

Spring 1990

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From the Director

Land Grant System: Help Farmers Change

Previously I have discussed the need for agriculture to set its own agenda and what farmers can do on their own farms to face the current transition in California agriculture. These two ideas reflect a new and changing goal for agriculture.

New Goal

In the past, our goal was to produce abundant food at reasonable prices. Agriculture was very successful - that goal has clearly been met. Now, however, there is debate about how agricultural production is achieved: how farmers farm. This reflects a change in emphasis in agriculture's goal. The new goal is to produce food and fiber at reasonable costs while maintaining the natural resource base and safeguarding the environment. The new goal makes sense, assuming that agricultural production will continue to be based on natural and man-made inputs derived from a resource base that must be used by future generations.

Land Grant System

Society and growers are increasingly changing their view of what they want from agriculture. The new goal of reasonably priced, environmentally-sound production will directly affect universities throughout the country. The question for us in the land grant system is: How do we help meet the new goal?

Both short-term and long-term questions about this issue require discussion. The short-term questions relate to the fact that California growers are facing a transition involving farming practices, regulations and marketing. The pace of legislative changes, consumers' changing desires, and chemical company actions have the potential to rapidly alter production tools now available to farmers.

Short-term goals

For the short-term, we must help growers address this rapidly changing regulatory environment. In many cases this means finding alternatives for herbicides, insecticides, and nematicides presently in use. As farmers are called upon to be flexible and open-minded, we in the land grant system must be flexible, open-minded and **creative** so we can help growers find new management strategies to produce the food and fiber our society needs.

We must take the lead in helping growers as they work to change their production systems. We must help them develop new cultural, biological,

mechanical, and chemical pest control practices where appropriate.

We need to be willing to consider almost any option that has potential, as the entire agricultural industry is part of a picture that is changing fast. We must also consider preventative strategies, rather than those solely designed to treat problems. Preventative approaches suggest that soil, water, and cultural management may be related to a plant's ability to resist or succumb to pests.

Long-term goals

Long-term goals that will help agriculture address these changes must be explored, including the development of more pest-resistant plants. In many production systems, there are two or three key pests which must be managed in order to achieve a successful crop. Environmentally-sound control of these pests is often not possible based on present knowledge. A longer time commitment is necessary to provide these answers: Long-term research is essential. Long-term funding is a major problem for universities across the country, and is an issue that must be addressed if we are to reach society's new goal for agriculture.

- **Bill Liebhardt**, *director; UC Sustainable Agriculture Research & Education Program*

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SAREP Funds 22 New Projects for \$350,000

Twenty-two projects focusing on sustainable agriculture - ranging from post-harvest fungicide alternatives to labor comparisons of agricultural production systems - have been awarded \$350,000 in grant money from the UC Sustainable Agriculture Research and Education Program (SAREP), according to **Bill Liebhardt**, extension specialist and director of the program.

The statewide sustainable agriculture program was created by the California Legislature in 1986 to address issues facing California agriculture: increasing environmental concerns, food and worker safety, and fluctuating producer profitability. The program funds research and distributes information on sustainable farming practices.

UC SAREP has spent \$1.2 million dollars on 51 sustainable agriculture research and education projects since 1987.

Projects funded this month include:

- a comparison of the work and labor needed in sustainable and conventional agricultural production systems. Focusing on table grapes and carrots, this project will document labor management adjustments needed during the transition to more sustainable production Systems. Slide shows and outreach manuals of results are planned. Investigators: Suzanne Vaupel, agricultural economist, Sacramento; Howard Rosenberg, agricultural and resource economics, UC Berkeley. \$14,995 for one-year study.
- an evaluation of hot water, hot air and high carbon dioxide as alternatives to the application of post-harvest fungicides on melons and tomatoes. This will include an evaluation of fruit quality after it has been treated with hot water, hot air or carbon dioxide. Investigators: Marita Cantwell and Xunli Nie, vegetable crops, UC Davis; Noel Sommer, pomology, UC Davis. \$24,238 for first year.
- introducing sustainable agriculture practices and principles through urban gardening programs in San Francisco neighborhoods. This project will bring together the extensive experience of the San Francisco League of Urban Gardeners (SLUG) and UC researchers to assess city dwellers' understandings and perceptions of sustainable agriculture. They will survey San Francisco gardeners and non-gardeners, develop and test educational materials that expand urban residents' understanding of sustainable agriculture, and apply these findings toward the development of a model demonstration garden. Investigators: Mark Francis, environmental design, UC Davis; Cynthia Hall and Stanton Jones, SLUG. Cooperators: Argonne Community Garden, Richmond District; Dearborn Community Garden, Mission District; Alice St. Community Garden, South of Market. \$6,000 for

first year.

