

SUSTAINABLE AGRICULTURE

Methyl bromide alternative results for strawberries

by Sam Prentice and Jenny Broome, SAREP

Our last newsletter (Vol. 15, No. 2, www.sarep.ucdavis.edu/newsltr/v15n2/) outlined the results of three projects funded by SAREP in grapes, stonefruit, and ornamentals. In the second part of the series, we present results from three additional projects addressing the challenges facing the California strawberry industry. These projects focused on producing clean planting material as transplants, biological alternatives to pre-plant fumigation, and alternatives to post harvest fumigation.

In 1998 SAREP was awarded a one-time legislative augmentation to support research into alternatives to methyl bromide. Six projects were funded with the special allocation (AB 1998) sponsored by Assemblywoman **Helen Thomson** (D-Yolo County) with a friendly amendment by then-State Senator **Mike Thompson** (now U.S. Congressman, Napa) and funded through the Department of Pesticide Regulation. Methyl bromide is a broad-spectrum fumigant that is widely used to control insect, pathogen, nematode, weed and rodent pests. It has also been identified as a Class I ozone-depleting substance. Under the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has prohibited the production and importation of methyl bromide starting January 1, 2005. In addition, the United States has joined 140 other nations in signing the Montreal Protocol, which in 1994 froze production and importation of methyl bromide at 1991 levels, and which requires use to be reduced in developed countries by 25 percent in 1999, 50 percent in 2001, 70 percent in 2003 and 100 percent in 2005. According to EPA, continued use of methyl bromide as an agricultural pesticide may contribute five to 15 percent to future depletion of the ozone layer if it is not phased out.



Strawberry growers seek options to methyl bromide.

This phase-out has significant implications for California agriculture, since methyl bromide is widely used as a pesticide for the production and export of high value crops and commodities produced statewide. Approximately 90 percent of the methyl bromide used in California is for pre-plant soil fumigation to control soil-borne pathogens and pests principally in strawberries, nursery crops, grapes, and tree fruits and nuts. When used in this manner, about 50 to 95 percent of the methyl bromide injected can eventually enter the atmosphere. Postharvest commodity treatment accounts for another five to 10 percent of the methyl bromide use statewide and is directed largely at insects that damage nuts, cherries, grapes, raisins, and imported materials. About 80 to 95 percent of the methyl bromide used in a commodity treatment eventually enters the atmosphere. Structural fumigation accounts for most of the remainder of the methyl bromide use in California.

Several potential chemical and non-chemical alternatives to methyl bromide have been identified nationally and internationally and some of these alternatives have been and are currently being evaluated in California. The previous issue of *Sustainable Agriculture*

See **METHYL BROMIDE** p.14

INSIDE	
SAREP'S FATE LINKED TO AGRICULTURE'S IMPACT, FUNDS	2
ORGANIC WINEGROWING SHORT COURSE	4
SAREP ORGANIC NEWS	5
ORGANIC TRAINING	6
USDA-SARE NEWS	6
GROWERS ASSIST 'BUY CALIFORNIA' BIFS OUTREACH	7
SUSTAINABLE AG SERIES ENDS	8
METHYL BROMIDE CONFERENCE	12
SAREP/SAFS COLLABORATION	13
RESOURCES	18
SOURCES OF FUNDING	19
CALENDAR	20

SAREP's future linked to environmental impact of California agriculture, lack of funding

[Note: This column is excerpted from the "Letter from the Director" in SAREP's new Biennial Report covering July 2001-June 2003, soon to be available on SAREP's Web site, www.sarep.ucdavis.edu.]

The future of SAREP is inextricably linked to the fact that agriculture is California's most fundamental environmental resource. The future sustainability of California agriculture is one of the most important environmental issues of the 21st century. Privately owned working agricultural lands, forests and open space are the key elements of the entrepreneurial stewardship of California's natural resources. While nearly 40 percent of the state is publicly managed in the form of national and state parks, forest, and rangeland (California has more public forest and national park land than any state except Alaska), a similar land area (38 %) of the state is privately owned agricultural and forest land managed for production. Agroecosystems managed for food and fiber crops cover 27.8 million acres, or 28 percent of the nearly 100 million acres of land in the state, compared with 4.5 million acres (4 %) in urban land. While over 30 million Californians crowd nearly 480 cities on this urban land base across the state, a mere handful of the population, 74,000 farmers and ranchers (over 10,000 of them women), manage California farmland on an area nearly seven times as large. Much of California's 9.5 million-acre irrigated agriculture is the highest value farmland in the world. On that valuable acreage, California farmers and ranchers use 80 percent of the developed water resources of the state. Often, managed agroecosystems are familiar to the public as much desired "open space" and "greenbelts" at the edge of many major coastal and valley urban areas.

Ag helps ecosystems

The vast ecosystems services provided to urban residents by this agricultural land (carbon sequestration and climate moderation; infiltration and retention of water;

formation, building and retention of soil; cycling of nutrients and organic materials; pollinator and wildlife refuges; open space and view sheds; agri-education and tourism), cannot be appraised in value as easily as the \$27 billion of annual agricultural food and fiber produced and sold. However, ecosystem services in California agriculture alone could be estimated at one hundred billion dollars or more. As California's population increases to 50 million inhabitants by mid-century, these ecosystem services will become increasingly valuable. While much environmental conservation has been successfully advocated and funded on public wild lands, the vast stewardship potential and positive environmental impact to be gained on largely privately held California agroecosystems is unrealized.

The human dimension and economic contribution of California's farmlands to the state's economy are no less important. The state's farmers, only a tiny fraction of a percent of the population, create over 1 million jobs for farmworkers, machinery and input sales personnel, and other local processing employees directly associated with farm production. Eight percent of the total state jobs and seven percent of California's GNP are created initially by just over 74,000 farmers and ranchers. However, many of California's highest agricultural and timber production counties are also associated with the highest rates of poverty. Sustainability solutions necessarily include human needs in California.

Farm communities suffer

Despite this remarkable geographic and economic impact, the sustainability of California agriculture is uncertain. California farmers and ranchers confront historically flat and lower real prices for their production in an increasingly globalized and costly operational environment.

The cost-price squeeze on the small and mid-size growers (the majority of California farmers) has been particularly pronounced over the past decade, and has led to increased average farm size and net losses in the number of small to medium sized farms and their contribution to sales, according to the National Agricultural Statistical Service of the USDA. At the same time as their economic position erodes, California farmers continue to face expanded demands for land and water by a growing urban population, and increased regulations to improve water and air quality, protect wetlands, and conserve other endanger habitats and species. Can these same farmers and ranchers maintain high levels of productivity and efficiency? Or will agriculture be abandoned in California's economic future, because we continue to ask our farmers to produce bulk commodities as cheaply as possible without regard for environmental and social impacts?

It is clear that increasingly unified but diverse partnerships will be required to shape a sustainable future for California's agricultural communities. I believe that farmers and ranchers, in proactive partnership with sustainable agriculture researchers, consultants, industry representatives, public agencies, farmworkers, consumers, and other food system stakeholders, can solve the most serious challenges of environmental quality, loss of open space, economic viability, and quality of life facing our state. That is, these partnerships are "civic" in nature, entailing public objectives of interest to broad groups of citizens. And this civic partnership is growing every day to advance sustainable agriculture in California. Never before have California's consumers been more motivated to act, through market choices, on the issues of

sustainability. Increasingly, the public is asking if their food choices are not only healthy, but are the production practices that produce them sustainable? Is the food grown and harvested in ways that do not harm the environment or farmers and workers that produce it? Major market trends suggest sustained growth in organic and direct market fresh food consumption. The number of farmers markets in California increased by nearly 80 percent over the last ten years. More and more, people want to know where and how their food is produced. The promulgation of the Federal Organic Foods Production Act of 1990, and USDA enforcement provisions beginning in late 2002, are emblematic of increasing consumer engagement in farm production practices. Now, more than ever, California consumers are becoming aware of what they eat.



Agricultural lands are key to the environmental future of California. (photo by Jenny Broome)

Sustainable agriculture has never been more important as a guide to action. Future generations will commend us for our commitment now. No less than the environmental future of the state is at stake. SEAN L. SWEZEY

SAREP budget cuts

On October 8, 2003, UC ANR Vice President W. R. “Reg” Gomes assigned a 33 percent permanent budget cut to SAREP, reducing SAREP’s state general fund-supported budget by more than \$210,000. Listening sessions took place in January and February to discuss these cuts and other more severe possibilities for our program. We urge you to comment on the ANR Web site at <http://groups.ucanr.org/directions/>. This cut is being absorbed through a combination of reduced operating expenses, work time reductions, closure of the competitive grants program for 2003/2004, and increased reliance on extramural funding. I

am fortunate to have a dedicated staff working to retain the program while reducing costs.

Despite this uncertain fiscal situation, it is important to all Californians that SAREP continue to deliver research based information and educational programs to support its Biologically Integrated Farming Systems, Organic Initiative, and Community Development and Public Policy programs. In the face of possible additional cuts in state general funds in the future, and as ANR moves forward on its plans, I will be working to keep SAREP intact as a special program assisting the critical public work toward the development of sustainable agriculture and

food systems in the state. California’s citizens, especially farmers and ranchers under multiple economic, environmental, and social pressures, urgently need and deserve increased support from our public institutions to ensure the future sustainability of agriculture in California. Sustainable agriculture has never been more important as a guide to action. Future generations will commend us for our commitment now. No less than the environmental future of the state is at stake.—Sean L. Swezey, director, University of California Sustainable Agriculture Research and Education Program

Organic winegrowing short course reflects new market

by Jeri Ohmart, SAREP

An increasingly competitive global trade environment and a desire to improve the ecological health of vineyard systems are providing the impetus for many California viticulturists to explore organic production practices. Within the last decade, more research has been focused on organic winegrape production, and the result has been high quality organic grapes for a high quality finished product.

On Nov. 17-18, 2003, farm advisor **Glenn McGourty** of UC Cooperative Extension Mendocino County, **Ann Thrupp** of Fetzer Vineyards and SAREP teamed up to present an intensive two-day “Organic Winegrowing Short Course” on organic winegrape production research and practices. Additional sponsors included the California Department of Food and Agriculture (Buy California Initiative), Mendocino Winegrowers Alliance, California Association of Winegrape Growers, USDA, and Brutocao Cellars in Hopland, which donated the attractive conference space.

