

Spring 1991

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Spring, 1991 (v3n3)

From the Director

Farm Survival

California farmers and ranchers continue to feel the results of Mother Nature's latest one-two punch: the freeze and the drought. Fiscal crises continue to affect rural counties' survivability.

With so many issues out of their hands, what can farmers do to make their own survival easier?

Reducing off-farm inputs is a theme we've addressed before. California is in a major transition. By planning for this and taking action farmers help set their own agenda. Increasing their reliance on internal resources and their own management skills will help. Farmers who take advantage of information the university system has to offer may be less damaged by the drought. (See **Drought & Sustainability** this page.)

Good basic soil management and preventative pest management is a starting point. Soil management may involve the use of biological material including green manures, manure, and compost. Many farmers may be able to avoid purchasing much of the nitrogen they thought they needed just by using what is still in their soil. Due to the lack of rain, most nitrogen in the soil last fall is probably still there. A simple soil nitrate test can confirm this. Other on-farm sources could include irrigation water and legumes in the rotation. If manures or composts are used as soil amendments, they also contribute nitrogen.

Creating biological diversity in farms and ranches can help reduce pest problems. Grass and legume covers do this by providing habitat for beneficials. Diversified farms offer growers some protection from crop-specific freezes or droughts. **Mas Masumoto** notes in an article on farms in transition (see page 10) that the chaos of changing water patterns can actually inspire creativity and innovation on the farm. Philosophical shifts can help farmers make decisions that may save their farms' economic viability. -*Bill Liebhardt, director, UC Sustainable Agriculture Research & Education Program*

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Spring, 1991 (v3n3)

New SAREP Publications

Sustainable Agriculture in California: A guide to Information, by Steve Mitchell and David Bainbridge is now in press. This updated and expanded (200 pages) version of our 1988 guide is aimed at helping farmers, ranchers, researchers, farm advisors, planners, gardeners and consumers find information about sustainable agriculture. It lists a wide variety of resources addressing the economic viability of farming and the effect of farm practices on the natural environment. Topics include pest management, farming systems, new crops, soil conservation, microclimates, agricultural engineering and equipment, crop rotations and water management and many others. The guide refers readers to libraries, organizations, books, journals and indexes and explains how to determine which libraries and electronic databases have an agricultural focus. It will be available for \$12.00 Many 15 from UC ANR Publications, University of California, 6701 San Pablo Ave., Oakland, CA 94608-1239, or call (415) 642-2431. Price includes postage and tax.

Proceedings/Sustainable Agriculture in California: A Research Symposium is also in press. It will be available May 15 from UC ANR Publications for \$15.00 (150 pages, ordering information above). These proceedings from the spring 1990 symposium highlight current progress in sustainable agriculture research and extension. Contents include: 1) selected papers from SAREP-funded research projects, as well as from invited speakers addressing special issues and topics; 2) 40 abstracts from the poster session; and 3) a transcript of the closing panel discussion featuring farmers Bruce Rominger, Yolo County and Brock Taylor, Contra Costa and Fresno counties, agricultural economist Suzanne Vaupel, and UC researcher and administrator James Lyons.

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Drought & Sustainability

by Dave Chaney & Chuck Ingels, SAREP

The current drought, possibly more than any other issue this century, raises serious questions about the sustainability of California agriculture. Concerns about economic viability, food safety, groundwater contamination, and farm labor health and safety have motivated both researchers and farmers to develop more environmentally sound, resource-enhancing production systems. But none of these can match the implications, anxiety and urgency of a severe drought.

Surface water supplies are the hardest hit and farmers in many irrigation districts are already feeling the pinch. Growers in some locations will receive 25 percent or less of their normal deliveries. The ramifications of these restrictions depend on the crop grown and on whether other sources of water are available. It is likely that in some areas, the acreage planted to field and vegetable crops will be drastically reduced. Already established orchards and vineyards require a certain amount of water to stay alive, but the chances of actually harvesting tree or vine crops will depend on growers being able to locate other sources of water.

Groundwater is the major alternative to decreasing surface supplies, but drilling a well can be very costly and take up to six weeks or more. Furthermore, as farmers increase groundwater pumping or drill additional wells the depth to groundwater gradually increases. This adds to the expense of drilling a well and compounds the groundwater overdraft problem. (Overdraft occurs when more groundwater is pumped than is replaced each year by percolation.) Among the side effects of overdrafts are the increased cost of pumping water and declining water quality.

Another reason the drought is a focal point for agricultural sustainability is the increasing tension between urban/industrial demands for water and agriculture. An indicator of this can be seen in estimates for changes in water use between the years 1985 and 2010 (Table 1). Overall, the demand for water is expected to increase by 4.2 percent during this period, largely in the urban sector.

Sector	1985	2010	% Change
	millions of acre feet		
Agriculture	27.7	27.4	-0.1
Urban	5.6	7.2	+28.9
Wildlife, Energy, Recreation	0.9	1.0	+10.0

Total	34.2	35.6	4.2
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Source: California Dept. of Water Resources Bulletin 160-87

Population growth in California will significantly increase municipal and industrial demands. In contrast, net water use in agriculture is estimated to decline slightly. This is based on the assumption that California agriculture may become somewhat less competitive in national and international markets. Water officials estimate that the demand in the year 2010 will outstrip supply by about 2.1 million acre feet. In a serious drought situation this deficit would be even greater.

The prospect of a very long-term drought compounds the problem even further. Historical data shows that we are faced with the distinct possibility of continued below average rainfall. In 1980 the California Department of Water Resources funded a study by the University of Arizona's Laboratory of Tree-Ring Research that showed a 50-year drought during the late 1700s and early 1800s (Figure 1).

Figure 1. Long Term Reconstructed California Precipitation not available

Precipitation was lower in each of these years than during the dry seven-year span from 1928 through 1934 which the DWR uses for planning projects with sufficient capacity to furnish a reliable water supply. Thus, California's water planning may be based on relatively optimistic estimates of drought conditions. (*Association of California Water Agencies, 1989*)

Another long dry period identified in the tree ring study included a 20-year period between 1865 and 1885, which wiped out the cattle industry in Southern California. Even if average or high rainfall years punctuate long drought periods, the basic problem remains: How to meet the water demands of agriculture and a growing population with limited supplies.