- a method for estimating the rate of inorganic nitrogen release from organic fertilizers. A frequent feature of sustainable agriculture systems is the use of animal manures or other organic nitrogen-containing materials in place of petroleum-derived nitrogen fertilizers. But currently only the crudest methods exist for calculating nitrogen fertilizer value of organic materials. The objective of this project is to develop and test a practical method for predicting the rate at which nitrogen found in manures or composts is converted to usable forms for plant growth. Investigators: Stuart Pettygrove, land, air and water resources, UC Davis; Ken Cassman, agronomy and range science, UC Davis; Richard Smith, farm advisor, San Benito County; Marsha Feyler, farm advisor, Stanislaus County; Thomas Shultz, farm advisor, Tulare County; Ralph Jurgens, New Era Farm Service, Tulare. \$25,000 for first year.
- profiles of five sustainable farms. Survey of the short and long-term consequences of adopting sustainable practices, including biocontrol (use of beneficial insects to control insect pests) in relation to cover crop choices, natural fertilization and integrated pest management systems on five grape and stone fruit farms. Investigators: Everett Dietrick, field entomologist, Rincon Vitova Insectaries, Inc., Oak View; Paul Buxman, farmer, Dinuba; David Mas Masumoto, farmer, Del Rey; Fred Smeds, farmer, Reedley. Other cooperators: Richard and Karen Peterson, farmers, Kingsburg; Rod Riffel, Finca Del Rio Farms, Parlier. \$15,000 for first year.
- ranch monitoring project in the Upper Stony Creek Watershed area of western Glenn and Colusa counties. The problem of declining productivity in the 243,200 acre Upper Stony Creek Watershed area is recognized by land owners and public agencies. In 1989 the Resource Conservation districts requested and received funding from USDA Soil Conservation Service for a ten-year project to reduce erosion, improve water quality and help sustain agricultural production. SAREP funding will cover monitoring of the project in order to quantify the results as well as to provide direction for future activities. Data on ground cover, plants and soil will be collected. Workshops and demonstrations will be scheduled for land owners and managers. Investigators: Monte Bell, farm advisor, Glenn County; John Menke, agronomy and range science, UC Davis; Wendell Gilgert, Soil Conservation Service, Glenn County; Alan Forkey, Soil Conservation Service, Colusa County; Richard King, Soil Conservation Service, Red Bluff. Cooperating ranchers: Jack and Jeff Somerville, Larry Groteguth, Elk Creek; Svend Steffen, Ray Williams, David Brandenberger, Stonyford. \$15,000 for first year.
- a Central California comparison of organic and conventional commercial almond operations. This is a continuation of a popular project that compared organic and conventional almond orchards farmed side-by-side by two brothers. Two additional orchards are being added to the study, which will focus on developing management guidelines for low-input organic or low-input sustainable almond farming practices. Investigator: Lonnie Hendricks, farm advisor,

Merced County. Cooperating farmers: Glenn and Ron Anderson, S.S. Takhar, Hilmar; Doug Betschart, Livingston. \$5,500 for first year.