Held in beautiful Mendocino County—the center of organic winegrowing in California—the course attracted over 100 participants, including growers, vineyard managers, winemakers, researchers, consultants and other agriculture professionals. The course emphasized practical, useable information to help growers consider growing winegrapes organically, or to improve their practices if they are transitioning to organic. There was much to offer all winegrape growers also, as several presentations emphasized soil building, cover cropping systems, nutrient and disease management.

Speakers included university researchers, farm advisors, certification experts, growers and winemakers. **Paul Dolan**, president of Fetzer Vineyards, offered introductory remarks, while **Janet C. “Jenny” Broome**,

SAREP associate director, set the tone for the two days in her presentation, “A Systems Approach to Organic Winegrowing.” Morning sessions on the first day emphasized soil management in organic vineyards. **John Reganold**, soil scientist from Washington State University, spoke about the importance of good soils in the production of good wines. McGourty followed with a presentation on the uses and benefits of cover crops, rotations, and tillage vs. no-till practices. Soil scientist and Sonoma Compost owner **Will Bakx** made a presentation on “Making and Using Compost,” and **Rhonda Smith**, UC Cooperative Extension, Sonoma County farm advisor, discussed irrigation management.

Afternoon sessions emphasized pest management. **Tom Lanini**, UC Extension weed specialist, UC Davis, spoke about weed management; **Michael Costello**, professor, Cal Poly San Luis Obispo, addressed insect problems; and **Doug Gubler**, UC Extension plant pathologist, UCD, presented information on disease control. The afternoon was capped off with a lively field activity on the site of Fetzer Vineyards’ Valley Oaks Ranch in Hopland, where participants were shown how mini-sheep could be used as natural grazers and weed-eaters, attended a machinery and equipment demonstration, and enjoyed the beautiful organic gardens tended by **Kate Frey**. Frey explained the complex planning that has gone into Fetzer’s gardens, the multiple functions of many plants and herbs, and how they interact with the entire organic farming system. After the field event, the group retired to a “Share Fair” that included exhibits and a wine tasting.

The second day focused on other aspects of organic winegrape growing and the relationship between vineyards and their surrounding environments. **Karen Klonsky**,



Mini-sheep are natural weed-eaters at Fetzer Vineyards. (photo by Jenny Broome)

UC Extension agricultural economist, UC Davis, presented her recently completed Organic Winegrowing Cost Studies, a topic of great interest to the audience. **John Trinterud** of California Certified Organic Farmers, explained the organic certification process and detailed issues faced by growers during the transition to organic. The grower and winemaker panels offered the audience the opportunity to learn from actual examples of organic production. Panel members were able to address many practical, on-the-ground questions from the audience.

The short course concluded with a return to organic winegrowing as a whole systems approach. McGourty spoke on water quality issues, and **Robert L. Bugg**, SAREP farming systems analyst, expanded the discussion to “Understanding the Importance of Habitat and Biodiversity.” The course concluded with a presentation on “Integrated Canopy Management for Organic Vineyards,” by **DeWitt Garlock** of Robert Mondavi Winery and “The Biodynamic Approach to Winegrowing,” by **Alan York**, viticulture and horticulture consultant.

The Organic Winegrowing short course offered an agenda packed with information based on research and practical grower experience. Participants’ feedback indicated that the two days were well worth their time, and many suggested that this course be repeated in different locations around the state.

ROUNDUP: County organic leaders; compliance training; short courses

by David Chaney and Sean Swezey, SAREP

In addition to the organic winegrowing course described on page 4, SAREP has been working to develop and extend information on organic farming for the state's growers.

COUNTY ORGANIC LEADERS

Coordinators of SAREP's county-based organic outreach projects met in October 2003 to share their research and extension activities, prioritize future research directions, and identify key elements of an expanded "organic initiative" that could enhance current projects and extend organic outreach to other counties in the state. The organic county-based research and education activities are summarized at www.sarep.ucdavis.edu/organic/county-connections.htm. For results of the planning session, see www.sarep.ucdavis.edu/organic/workgroup.htm.

ORGANIC COMPLIANCE

In December 2003, SAREP coordinated an organic compliance training session at the annual UC Agriculture and Natural Resources (ANR) Vegetable Crops Continuing Conference. **Sean Swezey** (SAREP director), **Rick Melnicoe** (Western Region IPM Center director), **Ray Green** (CDFA California Organic Program director) and **Brian Baker** (Organic Materials Review Institute) presented information on the national organic program and the California state organic program, and the major components of grower compliance under the new National Organic Program (NOP) rule. UC Cooperative Extension (UCCE) farm advisors **Ramiro Lobo** (San Diego County), **Mark Gaskell** (Santa Barbara/San Luis Obispo counties), and **Annie Eicher** (Humboldt County) described their experiences working with organic clientele and helped define the potential role of Cooperative Extension advisors in the compliance process. Participants learned how NOP regulations affect field and on-farm research activities, and what steps to follow

for compliance in that context. SAREP education coordinator **David Chaney** organized and facilitated the session for about 30 UC farm advisors attending the conference. A repeat of this session was scheduled in late March as part of the UC ANR Pomology Extension Continuing Conference.

STRAWBERRY, PEAR COURSES

An Organic Strawberry Production short course took place in January 2004 in Ventura. **Vanessa Bogenholm**, organic strawberry grower and chair of the Board of Directors of California Certified Organic Farmers, was the opening speaker at this shortened version of the two-day short course presented in Salinas in early 2003. Bogenholm covered compliance issues relevant to certification, labels, recordkeeping, and marketing issues, and explained the inspection process. Other speakers included UCCE specialists **Karen Klonsky** (cost of production study) and **Steve Fennimore** (weed management), farm advisors **Richard Smith** (rotations and cover crops), **Mark Bolda** (soil-borne diseases), **Oleg Daugovish** (biofumigation), SAREP associate director **Jenny Broome** (foliar diseases) and director **Sean Swezey** (insect management). Research scientist **Joji Muramoto** from the University of California, Santa Cruz, rounded out the program presentations with a talk on nitrogen management in organic strawberries. **Curt Gaines**, a private consultant from Sierra-Cascade Nursery, presented information on the feasibility of organic strawberry transplant production. About 45 people attended the event. Many growers were already involved in organic strawberry production, and others indicated that the information presented would stimulate changes in their current production and marketing systems. Daugovish coordinated the event with sponsorship from UCCE-Ventura County, the California Strawberry Commission, and the Clarence E. Heller Charitable Foundation.

In response to increased interest in organic practices and market potential for California organic pears, SAREP co-sponsored the Organic Pear Production and Marketing Workshop at the Sonoma County 4-H Center in Rohnert Park in February 2004. Co-sponsored by UCCE, and a grant to SAREP from the Columbia Foundation, the course brought together 53 pear producers, marketers, pest control advisors, UC specialists and farm advisors, and students. UCCE farm advisor and Lake County director **Rachel Elkins** hosted the course. Presenters included SAREP director **Sean Swezey** (overview of organic production in California), UCCE specialists **Steve Southwick** (managing orchards organically), **Rollie Meyer** (fertility management), **Desley Whisson** (vertebrate pest management) and **Trevor Suslow** (post harvest and food safety considerations). Other presenters were farm advisors **Chuck Ingels** (orchard floor management/ cover crops), **Lucia Varela** (insect management), **Rachel Elkins** (disease management), and CDFA Organic Program manager **Ray Green** (allowable materials and certification). The workshop also featured a marketing panel including **David Granatstein** (Washington State University sustainable agriculture specialist), **Chris Zanobini** (California Pear Advisory Board), **John Aselage** (Gerber Products Company), **Dan Varnau** (J.M. Smucker Co.), and **Joe Gabriel** (CF Fresh). Pear grower **Dan Todd** (Todd Organic Orchards, Potter Valley), and PCAs **Devlin Gordon** (Ag Unlimited, Ukiah), **Tim Neuharth** (Steamboat Acres, Courtland), and **Duncan Smith** (Western Farm Service, Walnut Grove) spoke about actual production practices and experiences. These producers and consultants provided important information on the feasibility of organic pear production under different climatic and economic conditions. The CDFA Organic Program database shows that organic pear growers produced a crop valued at close to \$1 million on 500 acres in 2003.

Organic training for certifiers, specialists, ag commissioners, industry

The California Department of Food and Agriculture (CDFA) has been approved as a State Organic Program by the USDA's National Organic Program, according to **Ray Green**, supervisor of the California Organic Program inspection and compliance branch. CDFA's primary responsibility will be industry enforcement, including education and outreach to those conducting certification and to other agencies involved in enforcement.

The first educational events related to enforcement are scheduled from March through May, Green said. County agricultural commissioners' staff, organic certifiers, county farm advisors/extension specialists, and the organic production and marketing industry are invited to attend free seminars on the "Legal rights and Responsibilities of an Organic Marketing Operation." Seminars do not require advance registration and will be offered throughout the state. For more information please visit www.cdfa.ca.gov/is/fveqc/organic.htm.

Organic Training Dates

Thursday, March 11, San Diego
 Friday, March 19, Santa Rosa
 Tuesday, March 23, Ventura
 Wednesday, March 24, Indio
 Thursday, March 25, Anaheim
 Thursday, April 1, San Luis Obispo
 Friday, April 2, Salinas
 Tuesday, April 6, Sacramento
 Thursday, April 8, Redding
 Monday, April 12, Stanislaus
 Wednesday, April 14, Fresno
 Monday, April 19, Humboldt
 Friday, May 21, Bakersfield

News from USDA SARE and the Sustainable Agriculture Network

UC SAREP's counterpart at the national level is the USDA Sustainable Agriculture Research and Education program (SARE). SARE works primarily through competitive grants offered through four regional programs. The Western Region SARE program is based at Utah State University; information on its grants programs can be found at wsare.usu.edu. Through its outreach program SAN (Sustainable Agriculture Network), SARE highlights results of its funded projects and develops and distributes information for farmers, ranchers, and educators interested or involved in sustainable agriculture.

