIFS coordinator, is that biologically integrated farming systems will enable farmers to maintain yields and quality while greatly reducing their reliance on agricultural chemicals, including pesticides and synthetic fertilizers.

BIFS is designed around a team approach to farm management, using farmers, pest control consultants, University of California farm advisors and researchers. Like the walnut, prune and rice projects (see *Sustainable Agriculture Vol.10, No.3, Fall 1998*), and the 1994-funded wine grape and cotton/vegetable crops BIFS projects (see *Sustainable Agriculture Vol.7, No.4, Fall 1995*), the citrus project will be using successful working farms to demonstrate agricultural operations that have reduced pesticide use in high-value crops. Other area farmers have agreed to participate by adapting the methods demonstrated to sections of their own farms and then monitoring and comparing results with their normal practices.

"This citrus project presents a road map of the transition from more conventional, to transitional, to more biologically based citrus farming systems in California," says Broome. "Interested growers will be able to learn from the citrus BIFS growers, consultants, and UC researchers and extensionists about adopting the most environmentally sound and economically viable practices for their particular citrus orchards."

The citrus BIFS project is funded for one year. Contingent upon demonstrated progress, the project will be eligible for renewed funding for two additional years.

Project Update

A Nitrogen Fertilizer Recommendation Model for Almonds

by Patrick Brown, UC Davis

[Editor's Note: Patrick Brown is an associate professor in the UC Davis pomology department. He received a 1996-97 SAREP grant for his project "Development of a N-Fertilizer Recommendation Model to Improve N-Use Efficiency and to Alleviate Nitrate Pollution to Ground Water from Almond Orchards."94]

Fertilizer management advice for California orchard crops like almonds has depended on generalized recommendations and outdated information. There have been very few experiments conducted to determine optimum fertilization rates and no information is available that defines how much N is used to produce a crop, or to determine when during the year the tree acquires N from the soil. Without this fundamental information it is impossible to define a rational N-fertilization program in almonds.

The goal of this study is to develop and test better tools for precision nitrogen measurement in the field, to determine seasonal as well as total nitrogen demands, and to prepare a user-friendly computer program for growers so they can enter local variables and receive best management recommendations for N-fertilization.

Efforts to refine tissue testing procedures failed to develop a method that was superior to the widely used total nitrogen determination. Analysis of leaf nitrate levels, as used in field crops, does not appear to be effective for tree crops due largely to the low and highly variable amounts of nitrate found in mature almond leaves. A three-year comparison [1996-98] of total leaf N, though superior to leaf nitrate determination, was still only poorly correlated with yield. Together these results suggest that the use of leaf analysis alone is inadequate for determining the N-fertilization requirements of almond.

To determine precisely how much N is utilized by a mature almond tree and to define when during the year that the roots are effectively using soil applied N, we conducted the following experiment. Every two to three months from April 1997 through January 1998 five mature bearing almond trees were excavated from the soil and the N contained in each tree part was determined (leaves, fruits, young wood, mature wood, roots). Using this sequential harvesting approach it was possible to determine the total N required to satisfy the N demand of fruits, leaves and tree N storage, and it was also possible to determine when during the year N is acquired from the soil. The results will be used to develop a computer program to be used by growers to refine their N-fertilization program.

Results of tree excavation at different growth stages suggested that total removal of N from almond harvest and leaf drop from a mature tree with a

per acre nut meat yield of 4200 lb was 3.8 lb per tree. Nitrogen stored in wood parts of the plant contributed 1.7 lb per tree to supply the N demand of early season growth. This storage pool was subsequently replenished in late summer. During spring flush, plant growth N needs are satisfied by storage transfer from the stem, roots and uptake from soil (33 percent each). To balance the full year N demands of the almond tree, total N uptake from soil was 4.3 lb per tree. Of this amount, 13 percent was taken up during spring flush (Jan-mid-March), 42 percent between spring flush and nut fill (mid-May), and 45 percent during summer. This information on N uptake throughout the growth season, will provide guidance for determining the timing of split N applications, to optimize the nitrogen use efficiency.