- a directory of least-toxic agricultural pest management products and services for California. A major obstacle to reducing toxic pesticide use in agriculture is lack of knowledge of the many effective, less toxic pest management products and services available. This project will create a computerized database of commercially available non-chemical pest control products and services, and "least toxic" botanical, microbial and inorganic/mineral pesticides and other products (insect growth regulators, pheromones, etc.) Investigators: William Olkowski and Sheila Daar, Bio-Integral Resource Center, Berkeley. Farmer cooperators throughout the state will be interviewed. \$15,000 for one-year project.
- biological control of aphids in lettuce using in-field insectaries. Aphids are the most serious lettuce pests in the California central coast area, but no effective botanical, biological or cultural control techniques are available. This project will begin a multi-disciplinary study to improve biological control of aphids with in-field insectaries: carefully chosen plant species planted in lettuce fields to provide food and shelter for both existing and introduced natural enemies of aphids. Investigators: William Chaney, farm advisor, Monterey County; Louise Jackson, vegetable crops, UC Davis; Steven Koike, farm advisor, Monterey County; Richard Smith, farm advisor, San Benito County. \$23,200 for first year.
- farmer-to-farmer field days. This project will coordinate three farm field day conferences to promote and distribute information on alternative agriculture, featuring low or no-chemical input methods, tours of organic and transitional farms, and regionally-specific techniques. The project will survey participants to determine future educational needs, and develop printed materials and videos. Investigators: Otis Wollan, executive director, Committee for Sustainable Agriculture, Colfax, and staff. \$8,975 for one-year project.
- a videotape, "Soils Management: the Key to Sustained Fertility." Directed at growers, this video will include an overview of fertility. The use of cover crops, crop rotation, composts and tillage will be featured, as will the economic sustainability and benefits of change. Investigators: Glenn McGourty, farm advisor, Mendocino County; Roland Meyer, land, air, water resources, UC Davis; Oleg Harencar, video consultant. Farmer cooperators: John Jeavons, Common Ground Mini Farm, Willits; Michael Maltas, Fetzer Valley Oaks, Hopland. \$14,816 for first year.
- case studies of controlled grazing systems. Traditional, "eat-it-all-today" grazing practices are inefficient energy and production systems that also have adverse environmental impacts, including soil erosion, habitat destruction and weed invasions. This project will evaluate and document operational efficiency and profitability of controlled grazing systems on six family ranches and on University of California field stations. This information will be useful to the 38 million acres of range and pasture lands in California, one-third of the state's land area.

SAREP funding will be used to add an additional location to the study, the Sierra Foothill Range Field Station. Other funding is provided by the California Energy Commission, the Renewable Resource Extension Act, and the UC Division of Agriculture and Natural Resources. Investigators: Mel George, agronomy and range science, UC Davis; Monte Bell, farm advisor, Glenn County; Gary Markegard, farm advisor, Humboldt/Del Norte counties; Chuck Wilson, farm advisor, Sutter/Yuba counties; Wayne Jensen, farm advisor, Santa Barbara County; Bill van Riet, farm advisor, Stanislaus County; Roger Ingram, farm advisor, Nevada County. Farmer cooperators: Rich Hunt, Arcata; Jere Cox, Hydesville; Jeff Somerville, Elk Creek; Dave DiBenedetti, East Nicholas; Duncan Blair, Los Alamos; Lloyd Stueve, Oakdale. \$1,000 for first year.

- nematode control in carrots using microbial and natural materials. California's vegetable industry is mainly dependent on one pre-plant fumigant (Telone) for nematode control, and would suffer major losses in yield and quality if it is taken off the market or severely restricted. This project will evaluate the use of biologically-derived and naturally occurring products to manage nematodes in summer planted carrots on both conventional and organic farming operations to determine possible alternatives to Telone. Investigators: John Guerard, farm advisor, Kern County; John Radewald, nematology, UC Riverside; Pete Goodell, UC Integrated Pest Management (IPM) advisor, Kern County. Farmer Cooperators: Erik Wilkins, Mike Yurosek and Son Farms, Lamont; Dan Duncan and Ed Davis, Cal-Organic Farms, Lamont. \$7,500 for one-year project.
- comparison of two high-value perennial cropping systems (apples and artichokes) in Coastal Central California during conversion to low-input farming practices. This project will document the ecological and economic trends of these crops during the transition from conventional to low-input management. Information about important limiting factors during the transition to low-input production is critical in order to lessen economic risk. Investigators: Sean Swezey, Agroecology Program, UC Santa Cruz. Cooperators: Jackelyn Lundy, Agroecology Program, UC Santa Cruz; Richard Nelson, Plant Sciences, Inc., Watsonville; Carolyn Pickel, UC IPM advisor, Watsonville; Jim Rider, farmer, Watsonville; Ed Boutonet, farmer, Sea-Mist Growers, Castroville. \$47,061 for first year.
- Ventura County food safety/agricultural sustainability policy project. Agriculture is directly affected by political decisions made about food safety. The Ventura County Food Safety Study Group has become an effective networking system among often opposed points of view (producers, consumers, retailers, environmentalists, etc.). The project will document the group's work as a model of the integration of sustainable agriculture with food safety policy. Investigators: Tim Wallace, agriculture and resource economics department, UC Berkeley; Lawrence Yee, UC Cooperative Extension director, Ventura County. Cooperators: Members of the Ventura County Food Safety Study Group. \$4,500 for one-year study.