NATIONAL SARE CONFERENCE

The 2004 Northeast SARE conference will be held in Burlington, Vt. on Oct. 19-20, 2004. There will be workshops on regional food systems, marketing, ecological production, policy and planning, farmer profiles and poster sessions, and sessions on communications in the agricultural community. For more information visit www.uvm.edu/~nesare/index.html.

PATRICK MADDEN AWARD

SARE announces its second "Patrick Madden Award" to honor farmers and ranchers who raise food or fiber in ways that are profitable, good for families and communities, and beneficial to the environment. Four regional winners will receive \$1,000 each and a travel scholarship to "Toward a Sustainable Food System," the SARE conference in Burlington, Vt., Oct. 19-21, 2004. All producers farming in the United States and its protectorates are eligible, except for previous winners and finalists. To nominate someone, go to www.sare.org/madden/. (No self nominations, please. Nomination deadline is May 10, 2004.)

NEW PUBLICATIONS

Opportunities in Agriculture: Transitioning to Organic Production. Provides a detailed overview of organic farming and ranching including: designing profitable rotations, building healthy soil, weed and pest control options. The bulletin also has special sections on livestock production, and profiles of four diverse organic producers. www.sare.org/bulletin/organic/prNov2003.htm.

Building a Sustainable Business: A Guide to Developing a Business Plan for Farms and Rural Businesses. Step-by-step strategies to help alternative and sustainable agriculture entrepreneurs transform farm-grown inspiration into profitable enterprises. This book will help readers develop a detailed, lender-ready business plan or map out ways to take advantage of new business opportunities. www.sare.org/htdocs/events/pr/sep2003.htm.



Growers assist SAREP's Buy California Initiative BIFS outreach project

by Bev Ransom, SAREP

In January 2003, SAREP was awarded Buy California Initiative funds by the California Department of Food and Agriculture and the USDA to coordinate a project extending the adoption of biologically integrated farming systems. This outreach project builds on the successes of SAREP's Biologically Integrated Farming Systems (BIFS) program by enlisting experienced growers to inform a wider audience of farmers about the practices demonstrated in the prune, walnut and dairy BIFS projects. An update on the outreach project follows.

Prunes/Dried Plums

Dan Bozzo, a Butte county prune grower, shared his experiences growing cover crops with other prune growers at a short course held in Gridley last June. Due in part to his experience as a participant in the SAREP BIFS prune project for the last five years, Bozzo was able to answer growers' questions and describe how cover crops are particularly helpful in orchards where standing water is a problem.

Fred Thomas, CERUS Consulting, is coordinating the prune outreach component of this project. Thomas has assembled a team of prune growers including Bozzo and management team members from the prune BIFS project to guide this outreach. At winter field meetings for Yuba, Sutter, Madera, and Merced county growers, the outreach team prune growers helped farm advisors **Franz Niederholzer**, **Brent Holtz**, and **Maxwell Norton** describe the potential money saved on dormant sprays when growers use the decision guide demonstrated in the prune BIFS project. (All farming decision guides developed as part of the Integrated Prune Farming Practices/BIFS project are available at: www.agresearch.nu/ipfp_wsrld.htm.)

Walnuts

Farm advisors **Joe Grant** and **Kathy Kelley Anderson**, who coordinate the walnut outreach component of SAREP's project, have met several times with a team of seven walnut growers to guide their outreach to other growers. Based on recommendations from the team, Grant and Anderson conducted focus groups with growers and pest control advisers to learn more about grower decision-making in nitrogen fertilizer use. Grant and Anderson are working with their outreach team to determine the most effective ways to encourage the use of leaf sampling, irrigation water testing, calculating nitrogen contributions from cover crops, and other nitrogen-budgeting practices to prevent overfertilization that can affect water quality.

Walnut outreach efforts included a Walnut Orchard Floor Management field day in August where Stanislaus and San Joaquin county growers learned about cover crops and how to manage weeds without herbicides. (A handout on Organic Weed Management in Walnut Orchards by **Tom Lanini**, Cooperative Extension weed ecologist, and Grant is on the Web at: www.sarep.ucdavis.edu/bifs/organicweedmanagement.pdf.) The most recent event was a 2003 fall field day to demonstrate how to chip and shred orchard prunings as an alternative to burning. This event, presented in collaboration with the Community Alliance with Family Farmers, provided growers with a practical way to address air quality concerns.

Dairy/Forage Crops

Stuart Pettygrove, Cooperative Extension specialist, is coordinating the dairy outreach component of this project. The dairy BIFS project demonstrated ways to integrate forage production with manure



BIFS grower Dan Bozzo explains how using a hand lens helps him manage pests. (photo by Bev Ransom)

management to protect water quality and save money. These practices will be disseminated to a wider audience with a manual developed for Central Valley and North Bay dairies that will highlight the experiences of dairy farmers successfully using environmentally sound practices on their farms.

Results from SAREP's walnut, prune, and dairy grower surveys have also provided information on effective BIFS practices and their degree of adoption, as well as attitudes and exposure to BIFS, which will help guide future work with Buy California funds. Additional outreach events for prune and walnut growers will be scheduled through 2004. For information on upcoming events, check SAREP's Web site at: www.sarep.ucdavis.edu/BIFS/BuyCA.htm.

Successful 'Science of Sustainable Agriculture' series wraps up

by Jenny Broome, Lyra Halprin and Gail Feenstra, SAREP

(Note: This article summarizes the 10 speakers featured during the fall lecture series. Spring series lectures were summarized in Sustainable Agriculture, Vol. 15, No. 2, Summer 2003, available online at www.sarep.ucdavis.edu/newsltr/v15n2/sa-3.htm.)

The major lecture series *The Science of Sustainable Agriculture: Measuring the Immeasurable* concluded its spring/fall presentations at UC Davis in December with the final 10 of 19 internationally recognized experts on sustainability in agriculture, the environment and society. The series began in April and continued weekly through December 2003.

"SAREP was pleased to help organize and coordinate this highly successful multidisciplinary speaker series," said **Jenny Broome**, SAREP associate director. "It was standing room-only at every lecture." More than 1330 attended the 19 talks, and video lectures online have been accessed more than 1000 times at www.sarep.ucdavis.edu/seminar/.

The series received support and leadership from the UC Davis College of Agricultural and Environmental Sciences, Unilever Bestfoods Corporation, Kearney Foundation of Soil Science, UCD Department of Agronomy and Range Science, UCD Department of Land, Air & Water Resources, as well as the UCD Center for History, Society, and Culture.

Economics, Rangelands

The fall series began with professor **Jeff Krautkraemer** from the economics department at Washington State University, Pullman, who discussed "Natural Resource Scarcity and Sustainable Agriculture." Economists have often been concerned with the question of resource scarcity; Krautkraemer provided an overview of how technological innovation has improved the efficiency of renewable resource use, particularly fossil fuels, when the resources are treated solely as commodities.

But addressing broader public costs/benefits related to fossil fuel use and links between scarce resources and unintended

effects like global warming (and the unknown ability of technical innovation to address these) is harder to assess and accomplish, he said. Krautkraemer addressed ways to account for resource abundance and scarcity, including measuring physical reserves or cost measures of scarcity including price, user and opportunity cost. He also provided historical data trends for energy use and fossil fuel availability.

Speaker **Jill Landsberg** shifted gears and addressed "Managing Rangelands to Conserve Biodiversity." Landsberg is a theme leader, Tropical Savannas Cooperative Research Centre, and adjunct associate professor at James Cook University in Queensland, Australia. She noted that although rangelands are inherently unproductive, infertile, and not suitable for cropland, these biophysical properties can also provide opportunities for mixed land use.

Landsberg described the social context of Australian rangelands, which includes population pressures, isolation, low income, and large numbers of indigenous peoples. She said Australian cooperative research centers focus on integrative research that attempts to address academic, political, and on-the-ground change simultaneously to benefit a range of stakeholders. This differs from principal investigator disciplinary-directed research more typical of university settings.

She noted that integrative rangeland studies have focused on researching and improving the management of rangelands with fire, which if properly managed can address biodiversity, grazing access, and the social and economic needs of the community.

Soils, water

Pete Smith's lecture addressed "Sustainable Soil Management to Help Mitigate Climate Changes: Opportunities and

Limitations." Smith, a reader in Soils and Global Change, School of Biological Sciences, University of Aberdeen, United Kingdom, discussed unequivocal evidence from the last 1,000 years that shows global warming is caused by human activity.

According to Smith, 1998 was the warmest year over the last millennium. He discussed data that show carbon dioxide and methane gases account for approximately 85 percent of the warming trend, and presented four scenarios (world market, provincial enterprise, global sustainability, and local stewardship) for the next 100 years showing how CO₂ concentration may change and influence global warming. He addressed the potential for carbon sequestration in farming and forestry systems that include the use of organic amendments (animal manure, sewage sludge), no-till practices, deintensified farmland, and increases in woodlands and biofuel plantings.

Smith cautioned that while this approach can assist Europe in complying with the Kyoto Protocol, it is not a "cheap" option to avoid the hard choice of limiting fossil fuel use. He explained carbon markets and carbon credits as well as creative commercial links that fund reforestation efforts (including those supported by consumers purchasing "Foo Fighters" music CDs!). He stressed that social and economic issues such as poverty and education are also key to addressing global climate change challenges.

"Land and Water Management in Arid Regions: Historical and Contemporary Perspectives," was addressed by **Daniel Hillel**, senior research scientist at Columbia University, professor emeritus of plant, soil and environmental sciences at the University of Massachusetts, Amherst,

and an internationally renowned environmental scientist and hydrologist who has worked throughout the Middle East. Hillel provided fascinating historical data on land and water management in the Middle East.

He noted that the Middle East, which is the juncture of the continents of Asia, Africa and Europe, has been subject to human exploitation for the longest period of time of any region on Earth. Hillel discussed destructive practices that occurred in the Middle East, including the twin processes of terraced farming on mountain slopes that caused erosion in the uplands, and overgrazing that caused rivers to carry loads of silt that created levees, which broke and flooded. He noted that areas prone to flooding are notoriously ill-drained and prone to rising water tables. As water rises from flood-irrigated soils, it begins to infuse the topsoil with salt. He pointed to Egypt as an example of more stable fertility because of the annual pulsation of rivers that irrigated, fertilized and drained the land. It supported a generally stable civilization for more than 5,000 years until 1964, when Egyptians interfered on a massive scale with this natural cycle and built the Aswan Dam. The dam was built to increase food production to support its increasing population, but the effect has been to contain the water in canals at high levels year-round, which has resulted in salt accumulation in the soil. Additionally, by containing river silt behind the dam, offshore erosion and seawater intrusion into the agricultural lands of the Delta has occurred, which has destroyed fisheries fed by the plankton supported by nutrient-rich silted water.

