

Fall 1989

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Agriculture's Agenda

California growers find themselves in a vulnerable position. The combined issues of food safety and environmental problems caused by agricultural practices have been building for many years.

In food safety, the use of Alar on apples hit the front pages of newspapers and magazines across the country last winter. The Alar issue is symbolic of the credibility problem that agriculture faces. Consumers do not believe that the regulatory process is protecting their interests. As a result of this lack of credibility, many stores and consumers are making independent judgments about food safety that affect the marketplace. Increasingly, people want food they believe is clean, healthy and nutritious at an affordable price -but they are also willing to pay more for produce that does not contain pesticide residues.

Growers are Vulnerable

As a result of these collective decisions in the marketplace and the judgment of legislators who follow consumer movements, growers are increasingly vulnerable to market and legislative actions. Even if chemicals used on crops are approved, the produce may not be accepted in the marketplace by consumers. And increasingly, chemical production tools are being removed from the marketplace by either legislative or chemical company action. As one grower told me 18 months ago, laws without alternatives don't help. Increasingly, growers want alternatives to toxic materials which are disruptive to their production systems or which interfere with the marketing of their products.

Set Our Own Goal

The question is, how is agriculture going to reduce its vulnerability to these forces? Most importantly, we must decide on a primary goal- *that we will move agriculture toward economically and environmentally sound production and marketing practices*. Individual farmers and ranchers, public institutions such as the University of California and the

California Department of Food and Agriculture, agricultural organizations and chemical companies can help. This goal makes good business sense. In a marketplace economy, those who produce what consumers want will remain in business.

Working toward the goal of economically and environmentally sound farming will help reduce agriculture's vulnerability. And, finally, it is a step in helping *agriculture* set agriculture's agenda. - **Bill Liebhardt**, director, UC Sustainable Agriculture Research & Education Program

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IPM Guide Includes Organic

The most recent revision of the grape chapter in **Pest Management Guidelines** includes a new section: "Organically Acceptable Methods." The **Pest Management Guidelines** is a handy summary of recommendations by crop and pest produced by the statewide UC Integrated Pest Management (IPM) Project's Education & Publications section headed by IPM Specialist **Mary Louise Flint**. It is distributed to all county extension offices as well as other sites. It is also available through the UC IPM computer system. For IPM computer information contact **Joyce Strand** at (916) 752-8350. The recommendations have always included sections on "Cultural Controls" and "Biological Controls." Future revisions and additions will include "Organically Acceptable Methods" where this information is available.

Crop Rotations: What do *You* Use?

Crop rotations are often recognized as an important means of pest control or of improving soil quality in annual cropping systems. Lack of research on this topic, however, has resulted in very sparse information on crop rotations for California farmers. Growers' decisions regarding rotations are largely based on their own knowledge and experience about what works for them rather than on scientifically-based research information. UC SAREP is initiating a project to organize some of this experience-based and scientifically-based information into a database of particular crop sequences. A synthesis of old and new information on crop rotations will be of assistance to growers interested in making the transition to production systems less dependent on off-farm purchase of petrochemical inputs.

Drawing from your own expertise and experience, do you have information on crop rotations? If you know of *specific* advantages or disadvantages of various crop sequences we would like to hear from you. Contact **Dave Chaney** by telephone (916/752-8667) or mail (UC SAREP, University of California, Davis, CA 95616) with your ideas and suggestions.

A CALL FOR POSTERS

Researchers involved in sustainable agriculture are encouraged to present posters and published abstracts of their work in a poster session at "Sustainable Agriculture in California: A Research Symposium" March 15-16, 1989 sponsored by the UC SAREP at the Sacramento Hilton.

"We know the projects funded by our program are just a small part of the sustainable agriculture research and education taking place in California today," said **Bill Liebhardt**, UC SAREP director. "It will be exciting to see what is happening throughout the state."

The symposium will feature research reports funded by the statewide program in the last three years. An evening poster session and social event will showcase the wide array of California research and extension activities that address the goals of sustainable agriculture. Anyone interested in presenting a poster may contact **Dave Chaney** at (916) 7S2-8667.