- effect of rice straw incorporation and green manure cropping on rice nitrogen nutrition, stem rot incidence and soil tilth. Most California rice growers depend on commercial nitrogen fertilizer, and dispose of rice straw by burning. Restrictions on field burning, fertilizer price increases, and farmer interest in soil improvement and organic rice production methods have raised questions about green manures (crops grown to be incorporated into cash crop for soil enhancement) and straw incorporation and the interaction of these two practices. This project will continue a 15-acre experiment to determine nitrogen nutrition and soil tilth effects of green manuring with purple vetch. Investigators: Stuart Pettygrove, land, air and water resources, UC Davis; Jim Hill, agronomy and range science, UC Davis; Shrinivasa Upadhyaya, agricultural engineering, UC Davis; Robert Webster, plant pathology, UC Davis; Jack Williams, farm advisor, Sutter County; Donald Munns, land, air and water resources, UC Davis. Farmer cooperator: Ed Sills, Pleasant Grove. \$15,000 for first year.
- comparison of conventional, integrated pest management, and organic apple production systems. Low returns in apple production caused by consumer response to reports of Alar residue in apple products has motivated a search for production alternatives. This project will compare conventional, organic and IPM systems in apples for economic performance, horticultural characteristics, biological and chemical nitrogen supply systems, and levels of beneficial insects and pest damage. Investigators: Paul Vossen, farm advisor, Sonoma County; Desmond Jolly, agricultural economics, UC Davis; Roland Meyer, land, air, water resources, UC Davis; Kate Burroughs, pest control consultant, Sonoma County; Sue Blodgett, farm advisor, Sonoma County. Cooperator: George Jewell, apple grower, marketer, Jewell Ranch, Sonoma County. \$21,806 for first year.
- a comparison of nematode-tolerant rootstocks, winter cover crops and standard chemical treatment to determine best production improvement method for English walnuts. Root lesion nematodes (microscopic roundworms) are stunting growth and production in Butte County walnut orchards. This project will compare the grafting of nematode tolerant rootstock onto current susceptible rootstock, the use of barley cover crop which is suspected of being a natural nematicide, and standard chemical treatments. Investigators: Bill Olson, farm advisor, Butte County; Becky Westerdahl, nematology, UC Davis. Farmer cooperator: Delbert Siemsen, Durham. \$2,200 for first year.
- potential for nitrate leaching and recovery in nitrogen fertilizers used in almond orchards. Nitrate pollution in groundwater is of increasing concern in California, particularly in nitrate-sensitive areas including Stanislaus and San Joaquin counties. This project will establish research plots in mature almond orchards with differing soil texture and compare nitrate movement below the root zone for different fertilization practices. Management guidelines will be developed to reduce the potential for nitrate pollution. Investigators: Steven Weinbaum, Robert Carlson, Patrick Brown, and Warren Micke, pomology, UC Davis; David Goldhamer, land, air and water resources, UC Davis. Farmer cooperators in Stanislaus County will be identified. \$25,000 for first year.

