

## *Winter 1996*

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## From the Director: Advisory Committees Provide Perspective

When legislation was passed requesting the university to create the UC Sustainable Agriculture Research and Education Program in 1987 (SB872, Petris), it included the directive to form two advisory committees to advise program staff on planning, administration and competitive grants. The Technical Advisory Committee is made up of individuals from within the UC system, while the Public Advisory Committee consists of Californians from outside the university.

The people on these committees have been very helpful to SAREP. They have made important suggestions and provided useful advice on our competitive grants. They have also offered invaluable guidance on short- and long-range planning issues. A wide diversity of people is represented on both committees, which is intentional, as "sustainable agriculture" is a very broad subject.

There is not always complete agreement among committee members, as there rarely is when individuals from diverse backgrounds work together. A case in point was the 1990 negotiation about funding the 100-year farming systems project at UC Davis, known as the Long Term Research on Agricultural Systems (LTRAS) project. Disagreements among committee members regarding the funding of that project were a result of honest differences of opinion. In the final analysis, the LTRAS project was improved by intense debate. That debate also sent an important message to SAREP staff about improving the ways in which we deal with differences of opinion. Partly as a result of the LTRAS discussions, SAREP staff members have devoted time to facilitation training, including sessions with UC Cooperative Extension advisor Jim Brenner, which has helped our advisory committee meetings (and many other meetings) run more smoothly and effectively. We still air differences of opinion, but we know how to lead these discussions in productive, non-confrontational directions.

Our committee members have always provided helpful, thoughtful comments. **Bill Rains**, professor of agronomy and range science at UC Davis, provided important leadership when SAREP first began, and was an important advocate of long-term natural resource research. At least seven years ago Yolo County farmer **Fran DuBois** supported the idea that SAREP's research experiments be brought to farmers' fields rather than doing them at UC field locations, because of the "reality check" that actual farm fields provide. Kern County farmer **Jack Pandol** advised that we use the case study approach in our research projects, similar to the approach used in business schools. He believes well-documented case studies are very worthwhile, and provide information farmers find helpful. Kern County farmer **Steve Pavich** recommended that we needed to provide more information on soil fertility. Santa Cruz County farmer **Kay Thornley** and Yolo County farmer **Kathy**

**Barsotti** urged us to support projects that acknowledge the importance of labor. California State University, Sacramento philosophy professor **Stan Dundon** asked us to consider the importance of ethics in agricultural research projects and educational activities. **Maren Hansen**, former director of the Santa Barbara County Safe Food Project, and Santa Barbara County Cooperative Extension Director **Larry Yee** underscored the value of including broad community coalitions in the discussion of food safety issues. Plumas/Sierra counties Cooperative Extension Director **Holly George** has encouraged SAREP to understand the importance of economic diversification for communities in timber- and cattle-dependent areas. Amador County Director **Donna Hirschfelt** emphasized the huge responsibilities of farm advisors, who are operating in an era of dwindling resources. Agriculture writer **Sibella Kraus** made the case for community gardens and agriculture education in the context of our program. Sonoma County farm advisor **Dan Desmond's** perspective on educating the urban population about the realities of food and fiber production was very useful. Tehama County ranch manager **Frank Dawley** has championed the importance of beef cattle management in watershed research. San Diego County farmer **Bill Brammer** stressed the importance of funding research showing why and how organic farming methods work, and studies of the conversion of conventional agriculture to organic production. **Jim Grieshop**, community education specialist in the UC Davis Department of Human and Community Development, provided invaluable information from his surveys documenting farmers' processes during the transition. **Duncan McMartin**, Extension Specialist emeritus at UC Davis' Veterinary Medicine Extension Unit, was particularly helpful in animal welfare issues. Sonoma/Marin counties Cooperative Extension Director **Ellen Rilla** has stressed the importance of working with local groups to solve public policy issues. Monterey County farmer **George Work** asked SAREP to strongly consider the importance of the entire farm family in production agriculture decision-making, while **Lupe Sandoval**, pesticide safety educator for the UC Statewide Integrated Pest Management Project, made sure that farmworker input was considered in our funded projects. I haven't named every member of SAREP's committees, but we have learned from them all, and they have contributed vastly to the program's charge to serve California's extensive agricultural community. All of their suggestions and expertise have been helpful in providing us guidelines for the future.

It is extremely useful for people inside and outside the UC to sit around the table and listen to each other. In discussions about research projects or about issues facing California agriculture, we need to have diverse perspectives in order to make sure that our decisions reflect the needs of the state. We try to reach consensus among our advisory committee members so that this diverse group of individuals can feel they have had an impact and have been heard. There are many opinions about how we ought to deal with present and future issues in California, and we need to provide a way for these perspectives to be heard. We hope that is what we are doing with our committees, and we salute those who have given and continue to give their valuable input. -*Bill Liebhardt, director, University of California Sustainable Agriculture Research and Education Program.*

## SAREP Information on Web

UC SAREP is part of the information superhighway through its World Wide Web server located at <http://www.sarep.ucdavis.edu/>

The Web (WWW) is a hypertext and multimedia server of electronic information on the Internet. We post information on the dozens of SAREP-funded research and education projects, hundreds of articles from seven years of quarterly newsletters, and much more. Nearly all SAREP information appears in print as well as electronic forms. To receive print copies of SAREP documents, write UC SAREP, University of California, Davis, CA 95616; Tel: (916) 752-7556; Fax: (916) 754-8550; e-mail: [sarep@ucdavis.edu](mailto:sarep@ucdavis.edu)

### Other Interesting Sites...

If you do have access to the Internet and have been curious about what is available related to sustainable agriculture, you may be interested in the Web site of the University of California Integrated Pest Management Project, <http://www.ipm.ucdavis.edu/>

The UC IPM Project was established in 1980 to develop and promote the use of integrated, ecologically sound pest management programs in California. Its Web site includes the Project's newest directory, its 1995 annual report, a database of UC recommended alternatives for controlling pests, and descriptions of UC IPM on-line resources, microcomputer software and databases, publications, slide sets and videos, training programs, and information on ordering or scheduling them.

Another site related to pest management was set up by the Pesticide Action Network North America (PANNA). PANNA's site is located at <http://www.panna.org/panna/>

PANNA is a nonprofit citizen-based organization that advocates adoption of ecologically sound practices in place of pesticide use. Its Web site includes PANNA's worldwide news weekly, a resource section with reviews of periodicals, reports and videos, and a section linked to pesticide reform reports published on the Web.

## SAREP Funds New Projects

- [Community Development and Public Policy Projects](#)
- [Production Projects](#)
- [Graduate student awards.](#)
- [Grants for Educational Events](#)

Thirty-six research and education projects have been granted a total of \$203,430 by UC SAREP in the 1995/96 funding cycle, according to **Bill Liebhardt**, SAREP director. New projects were chosen in four different areas: community development and public policy, production, educational events, and graduate student awards. A brief description of the projects, principal investigators and amounts awarded for the first year follows.

### **Community Development and Public Policy Projects (6 Projects; \$51,699)**

- **Patricia Allen and Jackelyn Lundy**, Center for Agroecology and Sustainable Food Systems, UC Santa Cruz, "Food Security in Santa Cruz, California: Building a Foundation for Community Action": \$8,560. This project will focus on the city of Santa Cruz and its issues of food security, which means the ability of community members to have a secure, culturally acceptable, nutritionally adequate diet through local non-emergency sources within a viable, environmentally sound agricultural system. This will be addressed by research, policy analysis, community networking and publications to support the development of a local food policy council. Guided by an advisory committee of local stakeholders and food policy experts, the investigators will prepare a report on food security in Santa Cruz, including who is most at risk nutritionally and why.
- **Joyce M. Ewen**, Pomona-Inland Valley Council of Churches, "PIVCC's Food Security Project": \$5,000. This project will increase food security by building the capacity of a low-income neighborhood to produce its own food, increase knowledge and practice of good nutrition, and expand accessibility of fresh, locally grown food. The collaborative project will link several key organizations to create solutions for hunger issues and long-term food security.
- **Santos Gomez**, Pacific Institute for Studies in Development, Environment and Security, "Using Water Transfers to Promote Sustainable Rural Development": \$11,000. This project will determine the conditions under which water transfers can promote the health and sustainability of rural communities. Working collaboratively with farmer and farmworker organizations, rural community leaders, and other researchers, the investigators will determine where water transfers

could generate significant positive or negative impacts and identify policy alternatives for water transfers that encourage sustainable rural development.

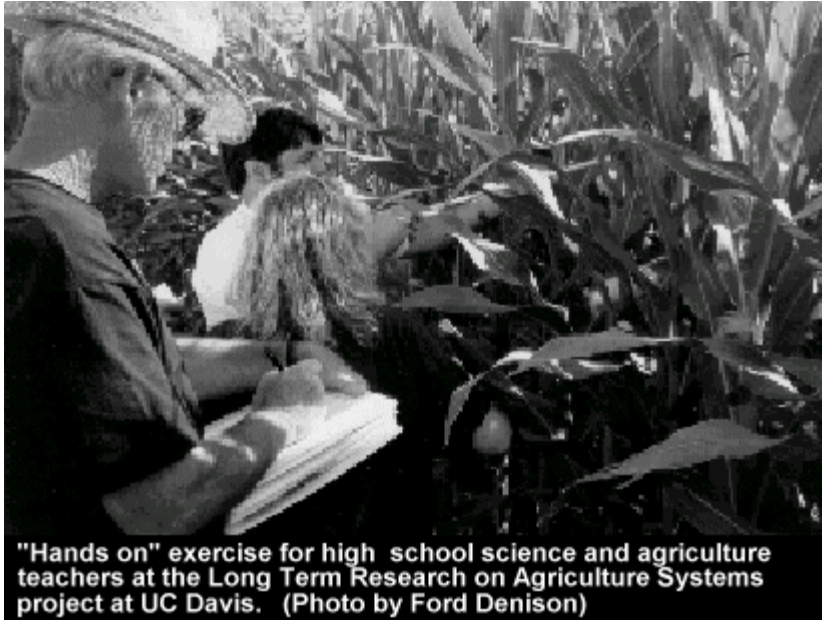
- **Robert Gottlieb**, Urban Planning, UCLA, "Expanding Direct Marketing Opportunities for Community Development and to Reduce Pesticide Use": \$10,139. This continuing project will complete a feasibility study of a "Market Basket" program in which farmers who sell at farmers' markets use a new marketing arrangement resembling community supported agriculture. Demonstration projects will be launched in two low- and middle- income communities with large minority populations, one in Southwest and one in East Los Angeles.
- **Sharon Junge**, Placer County Cooperative Extension Office, "Impacts of Local Food Systems on Communities and Agriculture/Reason for the Seasons...Increasing Sustainable Practices Among Consumers": \$10,000. This continuing project is encouraging greater purchasing and production of local agricultural products to create a more stable and sustainable community. The investigators are working with a grassroots agricultural marketing association, PlacerGROWN, to educate consumers on the benefits of purchasing locally produced, processed and distributed food that is geared to seasonal availability.
- **Sibella Kraus**, Center for Urban Education about Sustainable Agriculture, "Market Cooking for Kids: Developing Children's Consciousness of Regional Sustainable Agriculture": \$7,000. This project is an innovative cooking and science program for children in Bay Area public schools which combines hands-on education about the biology and production of local seasonal foods with basic cooking instruction about how to appreciate and prepare these foods. The program will reach almost 500 children, primarily from low-income backgrounds and will be a year-long collaborative effort among the school district, restaurants, produce businesses, farmers' markets, and regional farms.