On-Farm Conversion Studies at UCSC

Editor's note: *Sustainable Agriculture News* features occasional articles from other UC programs which have similar goals. The following article is by **Martha Brown**, publications coordinator, UCSC Agroecology Program.

Research efforts at the UC Santa Cruz Agroecology Program include a focus on production farm systems in transition from conventional, high-input management to sustainable, low-input management. Program researchers monitor a wide variety of factors including nutrient levels, populations of pest and beneficial insects, economic inputs, yield, and income to develop an overall picture of the agroecosystem during the conversion process. They hope to identify major challenges to growers who want to reduce or eliminate synthetic chemical inputs, and suggest ways to mitigate yield losses. With funding from the UC Sustainable Agriculture Research and Education Program and other sources, on-farm studies of strawberries, apples and artichokes are underway. It is hoped that work will expand this fall to include lettuce and cole crops.

Now reaching the close of its second season, the strawberry conversion study has revealed several factors which can limit yield during the transition process. Nutrient availability, soil temperature, and the presence of beneficial insects appear to be key factors affecting yield. Researchers will continue to work with Davenport grower **Jim Cochran** to boost yields in the organic plots by planting cover crops, increasing soil organic matter, and augmenting beneficial insect populations.

Faculty, staff, and students from the Agroecology Program have worked for one season with apple growers **Robert Stephens** of Soquel and **Jim Rider** of Watsonville in studies of plots undergoing conversion to certified organic management. These studies have focused on codling moth infestations; they will be expanded soon to examine changes in soil fertility in response to cover crops and other amendments, weed growth, and vegetative growth and yield in the two systems.

Artichoke grower **Ed Boutonet** and agronomist **Pete Puck** of Castroville are cooperating with Agroecology Program members in a study of artichoke acreage undergoing conversion to certified organic management. Key factors being monitored include the response of artichoke plume moth populations to microbial controls and cultural management, soil fertility response to cover crops, and the effects of organic soil amendments. The project will provide data on crop responses as harvests begin in the fall.

The Agroecology Program hopes to document obstacles to alternative management by working with growers. Overcoming these obstacles will play a key part in reducing synthetic chemical use and ensuring long-term economic and ecological sustainability.

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Researchers, Farmers Share

Fifty researchers, educators, and growers met in Davis July 18-19 to discuss their experiences with cover crops, green manures, and living mulches in orchards, vineyards, vegetables, and field crops. Sponsored by UC SAREP with funding from the USDA's Alternative Agricultural Opportunities program, the purpose of the small meeting was to stimulate interaction among people with both research and practical experience. The information presented is being compiled by SAREP for publications, grower meetings, and other research and extension purposes. Similar meetings in other states within the western U.S. are planned as part of a two-year grant from the USDA's Low-Input/Sustainable Agriculture program.

The first day's presentations included four sessions: *Soil and Water*, *Nematodes*, *Weeds*, and *Databases*. The second day began with a visit to research projects at the UC Davis Student Experimental Farm and continued with presentations on *Insects and Mites*, and *Grower Experiences*, and concluded with small group discussions. The following summaries are from the *Soil and Water* session on Day 1.

Summer Cover Crops

San Benito County Farm Advisor **Richard Smith** began the meeting with results of his work on summer cover crops in Stanislaus and San Benito counties. Summer covers are important as a source of nitrogen for organic farmers, particularly for winter vegetables. *Crotalaria juncea* (Sunn hemp) produced well in Stanislaus County, producing 137 pounds of N per acre in the tops 93 days after the first irrigation. The *Crotalaria* was so productive that it vastly outstripped the watergrass being grown for comparison. Their growth rate was similar up to 78 days after irrigation, then the *Crotalaria* produced approximately one ton of biomass per acre in the next two weeks, while the watergrass almost stopped growing. This difference in growth pattern made it difficult to estimate how much of the *Crotalaria's* N came from fixation and how much from the soil profile, since the usual method of subtracting the N in the non-legume (watergrass) from the N in the legume (*Crotalaria*) would be misleading with such different biomass amounts.