“These things are happening today in California, Australia and all arid regions that are under irrigation and injudicious cultivation,” Hillel said. “Sustainability is not to be taken for granted. It is conditioned on very careful control.”

Hillel said he is not a pessimist, and is convinced that irrigated agriculture can be sustained if environmental consequences are taken into account. He noted that parts of California, Israel, India and Pakistan support sustainable systems of irrigated

agriculture with proper drainage and cultivation. Hillel predicts that by 2050, agriculture will be withdrawn from marginal lands, increased in more fertile lands and made much more efficient. He said we must concentrate and invest in these intensive and sustainable systems, and offer assistance to countries without the resources to do it carefully. He said international cooperation and investment is necessary to sustain us as a species.

Quality of life, food

Several talks looked at the roles of consumers and citizens in the food system and how to measure “quality of life.”

Cornelia Butler Flora, Charles F. Curtiss Distinguished Professor of Agriculture and Sociology at Iowa State University, and director of the North Central Regional Center for Rural Development, Iowa State University, posed the question, “How do we know the impact of sustainable agriculture on quality of life?”

She said there is no correlation between standard of living and quality of life, noting that standard of living primarily looks at indicators such as possessions. She noted that it is important to determine whose quality of life is being examined, as many individuals are impacted by quality of life and standard of living in a broader and broader way, i.e., there is a relationship between increased pollution from some agricultural practices and children who can't play outside due to asthma.

She noted that agriculture has long been the ultimate “modernization project,” which asserts that knowledge is cumulative, and the increased use of “sound science” will increase productivity. She said productivity is an easier variable to measure than profitability or environmental impacts, which are often ignored because of the difficulty in quantifying them.

Butler Flora noted that the increasingly fragmented nature of our society affects agriculture and has different effects on managers, farmworkers, custom pest control applicators, harvesters, and farm families. She noted that the advent of digital technology has speeded up the work



Cornelia Butler Flora, Iowa State, talked about quality of life and sustainable agriculture.

(photo by Jan Flora)

of biotechnology, and provided us with an overload of information. Additionally, technology has helped turn us into a 24-hour society: Americans work more hours per day than any other nation, and more per day than five years ago. The 24-hour society has changed concepts of community and family by separating people from each other, she said.

Butler Flora noted that a new “post-post modernist” revolution is evolving, which increasingly identifies sets of choices with multiple indicators that might vary in different communities and with different contexts.

Joan Dye Gussow spoke about “Why You Should Eat Food and Other Nutritional Heresies.” Gussow, emeritus professor of Nutrition Education, Columbia University, described how difficult it is to “eat by the numbers.” She noted that we couldn't patch together the right amounts of dozens of vitamins and minerals and newly fashionable phytochemicals recommended by experts from package labels or nutrient charts. She described how the current food marketplace developed, and how, despite all these “newly popular micronutrients,” it has contributed to a national eating disorder. Gussow has spent the last 20 years trying to show why and how the foods people eat should be whole, minimally processed, locally grown and, therefore, mostly seasonal.

Ag education

The final discussions returned to the university and education and outreach efforts needed to increase the adoption of sustainable farming and food systems.

Charles Francis talked about “Developing a Curriculum for a Sustainable Agricultural: Educating the Researchers and Farmers of the Future.” Francis is a professor of agronomy at the University of Nebraska, Lincoln, and visiting professor of agroecology in Sweden and Norway and frequently teaches in their MSc courses. He noted that there is interest in studying sustainable agriculture or agroecological systems because there is increased consumer demand for sound practices, there may be cost reductions and a possible competitive advantage for farmers, farmers face increasing regulations, and there is increased interest in the social and environmental responsibility of agriculture.

Francis noted that agroecology courses are being offered throughout the country that require students to think, process and fit information into context, explore new options, and include whole systems approaches to production, processing, marketing and consumer issues. Those in agriculture must understand intensive management in farming and food systems, be life-long learners in a complex and unpredictable future, value nature and biodiversity in local contexts, and understand linkages and partnerships, he said. He noted, as an example, that more than 170 environmental organizations are working closely with the Leopold Center for Sustainable Agriculture at Iowa State.

Francis said Nordic countries use the term “ecological agriculture” for organic farming, which is seen as a practical application of principles rather than an academic discipline. He said Nordic MSc. programs he works with focus on economics (direct markets, local food systems), long-term impacts of alternative systems, social impact of systems (family farm emphasis, local business, cooperatives, fair wages, social capital), and nature as guide (using

the study of natural systems to provide guidance for the design of cultivated crops and crop/animal systems).

In those programs, there is a broader concept of faculty that includes farmers. Francis said researchers often become co-learners, and the focus is on life-long learning and how to adapt. Universities include “just-in-time” and “context” education, which tailors students’ learning experiences to their needs; some work in the field first, and learn chemistry or statistics as they apply. He said a more fluid university organization, in which multidisciplinary faculty work in teams with students moving in and out of the university setting, is a worthy goal.

Fred Kirschenmann, director of the Leopold Center at Iowa State University eloquently described “Unfolding a Sustainable Agriculture for the 21st Century: Some Challenges for Education and Extension.” He discussed the “hollowing out” of rural America as mid-sized farms, or “agriculture of the middle,” is disappearing from the American landscape in the face of the current global economy. Nationally, these farms still make up the largest share of “working farms” where the chief source of income is farming. They are also the farms that have sustained rural communities by making local purchases, creating jobs, and maintaining local tax bases.

Kirschenmann framed a convincing rationale for developing new value chains—connecting new sustainable production systems with new food microenterprises on a regional basis. These new food system approaches would explore links between mid-scale producers and regionally based food processors, distributors and retailers. They could take advantage of the new market climate, which Kirschenmann said highlighted “memory, romance and trust”—the attributes that an increasing number of food-conscious consumers are looking for. Kirschenmann ended with a few examples of farmers and food systems entrepreneurs who are using new enterprise structures and value chains

to simultaneously serve the environment, rural communities, farmers and a public that wants to support this new agriculture.

Science of organic

John Reganold, professor in the crop and soil sciences department at Washington State University, Pullman, focused on “The Science Behind Organic and Biodynamic Farming.” He presented results of his 15 years of farming systems research recently featured in *Nature* and *Science*, where he compared organic, conventional, and integrated farming systems. In the late 1980s he studied wheat in Washington State and found organic farming systems to be equal or better in yield, crop and soil biological and physical quality parameters, lower in energy use per unit produced, and soil erosion was three times less in the organic compared to the conventional systems.

Reganold also discussed his work with organic, conventional and integrated apple production systems in Washington State, where he found the organic apples to be firmer and slightly sweeter than those produced in either the conventional or integrated systems. This multidisciplinary study included economists and engineers; the economists calculated the breakeven point for organic production at six to nine years, compared to eight to 15 years and nine to 17 years for conventional and integrated production, assuming a 50 percent price premium on the organic with the range related to the russetting challenges in all three systems. His study used the Environmental Impact Quotient developed at Cornell, and found that organic production had the lowest (best) score. The study combined all data collected, developed a sustainability ranking and found that organic production ranked first in environmental and economic sustainability, with integrated production second, and conventional third.

Reganold also presented his work in New Zealand where he compared biodynamic and conventional management of crop and pasture systems, and impacts on

crop and soil quality. He is currently on sabbatical in Mendocino County working with Fetzer Winery and its Bonterra vineyard, and writing a book on organic and biodynamic winegrape growing.

UC Davis' own **William Horwath**, associate professor in the Department of Land, Air and Water Resources, ended the series with an overview of research and education in sustainable agriculture at UCD, and offered a vision for the future. His talk, "Past, Present, and Future of Sustainable Agriculture at UC Davis," provided historical context by discussing the creation and intended role of the land grant university. He drew on some of the previous speakers' themes and provided specific California data on the impacts and contributions of California agriculture.

Horwath used the rice industry as an example of how research needs and priorities have changed, from focusing solely on increasing yields to adding additional environmental elements such as winter wildlife habitat and protecting air quality. He described the milestones over the past 30 years that have culminated in demands for sustainable agriculture and food systems that included social movements critical of environmentally damaging farming practices and legal challenges about who benefits from publicly funded mechanization research, as well as the rise of the organic farming and natural foods and cooperative movement.



The UC Davis campus is host to a variety of sustainable agriculture projects, including the Long Term Research on Agricultural Systems (LTRAS) project, which is now also the location of the Sustainable Agriculture Farming Systems (SAFS) project.

He discussed the key and complimentary roles that the Student Experimental Farm, SAREP, the Sustainable Agriculture Farming Systems (SAFS) project, the Long Term Research in Agricultural Systems (LTRAS) project and others have played at UCD. He reported on the recently released report by the UCD College of Agricultural and Environmental Sciences on sustainable agriculture at UCD released in 2003 and available online at www.aes.ucdavis.edu/AcadProg/SustAgCmte.htm. In looking to the future, Horwath highlighted the need for multidisciplinary, long-term collaborative efforts and creative but grounded

educational approaches that will support the next generation as they work to develop sustainable food and agricultural systems.

An undergraduate and graduate seminar course linked to the speaker series was held with additional discussion sessions. See the SAREP Web site for more details and video archives www.sarep.ucdavis.edu/seminar/.

MEMBERS OF THE UC DAVIS COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCES SUBCOMMITTEE ON SUSTAINABLE AGRICULTURE SPEAKER SERIES:

Janet C. "Jenny" Broome, associate director, SAREP (chair)

Chris van Kessel, chair and professor, Department of Agronomy & Range Science

William Horwath, associate professor, Department of Land, Air, and Water Resources

Leisa Huyck, Sustainable Agriculture Farming Systems/IA Conservation Tillage project

Karen Klonsky, extension specialist, Department of Agricultural and Resource Economics

Wolfgang Pittroff, assistant professor, Department of Animal Science

Kate Scow, professor, Department of Land, Air, Water Resources; director, Kearney Foundation of Soil Science

SAREP-funded methyl bromide alternatives highlighted at conference

by Jenny Broome, SAREP

The “2003 International Research Conference on Methyl Bromide Alternatives and Emissions Reductions” in San Diego in November included a session on SAREP-funded methyl bromide alternative projects. The annual conference, sponsored by Methyl Bromide Alternatives Outreach, in cooperation with the Crop Protection Coalition, the U.S. Environmental Protection Agency, and the U.S. Department of Agriculture, is devoted to the sharing of information on current and ongoing research into methyl bromide alternatives.