- the feasibility of using manure and other selected practices in organic and conventional cropping systems. Use of manure as fertilizer for most cultivated agriculture has been avoided due to concerns that quantities required would be huge and costly. But there is now evidence that California has a net surplus of cow manure. The first part of this project will look at the costs and benefits of manure fertilizer. The second part will calculate the costs of production and economic analysis of other practices in whole farm production systems. Investigators for part one: Karen Klonsky, agricultural economics, UC Davis; Richard Smith, farm advisor, San Benito County; Stuart Pettygrove, land, air, water resources, UC Davis. For part two: Karen Klonsky; Roberta Cook, agricultural economics, UC Davis. Farmer cooperators will be determined. \$16,500 for one-year study.
- alternatives to herbicides for weed management. There is increasing pressure on growers to find environmentally-sound methods of weed management. This project will compile information on a wide variety of weed control practices, including cultural, mechanical and biological methods. It will concentrate on old and new approaches that are effective and economical, and produce written material and a video for farm advisors and growers. Investigators: Tom Lanini, botany, UC Davis. Other researchers and farmer cooperators will be identified. \$20,000 for one year study.
- a comparison of organic and conventional production systems for Granny Smith apples. This is a side-by-side comparison in an apple orchard where 30 acres out of 300 have been converted to organic production. Guidelines for organic apple production based on this project and other research will be produced. Investigators: Janet Caprile, farm advisor, Contra Costa County; Roberta Cook and Karen Klonsky, agricultural economics, UC Davis; Warren Micke, pomology, UC Davis; Bob Van Steenwyk, entomology, UC Berkeley. Farmer cooperator: Gregory House, Byron (Contra Costa County.) \$9,190 for first year.

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UC Sustainable Ag Course

Reservations are now being accepted for a summer course at UC Davis that will explore the theory and practice of sustainable agriculture.

Introduction to Sustainable Agricultural Systems (Agronomy 192) will be offered from June 25 through August 31. Students devote 30 hours per week to lectures, labs, discussion sections, practical field experience, and field trips.

Course topics include the ecological, social and economic implications of sustainable agricultural systems, soil and water management, weed, insect and disease management, integration of animal and crop production, economics and marketing, small farm equipment use and production techniques.

The course is open both to UC students and non-students, with instructor's consent. Enrollment for the eight-unit course is limited and space should be reserved by May 11. The fee is \$424. For more information or space reservation, contact Mark Van Horn at the Student Experimental Farm, Agronomy and Range Science Department, University of California, Davis, CA 95616; phone (916) 752-7645.

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Insect Videotape Available

A videotape on handling beneficial insects for the control of agricultural pests is now available in English and Spanish. "Handling Beneficial Organisms on the Farm" was produced by **Bob Wise** of **Videowise** of Fresno, with technical information supplied by **Kenneth Hagen** of the UC Berkeley entomology department, **John Plain** of the Association of Applied Insect Ecologists, and **Lyndon Hawkins** of the California Department of Food and Agriculture. It was funded by UC SAREP. The videotape prepares farmers for handling shipments of live beneficial insects, making it easier for them to use these techniques on their own farms. To order the 28-minute, 1/2 inch VHS video, contact Wise at Videowise, 2156 N. Fine, Fresno, CA 93727, (209) 251-8668. The cost is \$23.00, which includes tax, shipping and handling.

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SAREP Sets Transition Document

UC SAREP is producing a booklet designed to help California growers incorporate sustainable agriculture practices into their farming operations. The booklet will include information on making the transition to farming systems with long-term viability, and will include bibliographic references on increasing soil fertility, the efficient use of energy and other inputs, and other farming practices.

SAREP staff members will be conducting interviews with California growers in all stages of transition. UC farm advisors are being contacted to suggest names of individuals who may wish to participate. For further information, contact county farm advisors or **Ann Mayse** at the SAREP office: (916) 752-7556.

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Free Farm Safety Program

A *Farm Safety Program* designed by agricultural engineering extension at UC Davis is available for public use. Established to promote safety in the agricultural workplace, the project has a no-charge library of safety videos, films and other training materials for farmers or others wanting to develop safety programs for themselves or their employees. Safety in agriculture includes avoiding short-term injuries and illness, as well as the effects of long-term exposure to farm hazards. **William Steinke** is the director of the program and can be reached at (916)752-1613. The phone number for the video library is (916) 752-0563.