## **Production Projects**

**(11 projects; \$128,481)**

- **Roger Ingram**, Placer-Nevada counties farm advisor, "Controlled Grazing on Foothill Rangelands": \$21,500. This project will address the expressed needs of Northern California livestock producers for research-based information on controlled grazing and sustainable livestock production practices. It will also demonstrate how land owners and ranchers can monitor the effects of these practices so they can decide for themselves whether controlled grazing is appropriate for their business. The project will also address public concerns about the environmental impacts of grazing.
- **Rob Atwill**, UC Davis Veterinary Medicine Teaching and Research Center, Tulare CA, "Assessing the Environmental Risk from Rangeland Cattle Shedding *Cryptosporidium parvum* in their Feces": \$7,966. Large municipal water-borne outbreaks of *Cryptosporidium*-induced gastroenteritis in humans has raised questions among ranchers,

government regulators and watershed managers as to whether cattle grazing is a leading source of this pathogen and how best to equitably minimize its possible impacts. This project will determine whether and under what conditions eggs of the pathogen shed in the feces of rangeland beef cattle can survive the ambient temperatures typical of California rangeland from spring through fall.



- **Larry Forero**, Shasta-Trinity counties farm advisor, "History of Livestock Grazing on the Shasta-Trinity Forest: Implications for the Future": \$5,000. Historical documents indicate that livestock grazing in Shasta, Siskiyou, and Trinity counties has decreased from 90,000 animal unit months (aum: amount one cow with a calf eats per month) during the 1930s to about 9,400 currently. This study will reconstruct the history of grazing in the Shasta Trinity National Forest and determine the causes for this reduction of grazing activity. The data could be used to demonstrate how reduction in livestock grazing on public land translates to private land use decisions.
- **Bruce Jaffee**, Nematology, UC Davis, "Suppression of Plant-Parasitic Nematodes in Conventional and Organic Farming Systems": \$9,000. This is the second year of a study in which soils from conventional and organic farming systems are being examined for their suppressiveness to plant-parasitic nematodes. The project will be conducted at the Sustainable Agriculture Farming Systems project at UC Davis.
- **Steve Temple**, Agronomy and Range Science, UC Davis, "A Comparison of Conventional, Low Input and Organic Farming Systems: The Transition Phase and Long-Term Viability": \$37,500. The [Sustainable Agriculture Farming Systems](#) project at UC Davis, now in its eighth year, compares four farming systems with varying levels of dependence on external resources over a 12-year period.
- **Ford Denison**, Agronomy and Range Science, UC Davis, "Rotation Length and Organic Transitions": \$7,000. An additional four-year organic rotation was added last year to the Long Term Research on Agricultural Systems (LTRAS) project at UC Davis. SAREP provided

the start-up money for this 100-year long-term farmland research experiment in 1990. This part of the LTRAS project will continue to evaluate two-year and four-year rotation length and will assess the contributions of soil quality and human factors in the transition to organic farming.

- **Steven Koike**, Monterey County farm advisor, "Determination of the Effect of Cover Crops on Lettuce Drop Disease": \$3,540. This is the second year of a study that will determine the ability of cover crop residues to reduce lettuce drop disease. Another objective of the study is to determine the effects of compost on populations of the lettuce drop pathogen.
- **Krishna Subbarao**, Plant Pathology Specialist, U.S. Agricultural Research Station, Salinas, "Subsurface Drip Irrigation for Soilborne Disease Management in Lettuce": \$8,000. In the first year of this study, the use of subsurface drip irrigation compared to furrow irrigation was shown to reduce the incidence of lettuce drop and the severity of corky root, two serious diseases of lettuce in the Salinas Valley. Also, yields were higher under drip irrigation. The second year of the study will continue with the same objectives to verify the results and will include fungicide-sprayed vs. unsprayed subplots.
- **Jay Rosenheim**, Entomology, UC Davis, "Ecology of a Group of Generalist Predators, the Green Lacewings, and their Contribution to Biological Control in Almonds and Walnuts": \$8,000. This project seeks to develop an improved understanding of the ecology of green lacewings, one of the dominant groups of generalist predators in almonds and walnuts. The research will evaluate whether releases have the potential to substantially augment natural populations, and will determine the optimum timing and developmental stage of release.
- **Marita Cantwell**, Vegetable Crops, UC Davis, "Alternative Postharvest Treatments for Decay and Insect Control": \$13,000. Consumer demand for pesticide-free produce is increasing while consumers also continue to expect insect-free and decay-free products. This project will evaluate the two important benign postharvest treatments, high carbon dioxide atmospheres and heat therapy, for their effects on decay and insect control on grapes, pears, leafy greens, tomatoes, and peppers.
- **Michael Costello**, Fresno County farm advisor, "Fostering Transition toward Balanced Predator/Prey Mite Populations in Vineyards Using Narrow Range Summer Oil": \$7,975. While the most frequently applied pesticide for Pacific mite on grapes is effective, it has a 30-day reentry period and is scheduled for cancellation due to regulatory changes. This project will evaluate the effects of narrow range summer oil, which has a 12-hour reentry period, on Pacific mite and predator mite populations in comparison with the standard mite treatment.

## **Graduate Student Awards (6 projects; \$10,250)**



- **David Smethurst**, Geography, UC Berkeley, "The Effects of Changes in Landholding Patterns and Land Use on Vegetation in El Dorado County": \$2,000.
- **Jacqueline Chu**, Geography and Environmental Studies, San Jose State University, "Social and Environmental Restoration through Urban Therapeutic Gardens": \$900.
- **Clara Nicholls**, Entomology, UC Davis, "An Agroecological Strategy for the Conversion of Commercial Flower Production Systems to Low-Input Organic Management": \$2,000.
- **Jennifer Thaler**, Entomology, UC Davis, "Artificial Stimulation of Host Plant Defenses in Cultivated Tomato and Effects on the Herbivore and Natural Enemy Community": \$1,939.
- **Lynn Wunderlich**, Plant Protection and Pest Management Program/Entomology, UC Davis, "Evaluating Release Techniques for Efficient Delivery of Green Lacewings (*Chrysoperla rufilabris*) for Control of Mealybug on Grapes [*Pseudococcus maritimus* (Ehrhorn) and *Pseudococcus affinis* (Maskell)]: An On-Farm Study of Augmentative Biocontrol": \$1,846.
- **Daniel Carroll**, International Agricultural Development/Human and Community Development, Davis, CA, "The Effects of Health and Safety Regulations and Labor Management Practices on Production Agriculture in California: A Case Study of Winegrape Operations in Sonoma and San Joaquin Counties": \$1,565.

## Grants for Educational Events (8 projects; \$13,000)

Educational grants are awarded to individuals and organizations to conduct workshops, field days, and other educational events related to sustainable agriculture. Eight grants were awarded to support 13 different programs around the state. For more information on a particular event, call the telephone number shown. To learn more about SAREP's educational grants program, call [David Chaney](#) at (916) 754-8551.

[Click here to view updated 1995-1996 Grants for Educational Events information](#)

- **Roger Ingram**, Placer-Nevada counties farm advisor; **Dave Pratt**, Napa-Solano counties farm advisor; "The California Grazing Academy": \$1,000. (916) 889-7385.
- **Miguel Altieri**, Entomology and Plant and Soil Microbiology, UC Berkeley, "A Mobile Workshop on the Scientific Basis of the Conversion Process of High Input Conventional Systems to Agroecological Management": \$1,000. (510) 642-9802.
- **Mark Freeman**, **Michael Costello**, Fresno County farm advisors, "Sustainable Production in the San Joaquin Valley: Grapes, Citrus, Nut

Crops, and Stone Fruits": \$2,000 (2 workshops). (209) 456-7265.

- **Stephanie Larson**, Sonoma-Marin counties farm advisor, "Determining the cost of Forage Production and Grazing Land Rental to Maintain Sustainable Beef Cattle Operations": \$1,000. (707) 527-2621.
- **Jill Klein, Richard Reed**, Community Alliance with Family Farmers Foundation, "The Lighthouse Farm Network Educational Events": \$5,000 (5 workshop/field days). (916) 756-8518.
- **Desley Whisson**, Wildlife, Fish and Conservation Biology, UC Davis, "A Workshop on Vertebrate Pest Management in Agriculture": \$1,000. (916)754-8644.
- **Paul Vossen**, Sonoma County farm advisor; **Michael Dimock**, Sunflower Strategies, "Sustainable Practices Marketing Initiative": \$1,000. (707) 527-2621.
- Douglas Parker, Agriculture and Resource Economics, UC Berkeley; **Lee Fitzhugh**, Wildlife, Fish and Conservation Biology, UC Davis; **Bruce Roberts, Allan Fulton**, Kings County farm advisors, "Workshop on Agriculture/Wetlands Coordination in the Tulare Lake Basin": \$1,000. (510) 642-8229.

# Fresno & Madera CE Highlights

by Ann Mayse, SAREP

*[Editor's Note: This is the second of a series highlighting selected research projects and other information from University of California Cooperative Extension personnel. Due to space limitations, this will not be a complete summary of all farm advisor, home advisor or specialist work, but rather a forum to share selected projects of interest and other information with our diverse readership. Individuals who would like to submit information for consideration for future issues are welcome to contact Ann Mayse or [Lyra Halprin](#) of SAREP for more information. (Ann Mayse, UC SAREP, 4930 North Van Ness Blvd., Fresno, CA 93704; voice/fax: (209) 229-9033; amayse@cati.csufresno.edu; [Lyra Halprin](#), UC SAREP, University of California, Davis, CA 95616; voice: (916) 752-8664; fax: (916) 754-8550; lhalprin@ucdavis.edu.)]*

This article highlights selected research of farm advisors in Fresno and Madera counties. Information was gathered at two 1995 meetings of the farm advisors and SAREP staff, and from personal and written interviews.

## FRESNO COUNTY

**Steve Sutter:** Sutter started with Fresno Cooperative Extension in 1990 and serves Fresno, Kings, Madera and Tulare counties. He works in the Agricultural Personnel Management Program, which is a special UC program started in 1981 to work on issues of labor management and safety. There are only two agricultural personnel management farm advisors and one specialist in the state. His colleagues are **Gregory Billikopf** who is housed in Modesto and serves Merced, Stanislaus, and San Joaquin counties, and **Howard Rosenberg**, a specialist housed at UC Berkeley.