More than 400 international researchers, growers and others attended the gathering, which featured sessions concerning research on alternatives to methyl bromide for preplant, post-harvest, and structural uses, international concerns, and California and Florida issues.

Under the Clean Air Act and the Montreal Protocol, production of methyl bromide, a widely used fumigant in agriculture and forestry, will soon be phased-out due to its ozone-depletion qualities. Efforts are continuing to develop and implement economically viable and environmentally sound alternatives. Since 1994, agricultural and forestry researchers from governmental, academic and private institutions, as well as extension agents and users, have gathered together at the annual forum to share information on a variety of laboratory, field, and on-farm research and technology transfer topics.

SAREP Associate Director **Jenny Broome** moderated the session “Pest Monitoring and Stress Avoidance in Crop Production Systems,” featuring presentations by principal investigators from UC Davis, including **John Duniway**, UCD plant pathology department, and **Greg Browne**, USDA-Agricultural Research Service/UCD plant pathology department. In addition, a poster presented by **Clyde Elmore**, UCD

vegetable crops/weed science department, outlined results of the joint work conducted by Elmore and **James MacDonald**, UCD plant pathology department, and others. (See summaries of these projects in “Methyl bromide alternative results for strawberries,” p.1)

Other research results presented at the conference included the following biological approaches of potential interest to our readers:

- Work in Morocco on grafting tomato plants onto rootstock with resistance to Fusarium, Verticillium, Pseudomonas, Meliodogyne, Pyrenochaeta species, and Tobacco Mosaic Virus. The rootstock (*L. hirsutum* x *L. esculentum*) is known as Beaufort or Big Foot RZ or King Kong RZ. The study compared this novel system where researchers planted 10,000 plants per hectare grafted with two stems per plant to ungrafted plants grown at 20,000 plants per hectare in covered production systems in Morocco. They found higher costs but also higher yields that resulted in the system paying for itself. Yields ranged from 134 to 174 tons per hectare. In Morocco, currently 25 percent of tomato production is grafted (950 ha out of 3800 ha). The research was highlighted in a recent report by the United Nations Environment Program, available on-line at www.uneptie.org/ozonation/library/tech/mbcasest.pdf
- UC Cooperative Extension farm advisor **Oleg Daugovish** and colleagues presented work on the biofumigation potential of mustards used in crop rotations with lettuce and celery to control *Scerotinia minor*, citrus nematode (*Tylenchulus semipenetrans*), and various weed species. Oriental mustard (*Brassica juncea*) and yellow mustard (*Sinapis alba*) suppressed nematodes, while only oriental mustard reduced

Sclerotinia minor sclerotia growth. In the treatments with oriental mustard, lab examination of sclerotia of the pathogen, revealed them to be covered with a biocontrol fungus, *Trichoderma* sp. No weed suppression was observed in the field, but in the lab aqueous extracts of the oriental mustard completely inhibited germination. There is a need to identify specific allelochemicals responsible for the effects and also determine the concentrations needed to be effective in the field. The biofumigation may well be a combination of direct kill based on the isothiocyanates present as well as a selection of indigenous biological control agents that can survive the chemicals and multiply rapidly in the soil after fumigation. See abstract 6-1 and also www.ceventura.ucdavis.edu.

- Mycofumigation work was presented by **Nina Zidack** of Montana State University. *Muscodor albus* is an endophytic fungus isolated from a cinnamon tree in Honduras that can kill other microorganisms via production of volatile microbiocidal compounds. *M. albus* and other species of Muscodors produce seven different chemicals; one is naphthalene that is repellent to certain insects. These fungi produce alcohols, esters, ketones, acids, and lipids, which can reduce growth of pathogenic fungi; esters seem to be the most inhibitive. Substrates used to produce the *M. albus* mycofumigant influence the gases released; particular substrates can stimulate the fungus to produce more of the active compounds. Researchers looked at its effectiveness in potato field experiments and found the mycofumigant as effective as the standard chemical controls for control of *Verticillium dahlia* and Rhizoctonia stolen canker. They

also found seedling diseases caused by *Aphanomyces* and *Pythium* species reduced in sugar beet microplots. These researchers and scientists at Davis-based Agraquest are studying the effects of the mycofumigant on nematodes, smuts, post harvest pathogens on fruit, several vegetable diseases, and decontamination of human waste. (Agraquest has submitted a production registration package to US-EPA for a reduced risk product, Arabesque Biofumigant, with *M. albus* as its active ingredient.) Researchers are also looking into the identification and exploitation of water-soluble antimicrobial compounds produced by *M. albus*.

In addition to research on alternatives to methyl bromide, policy issues related to the regulation of ozone-depleting chemicals were discussed. The Montreal Protocol does allow for some Critical Use Exemptions (CUE) for agricultural uses of methyl bromide past the January 2005 phase-out date. The CUE requests must specify the quantity, be for a specific time period (one year), and only for agricultural uses where it is determined that there are no economic or technically feasible alternatives. In addition, applications for CUEs must describe steps taken to minimize use, minimize emissions, address recycling and stockpiling issues, as well as efforts to secure alternatives. In mid-2002, several U.S. commodity organizations submitted Critical Use Nominations (CUN) requesting CUEs to the US-EPA. US-EPA staff consulted weekly with appropriate USDA scientists in evaluating the CUNs and the industry's assessment of the technical feasibility and economics of potential alternatives to methyl bromide in specific cropping systems in the U.S. The US-EPA then submitted the U.S. request for CUEs to the United Nations Environmental Program (UNEP) in January 2003 through its Technology and Economic Assessment Panel's (TEAP) Methyl Bromide Technical Options Committee (MBTOC). The MBTOC reviewed the requests and then made recommendations to the parties (countries) that signed the Montreal Protocol.

The final decision on these requests was expected to occur at the 15th Meeting of the parties to the Montreal Protocol, Nov. 10-14 2003, in Nairobi, Kenya. However, at this meeting delegates decided they needed more time to discuss complex questions related to these exemption requests for countries in the developed world. The UNEP has now scheduled an "extraordinary meeting," in Montreal in March 2004. Crops/uses for which CUEs were requested include strawberry, cucurbits, eggplant, pepper, tomato, sweet potato, cut flowers, nursery, orchard replant, commodity storage, and food processing, predominantly in North America, Australia, and Europe. The applicants had argued that the current available alternatives are not technically or economically feasible. They had asked parties to the Montreal Protocol for exemptions that amount to approximately 15,000 tons of methyl bromide for the year 2005, of which the U.S. requested almost 10,000 metric tons. The amount requested by the U.S. represents 39 percent of its baseline amount or nine percent more than is currently allowed. Delegates to the meeting felt they needed more time to find an agreement that balances the interests of growers and other users of methyl bromide with international agreements to repair the Earth's protective ozone layer that filters out harmful levels of ultra violet light from the sun.

For more information on the Montreal Protocol and Critical Use Exemptions please see www.unep.org/ozone/index-en.shtml.

For further information on research projects into alternatives, as well as an up-to-date summary of the science behind the phase-out and the process for the phase-out, please see the *2003 Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions—Conference Proceedings*, available in PDF format at <http://mbao.org/2003/mbrpro03.html>. SAREP contributed funding to help support the work presented in abstracts # 44, 44A, and 112.

New campus/ statewide collaboration bears fruit

SAREP collaborated with the UC Davis Sustainable Agriculture Farming Systems (SAFS) project on SAFS' December 2003 newsletter report on the completion of its first phase and the beginning of its new focus. SAFS is an effort established at UCD in 1988 by a multidisciplinary team of researchers, farmers, and farm advisors to study the transition from conventional to low-input and organic systems. The project's new focus is the examination of conservation tillage in various cropping systems.

SAFS' newsletter was produced as a part of a grant from CALFED, a consortium of federal and state agencies that includes in its charge the restoration of the ecosystems of watersheds feeding into California's Bay-Delta watershed. The California Department of Food and Agriculture (CDFA) and Unilever Bestfoods Corporation, a major buyer of California processing tomatoes, also support SAFS' new focus. The three organizations are interested in questions raised by the first 12 years of SAFS research that indicate alternative farming practices could make a significant contribution to solving problems and concerns of California growers, consumers and policymakers.

Jenny Broome, SAREP associate director, helped establish the cooperation with SAFS. **Lyra Halprin**, SAREP public information representative, edited the SAFS newsletter, while **Linda Fugitt**, SAREP office manager, coordinated the mailing and is producing a PowerPoint presentation for the project. **James Cannon**, SAREP computer resource specialist, has updated the SAFS Web site (<http://safs.ucdavis.edu>).

SAREP looks forward to continuing the cooperation through a more formal agreement to cover the next three years.

METHYL BROMIDE CONTINUED FROM PAGE 1



Bacterial inoculum used in John Duniway's strawberry root health project is prepared in the lab for transfer to the field. (photo by Jianjun Hao)

(Vol. 15, No. 2, www.sarep.ucdavis.edu/newsletter/v15n) publicized the results of three projects funded by SAREP on environmentally sustainable alternatives to methyl bromide. The three summaries presented here constitute the remainder of the projects funded through this effort. Overall, it appears that there is no single alternative for the use of methyl bromide that is both as effective and economical. Rather, the SAREP-funded research indicates that a matrix of alternatives is necessary to manage pests currently controlled by methyl bromide within California farming systems. In addition to the SAREP funded research, from 1993 through 2002, the USDA-ARS has estimated that they have spent \$135.5 million to develop alternatives to methyl bromide. Through their competitive grants programs, USDA has provided an additional \$11.4 million to state universities for research and outreach. This research is ongoing, as there is a continued urgent need to develop and evaluate effective, economical alternatives to the agricultural use(s) of methyl bromide as a pre-plant soil fumigant and postharvest commodity treatment.