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North Coast Organic Winegrape Workshop

Editor's note: *UC SAREP has worked with Cooperative Extension on several grape conferences (see "Visalia Conference Addresses Reduced Inputs in Grapes", Sustainable Agriculture News Vol.1, Number 2 and "500 Attend Low-Input Grape Meetings" in Vol. 2 Number 2.) A recent industry-sponsored workshop in Healdsburg also provided information of interest to growers, farm advisors and researchers.*

"Organic Farming of Winegrapes: Is Organic the Way of the Nineties?" was the question of the day and the subject of a February 21 seminar in Healdsburg sponsored by the California North Coast Grape Growers Association of Ukiah. The sold-out meeting drew 155 people. **Charlie Barra**, an organic grape grower in Redwood Valley, was the session moderator.

Hardy Character

Brian Fitzpatrick, of Fitzpatrick Winery and Lodge in El Dorado County, began by asking the rhetorical question "Can premium winegrapes be grown organically?" According to Fitzpatrick, the answer may be both "yes" and "no." The nitrogen needs of winegrapes are quite low, cosmetic appearance is not important, and grapes have an overall "hardy and thrifty character," which makes them one of the easiest crops to grow organically, he said. Growing grapes organically will be very difficult, however, if the grower has not carefully considered site and variety selection, which can drastically affect disease management, Fitzpatrick said. Weeds and persistent pest imbalances may wreak havoc for some, he said. Fitzpatrick emphasized, though, that many problems may be overcome by proper canopy management to increase airflow, pruning to manage annual crop loads, cover cropping to control weeds and to increase the diversity of predators, and improving soil fertility. He discussed the legal definitions of organic grapes, noting that there is a difference between wines that contain *organically grown* grapes, and *organic wines* that do not contain sulfites or synthetic acids. Most wines containing organically grown grapes are not organic wines.

Vineyard diversity

Ron Bartolucci, general manager of vineyard operations at Fetzer Vineyards in Redwood Valley, said his winery has attempted to eliminate pesticides for many years, but the decision to grow organically was made for three reasons: 1) the potential to produce a "better grape," 2) concern about natural resources, and 3) the trend in legislation toward reduction or elimination of pesticides. Bartolucci stressed the need for diversity in the vineyard ecosystem to improve the habitat for predators. He said "we must view the whole system, and not make decisions on individual parts." He noted that cover crops can improve soil fertility and microbial activity, provide an excellent source of organic matter, choke out weeds, open up the soil to

improve aeration and soil moisture, and provide nectar for predators. He said several cover crop experiments are underway at Fetzer, including mowing at different levels of maturity, and green manuring trials.

Will Dennison, of Dennison Vineyards in Boonville reminded the audience that the concept of organic farming is very old, and that current problems may be solved with old solutions.

Gradual conversion

The discussion of organic grape growing was continued by **Dennis Bowker**, vineyard manager of Hayward Winery in Sonoma. He said there are several levels in the transition to organic farming practices, and recommended that the process be a gradual conversion. He said that frequently his biggest problem is surrounding growers who use disruptive pesticides. Mildew remains a major problem for which there is no promising solution. Organic growers use sulfur for mildew control, which requires relatively large amounts of energy to produce, he said.

Why organic?

An extended question and answer period produced the following exchanges: *What is the best way to convert from conventional to organic practices?* Diligent integrated pest management practices should be used in the transition, using the least disruptive insecticides when control is required. Non-disruptive spraying techniques might include using low rates, spraying only every other row, using low volume spraying, and avoiding the use of broad spectrum insecticides. *Is there a monetary advantage in growing organically?* To date, there is no price premium for organic wines or wines made from organically grown grapes. The increased demand however, may eventually result in a higher price. *Then why grow organically, since it can be more expensive?* Consumption of alcohol worldwide is decreasing, and survival of California vineyards may mean keeping up with the times; furthermore, price is primarily related to quality, and organically grown grapes are believed to have excellent quality.

- *Chuck Ingels*

Low-Input Stone Fruit Pest Control Meeting

The UC Kearney Agricultural Center was the site of a January 5 workshop aimed at stone fruit growers seeking to reduce chemical inputs. "Stone Fruit Pest Management Strategies:

Past, Present and Future," was organized by **Scott Johnson**, extension pomologist, and **Bill Barnett**, area IPM advisor, and drew more than 100 people.