Smith is continuing this work in San Benito County, which has a much cooler climate. There he is trying winter legumes (Cahaba white vetch and Lana woollypod vetch) and summer legumes (cowpea), and Merced rye for a non-legume comparison, all planted as summer covers in mid-May. In this first year of the study, the vetches produced about twice as much biomass as the cowpeas after 45 days.

Mark van Horn, manager of the UCD Student Experimental Farm, is in his third year of work with summer covers. The objective is high biomass production and nitrogen fixation with minimal irrigation and both economic

and energetic efficiency: a low-input system. He has looked at cowpeas, *Crotalaria*, *Sesbania*, and *Lablab*, a tropical forage. Van Horn planted them into moisture (furrow irrigation), about 20 lb/acre in two rows per 30-inch bed (due to his equipment; alternatively, they could be drilled.) A second irrigation occurs at about 25-30 days, then the cover is plowed down at 60-75 days. So far, cowpeas look the best, since seed is readily available and farmers know how to grow them. *Crotalaria* has the potential to fix more N than cowpeas: Van Horn has observed 80-130 lbs/acre in *Crotalaria* vs. 70-120 lbs/acre in cowpeas. The literature says *Crotalaria* can reduce rootknot nematodes and according to Van Horn it seems to be well adapted to the Davis area, but seed is expensive at \$3/lb. *Crotalaria* does flower in Davis, but Van Horn hasn't yet been able to get it to set seed, which would save costs but potentially create a weed problem. Setting seed might reduce its N value, however, since it keeps producing vegetative growth longer than cowpeas, which seem to shut down when they produce seed. *Sesbania* isn't quite as well adapted to the low irrigation regime, he said, having produced only 50-100 lb N/acre in his trials, and the seed isn't available commercially.

Van Horn is testing a number of strains of each cover crop. An indeterminate variety of cowpeas might be a better N producer than the commercially available determinant variety. He said he may also develop water response curves, and wants to look at pest effects. He is interested in investigating *Crotalaria's* reported ability to reduce rootknot nematodes, and its apparent tendency to attract lygus bugs. If the attracted bugs moved to a cash crop, the *Crotalaria* would be unacceptable, but it might have a positive effect if it acted as a trap crop.

Green Manure, Rice Straw Interactions

Extension specialist **Stu Pettygrove** reported on a new rice cover crop project underway since last fall in Butte and Sacramento counties. Winter covers were common in rice until the 1960s. Information is available from past research on their value as a nitrogen source, but the older research may not relate well to current rice varieties, Pettygrove said. He said older information on rice straw management does not consider the integration of cover crop and straw management. With a planning grant last year from UC SAREP and a current grant from the Rice Research Board, Pettygrove and a team of UC research and extension workers are studying the effect of rice straw incorporation on subsequent green manure growth and N fixation, and the effect of green manure on the decomposition of rice straw.

Winter Cover Crops

Rick Miller, a UC Davis agronomy graduate student, is quantifying the effects of legumes on a subsequent corn crop in a study begun in 1986. Corn yields following each of six winter covers (oats, oat/vetch combination, Lana woollypod vetch, bell beans, Austrian winter peas, and berseem clover) were compared with winter fallow and spring fertilization (0, 50, 100, 150, 200, or 250 lb/acre ammonium sulfate broadcast before bedding up). Miller said corn response to bell beans was approximately equivalent to the 100 lb/acre fertilizer, while the response to vetch was about the same as the 200 lb/acre fertilizer (see table.) Since the yields were comparable to an amount of mineral fertilizer similar to that contained in the cover crop biomass, it was

concluded that nearly all of the N from the cover crop was completely available in the first year after incorporation.

Miller noted that bell beans haven't done as well in Davis as in coastal areas. He said each cover has been grown in the same place for three years, and the bell beans have been declining, perhaps because of root diseases. Rice growers like bell beans because they tolerate poor drainage well, but the vetch is clearly superior at this site, Miller said.

Cover Crops, Soil Crust Strength

The effect of cover crops on organic carbon accumulation and soil crust strength, and the effect of crust strength on tomato seedling emergence was investigated by graduate student **Kathleen Groody** and **Mike Singer**, UCD Land, Air and Water Resources professor. Groody used a soil micropenetrometer to measure crust strength in three replications of each of three cover cropped plots (oats, oats/vetch, and vetch) and three treatments with chemical fertilizer roughly comparable to the cover cropped plots (0, 150 and 200 lb/acre N, respectively) from Rick Miller's study. Not all results have been statistically analyzed Groody said, but it appears that the cover cropped plots had higher organic matter, dramatically reduced crust strength and better seedling emergence than in the comparable chemically fertilized plots. Crust strength appeared to increase with increasing fertilizer N, but decrease with increasing cover crop-derived N.

	lbs N	Corn	#lbs N Fert	Corn
	in cover	Yield	Applied.	Yield
Oats	25	4,700	0	5,000
			50	7,200
Bell Beans	101	8,600	100	8,600
OntIVetch	175	8,600	150	10,200
Peas	181	9,300	200	10,600
lana Vetch	220	11,000	250	11,400

Corn grain yield in response to different levels and sources of nitrogen (average of 1987 and 1988 summer crops) in Rick Miller's winter legume-corn crop rotation project funded by UC SAREP.

Farming Systems Comparison Field Day

Conventional, low-input or organic? Which farming system is most appropriate? Which makes the most efficient use of resources? What are the environmental effects of different production practices? These are some of the questions addressed by a farming systems comparison project at UC Davis. An August 29 field day at the UCD agronomy farm offered the public a hands-on view of the project, *Evaluating the Transition from Conventional to Low-Input and Organic Farming Systems in the Sacramento Valley*. The study is funded by the UC SAREP, the USDA Low-Input Sustainable Agriculture (LISA) program, the H.J. Heinz Foundation and the UC Davis College of Agricultural and Environmental Sciences.

Still in its first year, the project has not yet generated substantive information for growers. Baseline data and yield data from the first harvests are being collected. Over the next several years, however, the 11-member interdisciplinary research team will identify alternative farming practices that will help growers make the transition from conventional to low-input and organic farming systems while maintaining the long-term viability of their farm businesses. Other research objectives are to conduct interdisciplinary analyses of the processes that drive various crop rotation systems, and to test existing and novel farming practices.

Four Farming Systems

To accomplish these objectives, four farming systems that differ in their reliance on off-farm purchased resources are being compared. These systems are: 1) a two year rotation of processing tomatoes and wheat; 2) a four year rotation of processing tomatoes, field corn, safflower and wheat-dry beans or lupines under conventional production methods; 3) the same four-year rotation using low-input practices; and 4) the same four-year rotation using organic production methods. The low-input and organic rotations will attempt to reduce the need for off-farm purchased inputs by using alternative practices including cover crops, manures, biological control and reduced tillage. Insecticides and other materials not used in organic production may be used very selectively in the low-input plots.

Like a Farmer

The project is being conducted on 28 acres of UC Davis land with researchers having expertise in agronomy, entomology, soil science, irrigation, nematology, weed science, agricultural economics, environmental toxicology and plant pathology. UC farm advisors and conventional and organic farmers are providing guidance and suggestions for management. One of the most important priorities of this project is to manage it as farmer would, according to Mike Hoffman, a project entomologist. Because of this goal, management of the different production systems will be evolving as the experiment

progresses, he said.

Researchers and their specific studies include: **Bill Liebhardt**, analysis of soil nitrogen dynamics; **Mike Stimman**, toxicological evaluation of pesticide residues in soil and plant material; **Howard Ferris**, effects of production practices on soil nematode populations; **Frank Zalom**, insect pest population monitoring; **Karen Klonsky**, comparison of production costs and profit margins for the production systems; and **Steve Temple**, evaluation of alternative plant species for low-input and organic rotations.

Other researchers and their specialties include **Tom Lanini**, weed ecology; **Ted Wilson** and **Mike Hoffman**, entomology; **Don Grimes**, irrigation; and **Jim Marois**, plant pathology. Cooperators include **Gene Miyao** and **Tom Kearney**, Yolo County farm advisors; **Kathleen Barnes**, Capay Valley organic farmer; **Ed Sills**, Pleasant Grove organic farmer; **Tony Thrkovich** and **Chuck Dudley**, Yolo County farmers. **Mary Kirk** is the project research manager. The crop production manager is **Bill Cruickshank**.