For further information on research projects into alternatives, as well as an up-to-date summary of the science behind and the process for the phase out, please see the 2003 Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions—Conference Proceedings, available in PDF format at mbao.org/2003/mbrpro03.html. SAREP partial funding supported the work presented in abstracts # 44, 44A, and 112.

MICROBIOLOGICAL IMPROVEMENT OF ROOT HEALTH, GROWTH AND YIELD OF STRAWBERRY

Principal Investigator: **John Duniway**, UC Davis plant pathology department. Cooperator: **Kirk Larson**, *Submitted September 2002, Updated May 2003 and again in December 2003 from the abstract for presentation at the annual International Research Conference on Methyl Bromide Alternatives and Emission Reductions # 44-1.*

Objectives

The research objective was 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. While no individual microorganism or combination of beneficial microorganisms is likely to reproduce the large yield increases obtained by methyl bromide/chloropicrin fumigation of soil, evidence was found that inoculations with specific microorganisms are likely to increase yield significantly. These increases are most likely to be useful when combined with alternatives to methyl bromide, including fumigants other than methyl bromide. Candidate microorganisms are available commercially, but more likely to succeed are microorganisms isolated recently from roots of strawberry plants growing in fumigated soils in California. The approach was to use these microorganisms, which were found to promote growth of strawberry plants in the greenhouse, to inoculate plants grown for berry production in the field. Methods of field application were researched, and resulting growth and yield responses of strawberry measured, relative to those obtained by normal farming practices with and without fumigation. The educational objectives were to help demonstrate mechanisms by which strawberry responds to soil fumigation and to scientifically explore, with grower involvement, the feasibility of using biological agents to help improve strawberry health and yield.

Summary

Researchers continued to sample field sites throughout the project period for additional isolates of rhizosphere bacteria, and to test their effects on the growth and health of strawberry plants in the greenhouse and growth chambers. In the last two years, investigators improved their screening efficiency by testing bacteria for inhibition of several pathogenic fungi in culture. Several new isolates with beneficial activity were found and some were tested in the field.

In each of the three years of the grant, several bacteria (and sometimes specific fungi) were used to inoculate strawberry plants in replicated field experiments. These were done at the Monterey Bay Academy (MBA), Watsonville, and at the UC South Coast Research and Education Center (SCREC), Irvine. Three bed fumigation

treatments were applied each year at MBA, i.e., a standard rate of methyl bromide/chloropicrin (MBC), a low rate of chloropicrin (Pic), and not fumigated. Plants were root-dip inoculated at transplanting; some were reinoculated periodically during crop growth. While MBC fumigation approximately doubled strawberry yields, none of the inoculation treatments increased yields significantly in MBC-treated soil and very few did so in nontreated soil. In contrast, several of the bacteria tested increased yields in soil treated with a low rate of Pic at MBA, and some of these increases were statistically significant. Reinoculation during crop growth did not enhance the effects of the bacteria. Additional experiments were done in the last two years at MBA using the variety Aromas and nonfumigated soils. A few of the bacteria tested reduced the incidence of Verticillium wilt in 2001 and two isolates increased yields in 2002. Aromas appears to be more responsive to bacterial inoculations than Selva.

Sections of the ground used in 1999-2000 at SCREC were broadcast-fumigated with MBC or were left untreated. Bare-root Camarosa runner plants were obtained from a high elevation nursery and Camarosa plug plants were propagated by Kirk Larson. In 2000-01 ground at SCREC, which was new to strawberries, was bed-fumigated with MBC, Pic, or not treated, and in 2001-02 beds were fumigated with MBC, metam sodium, or were not treated. The field used in 2001-02 had a history of strawberry production. Rhizosphere bacteria were used to inoculate bare-root transplants only at the time of planting. The effects of the soil fumigation and inoculation treatments on plant size at SCREC were variable, but fumigation generally increased yields significantly on ground with a history of strawberries. One bacterium increased growth significantly in Pic- and non-treated soils, while two did so following metam sodium treatment of soil. The use of plug plants in 1999-2000 had only small and variable benefits relative to bare-root transplants.



Strawberry bare root plants are inoculated with bacteria in the field. Duniway's project is comparing the vigor of inoculated plants to those planted in fumigated fields. (photo by Jianjun Hao)

The main aspects of these experiments were repeated at MBA in 2002-03 with additional bacterial isolates from strawberries, and with support from the California Strawberry Commission.

Fumigation treatments were applied to preformed beds and included shank-applied MBC at 325 lb/a, drip-applied Pic at 200 lb/a, drip-applied Vapam at 70 gal/a, and a nontreated control. Five isolates of bacteria were used to inoculate transplants, some of which were beneficial in previous field experiments and some that had been tested only in the laboratory and greenhouse. The strawberry varieties Camarosa and Aromas were used. On MBC-treated soil, most isolates increased the berry yields of Camarosa but had small effects on the yield of Aromas. Bacterial effects on berry yields on Pic- and non-treated soils were smaller than before in both varieties. On Vapam-treated soil, however, one isolate increased the yield of Camarosa and two isolates increased the yield of Aromas significantly.

In the 2002-03 crop cycle, researchers found that marked strains (antibiotic resistant) do colonize soil and roots following inoculations, with high numbers on both older and new roots up to two months after inoculation. Dispersal of marked strains appeared vertically downward from the points (tested at about 10 cm). At five months, plants were nearly fully grown and there were still fairly high numbers of inoculated bacteria on roots at shallow depths, but low numbers deeper in soil. There was no spread laterally at the 10 cm distance tested.

Bacterial growth and yield promotion of strawberry following inoculation in the field was variable and depended on soil fumigation treatment, as well as isolate, strawberry variety, and probably location. The researchers are continuing to further characterize bacterial isolates from strawberries with the greatest beneficial activities, and to further optimize bacterial colonization and yield promotion of strawberries in field experiments.

Continued on next page

METHYL BROMIDE CONTINUED FROM PREVIOUS PAGE

CONTAINERIZED STRAWBERRY TRANSPLANTS AS A REPLACEMENT FOR METHYL BROMIDE SOIL FUMIGATION IN CALIFORNIA STRAWBERRY NURSERIES

Principal Investigators: **Kirk Larson**, UC Davis pomology department. *Submitted September 2002.*

Objectives

Annual plantings of pathogen-free strawberry transplants are the basis for high productivity and successful strawberry IPM programs in California, and the state produces more than 900 million strawberry transplants annually. In California, propagation of strawberry transplants for fruit production entails at least three field propagation cycles, with the final propagation phase conducted in high elevation (HE) nurseries in northeastern California. In this HE region, exposure to chilling temperatures (< 7°C) and short days in late summer and early fall results in transplants that produce greater yields and larger fruit with better appearance scores compared to low elevation (non-conditioned) plants. To ensure production of pathogen- and nematode-free transplants, strawberry nurseries fumigate the soil prior to each propagation cycle with mixtures of methyl bromide (MB) and chloropicrin (CP). The impending ban on MB requires development of alternative technologies for strawberry transplant production. Compared to MBCP, alternative fumigants are more difficult to use and less effective in controlling soilborne pathogens, and crop rotations provide ineffective control of serious pests and pathogens in strawberry nurseries.

The use of containerized transplants (“tray plants,” “plug plants,” or “plugs”) produced in disease-free, soil-less media has been suggested as an alternative to MB nursery soil fumigation, but information on plug propagation methods for California’s unique production system is unavailable. In addition, because plugs are not widely used in California, information on plug produc-

tivity and fruit quality is also lacking. Research is needed to determine: 1) cost-effective methods for strawberry plug propagation, 2) appropriate methods for conditioning strawberry plugs to maximize fruit quality and yield, and 3) plug performance (yield, fruit quality) in the state’s major strawberry production regions.

Summary

Containerized strawberry plants (“plugs”) are readily produced without soil fumigation, but little information is available for optimizing plug plant production and performance under California conditions. Although strawberry plug plants can be established with less irrigation water and enter into fruit production sooner than bare-root plants, plugs have relatively high production and transportation costs, and plug plants in California often produce a high proportion of off-grade (small and misshapen) fruit late in the season. This inferior quality fruit has low market value and high harvest labor costs.

This research has focused on developing protocols for producing high-quality strawberry plugs that have performance characteristics similar to, or better than, conventional (field-grown) nursery planting stock. By propagating runner tips at about two week intervals from mid-July to mid-August and using different container (cell) sizes, researchers have been able to compare the effects of plug plant size and plug physiological maturity on plug plant yield performance. To compare the effect of conditioning environment on yield performance, investigators propagated plug plants at a low elevation (LE) nursery site in Redding, Calif. in 1999 and 2000, and then conditioned a subset of these plugs at a high elevation (HE) nursery site (Macdoel, Calif.) for three to four weeks prior to transplanting. In the third year of trials, researchers propagated and conditioned plug plants at both HE and LE, thereby lengthening the HE conditioning period. Yield performance for all plant material then was



Containerized strawberry transplants grown in different soil and conditioning environments are compared to conventional bare-root transplants in Kirk Larson’s project. (photo by Kirk Larson)

assessed under commercial strawberry management systems typical of the farming practices in those regions.

In these trials, the effects of cell size and nursery environment on plug yield performance varied somewhat from year to year, but results demonstrated significant effects of rooting date, plug cell size and nursery environment on early season (December-March) yield performance, and early and total season fruit quality (fruit size and shape) in most years. Early rooting date (July), use of a large plug cell size, and HE conditioning generally maximized early season yields compared to later rooting dates, smaller cell size and LE conditioning. Compared to LE conditioning of plugs, HE conditioning also resulted in increased fruit size and fruit appearance scores. Compared to conventional bare-root transplants, HE plugs generally produced greater early-season yields but had reduced fruit quality (i.e., reduced size and appearance scores). However, in the third year of the investigations, propagation and conditioning of plugs at HE resulted in fruit quality equal to that of conventional transplants and yields that were superior to either conventional transplants or LE conditioned plugs. There was little or no difference in total yield (December-June) among bare-root plants and plugs in most years.

Also during two years (1999-2001), yield performance of plug plants vs. bare-root transplants was assessed in the Central Valley at the UC Davis Pomology Department's Wolfskill Experimental Orchards in Winters. In both years, plug plants yielded less than conventional plants, and had significantly reduced fruit size and fruit appearance scores.