Prevention

Joe Ogawa, a plant pathology professor at UC Davis, began the workshop with a discussion of disease control strategies. He noted that before the 1930s, disease management was directed solely against the pathogen through the use of chemical fungicides including sulfurs, coppers and chlorine solutions. Numerous synthetic fungicides developed since then provide protection against infection (protectants), but resistance to some has occurred, Ogawa said. Preventative measures for brown rot continue to be important, including greater care to prevent injury to fruit at harvest, and the improvement of postharvest handling. Current brown rot control focuses on reducing the spread of insects that injure fruit and create fungus infection sites, he said. Ogawa said new fungicides will be part of future disease control, as well as biological control measures including "inducing multiplication of antagonist bacteria on host surfaces" for brown rot control. Non-chemical insect control strategies to reduce the spread of brown rot, and new cultivars resistant to various diseases will also be important, he said. Ogawa emphasized the need for forecasting systems to predict disease incidence levels based on moisture and temperature data.

Nematodes

Howard Ferris, professor of nematology at UC Davis, outlined a six-point management plan for nematodes. He said the first step is to evaluate the potential orchard site by researching crop history and soil conditions, and determine nematode levels throughout the field. Second, the site must be prepared by removing roots or other refuse which may harbor nematodes, and by improving soil physical conditions. It may then be necessary to reduce nematode population levels, preferably in a manner which conserves beneficial soil organisms, said Ferris. If preplant fumigation is used, it may be advantageous to inoculate the soil with beneficial organisms, he said. The fourth step is to plant resistant (or tolerant) rootstocks, although he cautioned that no rootstock is resistant to all nematodes. The fifth step is to use orchard management practices which reduce tree stress. Finally, he discussed reducing harmful nematode population levels by encouraging beneficial nematodes and fungi. Nematicides have in some cases been shown to completely eliminate parasitization activity, he said. Ferris also said that an

attempt to increase the level of beneficial organisms by adding manure failed to reduce nematode populations significantly.

Historians

Jerry Uyemoto, plant pathologist at UC Davis, discussed current and past stone fruit virus disease management. He emphasized the need for strategists to become historians in order to manage recurring virus diseases. Frequently a disorder diagnosed as a new disease is caused by a previously identified pathogen, but because of different scion/rootstock combinations, unrecognized symptoms occur, he said. Future virus disease management will be aided by the use of resistant scions or rootstocks, although progress may be slow for perennial crops such as stone fruits.

Pheromones

Pheromone use in stone fruit orchards was the subject of a talk by **Dick Rice**, an entomologist at Kearney Agricultural Center. He said that until the 1960s, pest control research was directed primarily toward the screening, development and registration of new pesticides. In the 1970s researchers synthesized sex pheromones, which are airborne chemicals produced by an insect species to attract the opposite sex for mating. Sex pheromones had been used for the development of seasonal trapping data, but later became useful as a means to determine the timing of sprays. In 1985 the concept of mating disruption, or male confusion, was introduced in California. Mating disruption involves releasing pheromones into the orchard to disrupt the movement of male moths to female moths. It has proven effective and cost-competitive in oriental fruit moth control compared to standard spray treatments in spite of some limitations, Rice said. Pest management efforts will continue to include integration of existing technology, increased use of biological and cultural controls, and the development of resistant cultivars, he said.

Biological Control

Final discussions focused on the potential for biological control in stone fruits. **Kent Daane**, biocontrol specialist at Kearney Agricultural Center, discussed the three tactics of biological control: 1) classical: collecting predators or parasites from different areas and releasing them in an infested region, 2) conservation: using an alternate host or a breeding site, such as a cover crop, to increase beneficial insect populations, and 3) augmentation: the mass release of natural enemies such as green lacewing and parasitic wasps. Daane said augmentation will be the most important method of the future, except in the case of lady bird beetles, which fly away if they are released. They must be attracted to areas where they are needed by the establishment of habitats. It is important to make sure that purchased insects are healthy, with a high proportion of female insects, Daane said. Biological control of insects that attack fresh fruit is more complicated, because consumers do not tolerate much cosmetic damage.