Water Wise Farmers

What can farmers and ranchers do to make the most of limited water supplies and increase the stability of their farming systems during drought periods? Based on recommendations by University of California researchers, there are several key points that apply to all farmers and ranchers. These include:

- Improve the receptivity of rainfall catchment areas.
- Enhance soil water infiltration and soil water holding capacity by increasing soil organic matter.
- Match water applications closely to crop needs.
- Improve the efficiency of irrigation systems.
- Reduce evapotranspiration with windbreaks.
- Try to begin the season with a full profile of soil water.
- Control weeds that could compete with the crop for valuable soil moisture.

Field, Vegetable Crops

In conjunction with the principles outlined above, there are three additional

recommendations that apply specifically to annual cropping systems.

1. **Plan ahead.** Determine what your water supply will be and then decide the acres that can be effectively irrigated with that amount of water. Use your best land for limited plantings.
2. **Crop selection and rotation.** Select crops and growing seasons which use less water. Winter grains, for example, use significantly less water than summer field and vegetable crops. If you plant during the summer, choose short season crops and varieties.
3. **Know the critical stress periods for your crops.** Table 2 provides that information for several field and vegetable crops. It is particularly important to avoid drought stress during these developmental stages.

Tree Crops

"Tree growers have more potential to minimize adverse effects of deficit irrigation on crop production than do field and row crop growers. This is due mostly to the greater separation between the vegetative and reproductive growth stages in trees." This is according to a document entitled *Irrigation Management for Fruit and Nut Trees Under 1991 Drought Conditions*, which is available through most farm advisor offices. The author is **Dave Goldhamer**, extension specialist at Kearney Agricultural Center, who has performed numerous water stress experiments on other nut and tree crops. Goldhamer also wrote a more extensive 1989 UC publication, *Drought Irrigation Strategies for Deciduous Orchards*.

There are specific periods in the growing season during which applied water can be reduced or withheld from tree crops without significant yield losses, according to Goldhamer. At other times, deficit irrigation can result in substantial loss in yields in either the current season, the following season, or both. These critical periods vary with each tree species, and the 1991 report suggests general strategies based on tree species. In general, the drought-sensitive growth stages are early season (bud break through fruit set), fruit growth and development, and postharvest.

CROP	CRITICAL PERIOD
Alfalfa	Just after cutting for hay and at the start of flowering.
Small grains	During crown root development and from heading to anthesis.
Beans/Peas	Flowering, pod setting period, and ripening.
Corn/Sorghum	During crown root development and at pollination.
Cotton	During early canopy development. Mild stress desirable during early boll growth.
Sugar beets	During canopy development.

Sunflower	Flowering and seed development stages.
Brassicas	During head formation and enlargement.
Lettuce	Just before harvest.
Potatoes	After formation of tubers, from bloom to harvest.
Radish	During the period of root enlargement.
Tomatoes	Flower formation and fruit enlargement.
Strawberries	Fruit development to ripening.
Melons	From blossom to harvest.

Source: *Drought Tips for Vegetable and Field Crop Production*. UC Agriculture and Natural Resources Leaflet No. 21466.

Early season. Early spring growth is needed to establish the fruiting wood for the following year's crop. It is therefore essential to supply adequate water early in the season; this is done by starting the season with a nearly full soil water profile.

Fruit Growth and Development. Adequate water is required during the rapid growth of fruits which exhibit a "double sigmoid fruit development pattern," but stress can be imposed during the "lag (stage 2) phase of growth." Generally, nut growth is less sensitive to water stress than fruit growth, but other yield and quality components may be affected.

Postharvest. With the exceptions of almond and apricot, "the period after harvest is generally most water stress tolerant."

Other considerations in a drought year include good irrigation scheduling and proper irrigation system design, according to Goldhamer. Also, young trees should be fully irrigated since the goal is to maximize vegetative growth to bring trees into bearing early. Finally, some growers may be considering very severe pruning in order to simply keep their trees alive. This will greatly reduce water use, but only at the expense of production for several years. An even more drastic step would be to cut off all scaffold branches at waist level, a practice known as "dehorning." Goldhamer advises using this measure only if eight acre-inches or less water are available for the season. This drastic step would probably not be needed on pistachio or walnut, and trees of some species, such as almond, may never recover to their full size.

Almond Research. Critical information has recently been developed on managing almonds with deficit irrigation. **Terry Prichard**, water management specialist in Stockton recently reported on first year results of a four-year irrigation study. In this experiment, yield was not affected by up to 50 percent deficit irrigation, although the number of stick-tight hulls at harvest increased significantly. Similarly, in the first year of an irrigation cutoff study performed by Goldhamer, hull-splitting was reduced as the length of the preharvest water cutoff interval in-creased. Yields of all cutoff treatments were similar, even alter two years. However, withholding the

postharvest irrigation resulted in significantly lower yields in all the cutoff treatments in the second year.

Range, Pasture

The following tips are from an article by Plumas-Sierra counties farm advisor **Holly George** (March 1991 newsletter):

Roots transport moisture and nutrients to growing plants. When plants are overgrazed, root growth stops; when root growth stops, leaf growth stops too.

Irrigated pasture management practices which encourage root and leaf growth are the same practices which allow plants to make the best use of soil moisture. They include:

- rotation grazing with adequate rest and regrowth periods
- leaving 4-6 inches of top growth at the end of each grazing period
- fertilizing properly
- applying irrigation water in the right amount at the right time.

Range and dry pasture forage production depends entirely on natural moisture. Overgrazing during a drought does more damage to perennial plants than during a season of normal moisture. It reduces plant vigor, stops root and leaf growth, reduces ground cover, and invites accelerated erosion. Once erosion begins, it tends to get worse each year, further reducing plant vigor and forage production. This process is difficult to reverse.

Rather than risk permanent damage to grazing resources:

- reduce livestock numbers to balance with forage supply
- cull herds more than normal
- sell calves and lambs early
- determine forage needs and buy needed supplements early
- grow small grains or sorghums for hay or pasture (these need less water than conventional forage crops)
- defer planting perennial pasture, hay, or range seedings until a year with more favorable water outlook
- keep spring developments, stock tanks, float valves, and pipelines in good working order so water is not wasted
- cover troughs and tanks to reduce evaporation
- prepare for hauling stock water
- give spring development high priority (even mediocre springs will be helpful)
- consider herding or other livestock distribution methods to make use of under-used areas
- don't overgraze or otherwise disturb streambank vegetation (it will be needed to prevent erosion, reduce sediment, and provide food and cover for wildlife)
- well-established seedlings can tolerate heavy use better than native range.