This information is now being used to develop a fertilization recommendation model in which tree N requirements will be determined and N applications will be recommended to coincide with the time of optimum soil N usage. The combination of a precise knowledge of tree demand and the optimization of application method and timing provides an effective and environmentally sustainable approach to fertilization in almonds that has not been previously available. A computer program has now been developed and is currently being tested; this program will provide growers with a powerful tool for the optimization of almond fertilization.

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Retail Farmers' Markets and Rural Development: Creating Jobs and Growing Business

by Chris Lewis and Gail Feenstra, SAREP

Early on a Friday morning several years ago, **Trini Campbell** and **Tim Mueller** showed up at their first farmers' market in St. Helena, Calif. They brought with them produce from their nearby acre-and-a-half market garden and left that afternoon with \$30 in gross sales. Within a few years their market garden business has expanded to become Riverdog Farm, with more than 40 acres in cultivation, a restaurant and wholesale accounts, a community supported agriculture project (CSA or subscription farm) with over 100 subscribers and, of course, participation in several farmers' markets.

This is only one example of the many business success stories brought to life through farmers' markets. Across the country, many of the over 2500 farmers' markets appear to act as informal "business incubators" for farm, food processing and craft businesses. In 1998, **Gail Feenstra**, SAREP nutrition and food systems coordinator, and **Chris Lewis**, postgraduate researcher, were funded along with researchers from Cornell University in New York and Iowa State University to conduct a three-year study of the ways in which farmers' markets stimulate businesses and contribute to community economic development. While each group is conducting the research in its home state, and will provide analysis independently for their own states, a final report will be made based on the findings from all three states. We hope to document the features of farmers' markets and the initiatives taken by managers and vendors that support small business growth. Since most previous studies of farmers' markets have focused on consumer opinions, rather than management and vendor issues, the results of this study will provide valuable new information to those interested in starting or strengthening farmers' markets as well as to those involved with small business and community development.

The California Study

To identify important factors that contribute to "business incubation" at farmers' markets, all states are collaborating to conduct uniform surveys of farmers' market managers and their vendors. In addition, each state will develop six case studies of vendors or markets to provide more in-depth information. For the purpose of this update, we will focus on the progress of our group here in California.

Working with the two largest farmers' market organizations in California, the Southland Farmers' Market Association and the California Federation of Certified Farmers' Markets, we compiled a list of approximately 335 certified markets in California. This list was stratified using 1990 census data into

three categories based on the population of the market host communities: rural (populations under 10,000), urban (populations between 10,000 and 50,000) and metropolitan (populations over 50,000). Figure 1 shows how farmers' markets in California are distributed based on these criteria.

Phase 1: Farmers' market manager survey. From the three categories in our list, we have proportionally sampled 60 markets at random and begun conducting telephone interviews. In addition to the basic operating characteristics, we are asking managers about their market's rapport with other businesses in the community, what kinds of things they do to promote their markets and vendors' products and what they view as the main supports and obstacles to entrepreneurial development. This phase of the project is nearly complete.

Phase 2: Vendor survey. In this phase of the project, we will choose 20 markets from the original 60 and send a mail survey to 20 vendors from each of those markets. Some of the elements we hope to explore here are: What markets make good starter markets? How important are markets to a business once it's off the ground? What are some of the non-financial benefits (such as information sharing, networking, etc.) gained from participating in farmers' markets? How many jobs are generated from farmers' markets? How have farmers' markets contributed to developing value-added products?

Phase 3: Case studies. The last phase of our project will consist of six detailed case studies highlighting the most interesting and creative markets and vendors as well as some of the more problematic ones. The detailed attention provided by case studies will let us more fully explore the findings from the earlier sections.

Preliminary results from the market manager survey

Although all the data has not been analyzed from the market manager survey, we are seeing some interesting trends. Preliminary results reported here are only a small sampling of the rich information we have gathered. The results we have seen so far suggest that about one third of all farmers' markets have experienced a "slow down" due to rainy days and vendor losses associated with the El Niño weather conditions. Only markets from the urban category report any significant growth in the last three years in terms of the number of vendors who participate. Despite this slow down, about one half of all managers state that their markets are full with respect to the number of vendors they can accommodate.