Sutter says he handled 2,500 calls regarding agricultural personnel issues in 1994 and expects to exceed that count in 1995. Additionally, he presented more than 70 talks for employees and supervisors around the state. He works on laws and regulatory issues, safety training, development of job descriptions, and EPA worker protection standard training. Sutter noted that he "tries to run with the issues" and respond to current concerns. In 1991 he worked hard to procure relief for farm laborers and farmers during the disastrous citrus freeze. He runs a monthly farm labor contractor round-table to discuss issues and help resolve problems.

He has developed many leaflets, including at least one with an audio cassette narration in Spanish; a checklist of labor regulations (OSHA, Department of Labor, EPA); and safety programs in English and Spanish. He compiled a 43-page booklet on EPA worker protection standards. Since Sutter is not

bilingual, he relies on community members for translation when necessary. He has developed a set of postcards for employers to use for ordering required posters from various sources. He also writes a newsletter distributed statewide with a circulation of 3,700.



**Michael Costello:** Costello is the new viticulture farm advisor, and has been on the job since February 1995. Over the past three years a SAREP grant has partially supported his research, which investigated the effects of cover crops on spiders and the variegated leafhopper. He found that, contrary to popular belief, maintaining vineyard ground covers in the spring and summer does not affect the population of canopy spiders compared to clean cultivation. On the other hand, ground covers lowered leafhopper numbers, probably because they also decreased vine vigor.

More recently, Costello has helped organize a biologically integrated vineyard systems (BIVS) group in the central San Joaquin Valley. This project uses the Biologically Integrated Orchard Systems (BIOS) model, which brings together researchers, growers and pest control advisors (PCAs) to assess ways to enhance all vineyard inputs, and curtail those which are disruptive to the vineyard ecosystem or which are environmentally detrimental. So far twelve Fresno area growers are enrolled in the BIVS program, and strategies include: reducing rates of the herbicide simazine, using 'Cahaba white' vetch and compost to mitigate nematode pressure, and using summer oil for mite control. BIVS vineyards will be closely monitored beginning in the spring of 1996. The program was initiated through a grant from the US-EPA.

**Mark Freeman:** Freeman is working on several citrus projects, including a study with **John Menge** and **Ole Becker** of UC Riverside which is investigating the effects of mulches, compost and biocontrol agents on the health of citrus roots. **Neil O'Connell**, a Tulare County farm advisor, is collaborating with Freeman on a new project which will investigate different citrus ground floor practices on fruit yield and quality. Freeman is also working on a project investigating the safe use of citrus herbicides, including limiting their movement from fields, with **Tim Prather** of Kearney Agricultural Center (KAC), O'Connell and **Kurt Hembree**, a Fresno farm advisor. Freeman is involved in work on controlling ant damage in citrus with **Harry Shorey** of UC Riverside. Additionally, he is working on efficient citrus irrigation techniques.

Freeman's continuing almond projects include work with rootstocks and selected varieties, fire ant control, irrigation, and control of hull rot and bloom diseases. He is also involved in a project investigating the effect of barn owls on pocket gophers with **Lee Fitzhugh**, a wildlife biology specialist at UC Davis. That project was recently supplemented with a grant from the federal Renewal Resource Extension Act, which will result in a scientifically based manual about predatory birds of California. Freeman is pursuing funding to conduct more work with **Desley Whisson**, a UC Davis wildlife biology specialist, on monitoring methods and thresholds for pocket gophers found in orchards.

**Kurt Hembree:** Hembree was hired as the vegetation management farm advisor in December 1994. He works primarily with PCAs and growers. Previously he was a staff research associate in Fresno County for eight years, working in both IPM and conventional weed control.

He is investigating deep plowing for nutsedge control. Preliminary results indicate that this method suppresses the nutsedge until the crop gets established, but does not provide complete control. He notes that questions remain, including what effect this practice will have on nematodes, pathogens or salts, or what interval will be required between plowing.

Hembree believes that research should consider the economic impact of practices. He feels that if a method is not economical, the PCAs aren't likely to use it. For example, his work on alternatives to herbicides in tomatoes showed that it was more expensive to monitor for weeds than to use herbicides.

He says it is difficult to obtain long-term research funding, which is important to find more complete answers to questions. As an example, he has a trial using synthetic mats to reduce weeds around microsprinklers in citrus. The mats are saving labor, and herbicide rates are down about 10 percent. However, he notes that it is important to look at how long the mats last. He has found that within five years citrus roots grow up into the mats. He is not sure what impact this will have on herbicide use, diseases, or other pest effects.

Hembree is collaborating with **Tim Prather** at KAC on "smart spray" machine technology to reduce the amount of post-emergent herbicide needed to control seedling weeds in deciduous orchards and vineyards.

**Dan Munk:** Munk conducts research and extension on soil fertility, irrigation, land issues, and cotton. He works with PCAs and agronomists on soil fertility and cover crops, composts, and fertilizers, as well as with the cotton industry on improving cotton production practices. One of Munk's projects involves using gin trash on cotton fields.

Munk is very interested in the issue of chemicals for defoliation and weed control in cotton. He notes that industry is sensitive to the impacts of defoliant, i.e., public sensitivity to defoliant regarding reports of sinus problems and other health issues.

Munk, along with farm advisors **Alan Fulton** (Kings), **Bill Weir** (Merced-Fresno), **Blake Sanden** (Kern) and **Brent Holtz** (Madera), publishes the *Agricultural Resource Manager*, a newsletter to "encourage the wise use of soil and water resources in the San Joaquin Valley." He also publishes the *California Cotton Review*. He notes that it is difficult to find grants for interdisciplinary newsletters and has been working to find supplemental funding for the *Agricultural Resource Manager* for the last two years. [Contact Munk at (209) 456-7561 for information about his publication.]

He is working with irrigation districts on a project that uses water meters to help schedule irrigations and improve farm water management. He has conducted drip irrigation meetings on the West Side (the use of drip tape in row crops) in cooperation with Davis extension specialists and works on other methods of reducing drainage on West Side irrigated lands.

Munk is also involved in developing methods of managing cotton through detailed plant observation (growth, fruit development/retention.) From May through July he holds monthly meetings for cotton growers to discuss these ideas, as well as pesticide management and agronomy decisions.

Munk is working with **Stu Pettygrove** from UC Davis on a project to compost gin trash and municipal yard waste, sewage sludge and manures. He assesses gin trash applied to crops for its effects on yield, soil nitrogen levels, and plant petiole nutrient levels.

He notes that **Sean Swezey's** UC Santa Cruz conversion study from conventional to organic production in cotton has come up with good plant-based information.

**Rich Coviello:** Coviello has been working with Cooperative Extension since 1981. Previously he worked with **Charlie Curtis** (USDA) on almond winter sanitation, and with **Charlie Summers** (KAC) doing population ecology studies in various field and vegetable crops.

He is involved in a study to determine the damage threshold of thrips, an insect pest which significantly reduces processing onion yield and quality. This is new information and will allow growers to use an objective treatment threshold rather than a subjective "seat-of-the-pants" estimation, he says.

Coviello is also studying the timing of omnivorous leafroller (OLR) treatment. The objective of this project is to develop data to use the existing phenology model of omnivorous leafroller to accurately time treatments based on degree-days as is used for other pests such as peach twig borer (PTB) and San Jose scale. This information is essential for the effective use of biorational pesticides such as *Bacillus thuringiensis* (Bt) products.

In cooperation with IPM specialist emeritus **Bill Barnett**, Coviello explored the use and timing of Bt sprays as an alternative to organophosphate sprays at bloom to control PTB in stone fruits and almonds. Currently, materials are applied at early bloom and petal fall. He feels that it is important to correlate these applications with the phenology of the pest rather than the phenology of the plant, since they do not always coincide. Coviello notes that pheromone traps are not effective for tracking pest numbers for treatment. Rather, they indicate whether a pest is present and where it is in its life cycle.

Coviello participated in the release of biological control agents for the control of the ash whitefly, a new pest of ornamentals in the Central San Joaquin Valley. The biological control agents were successfully established by **Charlie Pickett** and colleagues at the California Department of Food and Agriculture's Division of Biological Control Program, and ash whitefly is no longer a serious pest. He is also evaluating conventional and biorational pesticides for the control of onion thrips, serpentine leafminers, melon aphids and silverleaf whiteflies.

During the past five years, Coviello has cooperated on a project funded by the UC IPM Project and the California Energy Commission to validate and demonstrate sampling methods for worm pests in processing tomatoes. Most PCAs are using at least some portion of the methodology determined by this project for making management decisions.

Ants continue to be a serious problem in almonds, causing significant damage to nut meats and disrupting naturally occurring biological control agents. Coviello will be cooperating with several researchers looking at various means of managing ant populations using selective baits with insect growth regulators. This may help maintain predaceous and beneficial ant species while controlling damaging species.

## **MADERA COUNTY**

**Ron Vargas:** County Director Vargas has been working for the university in Madera County for 23 years. His appointment is 40 percent county director and 60 percent agronomic crops and weeds farm advisor. He is the interim cotton specialist.

He has been working on an alfalfa interplanting trial that started in Madera County. Others have now joined the study which expanded to become a regional project. The northern part of the state has been added. The objective is to interplant alfalfa with oats to mitigate the use of herbicides in seedling alfalfa. In some cases the study found they could reduce herbicide use. Another problem is the invasion of weeds as alfalfa gets older. They are now looking at overseeding grasses and some clovers in old stands to reduce weeds and increase the feed value of alfalfa hay. Many herbicides cannot be used in the older alfalfa stands because of plant-back restrictions. **Tim Prather** at KAC is also involved in the study. It was funded through the UC IPM Project for implementation and demonstration. A recent survey of Fresno and Madera counties showed 20 percent of growers had tried or currently use this practice.

Vargas also works on cotton variety development for regional adaptability and resistance to verticillium wilt. Six Central Valley cotton farm advisors meet regularly and coordinate their work on cotton in general.

He is also working on a three-year project supported by Cotton Inc. investigating nitrogen and groundwater contamination. The project is looking at nitrogen rates on cotton. He has found as yield potentials increase, growers usually increase nitrogen inputs, which may not be necessary. The USDA is using a deep soil probe to trace nitrogen applications to cotton.

Defoliant studies are also part of Vargas's responsibility. He notes that defoliants may pose a public relations problem. He is investigating new materials and techniques that are odor-free and require lower application rates.

He is also working with Prather at the KAC investigating deep plowing (12 inches) using a new plow design for nutgrass, annual morning glory, and nightshade control. Preliminary data show a reduction in weed populations. Current work is aimed at determining how often the treatment needs to be repeated, since the practice may actually bring up buried seed if repeated the following year.