Wildlife will suffer during a drought as much or more than domestic livestock. The wildlife that shares your land is a valuable natural resource. To help wildlife:

- include additional features at stock water developments which will allow small animals and birds safe access to water (these are usually not expensive and are easily installed)
- fence ponds and springs and install collector pipes to deliver water to a tank or trough. This will save the water source from damage by livestock trampling, as well as allow access by small animals and birds to lush vegetation that grows close to wet areas.

For more information concerning your crop, and soil and water conditions, contact your local Cooperative Extension office and/or the Soil Conservation Service office.

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More Drought Information

More information about the drought for farmers, ranchers, consumers and consultants is available. Specifically:

A UC committee headed by Extension specialist Richard Snyder (UC Davis Department of Land, Air, and Water Resources) is updating tip sheets from the 1977 drought (and organized a series of grower meetings in March.)

Many other meetings scheduled for the spring will include presentations by farm advisors and irrigation specialists on drought-related topics. Contact your local Cooperative Extension office for specific topics, dates.

The March-April issue of *California Agriculture* includes several reports on research in irrigation techniques.

Several new publications are being developed to assist growers in management of limited water resources. ANR Publications (University of California, 6701 San Pablo Ave., Oakland, CA 94608-1239; 415-642-2431) is working with authors to complete publications on vineyard and turf management in sufficient time to be useful this growing season.

ANR Publications has reviewed more than 60 titles that relate to water use and irrigation listed in the 1990 publications catalog. A short list will be distributed to the public. Also see **Sustainable Agriculture News** 2(4):9 (Summer 1990) for an annotated list of ANR water conservation publications.

The Teletip automated phone information system, available in 30 out of California's 57 counties, has more than a dozen water messages readily accessible by the public. To find out your local Teletip phone number, call your local Cooperative Extension office.

Additional information and answers to specific questions can be obtained from local Cooperative Extension offices.

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MAIL LIST SURVEY

We have again enclosed a data form with this issue of Sustainable Agriculture News (page 17). We are required to purge our mailing list annually because we receive federal funds. Please fill out this form completely and return it to our office (it can be folded into a self-mailer). We will update our mailing list based on the forms received back: **You must return the form by June 15 in order to continue receiving our newsletters without interruption.** If your mailing label has an X after the ID number (top right hand corner) your updated form has been received (through March 15). We have received some forms that were incomplete or in poor condition, so please send your update if your label does not have an X by the ID number. You may photocopy the label, or peel it off and tape it on the update form, if you wish. Please make any changes to name, address or other fields.

By including your comments on the back of the update form, you provide information that will be valuable in planning future issues of **Sustainable Agriculture News**. **Remember:** If we do not receive a form back from you, you will no longer receive Sustainable Agriculture News after this issue.

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PHOTO CONTEST

UC SAREP announces a photography contest. We want to know what sustainable agriculture looks like to you. Please send black and white photos, 5 X 7 preferred, to Sustainable Agriculture Photo Contest, UC SAREP, University of California, Davis, CA 95616 by September 30, 1991. Five winners will receive copies of **Sustainable Agriculture in California: A Guide to Information**. (See description below.) Entries are not returnable and may be used by SAREP in future publications, with full credit for the photographer.

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UC Small Farm Program: Resource for Farmers, Gardeners

Editor's Note: *Preliminary results of the Sustainable Agriculture News mailing update indicate that many readers are interested in information aimed at small-scale farmers and gardeners. The following article profiles the UC Small Farm Program, a major resource for California's small-scale farmers. It is adapted from the program's report "The UC Small Farm Program: The First Fifteen Years," edited by John Stumbos.*

California is perhaps the only state that has established within its Land Grant/Cooperative Extension system a program funded specifically to address the needs of small-scale and limited resource farmers. The Small Farm Program began in 1979 with a state appropriation to Cooperative Extension to provide assistance to the more than three-fourths of California farmers who have limited resources and income. Of the 80,000 farms in California, more than 60,000 can be classified as small, regardless of which of several definitions is used. Although 10 percent of the state's largest farms produce more than 90 percent of its food and fiber, small farms have a tremendous impact on the state economy. They are responsible for much of the state's agricultural diversity and much of the leadership for sustainable agriculture, environmental quality and food safety. Small farmers are a broad mix of ethnic and social groups. A significant number of small farmers are Hispanic vegetable growers and organic farmers, although new groups with different needs have appeared on the scene, including the Hmong, Cambodians, Thai and Laotians who fled political unrest in Southeast Asia.

Seventy-five percent of small-scale farmers are likely to be full owners of the farm they operate, compared to less than 50 percent of large-scale farmers (more than \$100,000 gross annual sales). More than 65 percent of small farmers live on their farms. The 1982 Census of Agriculture showed that 41,000 small farms with gross sales of \$2,500 to \$100,000 made up half the number of farms in the state; another 25,000 had gross sales of less than \$2,500. These farms produced more than \$1 billion in sales annually; they operated 31 percent of the state's total farmland and represented 56 percent of all fruit and nut tree farms.

The Small Farm Program's 15-year report notes that "Small farmers have proven themselves a resilient, innovative sector of agriculture. Many have found marketing niches for products in high demand and/or low supply, and California small farmers lead the nation by virtue of their close proximity to urban centers and tremendous marketing opportunities provided by diverse ethnic groups and trend-setting consumer demands."

Program Focus

The purpose of the UC Small Farm Program is to benefit small farmers and

marketers and the natural and renewable resources they depend upon. It does this through a variety of educational means that are linked to research-based information in numerous academic disciplines ranging from pest management to marketing and engineering. The program's highest priorities are specialty crop production, direct marketing, organic and sustainable agriculture, entry-level farming, and ethnic farmers. Land use and other rural-urban interface issues and animal production-marketing systems are becoming increasingly important issues.

Staff

The program has developed into a statewide network of farm advisors, campus-based specialists, faculty and staff who contribute to the education and research needs of small farmers. **Ron Voss**, UC Davis extension vegetable specialist, is the part-time director of the Small Farm Program; associate director **Claudia Myers** is in charge of day-to-day activities. The nucleus of the program is the Small Farm Center located on the UC Davis campus. A staff of five serves as a clearinghouse of information for county advisors, farmers, direct marketers, governments agencies and the public. Throughout the state several UC Cooperative Extension advisors are specifically assigned to small farm clientele; to some extent most of the state's county extension offices work with small farm clientele.

Events

The Small Farm Program co-sponsors numerous conferences and events each year. In 1990 those events included: Farm Conference, a statewide event focused on production and marketing techniques for small-scale growers and markers; Women in Agriculture conference; bilingual strawberry production meetings; Rare Fruit Symposium; sustainable agriculture advisor training; Farmer-to-Consumer Conference For the Lower Sacramento Valley; and Tasting of Summer Produce events at the Oakland Festival-At-The Lake and the San Francisco Fair.

Publications

The Center maintains a library of books, scientific journals, reports, directories, and magazines on crop production, marketing, farm management, soil and water, energy, integrated pest management, agricultural engineering, specialty crops, rural sociology, organic farming and sustainable agriculture.

It produces a free bimonthly newsletter *Small Farm News* with profiles of small farms and farm advisors, reviews of publications and a calendar of state, national and international events.

Eight additional free publications are available from the Center including booklets on exotic livestock, foliage plants, herbs, shitake mushrooms, organics in farmers markets (statistics), sheep, specialty vegetables, and wildflowers.

The Center produces publications for its *Family Farm Series*, including inexpensive (\$2 to \$3.50) publications on statistics and resources, marketing, farm management, vegetable production and an organic farming directory.

The series is available from ANR Publications, University of California, 6701 San Pablo Ave., Oakland, CA 94608-1239, or (415) 642-2431.

The Center also offers help to UC farm advisors developing local and regional programs for small-scale growers and marketers. The staff helps advisors identify grants, organize and coordinate conferences, conduct information searches, edit publications and find other sources of information.

LISA Project

The Small Farm Center is also coordinating a USDA Low-Input Sustainable Agriculture (LISA) project. Project goals are to produce practical information based on LISA production, marketing, and food quality research; to determine the effectiveness of various education methods in the adoption of LISA practices; and to determine the market potential for various farming practices and develop educational materials based on these findings. The center is working with SAREP; UC extension specialists; extension representatives from the University of Idaho, Oregon State University, Washington State University, and the University of Arizona; the Committee for Sustainable Agriculture (CSA); and the UC Agricultural Publications office.

As part of the LISA project, the Small Farm Center is sponsoring *Organic '92* in cooperation with CSA January 22-23, 1992 at the Asilomar Conference Center in Pacific Grove. The symposium, which immediately precedes the Ecological Farming Conference, will present information on organic farming theory and practice including academic research and practical farming experience.

An important product of the symposium will be published proceedings, which will be the basis for an organic farming handbook. A call for papers/presentations has been issued for organic farming topics including practices, research, marketing and related subjects that have practical application for organic farmers. Farmers, researchers, consultants, regulators and educators are invited to send a suggested topic or title with a brief description to the Small Farm Center by April 12, 1991.

Contact the Program

For more information about the UC Small Farm Program or to order *Small Farm News*, the most recent annual report, *The UC Small Farm Center: The First 15 Years* or other free publications contact the Small Farm Center, University of California, Davis, CA 95616 or call (916) 757-8910.

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SAREP Project Update: 5 Encouraging Farms

by [Lyra Halprin](#), SAREP

What are the consequences of adopting more "environmentally sensitive" farming practices? Does the farmer change along with the farm? Can changes be categorized or documented? SAREP is funding a two-year project that hopes to systematically document what occurs after a farm makes the transition by monitoring production systems at five farms in Tulare and Fresno counties. Called "Encouraging Profiles," the project is examining habitats, biocontrol and farmer experiences at the farms of **David Mas Masumoto** in Del Rey, **Paul Buxman** in Dinuba, **Richard and Karen Peterson** in Kingsburg, **Rod Riffel** in Parlier, and **Fred Smeds** in Reedley.

The project is assessing the effects of biocontrol practices (use of beneficial insects to control insect pests) in relation to cover crop choices, natural fertilization, and IPM systems on grape and stone fruit farms. The baseline survey is being conducted by an interdisciplinary team of researchers and farmers headed by Ventura County entomologist **Everett Dietrick**, UC researcher **Harry Shorey** and farmer Mas Masumoto.

Technical Findings

Harry Shorey, entomologist, UC Kearney Agricultural Center in Parlier, has surveyed insects and arthropods on the five farms. He noted that beneficial arthropods were ten to 100 times higher in the cover crops per square foot than in nearby vines or trees. In a project report Shorey wrote that this was probably caused by the arthropods' response to plentiful food sources which were much higher in species diversity and numbers in the cover crop than in the vines and trees. Shorey noted that a comparison of data from farms with cover crops showed that they had a significant reduction in the number of variegated leaf hoppers, a serious pest in the area, compared to nearby farms without cover crops. His initial survey of species and numbers of pests and beneficials in the vines, trees and cover crops will be used as a baseline for further characterization of life on farms in various states of transition.

Everett Dietrick noted in a report that the project reinforces his experience with cover crops and mulch management, particularly periodic alternate mowing.

"Each time half of the cover crop strips are mowed, the other strips are left to regrow and attract the insects (pests and beneficials) from the cut area," Dietrick said. "This repeated removal reduces the food supply of plant-feeding insects. Many move into the adjacent uncut area instead of dispersing. This favors beneficials finding their prey," he added.

Dietrick said the strips act like farm field insectaries for natural enemies, providing habitat for larger numbers of resident beneficials in relation to their hosts, and helping to control noxious weeds. Dietrick said that "proof that pests are under biological control on all five farms is evidenced by the farmers' ability to market quality fruit competitively, and pest population increases observed where beneficials are disturbed."

He said diversity of cover crop species is less critical than the protection of soil surfaces with cover crops and mulches that provide habitat for living systems which improve biological control. The five farms range from the most complete coverage (shade from trees plus ground cover) maximizing biological control and allowing for minimum insect interference, to less managed land with large amounts of insect and weed problems.

"The duration that a farm is sustainable is less of a factor than total soil coverage of some form of cover crop mulching system," Dietrick said. He noted that mulching systems to provide food and niches for key natural enemies and the elimination of interference with beneficials should be demonstrated in future project work.

"The reason I have so much confidence in the effectiveness of strip cutting is that I've had about 30 years experience watching this," Dietrick said. "I'm excited about working with these farmers. We learned so much this last year. Now we can focus on some of things that will improve their farms next year."

Farmer Perspective

After one year of on-farm research, Masumoto said two concepts about the farms have emerged. First, it is clear that there is a lot of diversity, complexity and change going on simultaneously at the five farms.

"This often equals chaos, but chaos isn't necessarily bad," he said. "In "Farms work, nature's ecosystems, it is healthy to have chaos and even in an economic/business/management sense, chaos has its advantages. Creativity and innovation come out of chaos. That's one of the keys to success, for business people, farmers and the environment."

Masumoto said the other concept that has emerged from studying the farms is the fact that it is hard to pinpoint how they work.

"There's no repeated pattern, in that we can't give anyone a recipe in order to farm sustainably, nor predict what's going to happen when they farm sustainably," he said. "I think that's good, in the sense that it rewards innovation, it rewards a farmer who is very close to his land, who has a good sensibility, not only about his farm but about management, business and the social community."

Masumoto said it is important to explore the idea of chaos in farm work, and to tie the scientific community into this study. "Farms work, and we don't know why."

"Here in the working world it's so much different than in a lab, or even on a research farm," he said. "We're trying to bridge some of those differences

with our on-farm observations. It's important to research what is happening on our farms. Each farmer needs to conduct their own innovative on-farm research." Masumoto said the drought is illustrating that it might be important to farm differently.

"Clearly the drought is showing how much change is occurring everywhere, but specifically in agriculture," he said. "With the changing dynamics of less water, there's a whole new agenda being formed. Sustainable farming is by its very nature farming differently every day. It gets back to 'change/diversity/chaos,' which some people see as a vicious circle, but we see as a natural circle."

Masumoto said the project is continuing to observe how the individual farmers make decisions based on their own sense of their land, and their recognition that everything added to the land affects the entire farming system.

In the next year, the project will be examining on-farm research. "How does science examine a changing environment?" Masumoto asked. "A simple example is what happens when you add less water to farms. How does that affect the farm and the sustainable practices you're using?"

Additionally, the project will be focusing on specific farming practices, like the use of cover crops.

"We'll be looking to see not simply if cover crops are good or bad, but how long does a farm need its cover crop? Especially in relation to water use," he noted, adding that cover crops use a lot of water, which may not be sustainable in drought years.

Another specific process being examined in 1991 involves the appearance of thrips in orchards.

"In one window of a nectarine growing season they're considered a pest, but in the next window they're beneficial insects. We want to look at that," he said.

Masumoto said studying thrips will be useful in understanding both the "whole farm" picture and the "little microcosms" that occur, like "when a pest isn't a pest."

An important component of on-farm research, Masumoto said, is the study of the farmers and the communities they live in.

"The same themes that we see occurring in the farm ecosystems apply," Masumoto said. "Farmers are constantly changing, their needs are changing, they're very diverse. Most research projects tended to look at the farm only, and ignore the farmer. We're looking at management decisions and the decision-making process. We're examining innovation, how it works on farms. Sustainable farming by its very nature has necessitated innovation."

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SAREP Project Update: Postharvest Handling

by [Lyra Halprin](#), SAREP

Marita Cantwell de Trejo, UC Davis Extension vegetable crops specialist, heads a SAREP project on postharvest handling of tomatoes and melons using hot water, hot air, and high carbon dioxide regimes to control postharvest pathogens.

Cantwell de Trejo's preliminary work (1989) identified the time-temperature ranges for forced warm air which are effective in controlling pathogen growth on inoculated fruit without causing visible fruit injury and other quality losses (especially firmness and flavor in tomatoes.) An example of an effective treatment for tomatoes was determined to be 60 degrees C (140 degrees F) for two hours in non-humidified air.

Since 1990, the first year of the SAREP project, the focus has been on hot water treatments as alternatives to postharvest use of fungicides on fresh market tomatoes and cantaloupe melons. Tomatoes were inoculated with *Botrytis cinerea* and treated with hot water. Cantaloupes were inoculated with *Fusarium roseum* and treated similarly. To date the project has identified the limits of tolerance of the tomatoes and cantaloupes to hot water treatments. "An effective treatment is considered to be one that will stop the fungus dead in its tracks, i.e. there will be no fungal growth or decay development," Cantwell de Trejo said. Several hot water time-temperature regimes provided effective pathogen control without causing visible fruit injury. Heat treatments effective in controlling *Botrytis* were also effective in controlling other common postharvest pathogens. Although several regimes can efficiently control postharvest pathogens for each fruit, only a few treatments resulted in fruit of quality equal to that of untreated fruits, Cantwell de Trejo said.

"Generally, higher-temperature, shorter-duration treatment regimes had the least impact on fruit quality," she said. Cantwell de Trejo said the hot water treatments found to be most effective for tomatoes to date are: treated at 58 degrees C (136 degrees F) for three minutes; 55 degrees C (131 degrees F) for seven minutes; 53 C (127 degrees F) for ten minutes (although it softens the fruit too much).

Surface decay is the worst cantaloupe postharvest problem, Cantwell de Trejo said. Both fruit surface and stem-end decay were evaluated during the experiments. Lower temperatures for longer time periods (50 C for ten minutes) control pathogens better, but reduce fruit quality in comparison to shorter-term treatments.

Other effective treatments include 57 degrees C for 2.5 to 3.5 minutes.

"We're looking at ways to improve the higher-temperature/shorter-term treatments," she said, adding that off-flavor problems could result from the longer, lower temperature treatments.

Cantwell de Trejo said the principal benefit of hot water (or air) treatments is that they can kill the organisms on and below the fruit surface. "Postharvest fungicides only kill surface pathogens," she said. She said the heat may affect ripening behavior by slowing it, which could be good or bad. Heat treatments are currently used as quarantine treatments for imported crops like papayas and mangoes.

"The hot water treatments could be used in the future for quarantines if this is ever necessary," she said. "This is a side benefit that could result from our work if we know exactly how these heat regimes work."

Cantwell de Trejo said her research group will be testing the effects of modified atmospheres on the postharvest condition of fruit in 1991. Researchers will be testing high CO₂ on fruits, both alone and in combined treatments with hot air or hot water, she said. Investigators include **Xunli Nie**, UC Davis vegetable crops, and **Noel Sommer**, UC Davis pomology.

"We have tried hot water on honeydew melons and observed some benefit with pathogen control in longer-term storage, for more than three weeks," she said. "Lately we've also been playing around with onions. It looks like hot water might be an effective treatment to control pathogens like *Aspergillus*. There are other crops that could potentially use this treatment."

She said that research during the second year will also focus on the application of these techniques on a semi-commercial scale. Tests comparing the heat treatment with commercially applied fungicides will be part of the evaluation.

In addition to controlling temperature and relative humidity and modifying atmospheres, Cantwell de Trejo said that avoiding physical damage to the crops is critical to the maintenance of quality.

"Putting masking tape over fingernails, avoiding drops of the crop, these are not 'sexy' topics, but they are basic common sense strategies for avoiding postharvest problems," she said. "Generally, if proper postharvest techniques are used, few crops require additional treatments such as fungicides or hot air."

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Beyond Cost/Benefit Farming Research

by David Campbell SAREP

Editor's Note: *David Campbell has joined SAREP as an economics and public policy analyst. He also teaches in the UC Davis political science department.*

Kenneth Dahlberg lamented in *New Directions in Agriculture and Agricultural Research* (1986) that "we have few conceptual means, much less the necessary data sets, to assess either general societal benefits or costs of agriculture and agricultural research." He went on to call for "greater research into health, safety, social, environmental and resource externalities."

SAREP has been working systematically to determine how our program might sponsor research and education that meets the challenge of linking food production practices to the broader economic and political context. As reported in Vol.2, No.2 our Economics and Public Policy Advisory Committee has developed a comprehensive research agenda addressing economic, social and public policy issues that affect agricultural sustainability. Specific recommendations were made in four areas: food and agriculture policy, labor, land use, and rural community development.

A prerequisite to pursuing many of the questions raised by the committee is a clearer sense of how to build more complete cost-benefit assessments into agricultural research. Traditional farming research methods, grounded in narrowly conceived cost-benefit accounting, fail to adequately account for the impact of farming practices on the environment, public health, worker safety, and rural community development. We need new methods, concepts and indicators that include the effect of outside influences in the farming balance sheet.

The World Resources Institute has developed a method of natural resource accounting which makes possible quantitative measures of sustainability. By taking soil erosion and depreciation into account, they can compare the net economic value of conventional and more environmentally sensitive farms in a way not possible if one were only to measure net farm income. This as part of a broader effort to redefine agricultural productivity to take into account groundwater, soil fertility, and wildlife in addition to the crop produced. (*Reducing the Farm Bill: Agricultural Policy and the Adoption of Sustainable Agricultural Practices*, published this spring by The World Resources Institute).

Other examples of innovative methods exist, but little work has been done to systematically identify these and ask how they might be profitably incorporated into ongoing agricultural research. SAREP staff members are laying the groundwork for educational projects that would accomplish this objective. The aim is to identify and link individuals doing relevant research;

clarify data availability and needs; highlight innovative new methods; and allow sharing of concrete, ready-to-implement techniques for integrating these methods into agricultural research projects. We hope to build environmental and social costs assessments into our research funding proposals in a systematic fashion and serve as a model for other university research programs.

The effort to recast the methodological foundations for agricultural research necessarily means greater involvement of social scientists as part of interdisciplinary research teams. Most of the research to document the true costs of agriculture has been by social scientists grounded in their own disciplines with little or no ongoing connection to agricultural research programs. Thus, no matter how persuasive their analysis, they have tended to have little impact on the direction of agricultural research. And, these social scientists have not benefited in most cases from the perspective of production-oriented researchers.

One of the contributions SAREP hopes to make in economics and public policy is the development of interdisciplinary teams. that address sustainability issues from many perspectives.

Having already sponsored interdisciplinary work in production-oriented disciplines, we are aware of the personal and institutional difficulties that accompany this team-building. Going forward with this broad research is essential to addressing the sustainability question in its most inclusive sense.

It is easy to become overwhelmed as we confront the dizzying array of policies that affect agriculture at the national, state and local levels, and the long list of neglected research questions on the off-farm impacts of farming practices.

By focusing on the methodological and organizational tasks outlined here, SAREP can begin to establish a solid foundation for future research.

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1990 Farm Bill: Implications for California

by *Dave Chaney & Dave Campbell SAREP*

After much deliberation and negotiation, the 1990 Farm Bill was finally passed by Congress late last year. It contains new and revised provisions that may be of interest to California farmers. Critics argue that, like the 1985 Farm Bill, the new regulations still favor medium to large-scale farmers, leaving small and beginning farmers at a disadvantage. Nonetheless, the new bill takes some positive steps toward reducing penalties for farm diversification, rewarding land stewardship, and establishing new agricultural research and extension priorities. A synopsis of the major environmental and consumer-oriented provisions follows.

State, Private Forestry: The Forest Stewardship Act of 1990 includes various incentive and assistance programs to conserve and maintain existing forest lands. The *America the Beautiful Program* is established to promote tree planting.

Fruits, Vegetables, Marketing: This portion of the Farm Bill authorizes a research program to look at the impact of federal cosmetic grade standards on pesticide use in producing fresh fruits and vegetables. It also establishes new procedures for setting cosmetic standards. The new process will take into account potential effects of cosmetic standards on farmers' ability to reduce pesticide use. It also allows the public to give input on new or revised standards.

Agricultural Trade: One of the highlights of this title of the Farm Bill is a "debt for nature" swap program aimed at Latin American and Caribbean countries. It authorizes a reduction of food aid debt owed to United States in exchange for programs that conserve natural resources in the designated regions. Participating countries would enter into a specific agreement with the United States: Instead of repaying the U.S. government in dollars, the country would direct interest on the reduced debt to an Environmental Fund that could only be used for programs that enhance the environment.

Research: A new statement of purpose of the research and extension system is set forth, that gives greater prominence to sustainable agriculture concerns. Among the specific goals are "expanding economic opportunities in rural America and enhancing the quality of life for farmers, rural citizens, and society as a whole; developing information and systems to enhance the environment and the natural resource base upon which a sustainable agriculture economy depends; fostering the availability and affordability of a safe, wholesome, and nutritious food supply that meets the needs and preferences of the consumer; assisting farmers and other rural residents in the detection and prevention of health and safety concerns." (Summary of Title 16, 1990 Farm Bill)

The Sustainable Agriculture Research and Education subtitle expands the current USDA Low-Input Sustainable Agriculture (LISA) Program, and authorizes \$40 million annually for LISA-funded research. There is a big difference, of course, between authorization and appropriation. The actual increase in LISA funding is dependent on the outcome of current negotiations in Congress. (LISA is also renamed BUBA, Best Utilization of Biological Applications, although use of new name is uncertain.)

In addition to LISA, two new research programs are authorized, each with a \$20 million funding authorization for every year 1991-1995. The first, *integrated management systems*, directs the Secretary of Agriculture to establish research and dissemination of information related to farming operations, practices, and systems that improve crop and livestock production that are environmentally sound. The second, *sustainable agriculture technology development and transfer programs*, requires that technical guides, handbooks, and other materials be written to help farmers develop more sustainable farming systems. Included in the authorization are funds for direct training of extension agents and other professionals at regional training centers devoted to sustainable agriculture methods. No funds have been appropriated for these programs so far.

Organic Certification: This new title establishes a program to develop national standards governing the production, processing and labeling of organically produced food. It will be funded mainly through user fees paid by organic farmers and certifying agents, and will fall under the administration of the USDA. Farmers and processors who want to use an organic label for their products after October 1, 1993 must have their operation certified organic by a state or private certifying agent accredited by the USDA: They will also have to comply with the organic standards developed by the new National Organic Standards Board. The basis for these standards will be a list of approved substances and compounds for use by organic farmers. National standards will not preempt stricter state organic programs.

Commodity Programs: A major revision to the general commodity programs (cotton, wheat, corn, rice) is that land idled under the set-aside (acreage reduction) programs should be planted to an annual or perennial cover crop. A farmer participating in the acreage reduction program is required to plant a cover crop on at least half of the set-aside acres (but not more than five percent of the acreage base) established for that crop. This requirement does not apply to arid, summer-fallow areas where cover crops could deplete soil moisture needed for crop production. Cost-share assistance is available to farmers who establish a perennial cover crop (multi-year set-aside) for the purposes of improving water quality or wildlife habitat.

Other related sections increase farmers' flexibility to diversity their normal rotations and plant other non-program crops. For example, the 1990 Farm Bill permits farmers to plant and harvest specified non-program crops on the acreage base established for a program commodity without reducing that commodity's acreage base. A planting limit of 25 percent of the acreage base is being recommended. Alternate crops could include oilseed, industrial or experimental crops.

Conservation: This section of the Farm Bill contains numerous subtitles and chapters related to sustainable agriculture. Major components of the

conservation title include: Highly erodible land and wetland conservation; agricultural water quality incentives; programs for environmental easement, watershed protection, flood control, integrated farm management, resource conservation, Great Plains Conservation, state water quality coordination; administration of environmental programs; Agricultural Council on Environmental Quality; water quality research, education and coordination; water quality and nutrient management research; and pesticide record keeping.

Some of the most significant progress toward more sustainable farming practices is found in the new Integrated Farm Management Program Option (IFMPO). Under the IFMPO, farmers will be eligible to receive program payments for resource-conserving (non-program) crops planted on a portion of the base acres. Different from commodity provision planting flexibility noted above, this option also allows some harvesting on set-aside acres. According to the law, resource-conserving crops include: forage legumes, any legume grown for forage or green manure, legume/small grain mixtures, legume/grass mixtures, and legume/grass/small grain mixtures. Benefits of the program are:

- The commodity acreage base will not be reduced when a resource-conserving crop is planted on base acres.
- Program payment yields cannot be reduced even if a temporary yield decline results during the transition to a new cropping system.
- Deficiency payments will be made on resource-conserving crops as if the program crop had been planted. Restrictions on haying or grazing the resource-conserving crop apply.
- Farmers may hay or graze a resource-conserving crop on 50 percent of set-aside acres, without restriction. Non-program small grains (e.g. buckwheat, rye, triticale) interplanted with legumes may also be harvested for grain on these set-aside acres. Alternatively, cover crops grown for seed may be planted.

Since the specific rules and regulations governing the different commodity and cost-share programs are still being hammered out, contact your local office of the USDA Soil Conservation Service (SCS) or Agricultural Stabilization and Conservation Service (ASCS) for details about signing up and compliance.

Information for this article came from three publications:

Farm Program Options Guide to sustainable agriculture and conservation aspects of the 1990 Farm Bill. Available for \$3.00 from the Center for Rural Affairs, P.O. Box 405, Walthill, NE 68067.

1990 Farm Bill Environmental and Consumer Provisions. Vol.1 Statutory Language, Vol. II Detailed

Summary. Published by the Center for Resource Economics and Island Press, P.O. Box 7, Covelo, CA

95428. \$24.95 plus \$3.00 postage and handling for the set.

Summary of Title 16, 1990 Farm Bill. Prepared by Kathleen Merrigan. Free from Senate Committee on Agriculture, Nutrition & Forestry, attention Kathleen Merrigan, 647 Dirksen Senate Office Bldg., Washington, D.C. 20510. Send postcard specifically requesting this summary or call (202) 224-5207.

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Sources of Funding

CDFA Fertilizer Research & Education Program

The California Department of Food and Agriculture (CDFA) is soliciting proposals for its Fertilizer Research and Education Grants Program. Research or education projects that will improve fertilizer use efficiency and reduce groundwater contamination will be considered. Possible topics include water management related to nitrogen use efficiency and the reduction of groundwater contamination, fertilization practices, ways to determine acceptable levels of nitrogen in soil at fertilizer facilities, and Proposition 65 chemical and employee/customer exposure. Targeted audiences may include growers, fertilizer dealers, students, teachers, and the general public. New project proposals should be submitted through the Regular Approval Process (RAP). Projects already underway and expected to be completed within one year from fund disbursement may submit proposals through the Expedited Approval Process (EAP). Multiple-year proposals will be accepted. All interested parties are encouraged to apply for funding. EAP proposals are due April 4, 1991, and project suggestion sheets for RAP proposals are due April 30. For applications and a complete description of the proposal process, contact Jacques Franco or Barbara Elliot, California Department of Food and Agriculture, 1220 N St., Sacramento, CA 94271-0001 or call (916) 322-6832.

Organic Farming Research Foundation

The Organic Farming Research Foundation (OFRF) was established in August 1990 after almost two years of planning. "Formal establishment of the Organic Farming Research Foundation realizes a long-standing dream of organic farmers, to play a role in the development of America's farming research agenda and better educate the public on ecologically sound farming practices," said Mark Nielsen, OFRF president.

Foundation objectives are to conduct research into Organic farming methods, including soil building, pest and weed control, fertilizer and soil amendments, agricultural economics, animal husbandry, and alternative growing practices; to disseminate through publications and lectures the results of organic farming research to organic farmers; and to provide the public with information about methods, practices and current developments in organic farming.

OFRF was founded by grower members of California Certified Organic Farmers (CCOF). The Columbia Foundation provided a \$25,000 grant for the first year. Private donations and other foundation grants are being sought. Funds will be used to support research and education activities conducted by CCOF and by other research and educational organizations. Early proposals by OFRF board members include underwriting an organic farming show on regional public radio; publishing a directory of suppliers of organic seeds,

transplants, and other inputs; and providing a cash award for the best article published in 1991 educating the general public about organic farming. Priorities for funding research projects and other educational projects are being determined, in part by analyzing a farmer survey recently developed by OFRF's research and education committee.

The foundation's board of directors includes seven organic farmers, two agricultural researchers, one consumer representative, and the president of CCOF. The two agricultural researchers are SAREP's **Jill Auburn**, chair of the foundation's research and education committee, and UC Farm Advisor **Faustino Munoz**.

"We are looking for research suggestions from all sectors of the agricultural community," said Munoz. "We anticipate the results of our OFRF-sponsored research to be of interest to all growers."

For a copy of the OFRF's goals and objectives, write to: OFRF, P.O. Box 440, Santa Cruz, CA 95061 or leave a message on the foundation's message machine at (408) 426-6606.

No SAREP Grants

SAREP will not offer a Request for Proposals (RFP) in 1991, as grant money is currently committed to multiple year projects. When funding is available for another round of grants, it will be announced in **Sustainable Agriculture News**, and a copy of the RFP will be mailed to everyone on the newsletter's mailing list. (Remember to fill out and return the mail update form on page 17 or you will be dropped from the mailing list.)

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Resources

Ecological Gardening Directory

BUGS Directory of Ecological Lawn and Landscape Services, a directory of North American lawn and landscape services that use IPM or offer totally organic landscape maintenance programs is being assembled by Biological Urban Gardening Services, (BUGS), in Citrus Heights, CA. It will include listings by state and province, as well as by topic. A nominal fee will be required to list businesses. BUGS is an international membership organization aimed at reducing the use of chemical pesticides in urban areas, which publishes *BUGS Flyer, The Voice of Ecological Urban Horticulture*. Individual memberships/subscriptions are \$10/year; professional memberships/subscriptions, which include the supplement *Professional Collaborator* for horticulture professionals, are \$15/year. For inclusion in the directory or other information contact BUGS at P.O. Box 76, Citrus Heights, CA 95611-0076 or call (916) 726-5377.

Free Subject Printouts

agAccess, a Davis, CA agricultural book service will send a free printout of all its titles on any agricultural or horticultural subject upon request. The book service also offers a free *New Books Bulletin*, listing new agricultural and horticultural titles. A recent title is *Permaculture: A Practical Guide for a Sustainable Future*, a new hardcover printing of Bill Mollison's classic work. To request a bulletin or subject printout, contact agAccess at 603 Fourth St., Davis, CA 95616, or call (916) 756-7177 or FAX (916) 756-7188.

Iowa Farmers Survey

The first in a series of reports from an extensive survey of Iowa farmers is available free from the Leopold Center for Sustainable Agriculture at Iowa State University. Conducted by Michael Duffy, an Iowa State agricultural economist, survey results include 1,181 farmers' reports on energy use, crops and livestock, equipment, manure facilities, and application methods of pesticides and fertilizers. *Energy Use on Iowa Farms* is the first report available on the survey's findings. For copies of this report and others as they are made available contact the Leopold Center for Sustainable Agriculture, 126 Soil Tilth Bldg., Iowa State University, Ames, Iowa, 50011; (515) 294-3711.

Organic wholesalers Directory

The *1991 National Directory of Organic Wholesalers* is available from the California Action Network (CAN). Now in its eighth edition, the directory is aimed at those growing or marketing organic produce or products. It includes

information about 400 organic food wholesalers and distributors in North America and is indexed by 800 commodities. It also includes sources of organic farm supplies, summaries of all state and federal laws governing organic food, and the names and addresses of all certification groups in the U.S. It is available for \$34.95, including shipping and handling. For more information contact CAN at (800) 852-3832 or (916) 756-8518; or write CAN, P.O. Box 464, Davis, CA 95617.

SAREP Progress Report

Progress Report: 1986-1990, which reviews the work of the UC Sustainable Agriculture Research and Education Program (SAREP), is now available. The report includes summaries of the 51 projects SAREP has funded and its long-term farmland research project, and describes its information development and distribution efforts. Free copies may be requested from SAREP, University of California, Davis, CA 95616, (916) 752-7556.

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Organic/Sustainable Agriculture Policies Conference

More than 300 farmers, farm policy activists, environmentalists and consumer advocates met in Washington D.C. February 15-16, 1991 at the Third National Conference on Organic/Sustainable Agriculture Policies sponsored by the Center for Science in the Public Interest, the Institute for Alternative Agriculture, and the Texas Department of Agriculture. Participants discussed the positive impact of the sustainable agriculture coalition on the 1990 Farm Bill (see *1990 Farm Bill*, page 14), and debated topics including the federal government's General Agreement on Tariffs and Trade (GATT) negotiations, the continuing corporate concentration of food production and processing, new developments in biotechnology, and the difficulties already encountered in implementing environmental provisions of the 1990 Farm Bill. Promising initiatives from states, universities, non-profit groups and farmers were shared. **Dave Campbell** represented SAREP in a roundtable discussion with representatives from other universities including Ohio State University, University of Wisconsin-Madison, University of Missouri-Columbia, Tufts University, Columbia University, and Slippery Rock University (PA).

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