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Cooperative Extension Responds: Low-Input Workshops

In response to farmer requests for information on ecologically sensitive farming practices and alternatives to pesticides, the University of California Cooperative Extension has scheduled five new workshops throughout the state from October 1989 through February 1990, is planning two others and will co-sponsor an annual conference. For cost and registration information please see the CALENDAR on the back page.

Grapes

Growing Grapes with Reduced Inputs, is a workshop scheduled **October 24** at the UC Kearney Agricultural Center in Parlier. Co-sponsored by Cooperative Extension and UC SAREP, topics include principles of viticulture and integrated pest management, leaf removal, biological control, new approaches (soaps, oils and vacuum machines), management of leafhoppers, mites and mealybugs, and an open forum discussion. The workshop is planned by **Donna Hirschfelt** and **Harry Andris** of the UC Cooperative Extension (UCCE) office in Fresno County, **Bill Peacock** of the UCCE office in Tulare County, UC Viticulture Specialist **Pete Christensen** of the Kearney Ag Center, and **Jill Auburn** of the SAREP.

Introduction to Reduced-Input Wine Grape Management, is scheduled **November 7** in Stockton. This is a morning meeting addressing site and variety choice, vine nutrition and cover crop management, and management of leafhoppers, mites, bunch rots, powdery mildew, and nematodes, and will include a panel discussion. It is sponsored by the northern San Joaquin Valley counties Cooperative Extension offices, the Lodi District Grape Growers, and UC SAREP and is planned by Area Integrated Pest Management Advisor **Jim Stapleton**, **Kathy Kelley** (Stanislaus County UCCE), **Paul Verdegaal** (San Joaquin County UCCE) and **Jill Auburn** (UC SAREP).

Growing Grapes with Reduced Inputs, is a Santa Rosa workshop tailored to North Coast wine growers. This **November 14** workshop includes site and variety considerations, floor management, cover crops, insects and disease management, trellising, vineyard/winery wastes, and a panel discussion. It is sponsored by University Extension, Cooperative Extension and UC SAREP and planned by **Dennis Pendleton** of University Extension-Davis, UC Davis Viticulture Specialist **Jim Wolpert**, and several farm advisors. **Jill Auburn** is the SAREP contact.

Soil

Annual Crops: Enhancing Soil Quality for Successful Production, is scheduled **January 10, 1990** at UC Davis and is sponsored by University

Extension-Davis, UC SAREP and Cooperative Extension. Topics include improving soil structure, irrigation management, weed management with tillage and/or living mulches, fertility management (compost, manure, cover crops) and crop rotations. **Dave Chaney** is SAREP contact.

A second workshop on enhancing soil quality for annual crops is being planned and will be announced when a date and location are confirmed.

Vegetables

Organic Vegetable Production is a workshop scheduled **December 12-13** at the UC Kearney Agricultural Center, Parlier. This workshop will alternate between University personnel and experienced growers in sessions on marketing, soil management, and pest management. Sponsored by Cooperative Extension, UC SAREP and the Small Farm Center, it is planned by **Pedro Ilic** and **Rich Coviello** (UCCE Fresno County), **Norma Ray** (UCCE at Kearney), **Tom Willey** (Fresno area grower), **Jill Auburn** (SAREP), and **Claudia Myers** (Small Farm Center).

Citrus

Preliminary plans are underway for a low-input citrus meeting in mid-winter. The planning group includes **Neil O'Connell** of the Tulare County UCCE, Lindcove Field Station Citrus Specialist **John Pehrson**, **Jill Auburn** of SAREP, and members of California Citrus Mutual. **Sustainable Agriculture News** will provide more information when plans are complete.

Farm Conference

Additionally, the UC SAREP joins Cooperative Extension, the California Association of Family Farmers, the California Department of Food and Agriculture (CDFA) Direct Marketing Program, the Small Farm Center and other organizations in co-sponsoring the annual *Farm Conference* in Visalia **February 16-18, 1990**. This event emphasizes strengthening the family farm, innovative marketing methods, and sustainable farming practices.