Gross sales figures on a per market basis are clearly positively correlated with the population of the host community, but on a per capita basis, rural communities far out-spend larger populations at their farmers' markets. While they also only represent 18 percent of the farmers' markets in California, rural markets may act as an important first step for many agricultural-based businesses. These markets often place a stronger preference on local produce and are situated in close proximity to many other ag-related resources. The information we gain from vendors in Phase 2 will explore the role of rural markets in more detail.

All of the managers surveyed gave examples of vendor businesses that have

grown beyond their farmers' markets in the last three years. Examples of such growth include selling at additional farmers' markets, developing a CSA or expanding to include retail and/or wholesale accounts. Most managers also feel their markets have had an effect on other local businesses in their communities. Restaurants seem to benefit most from the increased customer traffic on market days, but a number of examples show that even large grocery stores gain customers. In one community, the local chain grocery store was so impressed, they now sponsor an annual benefit for the farmers' market and contribute the proceeds back to the market's operating fund.

Other strategies for integrating a farmers' market into the larger business community include free ad space for local merchants and non-profits at the market; raffles and contests involving both farmers' market products as well as merchandise and services from local business; and direct sales to local florists, restaurants and grocers of market vendor products.

Parking remains one of the most ubiquitous concerns around farmers' markets. One strategy some managers have suggested to deal with parking problems is a drive-up table for phone orders and handicap access. Scheduling markets during non-peak hours on non-peak days helps to mediate parking problems, as well as provide an incentive for some businesses to stay open longer hours.

While this project is only about one-third complete, it looks quite promising. The study is already providing new and useful information about the basic operation of farmers' markets and their potential for supporting small businesses. The research also presents a clearer picture of the larger issues facing managers, vendors and market communities. Throughout the project, our results and analysis will be shared widely through publications and meetings, with the hope that they will strengthen farmers' markets in communities throughout California and nationwide.

For more information, contact Gail Feenstra at (530) 752-8408, gwfeenstra@ucdavis.edu or Chris Lewis at (530) 752-7541, cjlewis@ucdavis.edu

Table 1. Recommended Practices For Improving The Efficiency Of Nitrogen Use By Cool-Season Vegetables

MM 1. Evaluate Current Irrigation And Fertilization Practices And Plan Improvements In Management.

RP 1.1 Determine the extent of nitrate contamination of groundwater beneath or near crop fields; assess the potential for transport of soluble contaminants (nitrates, salts) to ground and surface waters.

RP 1.2 Develop and implement a system for keeping long-term records on each field of water and nutrient/soil amendment inputs, cultural operations, pest problems, land leveling or other improvements, and crop yield and quality.

RP 1.3 Review current cultural practices and develop improved nutrient and water management plans.

MM 2. Avoid Fertilizer Material Spills During All Phases Of Transport, Storage And Application.

RP 2.1 When transporting fertilizer, do not overfill trailers or tanks. Cover or cap loads properly and display appropriate placards on vehicles.

RP 2.2 When transferring fertilizer into on-farm storage or into a fertilizer applicator take care to not allow materials to accumulate on the soil.

RP 2.3 Maintain all fertilizer storage facilities to meet government and industry standards and protect them from the weather.

RP 2.4 Clean up fertilizer spills promptly.

RP 2.5 Shut off fertilizer applicators during turns and use check valves.

RP 2.6 Maintain proper calibration of fertilizer application equipment.

RP 2.7 Whenever injecting fertilizer into irrigation water, ensure backflow does not occur.

RP 2.8 Distribute rinse water from fertilizer application equipment evenly throughout the field.

MM 3. Base The Amount And Timing Of N Fertilizer Applied On Crop

Needs And Production Goals.

RP 3.1 Before applying N early in the growth cycle, assess the amount of nitrate already present by soil (or soil solution) sampling and analysis.

RP 3.2 When applying manure shortly before a crop is planted, determine the nutrient content of the manure and the amount of nitrate already present in the soil. Apply manure at a rate consistent with the crop nutrient requirements.

RP 3.3 Split applications of N fertilizer.

RP 3.4 When possible avoid water-running N fertilizer in the furrows. If fertilizer N must be water-run, maximize irrigation uniformity and inject fertilizer during the last half of the irrigation set.

RP 3.5 Use plant tissue sampling for mid- and late-season fertilizer decisions.

RP 3.6 Do not apply excessive single amounts of fertilizer N during the rainy season.

RP 3.7 For fertilizer application during fall tillage use only low N-containing material. Higher N materials may be appropriate if a crop is to be planted soon.

RP 3.8 Measure nitrate levels in the irrigation water and adjust N fertilizer rate accordingly

MM 4. Place N Fertilizer Materials Where Maximum Plant Uptake Will Occur.

RP 4.1 Incorporate N fertilizer into the crop bed by placing fertilizer on the seed row and watering it in, by knifing fertilizer into the bed, or by broadcasting fertilizer and then listing it up into the bed.

RP 4.2 Incorporate manures and other organic amendments into soil with consideration of the timing of conversion of manure N to other forms.

MM 5. Minimize Leaching Losses Of Nitrate During Non-Crop Periods.

RP 5.1 If conditions permit, grow a cover crop rather than leaving fields fallow during the rainy season.

MM 6. Operate Irrigation Systems To Minimize Deep Percolation And N Losses.

RP 6.1 Monitor soil moisture between irrigations and use the information to guide irrigation timing decisions.

RP 6.2 Base amount of water applied on crop need.

RP 6.3 Know the flow rate and the time required to apply the desired inches

of water.

RP 6.4 Use the minimum leaching fraction that will prevent yield reduction from salinity or stand establishment problems.

RP 6.5 When injecting fertilizer into irrigation water, follow all applicable government agency and industry guidelines for backflow prevention and regularly check and maintain backflow prevention devices.

RP 6.6 If irrigation efficiency remains low after all practical improvements have been made, convert to a more efficient irrigation system.

MM 7. Improve Existing Furrow Irrigation.

RP 7.1 Convert to surge irrigation.

RP 7.2 If fields are more than 1000 feet long, consider cutting the furrow run length in half with a corresponding decrease in set time.

RP 7.3 Use high flow rates initially to get water down the field and then cut back to finish off the irrigation. Avoid doing the opposite.

RP 7.4 Prepare fields as uniformly as possible, with no major variations in slope.

RP 7.5 Use practices to increase uniformity among furrows (e.g. torpedoes, extra tractor trip, etc.).

RP 7.6 Collect surface runoff for recirculation or reuse elsewhere.

MM 8. Improve Existing Sprinkler Irrigation.

RP 8.1 Monitor flow and pressure variation throughout the system to detect non-uniform application.

RP 8.2 Maintain the irrigation system by repairing leaks, replacing malfunctioning sprinklers, and maintaining adequate water pressure through the entire set.

RP 8.3 To the extent possible, operate sprinklers during the least windy periods.

RP 8.4 Use offset lateral moves.

RP 8.5 When the pressure variation throughout the system is excessive, use flow control nozzles.

RP 8.6 Make set times as short as possible for stand establishment.

RP 8.7 For very large blocks, consider converting to linear move sprinkler systems.

MM 9. Improve Existing Drip Irrigation.

RP 9.1 Use appropriate lateral hose lengths to improve uniformity.

RP 9.2 Use drip tape that has a small emitter discharge exponent.

RP 9.3 Check for clogging potential by conducting water analysis and fertilizer/water compatibility tests.

RP 9.4 Use filtration, chemical treatments, and flushing as necessary to prevent or correct clogging problems.

***MM = Management Measure; RP = Recommended Practice**

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Technical review

Production guide: Nitrogen and water management for coastal cool-season vegetables.

G.S. Pettygrove, S.R. Grattan, B.R. Hanson, T.K. Hartz, L.E. Jackson, T.R. Lockhart, K.F. Schulbach and R. Smith.

Publication 21581, University of California, Division of Agriculture and Natural Resources, Oakland, CA. 1998.

The main cool-season vegetables grown in California are lettuce, broccoli, celery, cauliflower, and cabbage. The farm-gate value of these crops was \$2.2 billion in 1995 (about 10 percent of the total value of agricultural commodities in the state). There is some fall and winter vegetable production in the San Joaquin or Imperial Valleys, but the majority of cool season vegetable production takes place in the central and southern coastal areas, with over \$1 billion coming from Monterey County alone. Other important production areas are found in Santa Barbara, San Luis Obispo, Ventura, Santa Cruz, and San Benito counties.

The high level of productivity in these areas depends on a number of factors, but two of the most critical are nitrogen and water. Unfortunately, the shallow root systems of cool-season vegetables means that applied water and nitrogen are not used very efficiently: harvest removals of nitrogen are typically only half of the amount of nitrogen applied as fertilizer, for example. The result over the last several decades has been an increase in nitrate levels in the groundwater under these agricultural lands. This poses a significant problem as many municipal water supplies draw from this groundwater. This handbook provides important information about ways of managing water and nitrogen more efficiently in order to reduce the problem of groundwater contamination.

The first section of the book presents a concise and clear discussion of the nitrogen cycle and how farming practices influence the various processes and components of that cycle. The authors provide detail on the relative amounts of the various forms of nitrogen in the soil, and the factors that affect the transformation of nitrogen from one form into another, as well as its availability for crop uptake. Other topics include nitrogen additions to the soil plant system, plant uptake and harvest removal, and nitrogen loss pathways.

The heart of the guide is the chapter on management measures and recommended practices for improving nitrogen use efficiency. For the purposes of this book a management measure is defined as the best economically achievable technology or process for limiting movement of nitrogen into ground or surface waters, while a recommended practice is a specific farming technique for accomplishing the management measure.

The measures and practices described in the guide were developed by a team of growers, fertilizer retailers, crop consultants and University of California researchers. The authors state in the introduction to the book that, although there was not always consensus, the group was in most cases able to agree on practical and economically feasible practices. The resulting recommendations included in the guide have been scientifically validated under Central Coast conditions. The authors are careful to label the practices "recommended" (not "best") management practices since no single management technique will work well in all situations. A summary of the nine management measures and the recommended practices under them is included in [Table 1 \(p.12\)](#). Each of these is described in more detail in the guide.

The production guide is supplemented with numerous tables and figures and several excellent appendices on soil and plant tissue testing, cover crops, manure management, and other practices that alter crop nitrogen use efficiency.

Production Guide: Nitrogen and Water Management for Coastal Cool-Season Vegetables is available from DANR Communications Services at (800) 994-8849 or (510) 642-2431. The cost is \$10.

For more information: G.S. Pettygrove, Dept. of Land, Air and Water Resources, University of California, Davis, CA; Email: gspettygrove@ucdavis.edu

DEC.597 Contributed by David Chaney

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Resources

Print Publications

Learning from Community Gardens

Entrepreneurial Community Gardens: Growing Food, Skills, Jobs and Communities, by **Gail Feenstra** and **Sharyl McGrew** (UCSAREP), and **David Campbell** (California Communities Program), 110 pages, 1999, University of California DANR Publication 21587. Market gardens have gained attention as ways to enhance community economic development, increase community food security and employ local residents. These gardens are promising vehicles for providing job training, life skills, educational opportunities, improving the quality of life and forming creative collaborations in local communities. This study describes conditions under which they prosper or fail, and provides comparative data to help new garden projects judge their own capacities. Personnel at 27 entrepreneurial gardens were interviewed by telephone in 1997 and 1998. Five of the most innovative and "successful" gardens in California were selected for in-depth case studies. The report includes a comparative analysis of the 27 entrepreneurial gardens, five case studies and extensive appendices with urban agriculture and gardening contacts, an annotated contact list of entrepreneurial community gardens, business development resources and funding opportunities for job creation and training in urban agriculture. The price is \$10 (Calif. residents add \$0.83 sales tax) plus shipping and handling. To order, contact University of California, DANR Communication Services, 6701 San Pablo Avenue, Oakland, CA 94608-1239; Tel: (800) 994-8849 or (510) 642-2431; Fax: (510) 643-5470; Email: danrcs@ucdavis.edu Payment may be by VISA or MasterCard, U.S. check or money order (payable to "UC Regents") or purchase order.

Vineyards and Cover Crops

Cover Cropping in Vineyards: A Grower's Handbook, edited by **Chuck A. Ingels**, UC Cooperative Extension, Sacramento; **Robert L. Bugg**, UCSAREP; **Glenn T. McGourty**, UC Cooperative Extension, Mendocino; and **L. Peter Christensen**, UC Davis and UC Kearney Agricultural Center, 168 pages, December 1998, University of California DANR Publication 3338. Includes more than 100 color photographs, 59 black and white photographs, and numerous tables and illustrations. Its 22 contributing authors include University of California farm advisors, extension specialists, faculty and other personnel, as well as US Department of Agriculture staff members. This vividly illustrated book provides specific information on cover crops, how they affect various aspects of vineyards, and how to use them to enhance vineyard performance and ecological stability. The manual is intended to be used by vineyard owners, managers, pest control advisors and others as a practical reference, presenting "how-to" information for field applications and providing technical and theoretical information on the effects of cover cropping. The price is \$20 (Calif. residents add \$1.65 sales tax) plus shipping

and handling. To order, contact University of California, DANR Communication Services, 6701 San Pablo Avenue, Oakland, CA 94608-1239; Tel: (800) 994-8849 or (510) 642-2431; Fax: (510)643-5470, Email: danrcs@ucdavis.edu Payment may be by VISA or MasterCard, U.S. check or money order (payable to "UC Regents") or purchase order. Copies are also available at UC Cooperative Extension offices.

Herb Directory

The Herbal Green Pages, Ninth Edition, 400 pages, 1998-99, The Herb Growing and Marketing Network. Includes listings for 6,000 herb-related businesses, and sections on associations, publications, educational programs and product suppliers. The spiral-bound directory is part of the membership package of The Herb Growing and Marketing Network or can be purchased separately for \$35 plus shipping. Contact: The Herbal Connection, PO Box 245, Silver Spring, PA 17575; Tel: (717) 393-3295; Fax:(717) 393-9261; Email: HERBWORLD@aol.com ; Web site: <http://www.herbnet.com>

Farm View

You Can Go Home Again, by Gene Logsdon, 204 pages, 1998. This autobiography of an Ohio farmer and writer is being promoted by fellow farmers. Logsdon, who farms on 32 acres in Upper Sandusky, Ohio, has written *At Nature's Pace*, *The Contrary Farmer*, *The Contrary Farmer's Invitation to Gardening*, and books on small-scale farming and homesteading. A former editor at *Organic Gardening* magazine, he has contributed to *New Farm*, *Mother Jones*, *Ohio Magazine* and writes a weekly newspaper column. To order, send \$20.20 to Andy Reinhart, 3624 Twp. Rd. 136, Bellefontaine, OH 43311.

Low Income Farmers' Markets

Hot Peppers and Parking Lot Peaches: Evaluating Farmers' Markets in Low Income Communities, by **Andy Fisher**, Community Food Security Coalition, 65 pages, 1999. This publication, based on research funded by UC SAREP, covers eight case studies of successful and less-than-successful low-income farmers' markets in California and the East Coast, providing general guidelines for low-income market operation. It includes a discussion of consumer dietary and shopping preferences. The publication also describes policy barriers and opportunities related to the creation and operation of low-income farmers' markets. To order the \$10 publication (add \$2 postage), send checks payable to "CFSC," PO BOX 209, Venice, CA 90294; Tel: (310)822-5410; Email: ASFisher@aol.com

SAREP WEB Information

<http://www.sarep.ucdavis.edu>

In addition to its print publications, UC SAREP offers access to SAREP-funded research and education projects, its newsletter, its latest *Biennial Report*, an interactive calendar, and information databases through its World Wide Web server.

Recent additions include:

- *Requests for Proposals*
<http://www.sarep.ucdavis.edu/grants/request.htm>
- *Competitive grants funded by SAREP*
<http://www.sarep.ucdavis.edu/grants/competitive.htm>
- *Natural Beef: Consumer Acceptability, Market Development and Economics*
<http://www.sarep.ucdavis.edu/grants/Reports/nader/>
- *Earthworm Information*
<http://www.sarep.ucdavis.edu/worms/>
- *Cover Crop Resource Page*
<http://www.sarep.ucdavis.edu/ccrop/>
- *PestCast (link to Statewide IPM Program Web site; collaborative work with Jenny Broome, SAREP):*
http://www.ipm.ucdavis.edu/DISEASE/california_pestcast.html
- *News Releases/Media*
<http://www.sarep.ucdavis/news/PRyear.htm>
- *Soil Quality Information*
<http://www.sarep.ucdavis.edu/soil/>
- *Alternatives to Methyl Bromide*
<http://www.sarep.ucdavis.edu/mebralt/>

Sources of Funding

Biologically Integrated Farming Systems (BIFS) Grants

[*Note: The BIFS Request for Proposals (RFP) was released in October 1998. This is a reminder.*] Farmers, commodity groups and academic researchers are encouraged to apply for grants administered by SAREP to improve soil fertility and crop protection with cultural practices and biological pest control that reduce reliance on agricultural chemicals. In September 1998 the California State legislature authorized \$1 million for another round of BIFS funding. Awards range from \$70,000 to \$100,000 per year and will be available through the Biologically Integrated Farming Systems (BIFS) program. BIFS demonstration projects involve teams of farmers, researchers, and ag consultants who develop strategies for weed and pest control, including the use of beneficial insects and cover crops as a means to reduce agricultural chemical use. Proposals are due **March 15, 1999**. California institutions and individuals are invited to apply for funding. Principal investigators on BIFS projects may be private individuals, for-profit and non-profit corporations, including commodity boards, Resource Conservation Districts, Natural Resources Conservation Service District or soil conservationists, University of California Cooperative Extension farm advisors, Cooperative Extension specialists, Area IPM Advisors, and faculty of any accredited California institution of higher learning. Copies of the RFPs are available on SAREP's Web site at <http://www.sarep.ucdavis.edu> or by contacting SAREP grants manager **Bev Ransom** at (530) 754-8546 or baransom@ucdavis.edu

Organic Research Grants

The Organic Farming Research Foundation is offering funds for research on organic farming methods, dissemination of research results to organic farmers and growers interested in making the transition to organic production, and consumer education on organic farming issues. Projects should involve farmers in design and execution, and take place on working farms when possible. Proposals of up to \$10,000 are encouraged. Matching funds and/or in-kind contributions are recommended. Proposals are considered twice a year; the next round of proposals must be received by July 15, 1999. To receive copies of grant application procedures and the OFRF Research and Education Priorities describing target areas, contact Grants Program, Organic Farming Research Foundation, PO Box 440, Santa Cruz, CA 95061; Tel: (831) 426-6606; email: research@ofrf.org; Web site: <http://www.ofrf.org>

Calendar

*** SAREP WEB CALENDAR**

SAREP offers a regularly updated sustainable agriculture calendar on our World Wide Web site at:<http://www.sarep.ucdavis.edu/> (click on "Courses, Workshops, Events"). Please feel free to add sustainable agriculture events.

*** NATIONAL/INTERNATIONAL CALENDAR**

The National Agricultural Library maintains a calendar as part of AgNIC at <http://www.agnic.org> It links to more than 1,200 major national and international agricultural conferences.

*** MONTHLY MEETINGS**

Lighthouse Farm Network The Community Alliance with Family Farmers Foundation sponsors informal monthly meetings for growers to discuss issues related to pesticide use reduction. Contact: Reggie Knox, CAFF, (831) 457-1007.

FEBRUARY

TBA

Bring Farm Edges Back to Life, 2-hour field workshop, Yolo County. Sponsors: Yolo County Resource Conservation District, Community Alliance with Family Farmers, UC SAREP/International Tree Crops Institute. Contact: Paul Robins, Yolo County Resource Conservation District, (530) 662-2037 ext. 3, rednatives@hotmail.com .

26-27

Soil Fertility & Pest Management Conference & Farm Tour: Field Crops/Orchards/Vineyards, Modesto Junior College. Sponsors: Committee for Sustainable Agriculture, Nat'l Resources Conservation Service, CALFED Bay-Delta Prog., CAL/EPA IWMB, UC SAREP. Contact: CSA (831) 763-2111, csaefc@csa-efc.org

28

Annual Strawberry Growers Meeting, UC Cooperative Extension office, Fresno. Sponsors: UC Cooperative Extension Fresno, UC SAREP. Contact: Richard Molinar or Michael Yang, (209) 456-7555, rhmolinar@ucdavis.edu

MARCH

TBA early March

Marketing Your Agricultural Product workshop, Hyampom Community

Center, Trinity County. Sponsors: Hyampom Valley Growers Association, Trinity County Resource Conversation & Development, UC SAREP. Contact: William Huber, (530) 628-5128.