In additional trials conducted over a two-year period (1999-2001), yield performances of plug and bare-root transplants were evaluated in fumigated and nonfumigated soil in Irvine. In the 1999-2000 production season, plants established in fumigated soil out-yielded plants in nonfumigated soil, and there was no effect of plant type (plug vs. bare root) on yield, and no interaction between soil treatment and plant type. In the 2000-01 production season, an identical trial was established on a site that had been cropped only in barley during the previous 20 years. For this trial, both plug plant and bare-root plant yields were identical, and there was no effect of soil fumigation.

ACETALDEHYDE AND CARBON DIOXIDE FOR POSTHARVEST CONTROL OF ARTHROPODS ON STRAWBERRY FRUIT

Principal Investigator: **Elizabeth Mitcham**, UC Davis plant pathology department. Submitted October 2001.

Objectives

1. Determine the efficacy of acetaldehyde fumigation alone and in combination with carbon dioxide to kill western flower thrips and two-spotted spider mites.
2. Determine the affect of fumigation with acetaldehyde and carbon dioxide on strawberry fruit quality and postharvest life.
3. Demonstrate the commercial feasibility of the treatment within existing methyl bromide fumigation facilities.

Revisions to Original Objectives

1. In addition to acetaldehyde, researchers included tests with ethyl formate on both western flower thrips and two-spotted spider mites.

2. A repeated exposure technique with acetaldehyde was developed to determine if target pest mortality could be enhanced without significant fruit quality loss. Strawberry fruit was also exposed to ethyl formate, and effects on fruit quality were evaluated.
3. Research has not yet resulted in a commercially feasible treatment, and therefore has not been tested in a large-scale fumigation facility.

Summary

Methyl bromide fumigation is used prior to shipment of California strawberries to Japan and Australia. Methyl bromide will be phased out for soil fumigation in 2005 under the Clean Air Act and the Montreal Protocol. While there is currently an exemption for postharvest and pre-shipment uses, methyl bromide will likely be more difficult and expensive to use in the future. The value of the export market to Australia is more than \$1.3 million and to Japan is more than \$18 million. Alternatives to methyl bromide for postharvest insect and mite control on strawberry fruit are limited because of the perishable nature of the commodity. Natural fruit volatiles have been tested for efficacy against various insect pests.

Plant volatiles such as acetaldehyde (Aa) and ethyl formate (EF) have been shown to have varied effects on fruit quality parameters and have been demonstrated to have fungicidal and insecticidal properties. This study explored the possibility of using Aa and EF for postharvest disinfestation of western flower thrips and two-spotted spider mite on harvested strawberries.

Dose response curves for western flower thrips and two-spotted spider mites were developed for exposure to Aa. Strawberry fruit treated with 0, 1, 2, 3, or 4% Aa in air or in CO₂ and stored at 0°C or 20°C were evaluated for changes in fruit quality. Volatile compounds in strawberry juice after treatment were also quantified. A repeated exposure technique was developed to determine if low concentrations of Aa had less impact on fruit quality.

Western flower thrips were susceptible to Aa; however, quarantine levels of control were not achieved. Two-spotted spider mites were more resistant to Aa than western flower thrips and concentrations necessary to elicit high mortality were well above those tolerated by strawberry fruit.

Acetaldehyde concentrations >3% caused calyx browning and drying. Initially, fruit exposed to 2, 3, or 4% acetaldehyde in the presence of 20% CO₂ showed slightly less calyx damage than fruit exposed to acetaldehyde in air, however, after 24 hours, there were no significant differences.

Repeated exposures to low concentrations of Aa improved fruit tolerance to the treatments but did not maintain the same level of target pest mortality as a single, high dose of Aa. Acetaldehyde is readily absorbed and metabolized by strawberry fruit and was rapidly reduced to ineffective concentrations for control of target pests in the presence of strawberry fruit under the conditions of the experiments.

Strawberry fruit and target pests were exposed to varying concentrations of EF in treatments utilizing both single and multiple exposures. Although EF was toxic to both target pests, concentrations necessary for complete control of two-spotted spider mite were well above those tolerated by strawberry fruit.

While neither Aa or EF appear particularly promising for postharvest insect control in strawberry, the information gained in the research may lead to a new quarantine treatment for other commodities.

Note: Results of Mitcham's work on postharvest strawberry pest control have been recently published. Please see: Simpson, T., V. Bikoba and E. Mitcham. 2003. Effects of acetaldehyde on fruit quality and target pest mortality for harvested strawberries. Postharvest Biology and Technology 28(3):405-416.

DIAL, BROWSE ATTRA'S BILINGUAL FREE RESEARCH

Free research and information for farmers across the U.S. has been available from Appropriate Technology Transfer for Rural Areas (ATTRA) since 1987. ATTRA's 30 specialists have prepared reports on more than 150,000 topics for callers on a variety of sustainable farming topics. Because it is funded through the USDA Rural Business Cooperative Service, all ATTRA research services are free. Now available in Spanish as well as English, the one-on-one service has helped thousands of farmers, ranchers, extension agents, farm-based businesses and farm organizations via a toll-free telephone line (800-346-9140 or 800-411-3222 for Spanish) and through its Web site at <http://attra.ncat.org>. ATTRA, which is a project of the National Center for Appropriate Technology, also offers more than 150 free publications on a wide range of topics.

RESOURCE ON FEDERAL PROGRAMS

Federal Sustainable Agriculture Program Primer, The National Campaign for Sustainable Agriculture. The Primer is a compilation of information on the programs and policies that the National Campaign and partner organizations have helped to develop and/or get funded over the years. It provides descriptions and access information about each program, including application deadlines and criteria for eligibility. It is available at <http://www.sustainableagriculture.net/primer.php>.

PRINT PUBLICATIONS

ORGANIC GARDENING TEACHING MANUAL

Teaching Organic Gardening and Farming: Resources for Instructors, University of California, Santa Cruz Center for Agroecology and Sustainable Food Systems, 600 pages, 2003. This manual reflects 35 years of experience teaching organic farming and gardening to apprentices at UC Santa Cruz's Farm and Garden Apprenticeship program. It covers practical aspects of organic farming and gardening, applied soil science, and social and environmental issues in agriculture. Units, which are designed for a three-ring binder, contain lecture outlines for instructors and students, field and laboratory demonstrations, assessment questions, and resource lists and can be used by colleges, urban and community agriculture programs, farms with internships, agriculture extension stations, school gardening programs, Peace Corps, USAID, and master gardener programs. To order, send a \$45 check payable to UC Regents and your mailing address to CASFS, 1156 High St., Santa Cruz, CA 95064, attn: Teaching Manual, or download a free PDF of the manual at <http://zzyx.ucsc.edu/casfs/training/manual/index.html>.

BLENDING AG WITH PEOPLE

Agri-Culture: Reconnecting People, Land and Nature, by **Jules Pretty**, University of Essex, 280 pages, 2002. Despite increased agricultural productivity in the last century, millions of people are hungry or malnourished. Jules Pretty, director of the University of Essex's Centre for Environment and Society, looks at examples of successful ecological agriculture and food systems throughout the world and suggests that it is time for the next agricultural revolution—blending food and agriculture systems harmoniously with people, their societies and cultures. Aimed at policy makers, scholars and farmers, the paperback edition is \$24.95, available in the U.S. through Stylus Publishing, LLC, PO Box 605, Herndon, VA 20172-0605; fax: (703) 661-1501; email: stylusmail@presswarehouse.com, or in the United Kingdom through Earthscan (www.earthscan.co.uk).

ONLINE GUIDETO DIRECT MARKETING

SAREP announces the release of a new online *Guide to Educational Resources on Direct Marketing*. The Web-based guide is a searchable, annotated listing of information resources on topics related to farmer direct marketing. It focuses on resources that are practical, of high quality, and relevant to a broad audience, including farmers and ranchers, Cooperative Extension personnel, state NRCS and USDA personnel, and community groups. Topics include farmers markets, community supported agriculture, farm-to-school/selling to institutions, direct marketing livestock, selling to restaurants, and more. Resources include print materials (books, manuals, bulletins), videos and Web references. Guide listings include a brief item description directions on how to obtain it. Authors: **David Chaney, Gail Feenstra,** and **Jeri Ohmart**. Access the guide at www.sare.org/htdocs/dmrg/.

BioScience article

SAREP associate director **Janet C. "Jenny" Broome** is the co-author of "Rethinking the Vision for Environmental Research in US Agriculture" in the January 2004 (Vol. 54, No. 1) edition of the journal *BioScience*. The authors call for a new vision for environmental research in agriculture—"one that is anticipatory; promotes long-term, system-level research at multiple scales; better incorporates important interactions between the biophysical and social sciences; and provides for the proper evaluation of deployed solutions." Co-authors are **G. Philip Robertson, Elizabeth A. Chornesky, Jane R. Frankenbeger, Paul Johnson, Mark Lipson, John A. Miranowski, Elizabeth D. Owens, David Pimentel,** and **Lori Ann Thrupp**.

EPA GRANTS FOR FQPA TRANSITION

The U.S. Environmental Protection Agency (EPA) Region 9 (California, Nevada, Arizona, Hawaii, Pacific Trust Islands) is continuing a grant program to help implement the Food Quality Protection Act (FQPA) and support “transition” efforts by growers to more environmentally-sound pest management practices. Special emphasis will be on sustainable agriculture programs that address a diverse array of commodities and have a proven track record of grower participation and adoption of sustainable pest management practices. Successful applicants will also have an applied research and extension component to their program. State agencies, universities, Cooperative Extension, Tribes, and non-profit organizations are eligible to submit proposals. The grants will be awarded in two sections; approximately \$200,000 will be awarded as one large grant to an eligible applicant in California, with an additional \$200,000 will be available for small grant awards up to \$50,000. In addition, EPA is making \$70,000 available for a pilot project that addresses regional

air and/or water quality concerns, and leverages USDA funds from one of the conservation program resources such as the Environmental Quality Incentives Program (EQIP). Proposals must be received by April 5, 2004. Contact **James Liebman** at Agriculture Initiative, (415) 947-4241, or liebman.james@epa.gov. To view the grant applications on the Web, see Large Grants (up to \$200,000): www.epa.gov/pesticides/grants/fqpa-large.html; Small Grants (up to \$50,000): www.epa.gov/pesticides/grants/fqpa-small.html.