Mites

Biological control of mites, which attack the leaves, is easier to achieve

because larger pest populations can be tolerated, according to **Bill Barnett**, area IPM advisor. Several insect predators can be important in controlling the two-spotted and Pacific mites, the most serious mite pests of stone fruits, but the western orchard predator mite (*Metasieulus occidentalis*) can give complete control in non-stressed and non-disrupted orchards, he said. The peach silver mite, which can be tolerated in high numbers, should be preserved as alternate prey for the western orchard predator mite, he said. Releases of predators can help to establish populations in orchards that have none, but in most situations this practice is unnecessary, Barnett said.

- *Chuck Ingels*

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Native Grass Restoration Helps Control Erosion, Weeds

"Vegetation and Wildlife Habitat Establishment" was the topic of an Esparto conference February 10 sponsored by the Yolo, Dixon and Ulatis Resource Conservation districts, the Soil and Water Conservation Society, and the Yolo County Parks, Recreation and Wildlife Advisory Committee. The workshop was attended by 180 farmers, researchers and students.

Native grasses and their ability to control soil erosion, eliminate weeds and reduce herbicide use were discussed by John Anderson, a Yolo County veterinarian and restoration ecologist who initiated the annual vegetation workshops. A summary of Anderson's talk and related work follows.

Grasses Dominant

Anderson discussed California's ecological history, noting that perennial native grasses were the dominant vegetation before the state was widely settled. The native grasses remained green throughout the year and gave the landscape a soft, tufted appearance. During the spring, wildflowers would bloom in fields of needlegrass, blue wildrye, mountain brome, meadow barley, creeping or beardless wildrye, and creeping fescue. These native grasses were widespread and in many places formed native prairies, which were nearly wiped out during the mid-1800s, by overgrazing and weedy annual grasses from the Mediterranean area, he said.

Roadside Weeds

Anderson said roadside prairie restoration is a good solution to the expensive battle against weeds and erosion throughout the Sacramento Valley. He noted that Yolo County spends more than \$40,000 a year (\$100 per mile) for roadside weed control, including herbicides and plowing. Anderson described trial roadside plantings of native grasses in Yolo County north of Winters, studies which are continuing in 1990.

"We use some selective herbicides to keep the weeds down while we're getting the native grasses established. But after a couple of years, we can do away with herbicides, and manage by mowing. And these native grasses won't invade the farmers' fields like the noxious weeds you see along most roadsides," he said.

Orchard Use

In followup discussions, Anderson said it may be possible to use native grasses in orchards, too. Most native grasses don't grow during the summer, so they wouldn't compete with trees for water during the period when

moisture stress is the greatest, he said. He noted that native grasses should improve soil structure and add soil organic matter.

Anderson described native grasses now available, and specific techniques for their establishment in roadsides and on ditchbanks. He became interested in prairie restoration in 1979, when he learned to recognize native grasses. He searched Yolo County hills and creek banks for remnant stands of the old prairie, collected seeds, grew plants in a greenhouse, and established seed-producing stands on his own farm. He has had extensive contacts with ConservaSeed of Walnut Grove, the state's largest grower of native grass materials. ConservaSeed researchers are now growing offspring of some of the native grasses Anderson discovered. Researchers in the agronomy and range science department at UC Davis are also working with Anderson on the use of native grasses on rangelands.

Other Views

Other speakers at the vegetation and habitat establishment workshop included John Tiedeman, an agricultural engineer with the Soil Conservation Service, who spoke about water habitat management; Robert Bugg, UC SAREP cover crops specialist, who discussed perennial and annual insectary plants to provide habitat for beneficial insects; and Steve Chainey, a vegetation ecologist for Jones and Stokes Associates of Sacramento, who discussed different California plant communities worthy of restoration.

Also speaking were Ann Fisher, owner/operator of Cornflower Farms of Elk Grove, native plant specialists, who discussed propagating native woody plants; Bob Smith, California Department of Fish and Game wildlife biologist, who talked about restoring waterfowl habitat; David Amme, director of research at ConservaSeed, who discussed specific native grasses; and Charlie Rominger, Yolo County farmer, who discussed practical aspects of developing small-scale wetlands on farms. Rocky Thompson, a perennial native vegetation specialist for Circuit Rider Productions Inc. of Windsor, a native plant nursery, gave a practical demonstration on the establishment of native woody perennials.