TBA

Bring Farm Edges Back to Life, 2-hour field workshop, Yolo County. Sponsors: Yolo County Resource Conservation District, Community Alliance with Family Farmers, UC SAREP/International Tree Crops Institute. Contact: Paul Robins, Yolo County Resource Conservation District, (530) 662-2037 ext. 3, rednatives@hotmail.com .

3

Strawberry Grower's Conference & Farm Tour, UC Cooperative Extension, Watsonville. Sponsors: Committee for Sustainable Agriculture, Nat'l Resource Conservation Service, CALFED Bay-Delta Prog., CAL/EPA IWMB, UC SAREP. Contact: CSA (831-763-2111, csaefc@csa-efc.org)

17

Cool-Season Vegetable Grower's Conference & Farm Tour, Salinas Agriculture Center. Sponsors: Committee for Sustainable Agriculture, Nat'l Resource Conservation Service, CALFED Bay-Delta Prog., CAL/EPA IWMB, UC SAREP. Contact: CSA (831) 763-2111, csaefc@csa-efc.org

APRIL

TBA early April

Cover Cropping in Vineyards: Experimental Results and Species Demonstration, Deer Creek Vineyard, Sacramento County. Sponsors: UC Cooperative Extension Sacramento, UC SAREP. Contact: Chuck Ingels, (916) 875-6913, caingels@ucdavis.edu

3

Digging Toward the Future: Youth Urban Agriculture Conference, Grant High School, Sacramento. Sponsors: Project YE'ES Community Education Center/Urban Garden Program, UC SAREP. Contact: CEC(530)752-7956.

23

Community Food Security Access for All workshop, Humboldt County Agricultural Center, Eureka. Sponsor: UC Cooperative Extension Humboldt County, Food for People, Inc., UC SAREP. Contact: Deborah Giraud (707)445-7351, ddgiraud@ucdavis.edu or Cynthia Chason, (707) 445-3166.

TBA late April-early May

The California Grazing Academy 3-day workshop, UC Sierra Foothill Research & Extension Center. Sponsors: UC Cooperative Extension Napa & Solano counties, UC SAREP. Contact: Roger Ingram (530) 889-7385, rsingram@ucdavis.edu ; Dave Pratt (707) 421-6790 #7, dwpratt@ucdavis.edu

JUNE

TBA

Maintaining Sustainable Communities Through Effective Use of Easements and Estate Planning, Santa Rosa. Sponsors: California FarmLink, Community Alliance with Family Farmers, UC SAREP. Contact: Steve Schwartz (916) 443-4225, farmlink@tomatoweb.com

14-19

California Range & Natural Resources Camp, UC Elkus Youth Ranch, Half Moon Bay. Sponsors: Society of Range Management, Alameda County Resource Conservation District, UC SAREP. Contact: Rodney Tripp, (510) 287-2022 or Sheila Barry (925) 371-0154 ext. 41.

AUGUST

16-17

International Short Course on Agroecology, Center for Agroecology & Sustainable Food Systems, UC Santa Cruz. Full course announcement on-line: <http://www.agroecology.org/shortcourse.htm> Applications due Mar. 1. Contact: CASFS, UC Santa Cruz, Santa Cruz, CA 95064; Tel: (831) 459-2506; Fax: (831) 459-2867.

SEPTEMBER

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Food Safety Issues & Small Farms, Rancho Grande Restaurant, Watsonville. Sponsors: Community Alliance with Family Farmers Lighthouse Farm Educ. Events, UC SAREP. Contact: Reggie Knox, caff@caff.org ; (831) 457-1007 (Knox), reggie@cruzio.com

Winter 1999 (v11n1)

SUSTAINABLE AGRICULTURE is a publication of the UC Sustainable Agriculture Research and Education Program (SAREP). SAREP provides leadership and support for scientific research and education to encourage farmers, farmworkers, and consumers in California to produce, distribute, process and consume food and fiber in a manner that is economically viable, sustains natural resources and biodiversity, and enhances the quality of life in the state's diverse communities for present and future generations.

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