Vargas is also cooperating on **Sean Swezey's** UC Santa Cruz organic cotton project. The objective is to study the conversion from conventional to organic cotton production. The energy component was funded by a California Energy

Commission grant. They are completing their third year. **Karen Klonsky**, an agricultural economics specialist at UC Davis, is performing the cost study.

**Brent Holtz**: Holtz is the new pomology farm advisor in Madera County. He just finished a postdoctoral appointment at the KAC where he worked with **Themis Michailides** investigating the brown rot disease. Their work included a study which compared brown rot levels in orchards using a conventional approach to fertilization and pest control, and orchards that emphasized soil fertility and management through summer cover corps, both annually planted and native grasses. The study, *A Multidisciplinary Approach to Evaluate and Aid the Transition from Conventional to Low Input Pest Management Systems in Stone Fruits*, was funded by the USDA-SARE program.

Holtz is continuing to work on cultural control of brown rot. He is interested in finding inoculum sources and notes that the literature shows conflicting reports on disease sources in the field. He says that since the 1940s most brown rot control has been through the use of fungicides. He has found that the cultural control of inoculum sources includes the removal of mummies from the trees. The cost of this practice can average up to \$35/acre, since old mummies must be removed from the orchard, not just dropped to the orchard floor. He notes that the timing of this removal is also critical. Holtz suggests that the best practice is to drop all fruit to the orchard floor right after harvest before infected fruit has had a chance to form mummies. He will continue some of this work in his new role as farm advisor.

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## New PAC/TAC Member Joins SAREP

UC SAREP is required by California's 1986 Sustainable Agriculture Research and Education Act to have both public and technical advisory committees to advise the university on program goals and make recommendations on competitive grant awards. The Public Advisory Committee (PAC) includes individuals actively involved in agricultural production, as well as representatives from government, public organizations, and institutions of higher education. The Technical Advisory Committee (TAC) is made up of universitywide faculty and staff with knowledge and experience related to sustainable agriculture and makes recommendations about the scientific merit of grant applications. Each PAC or TAC member serves for three years.

In the last quarter of 1995, **Andrew Rubin** joined the Public Advisory Committee. Rubin is a staff toxicologist in the Medical Toxicology Branch, Department of Pesticide Regulation, California Environmental Protection Agency (Cal-EPA). His areas of expertise include cell biology (neoplastic transformation, progression), and pesticide toxicology. He is particularly interested in the uses and misuses of genetic technology in agriculture, and the role of pesticides in extractive and non-extractive agriculture.

### Continuing PAC/TAC

Public Advisory Committee: **Catherine Brandel, Gail Gant, Marion Kalb, Ron Mansfield, John Roberts, Bryte Stewart, Don Villarejo and Angus Wright.**

Technical Advisory Committee: **Edith Allen, Scott Johnson, Don Klingborg, Juan Palerm, Tom Shultz and Lucia Varela.**

Biographies of continuing PAC/TAC members appeared in the Summer 1995 (Vol. 7, No. 3), Fall 1994 (Vol. 6, No. 4) and the Summer 1993 (Vol. 5, No. 3) issues of *Sustainable Agriculture*.

### Retiring PAC/TAC

Advisory committee members who are rotating off the PAC or TAC in the spring of 1996 include: PAC: **Peter Coe, Jennifer Curtis, and Frank Dawley**; TAC: **Holly George, Don Nielsen, Carol Shennan and Ellen Rilla**. UC SAREP is very appreciate of the work that advisory committee members do for the program (See *From the Director*, p. 1.)



## California Farm Conference Set for Visalia

*by Jeannette Warnert, UC Agricultural Communications, Fresno*

Tremendous strides this century in agricultural science and technology have not made traditional, small, family farms obsolete. In fact, 60,000 small farms in California produce crops valued at roughly \$1 billion using sophisticated production and marketing systems.

These innovations are the hallmark of the annual California Farm Conference, which this year brings farmers, farmers' market managers, ag consultants and other members of the ag industry from all over the state to the Radisson Hotel and Convention Center in Visalia. Three days of workshops, tours, speakers and special events at the conference all focus on sustaining farm profitability.

"Operating a successful farm requires many special skills and abilities," says conference coordinator **David Visher**, program representative for the University of California's Small Farm Program. "These talents-including an intimate understanding of land and crops, market intuition and familiarity with new ag technology-are nowhere more important than on small, family farms."

The conference begins Sunday, Feb. 18, 1996 with optional tours and short courses, and formally opens that evening with a reception featuring California wine, food grown by local farmers and dishes prepared by local restaurant chefs.

"The tasting offers participants the chance to taste some of the best food in the region, and perhaps more importantly, it helps connect the produce harvested on farms with the food on consumers' tables," Visher says. The agenda Monday and Tuesday, Feb. 19 and 20, features nationally known keynote speakers and nearly 40 workshops. The workshops focus on four themes: marketing, production, sustainability and farm management.

"The workshops offer a wide variety of information, everything from improving soil fertility and using cover crop systems, to selling produce to restaurants and wholesale distributors," Visher says. "Participants can tailor the conference to their needs by selecting the workshops of their choice."

Keynote speakers include **Mas Masumoto**, a Dinuba farmer and the celebrated author of *Epitaph for a Peach*, and **Marty Strange**, program director and co-founder of the Center for Rural Affairs in Walthill, Nebraska.

The Center is devoted to the economic, social and environmental well being of rural America.

Basic conference registration is \$95. For more information, call the California Federation of Certified Farmers' Markets at (818) 449-0179 to request a registration packet.

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## Sources of Funding

### Fertilizer Research Awards

A Request for Proposals will be out in mid-January 1996 from the California Department of Food and Agriculture's Fertilizer Research and Education Program. Funding will be available for projects directed toward the environmentally safe and agronomically sound use and handling of fertilizer materials. For details and to be put on the mailing list, contact **Casey Walsh-Cady** or **Kertrina Anderson** at CDFA, (916) 653-5340; e-mail: [lwcady@ucdavis.edu](mailto:lwcady@ucdavis.edu)

### Funding Resource Note:

Funding-seekers may want to investigate *Environmental Grantmaking Funding 1995 Directory* (March 1995), published by Environmental Research Institute, 1655 Elmwood Ave., Suite 225, Rochester, NY 14620, Tel: (800) 724-1857; Fax: (716) 473-0968. The 700-page directory with information on 600 grantmaking foundations is available for \$70 plus \$5 shipping and handling.

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## Resources

### Compost Publication

*Compost Production and Utilization: A Grower's Guide*, by **Mark Van Horn**, Fertilizer Research and Education Program/CDFFA and UC Division of Agriculture and Natural Resources, UC ANR Publication 21514, 17 pages, 1995, \$5. This publication provides farmers and agricultural advisors with practical information on the production and use of compost, including benefits, basic biology of compost, and proportion techniques. Contact: UC ANR Publications, 6701 San Pablo Ave., Oakland, CA 94608-1239; Tel: (800) 994-8849 within California or (510) 642-2431; Fax: (510) 643-5470; e-mail: anrpubs@ucdavis.edu

### Organic Ag Statistics

*Statistical Review of California's Organic Agriculture 1992-93*, by **Karen Klonsky** and **Laura Tourte**, Cooperative Extension, Department of Agricultural Economics, University of California, Davis, 43 pages, 1995, free. This report was prepared for the California Department of Food and Agriculture Organic Program to summarize information on organic growers and handlers (those who handle, market and/or process organic products) for the first year in which the California Organic Foods ACT (COFA) was implemented. As a result of the state registration procedures for growers and handlers, data exists which makes it possible to statistically characterize California's organic agricultural industry for the first time. This statistical review for 1992-93 offers the most comprehensive analysis of the industry to date. Contact: Laura Tourte, Tel: (916) 752-9376; Fax: (916) 752-5614; e-mail: tourte@primal.ucdavis.edu

### Fertilizer Research Proceedings

*Proceedings: 3rd Annual CDFFA Fertilizer Research and Education Program Conference*, free. Proceedings are available from the California Department of Food and Agriculture's Fertilizer Research and Education Program (FREP) Dec. 7, 1995 conference at the Kearney Agricultural Center in Parlier. The 123-page publication includes new and completed FREP and related non-FREP project summaries and updates, and speeches of conference participants. FREP promotes the environmentally safe and agronomically sound use and handling of fertilizer materials by funding projects and developing and disseminating information. For free copies of the proceedings contact **Casey Walsh-Cady** or **Kertrina Anderson** at CDFFA, (916) 653-5340; e-mail: lwcady@ucdavis.edu.

### Dairy Options

*Profitable Dairy Options: Grazing-Marketing-Nutrient-Management*, Research highlights from USDA-Sustainable Agriculture Research and Education (SARE) program/Agriculture in Concert with the Environment (ACE), 8 pages, 1995, free. This focuses primarily on rotational grazing studies and new marketing approaches for dairy farmers, but also includes information on nutrient management and contact information for experts on

feedlot-oriented dairy systems. Contact: **Kristen Kelleher**, Western SARE communications specialist, (916) 752-5987; e-mail: [kkelleher@ucdavis.edu](mailto:kkelleher@ucdavis.edu).

### **Food Security Review**

*Without Waiting...How the International Community Can Promote Food Security*, a Development Education Exchange Papers (DEEP) publication, edited by **Clive Robinson**, **Laurence Tubiana**, and **Ad Ooms** of the Food Security Ad Hoc Group of the Food and Agriculture Organization (FAO) of the United Nations, 45 pages, September 1995. This review of projects, programs and documents related to food security includes articles on why the international food supply is insecure, the relationship of food security policy and poverty, trade, the international environment, food aid, investment in agriculture, and international food security advocacy. Available free to nongovernmental organizations or institutions involved in development work. Contact: DEEP, Office for External Relations, FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy; Tel: (396) 522 55106; FAX: (396) 522 55784; e-mail: [OER-Registry@fao.org](mailto:OER-Registry@fao.org)

### **Marketing Tipsheet**

*The Hot 50 Farm Marketing Tips*, by **Eric Gibson**, New World Publishing, 6 pages, 1995, free. This pamphlet contains 50 of the best marketing tips from *Sell What You Sow! The Grower's Guide to Successful Produce Marketing* by Gibson. Subjects include direct marketing, selling through grocery stores, restaurants and wholesale channels, merchandising, customer service, promotion and advertising. To order the free (include \$2 for shipping and handling) pamphlet, write to New World Publishing, 3085 Sheridan St., Placerville, CA 95667.

### **Biointensive Book**

*How to Grow More Vegetables (than you ever thought possible on less land than you can imagine)*, fifth edition, by **John Jeavons**, Ten Speed Press, 228 pages, 1995, \$19.95. Jeavon's book has been the text/reference of ecological food growers worldwide for almost 25 years. In addition to new and updated gardening information, this edition includes tables for accurate gardening planning. Price includes postage worldwide (California residents: \$21.18). Order from Ecology Action, 5798 Ridgewood Road, Willits, CA 95490-9730; Tel: (707) 459-0150 or (415) 328-6752; or from Ten Speed Press, Tel: (800) 841-BOOK.

### **Home/Market Gardening**

*The New Organic Gardener: A Master's Manual of Tools and Techniques for the Home and Market Gardener*, second edition, by **Eliot Coleman**, Chelsea Green Publishing Co., 304 pages, 1995, \$24.95. A revised, expanded second edition of Coleman's classic book on organic gardening, includes new chapters on farm-generated fertility, non-toxic pest management through the creation of optimum growing condition for plants, movable growing tunnels for season extension, and a list of information sources. Contact: Chelsea Green, Tel: (800) 639-4099 or (802) 295-6300.

### **Pesticide Hotline**

The toll-free National Pesticide Telecommunications Network (NPTN) has been funded for \$2.5 million for five years by the US Environmental

Protection Agency to answer questions about pesticide safety for the general public and the medical, veterinary and professional communities. Co-sponsored by Oregon State University Extension Service, pesticide specialist with toxicology training are answering about 2,200 calls per month from all over the U.S. NPTN provides science-based information about a wide variety of pesticide-related subjects including products, recognition and management of pesticide poisonings, toxicology, environmental chemistry, referrals for laboratory analyses, investigation of pesticide incidents and emergency treatment, safety practices, health and environmental effects, and clean-up and disposal referrals. NPTN staff refer calls to other sources including state departments of agriculture and Extension Service offices. Callers interested in alternative or least toxic pest control procedures may be referred to groups like the Biointegral Resource Center. Pesticide emergencies are directed to the Oregon Poison Control Center or the National Animal Poison Control Center. NPTN operates from 6:30 a.m. to 4:30 p.m., Pacific Time, Monday through Friday, excluding holidays. The telephone number is (800) 858-7378; Fax: (503) 737-0761. Written requests may be addressed to NPTN, Agricultural Chemistry Extension, OCU, 333 Weniger, Corvallis, OR 97331-6502.

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## **National survey of attitudes towards agricultural natural resource conservation.**

*Max D. Larsen and Patricia L. Colsher*

Natural Resources Conservation Service. 1995

This survey of a nationally representative sample of 1,250 persons was conducted via telephone interviews during December 1994 and January 1995. The purpose of this study was to evaluate the public perception of environmental issues such as pollution, food safety and water supply as well as to determine the level of recognition of the Soil Conservation Service (SCS), now called the Natural Resources Conservation Service. The survey was conducted by The Gallup Organization.

According to the results of this survey, issues of water quality and supply and air pollution were the foremost concerns for respondents when considering natural resource issues and problems in their own state and community. Community concerns also included landfill and toxic waste disposal issues, while statewide concerns included forestry, pesticide and other chemical use, and soil quality. It was interesting to note that respondents generally regarded the environmental condition of the entire world and the U.S. to be worse than that of their own community. In rating the environmental condition on a scale of 1 to 10, where "10" was "excellent" and "1" was "very polluted," the most frequent rating for the world and the U.S. was "5." The most frequent rating for participants' own communities was "7." Almost a quarter of respondents reported that there were no natural resource problems in their own community.

Participants were also asked to consider the level of environmental caretaking by different industries and groups. These groups were rated on a scale of 1 to 10 with "1" meaning "serious polluter" and "10" meaning "excellent caretaker of the environment." Of the ten groups named by the interviewer, "agriculture in general" and "individual farmers" were rated the highest. "Individual farmers" had an average rating of 6.7; "agriculture in general" averaged 6.3. However, "large corporate farms run by companies" were rated 5.4-similar to the mean rating scores of other industries such as construction, lawn services, timber, and high-tech industries.

Survey participants did, however, register concern regarding the impact of agriculture on the environment. Approximately half of the respondents disagreed with statements that suggested that current levels of agricultural pesticides and fertilizers in our food and water supply are safe. While a quarter of respondents agreed with these statements, the last quarter were undecided.

Some government regulation of agricultural natural resources seems to be

acceptable and expected by most respondents. When questioned on the appropriateness of different strategies that the federal government might use to handle natural resource problems, options such as voluntary incentive programs, withholding benefits, and imposing penalties were all seen as appropriate by at least half of the respondents. The only option deemed inappropriate by over half the respondents was the reduction or elimination of government involvement in agriculture such that "whatever happened would be allowed to happen."

Further acceptance of environmental protection by the government could be seen in the responses to questions regarding laws protecting threatened and endangered species and agricultural wetlands. About 40 percent of respondents felt that protection for both endangered species and wetlands did not go far enough, while 38 percent felt these protection laws were about right. About 15 percent thought wetlands protection went too far, and 24 percent thought endangered species laws went too far. Clearly, a majority of this sample did not feel that these environmental protections are too stringent. Even when faced with the issue of federal spending on resource conservation, over half of the respondents wanted to increase the spending (either a little or a lot); only 16 percent wanted to decrease spending.

In many of the survey responses, it was evident that the older respondents were less likely to regard environmental problems as seriously as the younger respondents. It is therefore not surprising that the younger respondents were more supportive of increased spending on conservation and were more likely to expect more government regulation of natural resources in the future.

This survey found that half of all respondents had heard of what was then called SCS. However, 80 percent of the farmers and ranchers surveyed were familiar with SCS. Although only 3 percent (43 persons) of the survey participants had received services from SCS, the majority of them were satisfied with the services they had received.

For more information write to: Conservation Technology Information Center, 1220 Potter Dr., Room 170, West Lafayette, IN 47906-1383; (317) 494-9555.

(CI-SUST.109) Contributed by Bev Ransom

# **Rangeland health: New methods to classify, inventory, and monitor rangelands.**

*National Resource Council, Committee on Rangeland Classification*

National Academy Press, Washington, DC. 1994

Rangeland ecosystems make up between 40 and 50 percent of the land area of the U.S., spanning a diversity of climates and geographic regions. As the debate over the health and management of these lands has increased, scientists have begun to question the methods and data used to classify and describe rangeland resources. One of the primary reasons for raising these questions is that, even when using the same methods and data, experts are not in agreement about the health and sustainability of our nation's rangelands. The purpose of this National Academy of Sciences report was to examine the scientific basis of the current methods of analysis and classification used by the three federal agencies involved in rangeland management: the U.S. Department of Agriculture's National Resources Conservation Service (USDA-NRCS, formerly SCS) and Forest Service (USFS), and the U.S. Department of Interior's Bureau of Land Management (BLM).

The Committee on Rangeland Classification that produced this report established three objectives for their study: 1) analyze historical and current procedures used by federal agencies to assess rangelands; 2) evaluate the success of current systems as tools for characterizing rangeland health and ecological condition; and 3) identify the primary scientific obstacles to developing improved systems.

In order to fulfill these objectives, the Committee organized their fact-finding and deliberations around five key areas. These five areas are reflected in the organization of the report.

## Report Highlights

Chapter 1, *Rangelands are Important*, inventories the various products, commodities and benefits derived from rangelands. This chapter also outlines the history of rangeland use and management and highlights the need for accurate assessments of rangeland productivity and long-term health.

Chapter 2, *Rangeland Health*, identifies the goals of national assessments and recommends standards for these assessments. This chapter also presents a method for determining when the threshold from health to degradation is crossed, and defines the role rangeland health assessments should play in the larger effort to characterize, monitor, and manage rangelands.

Chapter 3, *Current Methods of Rangeland Assessment*, examines the development of current theory and practice for rangeland assessment. This chapter also evaluates the assessment methods used by federal agencies and their suitability for assessing rangeland health.

Chapter 4, *Criteria and Indicators of Rangeland Health*, recommends that the health of rangeland be assessed by evaluating three sets of criteria: 1) the stability of soils and watersheds; 2) the integrity of nutrient cycles and energy flows, and 3) the functioning of ecological processes that enable rangelands to recover from damage. The Committee introduces an initial set of indicators and quality standards, and argues strongly for a more consistent interpretation of rangeland health among technical assistance and land management agencies.

Chapter 5, *Inventorizing and Monitoring Rangeland Health*, reviews some of the past inventories and national surveys of rangeland quality. This chapter also describes current inventoring and monitoring systems, and underscores the need for new or revised systems that are capable of generating the information needed for a national-level assessment.

1. The report acknowledges the importance of the many rangeland inventories that have been conducted in the past, but issues a challenge for a bona fide national-level assessment of rangeland health. Such an assessment, according to the report, would require:
2. adoption of a standardized and consistent definition of rangeland health and of measurable indicators of change; 2) consistent and well correlated classification of federal and nonfederal rangelands;
3. collection of data by the same or similar methods that will enable the data to be combined on a national level; 4) collection of data on the basis of a statistically valid sampling scheme; and 5) periodic and consistent repetition of sampling to detect trends in the measures used to evaluate rangeland health.

In conclusion, the committee identifies six action items needed to organize a meaningful and accurate national level assessment of rangeland health. These are:

1. The secretaries of the U.S. Department of Agriculture (USDA) and Department of the Interior (DOI) should convene an interagency task force to develop, test, and standardize indicators and methods for inventoring and monitoring rangeland health on federal and nonfederal rangelands.
2. The secretaries of USDA and DOI should develop coordinated plans for implementing a system of periodic sampling on federal and nonfederal rangelands that will produce accurate estimates of, and determine changes in the proportion of healthy, at-risk, and unhealthy rangelands.
3. Indicators of soil surface condition should be added to all current and ongoing range condition and ecological status assessments, and any other ongoing efforts to assess rangelands, as a first step toward a more comprehensive evaluation of rangeland health.
4. All current and ongoing rangeland assessments done as part of the Resources Conservation Act appraisals, Resources Planning Act assessments, national forest planning, USFS and BLM land use and allotment planning, and environmental assessments should be based on the analysis of multiple ecological attributes.
5. Basic data on soil surface conditions, erosion rates, plant composition, and biomass production assembled and used to assess rangelands should be made available to the public and the scientific community for independent review.
6. USDA-NRCS, USFS, and BLM should continue current and ongoing range condition and ecological status ratings while the transition to rangeland health assessment is made.

*Rangeland Health: New Methods to Classify, Inventory, and Monitor Rangelands* is

available for \$26.00 from the National Academy Press, 2101 Constitution Ave., NW,  
Lockbox 285, Washington, DC 20055.

(DEC.530)

Contributed by [David Chaney](#)

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## **Symposium proceedings: Sustainability of range livestock production systems in the West (held November 17-21, 1994).**

*Montana State University*

Montana State University Extension Service. 1994

The organizers of this four-day symposium had two objectives. Their first objective was to present the results of a major research project funded through the USDA-Sustainable Agriculture Research & Education (SARE) program. This project, *Specifying and Analyzing Whole-Ranch Systems for Sustainable Livestock Production in Environmentally Sensitive Areas*, was conducted on ranches in the plains and foothill-mountain regions of Montana. The second was to explore the adequacy of the various criteria being used to assess the sustainability of range livestock production systems in the West. To address this second objective, a variety of speakers was invited to present perspectives on rangeland sustainability, including scientists, ranchers, industry representatives, and representatives from environmental interest groups.

The proceedings contain abstracts from 20 different presentations given during the symposium. A wide range of subjects are addressed in these papers. They are not in-depth analyses, but contact information is provided for each abstract so that readers can pursue their areas of interest with the authors if they wish. Major topics covered in the symposium include the following:

- Perspectives on Sustainability
- Economic and Social Issues Affecting Sustainability
- Changing Range Conditions: Impacts on Sustainability
- Managing Rangelands: Strategies for Sustainability
- Effects of Wildlife and Livestock Interactions on Sustainability
- Impacts of Rangeland Management Policy on Sustainability: Views and Recommendations Regarding the Sustainability of Livestock on Federal Ranges

In their preface to the proceedings, the symposium organizing committee concludes that: 1) the research of the Montana-based SARE project indicates that the majority of ranches monitored in the study are profitable, financially sustainable, and compatible with environmental goals; 2) the ongoing research on range livestock production systems in the West and adjoining regions demonstrates progress on identifying attributes of sustainable systems; and 3) the debate about the adequacy and appropriateness of the criteria used to assess the sustainability of rangeland systems needs to continue.

Copies of the symposium proceedings are available for \$25.00 from Jack Riesselman, Department of Plant Pathology, 525 Leon Johnson Hall, Montana State University, Bozeman, MT 59717.

(DEC.531)

*Contributed by [David Chaney](#)*

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## **"How to" monitor rangeland resources.**

*University of California Intermountain Workgroup*

University of California, Cooperative Extension, Division of Agriculture and Natural Resources, Oakland, CA. 1994

Analysis and debate at the national and regional level point to the need for accurate and consistent methods of assessing the sustainability of rangeland ecosystems. One essential tool for accomplishing this task is rangeland monitoring. Monitoring is the systematic recording of observations, processes, or activities to detect how rangeland changes over time. Monitoring methods vary in their complexity, but all are focused on assessing the productivity and stability of the resource base.

This "how to" manual is a step-by-step guide for developing and implementing a ranch monitoring program. It was written and produced by a team of natural resources advisors from University of California Cooperative Extension. These include Glenn Nader (Lassen County), Mike DeLasaux (Plumas-Sierra counties), Rick Delmas (Modoc County), Dan Drake (Siskiyou County), Larry Forero (Shasta-Trinity counties), Sheila Barry (Tehama County), Holly George (Plumas-Sierra counties), and Rhonda Gildersleeve (Inyo-Mono counties).

According to the authors of this handbook, monitoring is useful for: 1) determining the effectiveness of management practices; 2) establishing a record of range conditions documenting the effect of livestock grazing on key areas; 3) measuring a trend toward a desired condition; and 4) defending grazing practices.

The handbook is divided into two levels. Level 1-Beginning, introduces the concepts needed to start a ranch monitoring program. It describes why monitoring is important and how it can be used in different situations, and covers some basic methods of monitoring and organizing information. Specifically, the authors focus on how to use information from historical documents, US Geological Survey Maps, and aerial photographs; how to monitor and keep records with a camera; and how to supplement photographic information with more detailed observations.

Level 2-Advanced, offers more detailed guidelines for monitoring vegetative cover and for mapping forage conditions on the range. In addition, the advanced level looks at special applications for rangeland monitoring including riparian monitoring, water quality and fisheries, and monitoring wildlife.

One section of the handbook profiles the monitoring practices of an Inyo county rancher. In that profile, he offers a rancher's perspective on the usefulness of monitoring. "The point of monitoring should not be just to



convince someone else of your management, but also as a document of changes over time. You, as the rancher, need to fine-tune your own observations and decisions for the land. Statistical concerns and techniques that the agencies use are really not very useful to ranchers-annual pictures of country you are familiar with can give you a lot of information to help you understand your land. A rancher's lifetime of observations, even though it can't be quantified, is still the best way to know the land. Taking pictures just makes the observations more acute, and documents what you already know. Do not be intimidated that there is a lot to know, just start on a simple level and get out there and do it every year. You will learn as you do it, and refine your techniques as you need to."

For more information, or to order copies of *"How To" Monitor Rangeland Resources*, contact Rhonda Gildersleeve, UC Cooperative Extension, 207 W. South Street, Bishop, CA 93514 Tel. (619)873-7854. Level 1 (44 pages) of the manual costs \$15.00 plus \$3.00 shipping. Level 2 is available at an additional charge (call for details). A companion video to this manual titled *Observing your Rangelands Over Time: Setting up a Monitoring Program using Photos* is also available for \$15.00 plus \$3.00 shipping.

(DEC.532) *Contributed by David Chaney*

## California Water 2020: A Sustainable Vision

*Peter H. Gleick, Penn Loh, Santos V. Gomez, and Jason Morrison*

Pacific Institute for Studies in Development, Environment, and Security.  
1995

This 113-page report is the product of a year-long investigation by researchers at the Pacific Institute, an independent, nonprofit center with offices in Oakland, Calif. The report contains a wealth of data on existing water use patterns and recommends changes that would enable the state to achieve water sustainability by the year 2020. The authors define "sustainable water use" as "the use of water that supports the ability of human society to endure and flourish into the indefinite future without undermining the integrity of the hydrological cycle or the ecological systems that depend on it."

In contrast to what many water analysts assume, the report asserts that "To realize this positive vision, no significant new supply infrastructures need be built, nor are any drastic advances in technology necessary. No 'heroic' or extraordinary actions are required of any individual or sector." Instead, needed changes can occur by extending existing technological innovations and encouraging changes already taking place in personal values and culture.

Although the report gives equal treatment to changes impacting urban, environmental, and agricultural interests, readers of this newsletter will be most interested in the report's vision for agriculture. Currently, agriculture accounts for over three-quarters of the net societal demand for water in California, and bears a major responsibility for the estimated annual groundwater overdraft of one million acre-feet. Most of the overdraft is concentrated in the Tulare Lake hydrologic study area (i.e. the southern San Joaquin Valley), which accounts for 58 percent of the state total, and in the Central Coast, which accounts for 28 percent.

The report asserts that with "modest" reorganization, "the agricultural sector can be more efficient, with lower total water demand and higher [net] agricultural revenues." Better managed and more efficient irrigation systems are part of the answer, including expanding the use of drip or microsprinkler techniques, and soil moisture sensors linked to computerized water monitoring systems.

But the authors' major recommendations for agriculture have to do with shifts in cropping patterns. They note that the water-intensive crops alfalfa, cotton, rice, and irrigated pasture now consume 54 percent of all agricultural water used, yet produce only 17 percent of the state's agricultural revenue. By shifting acreage from these to higher-value crops which use less water, "agricultural net water demand could decline by 3.5 million acre-feet while

farm income rises by \$1.5 billion (in 1988 dollars)."

They reach this conclusion by making projections from either of two crop change scenarios. The first, called "Balanced Groundwater," reduces irrigated alfalfa and pasture acreage within each hydrologic region to the point where the amount of water saved equals the amount of groundwater overdraft projected by the Department of Water Resources (DWR) in 2020. The second, called "Agricultural Restructuring," adds to these reductions a scaling back of cotton and rice acreage to 1960 levels. The authors are careful to note that the scenarios do not take into account all of the economic, social and technical barriers facing farmers contemplating such a conversion. Instead, they assume that in all cases in which crops are substituted, alternative crops in the region are increased proportionately, and that only crops which are currently grown in the region are introduced.

The report makes a number of recommendations for improving California's long-term water policy and planning. Among the recommendations are the following: 1) promotion of the use of water-efficient technologies; 2) gradual phaseout of most federal and state water subsidies along with subsidies for low-value, water-intensive crops; 3) establishment of a comprehensive groundwater management program; and 4) support for water transfers in ways that improve water efficiency, protect the environment, and promote the well-being of rural communities (see description of the new SAREP-funded Pacific Institute research project, page 3).

## **Reviewer's Comments**

The report exposes in clear detail the weakness of current water planning, marked by the persistence of a large gap between water supply and expected demand. Beyond sounding the call for more sustainable water use patterns, the report's chief appeal is its attempt to stake out plausible alternatives that do not cause severe negative impacts on any particular sector. Farmers and others involved in agriculture should be particularly interested in considering these alternatives, since DWR projections for 2020 show agriculture as the major economic loser if current water use trends favoring urban and environmental interests continue unchecked. By contrast, this report develops a scenario whereby agriculture and urban users both cut water use, environmental values are protected, and agriculture remains profitable. Whatever its shortcomings, the report is to be commended for attempting to stake out a "common ground" approach which advances sustainability without sacrificing agriculture in the process.

Determining the plausibility of the report's agricultural change scenario would require a more detailed follow-up study. This study would have to take into account agronomic and marketing realities which may prove to be more substantial barriers than this report envisions. By its own admission, the report has oversimplified the difficulties involved in the crop shifting scenarios at the heart of its agricultural analysis. At a minimum, the changes called for are not likely to be as painless as the authors suggest, nor will the recommendations be greeted with equal favor among all segments of the agricultural community. In trying to emphasize what will be good for agriculture generally, they understate the problems that these scenarios would imply for many individual farmers, particularly those in the regions where overdraft problems are currently the greatest. In the face of these difficulties

it is a little optimistic of the authors to state that no "heroism" will be required in realizing their vision.

By introducing charts which compare crop revenue per acre-foot of irrigation water used, the report focuses needed attention on a critical issue: Given that water is a finite resource, the achievement of sustainable agriculture in the state will require us to not only consider how we grow but also what we grow. At the same time, water is not the only criteria for defining the sustainability of crop choices. In many cases there may be good environmental or social reasons for using alfalfa, maintaining irrigated pasture lands, etc., even though these are heavy water users.

Like other sustainability issues, this one can only be resolved through public debates with full participation of all affected stakeholders. As the authors note, sustainability "is a social goal, much like equity, liberty, or justice. It implies an ethic. Public value judgments must be made about which needs and wants should be satisfied today-and what changes must be made to insure a legacy for the future." The Pacific Institute's report will no doubt become a common point of reference and a helpful catalyst as the water sustainability debate proceeds.

For more information write to: Pacific Institute for Studies in Development, Environment, and Security, 1204 Preservation Park Way, Oakland, CA 94612; (510) 251-1600.

(CI-SWN.142)

Contributed by David Campbell

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# **Urban and agricultural wastes for use as mulches on avocado and citrus and for delivery of microbial biocontrol agents.**

*W.L. Casale, V. Minassian, J.A. Menge, Carol J. Lovatt, Elinor Pond, E. Johnson, and F. Guillemet*

Journal of Horticultural Science 70:315-332. 1995

The use of mulches may be beneficial for citrus and avocado crops, since they are very shallow-rooted. Some mulches have been shown to reduce Phytophthora root rots through one or more of several mechanisms. This multidisciplinary project, conducted at UC Riverside, examined the use of various organic materials as mulches on young citrus and avocado trees. The goal of the research was to determine the effects of these materials on plant growth and health and their ability to support the growth of microbial biocontrol agents. The researchers also correlated biological parameters with chemical composition of the mulches to determine which mulch characteristics support growth of the trees and of microbial biocontrol agents. Field experiments are also underway to complement this greenhouse work.

## **Materials and Methods**

Eighteen mulching materials were used in the experiment, some of which were composted. Mulches were applied to 'Topa Topa' avocado and 'Troyer' citrange seedlings recently transplanted to pots in a greenhouse (500 ml of mulch per 3-liter pot). Five replicate plants each were used, and the experiments were terminated after three months. Analyses were made of numerous characteristics of the mulch materials, growth of three microbial antagonists of pathogens, and various plant responses.

## **Results**

The greatest amounts of ammonia were released from grass clippings, milled almond and peanut hulls, and alfalfa hay (Table 1). None of the mulches significantly increased shoot growth of citrange seedlings compared to the control. In contrast, avocado shoot growth significantly increased with mulches of yard waste, grass clippings, and earthworm-composted sludge. Almond and peanut hulls were clearly detrimental to the roots of both citrange and avocado roots and to the shoot growth of avocado. The microbial biocontrol agents as a group grew best in yard waste, sudangrass hay, wood compost, rice hulls and rice hulls/paper. Of these, only yard waste, rice hulls, and rice hulls/paper were completely acceptable as mulches for avocado and citrus.

## Discussion

Citrus and avocado are well suited to benefit from mulches. They have very shallow root systems, with the far majority of their roots located in the top 1 to 2 feet of soil. Avocado roots will often grow up directly into a mulch layer; this fact led the researchers to believe that avocado responds more positively to mulching than does citrus.

Among the mulches examined, the structure and chemical composition of yard waste most closely resembles a forest litter layer similar to that in which citrus and avocado evolved. According to the authors, the beneficial effects of yard wastes can be explained by the high-nitrogen grass that offset the high carbon-to-nitrogen composition of wood chips and greatly reduced any temporary nitrogen shortage.

The authors believe that citrus responded better with higher nitrogen and lower carbon mulches than did avocado because citrus responds to nitrogen deficiencies far more rapidly than does avocado. Some of the mulches, such as almond and peanut hulls, several manures, and alfalfa hay, had negative effects in this experiment: They reduced shoot and/or root growth, released large amounts of ammonia upon degradation, and resulted in undetectable populations of at least two of the three biocontrol agents tested.

Animal manures are among the most common amendments applied to citrus and avocado orchards. The authors noted that root damage after application of high ammonia-releasing manures is common, especially to young trees. (Well-composted animal manures which do not release ammonia are believed by the authors to be acceptable for use on citrus.) Young trees are also more sensitive to *Phytophthora* infection. The authors believe that young trees are more susceptible to damage due to the higher foliage-to-root ratio of young compared to older trees; also, older trees may not show damage from the use of manures even though some root loss occurs. They also caution against extrapolating the results of these greenhouse experiments to effects of mulching in the field.

The successful growth of the three microbial biocontrol agents on several mulching materials was promising. Strains of the three species tested, the common soil bacterium, *Pseudomonas fluorescens* and the ubiquitous soil fungi, *Gliocladium virens* and *Trichoderma harzianum*, have showed potential for suppressing *Phytophthora* root rots of avocado and citrus in previous greenhouse experiments.

The results of this research demonstrate several important points, including: 1) the excellent potential for some mulching materials, such as yard waste, for improving growth of trees; 2) mulches most beneficial to citrus and avocado roots are also efficient substrates for some biocontrol agents; and 3) a huge urban problem can be at least partially solved by diverting part of the waste stream to citrus and avocado orchards.

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## Cover crop biology: A mini-review. Part 2.

*Robert L. Bugg*

Article written for Sustainable Agriculture Technical Reviews. 1995

### Introduction

Managing cover crops in orchards or vineyards depends in part on understanding their basic biology. This article, presented in two parts, reviews several aspects of cover crop biology. Part I (see *Sustainable Agriculture*, Vol. 7, No. 4, p. 15) dealt with seeds, seedlings, root-zone biology, nutrient uptake, and the fate of cover crop-derived nitrogen. Part II presented here concerns plant community dynamics and allelopathy. Most of the plant species discussed may be used as cover crops or as forage crops in rangeland settings. The issues raised have general applicability to a number of farming systems in California.

### Yields and Competition in Multispecies Stands

#### Cover Crops and Trees or Vines

Wick and Alleweldt (1983) showed that, when grown together in containers, subterranean clover (*Trifolium subterranean* cv 'Clare') caused a 20 percent reduction in growth of Riesling grape vines. The mechanism for this inhibition was not known, and it occurred regardless of the level of nitrogen fertilization. No such inhibitory effect was seen for subterranean clover cv 'Daliak' or for white clover (*Trifolium repens*). The legumes supplied nitrogen to the vines when only low amounts of nitrogen were added, and there was higher use of water by vines with legumes. When grown in a young vineyard, 'Daliak' showed more rapid early growth than white clover, but was damaged by frost and did not reseed.

In Arkansas, Stasiak (1990) planted peach trees of two scion and two rootstock types into either bare ground or preestablished stands of subterranean clover in the tree rows. With both bare and clover plots, permanent drive middles were maintained in a sod of mixed tall fescue and bermudagrass. Comparison indicated that tree rows with preexisting subterranean clover led to reduced peach tree vigor (shoot growth, trunk cross-sectional area, foliar nitrogen content) during the first year of growth. By the second year, this tendency was eliminated. Stasiak suggested planting subterranean clover in August following the first season of peach tree growth, rather than planting peach trees into preestablished subterranean clover.

Orchardgrass (*Dactylis glomerata*, cv 'Berber'), a vigorous perennial bunchgrass, when grown as a cover crop reduced vine growth by 58 percent and yield by 53 percent of Cabernet Sauvignon grapes in Santa Barbara County of California, although the site featured highly fertile soil (Wolpert et



al. 1993). This effect was due at least in part to increased water stress of the vines.

### **Multiple Legumes**

Williams et al. (1968) showed that subterranean clover has, on the average, larger seed than does crimson clover (*Trifolium incarnatum*), and plot studies indicated that the former will tend to dominate in mixtures due to more rapid early growth and shading of the crimson clover. When larger seeds of crimson clover were selected and interseeded with smaller seeds of subterranean clover, the pattern was reversed. Crimson clover was not eliminated from any of the mixtures evaluated.

Hill and Gleeson (1991) found that when paired with either 'Seaton Park' or 'Daliak' subterranean clovers (both *Trifolium subterraneum* ssp. subterranean) in a three-year field study, the cultivar 'Clare' (*Trifolium subterranean* ssp. brachycalycinum) dominated the mixed stands. Soil pH was about 5.5, mowing was once every four weeks. Petiole length of 'Clare' is much greater than the early-maturing 'Daliak,' and slightly greater than the mid-season maturing 'Seaton Park.' 'Clare' also showed better seedling vigor and survival and greater seed production per plant under stress. Dry matter production by 'Clare' also is less dependent on plant density. There was evidence of overyielding by mixtures of 'Clare' and 'Seaton Park.' (Overyielding refers to the situation where the yield of the polyculture exceeds the yield of its highest yielding component grown in monoculture.) 'Clare' seed reserves appeared to be more greatly reduced over the summer months than those of 'Seaton Park' or 'Daliak'. *T. s.* ssp. brachycalycinum is supposedly adapted to neutral to alkaline soils, and is believed less tolerant to close grazing and less able to bury its burs than is *T. subterraneum*.

Williams (1963) sowed crimson clover (strain S. Australian commercial), rose clover (*Trifolium hirtum*, strain S.6), and subterranean clover (cv 'Bacchus') in pure plantings and in three 1:1 mixtures of two species each. Competition for light was assessed in relation to leaf area and leaf position in the canopy. Leaf area in 4-cm horizontal strata, leaf weight, shoot weight production, and light penetration through canopies were measured at intervals during the vegetative phase (i.e., through 99 days after sowing). Crimson and rose clovers held apparent initial advantages over subterranean clover, in terms of light-absorbing surface area of cotyledons and first unifoliate leaves, and because these leaves were elevated further from the soil surface. However, this situation changed with time. In paired sowings, crimson and subterranean clover became equally dominant over rose clover, while subterranean clover overtopped crimson clover despite the greater total leaf area of the latter. The most productive mixture (crimson clover + subterranean clover) was no more productive than the best species in monoculture (crimson clover). As noted by Williams (1963a), competition has other dimensions than those reported here, including the advantage conferred by hardseededness of rose clover, which enables it to dominate multispecies stands following droughts that kill clover seedlings.

### **Legumes and Non-Leguminous Forbs**

Guerrero and Williams (1975) conducted several growth chamber studies. In one study, Filaree (*Erodium botrys*) and subterranean clover (*T. subterraneum* ssp. subterranean cv 'Woogenellup') were grown in sole and mixed cultures in a phosphorus-deficient range soil (from Butte County) and

in sand with differing levels of supplemental nitrogen, phosphorus, and sulfur. Filaree dominated if phosphorus was limiting, whereas subterranean clover dominated if nitrogen was left out of the fertilizer. Subterranean clover has a higher requirement for phosphorus than does filaree, and also appears less capable of exploiting insoluble phosphate sources. For this reason, addition of superphosphate to rangeland soils was suggested by the authors as a means of promoting subterranean clover.

Moore et al. (1989) found in pot experiments in Australia that subterranean clover can suppress the seedlings of the perennial weed St. John's Wort (*Hypericum perforatum*) by overtopping the seedlings and shading them out. This study confirmed earlier findings that subterranean clover could suppress the weed if sown into native pastures, particularly if phosphate fertilizers had been applied. The importance of maintaining a closed canopy of subterranean clover during the early phase of weed seedling growth is emphasized.

### **Legumes and Grasses**

Motazedian and Sharrow (1986) conducted a field study of stands of subterranean clover and perennial ryegrass (*Lolium perenne*), in which mowing height and frequency were varied. In stands dominated by perennial ryegrass, greater stubble heights led to greater productivity; the opposite was true for stands dominated by subterranean clover. The greatest interval between defoliations (49 days) led to the greatest productivity of the stands.

In the southwest portion of Western Australia, Cotterill (1990) used unirrigated 35 x 35 cm plots to evaluate competition between cool-season annual grasses and either 'Serena' bur medic or 'Seaton Park' subterranean clover in a ley farming system (wheat-pasture rotation). He found that dry matter production by the legumes was depressed linearly with increasing seeding rates for various cool-season annual grasses, including ripgut brome (*Bromus diandrus*), wild barley (*Hordeum leporinum*), a ryegrass (*Lolium rigidum*), and rattail fescue (*Vulpia myuros*). Additionally, second-year legume biomass production was not significantly depressed by grasses seeded the first year, as long as grass seeding rates were less than 40 percent of the full rates. Full seeding rates for grasses were over eight million seeds per hectare, while those for the legumes were about two million seeds per hectare. When seeded without grasses, the subterranean clover produced the equivalent of 3.1 metric tons of biomass per hectare and the bur medic about 1.5 metric tons per hectare. Pooled across all levels of grasses, the corresponding results for subterranean clover and bur medic were nearly identical at about 1 metric ton per hectare.

In Austria, Danso et al. (1991) conducted a two-year trial in a triple-species mixed sward of white clover (*Trifolium pratense* cv 'Zapican'), birdsfoot trefoil (*Lotus corniculatus* cv 'Gabriel') and fescue (*Festuca arundinacea* cv 'Tacuabe'). White clover showed good production for the first harvest of the first year; thereafter, birdsfoot trefoil dominated. In the first year, both legumes contributed about equally to the approximately 130 kg of nitrogen per hectare fixed in the sward. In the second year, white clover only contributed five percent of the 46 kg of nitrogen per hectare fixed in the last two harvests. Mixtures containing the two legumes have an advantage because the early production by white clover is complemented by later production and better persistence by birdsfoot trefoil. Stands with multiple legumes often show better livestock weight gains.

### **Legumes, Non-Leguminous Forbs, and a Grass**

Mohler and Liebman (1987) reported that high-density plantings of barley were better at suppressing weeds than were intercropped barley and field pea (*Pisum arvense*). Weed suppression appeared to be a result of competition for soil moisture. Weed populations were not reduced, but weed biomass was lower.

Liebman and Robichaux (1990) found that intercropped barley and field pea were no better at suppressing weed mustards (*Brassica kaber*) and white mustard (*B. hirta*) than was a dense monoculture of barley. The main mechanisms of weed suppression were shading (especially by the pea) and competition for nitrogen (especially by the barley). A long-vined variety of field pea ('Century') was better than a short-vined variety ('Alaska') at suppressing mustard growth by shading. 'Century' also showed a greater yield.

### **Legume, Grass, and Various Herbs**

A four-year study in Maryland by Teasdale et al. (1991) suggested that, under no-till management, hairy vetch (*Vicia villosa*) was particularly effective at reducing the densities of the following weeds: goosegrass (*Eleusine indica*), stinkgrass (*Eragrostis cilianensis*), and carpetweed (*Mollugo verticillata*). Under conventional tillage, hairy vetch appeared during one year to increase the densities of large crabgrass (*Digitaria sanguinalis*) above those observed without a cover crop or with cereal rye (*Secale cereale* cv 'Abruzzi'). In some years, cereal rye grown as a no-till cover crop significantly reduced the densities of the goosegrass and carpetweed. In one year, cereal rye managed with tillage led to increased densities of common lambsquarters (*Chenopodium album*).

Teasdale and Mohler (1993) in Maryland and New York State tested the effects of mulching on light transmittance, soil temperature, and soil moisture. The mulch in this study was the clipped residue of herbicide-killed hairy vetch or cereal rye (cv 'Aroostook'). Data for light transmittance and soil temperature suggest that cereal rye and hairy vetch residues have similar initial properties, but that there is more rapid and thorough decomposition of hairy vetch residue. Therefore, cereal rye provides a longer-lasting mulch that blocks light and reduces soil temperature longer.

In a study encompassing two growing seasons at Beltsville, Maryland, Teasdale and Daughtry (1993) showed that living hairy vetch was more effective than standing, paraquat-killed vetch at suppressing weed germination and growth. During droughty periods in both growing seasons, soil moisture was significantly greater in the surface 2.5 cm of soil under living or dead hairy vetch, as contrasted with bare soil. In one year of this study (1990), living vetch led to significantly lower soil moisture than did killed vetch.

### **Grass and a Non-Leguminous Forb**

Soft chess (*Bromus mollis*) suppresses broadleaf filaree (*Erodium botrys*) by shading more effectively under conditions of adequate sulfur (McCown and Williams 1968). When sulfur is limited, broadleaf filaree accesses it sooner because of more rapid extension of its young roots.

### **Allelopathy**

Bialy et al. (1990) found that black mustard (*Brassica nigra*) and brown mustard (*Brassica juncea*) show allelopathic inhibition of other plants. Compounds involved probably include various isothiocyanates, which suppressed wheat germination and growth.

Cereal rye produces several compounds that inhibit crops and weeds. The most active compounds are two hydroxamic acids and their breakdown products (Chase et al. 1991). Wocjcik-Wojtkowiak et al. (1990) reported that residues of tillering plants and rye crop residues contain much lower amounts of allelopathic compounds (various phenolic acids) than do seedlings.

Various legumes in the tribe Viciae (peas, lentils, and vetches) contain Beta-(3-isoxazolinonyl) alanine, which is released into soil as a root exudate, and apparently is an allelopathic compound (Schenk and Werner 1991). This chemical can cause reduced growth in seedlings of various grasses and of lettuce. Pea was only slightly affected.

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*Contributed by Robert L. Bugg*



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**Table 1. Total ammonia released from mulches during**



**20 days of decomposition of mulch materials.**

<b>Mulch Material</b>	<b>Total Ammonia Released (g/g dry wt)</b>
Grass clippings	13,404
Milled almond hulls	10,943
Alfalfa hay	8,486
Milled peanut hulls	2,546
Composted sewage sludge	1,121
Chicken manure	943
Horse/cow manure	923
Sudangrass hay	706
Cow manure	558
Mushroom compost	546
Composted yard waste	545
Yard waste #1	182
Rice hulls	60
Rice hulls/paper	32
Earthworm-composted sludge	20
Wood compost	18
Orange peels	8
Soil (Maddock)	0.3
Yard waste #2	0.2

(CI-CIT.221)

*Contributed by Chuck Ingels*

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# **Urban and agricultural wastes for use as mulches on avocado and citrus and for delivery of microbial biocontrol agents.**

## **Urban and agricultural wastes for use as mulches on avocado and citrus and for delivery of microbial biocontrol agents.**

*W.L. Casale, V. Minassian, J.A. Menge, Carol J. Lovatt, Elinor Pond, E. Johnson, and F. Guillemet*

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The use of mulches may be beneficial for citrus and avocado crops, since they are very shallow-rooted. Some mulches have been shown to reduce *Phytophthora* root rots through one or more of several mechanisms. This multidisciplinary project, conducted at UC Riverside, examined the use of various organic materials as mulches on young citrus and avocado trees. The goal of the research was to determine the effects of these materials on plant growth and health and their ability to support the growth of microbial biocontrol agents. The researchers also correlated biological parameters with chemical composition of the mulches to determine which mulch characteristics support growth of the trees and of microbial biocontrol agents. Field experiments are also underway to complement this greenhouse work.

### **Materials and Methods**

Eighteen mulching materials were used in the experiment, some of which were composted. Mulches were applied to 'Topa Topa' avocado and 'Troyer' citrange seedlings recently transplanted to pots in a greenhouse (500 ml of mulch per 3-liter pot). Five replicate plants each were used, and the experiments were terminated after three months. Analyses were made of numerous characteristics of the mulch materials, growth of three microbial antagonists of pathogens, and various plant responses.

### **Results**

The greatest amounts of ammonia were released from grass clippings, milled almond and peanut hulls, and alfalfa hay (Table 1). None of the mulches significantly increased shoot growth of citrange seedlings compared to the control. In contrast, avocado shoot growth significantly increased with mulches of yard waste, grass clippings, and earthworm-composted sludge. Almond and peanut hulls were clearly detrimental to the roots of both citrange and avocado roots and to the shoot growth of avocado. The

microbial biocontrol agents as a group grew best in yard waste, sudangrass hay, wood compost, rice hulls and rice hulls/paper. Of these, only yard waste, rice hulls, and rice hulls/paper were completely acceptable as mulches for avocado and citrus.

## Discussion

Citrus and avocado are well suited to benefit from mulches. They have very shallow root systems, with the far majority of their roots located in the top 1 to 2 feet of soil. Avocado roots will often grow up directly into a mulch layer; this fact led the researchers to believe that avocado responds more positively to mulching than does citrus.

Among the mulches examined, the structure and chemical composition of yard waste most closely resembles a forest litter layer similar to that in which citrus and avocado evolved. According to the authors, the beneficial effects of yard wastes can be explained by the high-nitrogen grass that offset the high carbon-to-nitrogen composition of wood chips and greatly reduced any temporary nitrogen shortage.

The authors believe that citrus responded better with higher nitrogen and lower carbon mulches than did avocado because citrus responds to nitrogen deficiencies far more rapidly than does avocado. Some of the mulches, such as almond and peanut hulls, several manures, and alfalfa hay, had negative effects in this experiment: They reduced shoot and/or root growth, released large amounts of ammonia upon degradation, and resulted in undetectable populations of at least two of the three biocontrol agents tested.

Animal manures are among the most common amendments applied to citrus and avocado orchards. The authors noted that root damage after application of high ammonia-releasing manures is common, especially to young trees. (Well-composted animal manures which do not release ammonia are believed by the authors to be acceptable for use on citrus.) Young trees are also more sensitive to Phytophthora infection. The authors believe that young trees are more susceptible to damage due to the higher foliage-to-root ratio of young compared to older trees; also, older trees may not show damage from the use of manures even though some root loss occurs. They also caution against extrapolating the results of these greenhouse experiments to effects of mulching in the field.

The successful growth of the three microbial biocontrol agents on several mulching materials was promising. Strains of the three species tested, the common soil bacterium, *Pseudomonas fluorescens* and the ubiquitous soil fungi, *Gliocladium virens* and *Trichoderma harzianum*, have showed potential for suppressing Phytophthora root rots of avocado and citrus in previous greenhouse experiments.

The results of this research demonstrate several important points, including: 1) the excellent potential for some mulching materials, such as yard waste, for improving growth of trees; 2) mulches most beneficial to citrus and avocado roots are also efficient substrates for some biocontrol agents; and 3) a huge urban problem can be at least partially solved by diverting part of the waste stream to citrus and avocado orchards.

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<b>Table 1. Total ammonia released from mulches during 20 days of decomposition of mulch materials.</b>	
<b>Mulch Material</b>	<b>Total Ammonia Released (g/g dry wt)</b>
Grass clippings	13,404
Milled almond hulls	10,943
Alfalfa hay	8,486
Milled peanut hulls	2,546
Composted sewage sludge	1,121
Chicken manure	943
Horse/cow manure	923
Sudangrass hay	706
Cow manure	558
Mushroom compost	546
Composted yard waste	545
Yard waste #1	182
Rice hulls	60
Rice hulls/paper	32
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