ORGANIC RESEARCH GRANTS

The Organic Farming Research Foundation is offering research grants of up to \$15,000 for organic farming research and related topics. Deadlines for proposal consideration are December 15 (a change from the previous January deadline) for the spring funding cycle and July 15 for the fall funding cycle. For more information see OFRF's Web site (www.offr.org), call 831-426-6606 or email research@offr.org.

ORGANIC RESEARCH & EXTENSION INITIATIVE

The 2002 Farm Bill mandated \$15 million for the Organic Agriculture Research and Extension Initiative to be spent at \$3 million a year from FY 2004 to FY 2008. The program will be managed at the USDA Cooperative State Research, Education, and Extension Service (CSREES). CREES Requests for Applications are expected to be available in April 2004. Farmers may apply independently, but are strongly encouraged to have a county Extension Specialist connection to a university or other institution. For more information, contact **Tom Bewick** at tbewick@csrees.usda.gov or 202-401-3356. The Web site is www.reeuda.gov/pestmgt/org/organic.htm.

FERTILIZER RESEARCH AWARDS

The California Department of Food and Agriculture's (CDFA) Fertilizer Research and Education Program (FREP) is accepting project suggestions to advance the environmentally safe and agronomically sound use and handling of fertilizer materials. Projects may focus on research, demonstration and/or education activities. A project limit of \$50,000 per year is suggested, but larger projects will be considered. Project suggestions are due April 6, 2004; the Request for Proposals will be released in May 2004, with proposals due in June.

Topics areas include crop nutrient requirements; fertilization practices; irrigation interactions; site-specific fertilizer technologies; development, testing and demonstration of the use and benefits of practical field monitoring tools; nutrient/pest interactions and nutrient/ growth regulator interactions; composts and cover crops; and education and public information.

Any individual or group is eligible to submit project suggestions. Projects must be relevant to California conditions. For more information, contact **Ken Kitade**, CDFA/FREP, 1220 N St., Sacramento, CA 95814-5607; (916) 445-0444; kkitade@cdfa.ca.gov. Web site: www.cdfa.ca.gov/is/frep.

WEB SITE FOR ALL FEDERAL GRANTS

www.grants.gov

A new single Web site with information about finding and applying for all federal grant programs is now available. The Web site, **Grants.gov**, makes it easier for organizations to learn about and apply for federal grants. It includes information about more than 900 available grant programs involving the 26 federal grant-making agencies that award a total of more than \$350 billion in grant funds. The site provides information in a standardized format across agencies and includes a “Find Grant Opportunities” feature to help applicants find potential funding opportunities. The site also contains an “Apply for Grants” feature that simplifies the application process by allowing applicants to download, complete and submit applications for specific grant opportunities from any federal grant-making agency. To date, application packages have been posted to the Grants.gov Web site by five agencies—the U.S. Departments of Commerce, Education, Energy, Justice and Health and Human Services. Grants.gov is a collaborative effort involving Health and Human Services and the Departments of Agriculture, Commerce, Defense, Education, Homeland Security, Housing and Urban Development, Justice, Labor and Transportation, as well as the National Science Foundation.

CALENDAR

*SAREP WEB CALENDAR AND ONLINE COURSE

SAREP offers a regularly updated sustainable agriculture calendar on our World Wide Web site at: www.sarep.ucdavis.edu (click "Calendar" on top menu bar). Please feel free to add sustainable agriculture events. In addition, we offer an online course for pest control advisers and others titled *Ecological Pest Management in Grapes*. Up to 11 CE credits for California PCAs. See www.sarep.ucdavis.edu/courses/grapes/

*NATIONAL/INTERNATIONAL CALENDAR

The National Agricultural Library maintains a calendar as part of AgNIC at 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 sponsors informal monthly meetings for growers to discuss issues related to pesticide use reduction. Contact: Molly Johnson, (530) 756-8158, ext. 30, molly@caff.org; or Merrilee Buchanan, (831) 761-8507, merrilee@storypages.com; www.caff.org

MARCH

17, 25, 30 *Grapevine Powdery Mildew: Learning to Minimize Fungicide Use Seminars*, Madera (17th), Parlier (25th) or Kerman (30th). Sponsored by UC Cooperative Extension Fresno & Madera counties. Focus of identical free seminars is Information on technologies to control powdery mildew, save time & money. Topics: chemical powdery mildew biology, chemical methods of control, fungicide resistance, sulfur drift issues, UC Davis powdery mildew risk index. PCA and CCA credits applied for. Contact: Stephen Vasquez, UCCE Fresno, 559-456-7285, sjvasquez@ucdavis.edu or George Leavitt, UCCE Madera, 559-675-7879, gmleavitt@ucdavis.edu

24 *Avoiding Water Contamination & Pesticide Drift Workshop*, San Luis Obispo. Sponsors: UC Statewide IPM Program, UCCE San Luis Obispo County, San Luis Obispo County Dept. of Agriculture, San Luis Obispo County Farm Bureau, Cal Poly Dairy Science, USDA Natural Resources Conservation Service. Funded by CDFAs Buy California Initiative & USDA. For pesticide applicators & supervisors. 4-hr. workshop focused on practical tools. Demonstrations, on-farm tour, personalized checklists. English or Spanish sessions. \$25 for individuals or \$35 for supervisor-applicator pairs; includes materials, refreshments.

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. SUSTAINABLE AGRICULTURE is published three times yearly by SAREP staff from its UC Davis offices, with assistance from Circle Design, Sacramento. Mailing address: UC Sustainable Agriculture Research & Education Program, University of California, One Shields Ave., Davis, CA 95616-8716. Internet: www.sarep.ucdavis.edu Email: sarep@ucdavis.edu Telephone: (530) 752-7556. Material in this publication may be reprinted with credit, except articles that have been reprinted from other publications.



The University of California prohibits discrimination against or harassment of any person employed by or seeking employment with the University on the basis of race, color, national origin, religion, sex, physical or mental disability, medical condition (cancer-related or genetic characteristics), ancestry, marital status, age, sexual orientation, citizenship, or status as a covered veteran (special disabled veteran, Vietnam-era veteran or any other veteran who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized). University Policy is intended to be consistent with the provisions of applicable State and Federal laws. Inquiries regarding the University's nondiscrimination policies may be directed to the Affirmative Action/Staff Personnel Services Director, University of California, Agriculture and Natural Resources, 300 Lakeside Dr., 6th Floor, Oakland, CA 94612-3550, (510) 987-0096.

Download brochure at www.ipm.ucdavis.edu/IPMPROJECT/workshops.html or call 530-752-5273. PCA, QAC, QAL, & Private Applicator continuing education credit approved (2 Laws and 2 Other).

31 *Niche Markets for Meat Products Conference*, UC Davis Buehler Alumni Center. Sponsor: UC Cooperative Extension. For ranchers interested in grass-fed beef & other alternative markets (all species). Topics: business/marketing options, health claims/labeling, meat processing, dry aging, value-added products, alternative feedstuffs to supplement grass-based diets, cost studies. Chef/retailer panel: Chez Panisse Restaurant, Trader Joe's, Aidells Sausage Company. 9 a.m.-4:30 p.m.; \$60 pre-registration, \$70 day-of. Includes lunch, parking, handouts. Contact Roger Ingram, UCCE Placer/Nevada counties, 530-889-7385, rsingram@ucdavis.edu

JULY

13-15 *California Conference on Biological Control IV: Biocontrol and Organic Production*, Berkeley. Purpose: to promote biological control, facilitate contact between Calif. biological control practitioners & researchers. Focus: elements of biological control key to successful organic farming. Current practices, research/extension future needs for organic farming. Symposium on Day 3, co-sponsored by ANR Organic Farming Research Workgroup, CCBC IV. Contact: Lynn LeBeck, llebeck@nature.berkeley.edu, 559-360-7111, www.cnr.berkeley.edu/biocon/

SEPTEMBER

Society for Vector Ecology annual meeting, Boston. More information at SOVE Web site: www.sove.org; 909-340-9792, sove@northwestmosquitovector.org

OCTOBER

2-7 *International Congress of Vector Ecology*, Reno, Nev. More information at Society of Vector Ecology Web site: www.sove.org; 909-340-9792, sove@northwestmosquitovector.org

19-21 *USDA Northeast Sustainable Agriculture Research & Education (SARE) Program Conference*, Burlington, Vt. Focus on regional food systems, with workshops on marketing, ecological production, policy/planning, farmer profiles & and poster sessions, communications in the ag community. Farm tour Oct. 19, presentation of Patrick Madden Award honoring outstanding farmers. More information in spring at www.uvm.edu/~nesare/index.html.

SUSTAINABLE AGRICULTURE

Managing Editor: Lyra Halprin	lhalprin@ucdavis.edu
Education Coordinator: David Chaney	dechaney@ucdavis.edu
Associate Director: Jenny Broome	jbroomee@ucdavis.edu
Production Systems Analyst: Robert L. Bugg	rbugg@ucdavis.edu
Food Systems Analyst: Gail Feenstra	gwfleenstra@ucdavis.edu
Program Assistant*: Jeri Ohmart	jlohmart@ucdavis.edu
SAREP BIFS Coordinator: Bev Ransom	baransom@ucdavis.edu
Computer Resource Specialist (shared position): James Cannon	jhcannon@ucdavis.edu
Financial Manager: Joanna Luna	jluna@ucdavis.edu
Office Manager: Linda Fugitt	lfugitt@ucdavis.edu
Program Director: Sean L. Swezey	findit@cats.ucsc.edu

*grant-supported



SUSTAINABLE AGRICULTURE

COOPERATIVE EXTENSION
U.S. DEPARTMENT OF AGRICULTURE
UNIVERSITY OF CALIFORNIA
OAKLAND, CALIFORNIA 94607-5200
OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300
#6587

ADDRESS SERVICES REQUESTED

PRSR STD
U.S. POSTAGE
PAID
Davis, CA 95616
Permit #G-00268



Recycled and
recyclable.
Printed using
vegetable inks.

UNIVERSITY OF CALIFORNIA AND THE UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING