

Update

California State University, Fresno

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Irrigation specialist Greg Jorgensen of Fresno State's Center for Irrigation Technology examines the two drip lines that facilitate partial root-zone drying.

'New' vineyard irrigation technique shows promise

First-year tests at California State University, Fresno have shown that a “new” irrigation method called “partial rootzone drying” provided for a 35-percent reduction in water use without affecting yield of Sauvignon blanc wine grapes.

“The idea is not ours, but we are testing the technology for the first time in the United States,” stated project director Sanliang Gu, who holds the Ricchiuti Chair for research at Fresno State’s Viticulture and Enology Research Center. Partial rootzone drying (PRD) is also being tested in Australia, Gu said. He studied the technique there during a trip last year.

PRD involves irrigating half of a grapevine’s root zone at a time, alternating between one side and the other using, in this case, an above ground drip system. Actually two drip lines are used for each vine row.

Emitters are placed so that when one line is activated, one side of each vine receives water. When the first line is shut off and the second one activated, the other side of each vine is watered.

It is a way of tricking the vine into slowing growth without actually stressing it, Gu said.

“We use one half of the root zone to send a signal to the vine... ‘Well, you’re going to have to slow down,’” yet the vine always has access to water. The technique is designed to reduce vine vigor without affecting yield, and that is just what happened during the first season’s trials, he said.

Different irrigation regimes were tested, including conventional drip application and experimental PRD treatments of 0.8 and 0.4 crop evapotranspiration (ET). Comparisons revealed that yield and fruit composition were not significantly affected by either PRD

See *Promise*, Page 7

ARI funds expand research activities across CSU system

Appplied research on behalf of California agriculture and the environment was bolstered by more than \$5 million this year as the California Agricultural Technology Institute (CATI) began overseeing 37 new research projects funded through state government and industry partnerships.

The funding comes from the new California State University Agricultural Research Initiative (ARI) approved last year by the state Legislature. The research is designed to provide immediate and practical benefits to the agricultural industry and to bring improvements to our natural environment.

A key objective of the ARI is to bring California’s private industry into partnership with scientific institutions. Research projects were awarded through a competitive proposal process, with funding based on each project’s ability to attract matching support from industry.

See *Research*, Page 8



Study goes cold

Faculty/student research team steps into deep freeze to track peach cooling rates

A local peach processing facility has received some good news about energy use from a team of faculty/student researchers at California State University, Fresno.

Wawona Frozen Foods of Fresno learned it could significantly reduce the operation hours of its deep freeze unit and still produce frozen peaches of the same quality. The information came as part of a report recently completed by industrial technology professor Tony Au and his three-person research team.

The project began last summer following meetings between Au and representatives of Wawona. A student research team had already completed a smaller-scale research project for the firm the year before, Au explained. With a relationship established, the new university-industry partnership decided to tackle a larger issue – the deep freeze process and how it could be improved.

“They wanted to find out the most efficient way to freeze their product,” Au said.

type of box influences the freezing rate of the fruit. “Now we had a different focus. Instead of looking at the container [design] itself, we looked at the freezing pattern,” he said.

The experiment involved the use of electronic temperature sensors inside the fruit boxes. The sensors were placed inside the boxes, which were then placed in various locations in Wawona’s two deep freezers. Following the 24-hour freezing regimen the boxes were retrieved and the sensors removed. They recorded the rate of temperature reduction hourly over the entire 24 hours.

“What we found was that they really don’t need 24 hours in the deep freezer,” Au said. “They were using a lot of energy and a lot of space that they didn’t need to.” The sensors recorded that, on

Center for Food Science and Nutrition Research

In one phase of its operation, Wawona cleans, peels, slices and bulk-freezes fresh peaches in 28-pound boxes. The peach slices are sealed in plastic bags before being placed into the cardboard boxes. The boxes are then stacked anywhere from three to five high on pallets and then placed in a deep freezer, which is kept at -10 to -20 degrees Fahrenheit in order to freeze the fruit as rapidly as possible. Following a “standard” 24 hours in the deep freeze, the fruit is moved into a larger 32-degree cold storage facility for longer-term storage.

From earlier work, Au knew that the

average, only about 11 hours were needed in the deep freeze to bring the packaged fruit down to 32 degrees. Considering the cost of a cooling operation in Fresno, California in mid-summer, there is potential for significant savings in operating costs, Au noted.

Gaining those savings will not be that simple, however, Au said. The tests also showed that location of the boxes on the pallets also affected freezing rates. For example, some boxes located in the center of the stack on the pallet required up to 15 hours to freeze. On the other hand, some located near the outside required less than eight hours to freeze.

Below: Industrial technology professor Tony Au shows the electronic temperature sensors that were used to record freezing rates of peaches. Left: Pallet of 28-pound boxes are ready to be moved to the deep freezer.



Among the recommendations of the research team was implementing a system of product rotation inside the freezer. Rotating the boxes would tend to equalize the length of time required for all the boxes to cool and allow for overall time in the cooler to be reduced from 24 hours.

Another suggestion was for some form of pre-cooling, such as a cold-water bath, before the peaches are packaged and boxed, the research team suggested.

Au said that 24 hours has been the “industry standard” for this type of freezing operation for many years. With new methods of product handling put into place, that time could be significantly reduced.

Details of the project are found in a report soon to be released by CATI. It is titled “Determination of Temperature Reduction Rates in Freeze Processing Peaches in Bulk Containers.” It will be on the CATI website in the CFSNR section (cati.csufresno.edu/cfsnr). Hard copies may be requested using the publications order form on Page 7.

The work was funded by the California Agricultural Technology Institute (CATI) with support from Wawona. Research was conducted through CATI’s Center for Food Science and Nutrition Research (CFSNR).

Center for Agricultural Business

New website to make safety info accessible to all

An electronic effort to reduce job-related death and injuries in agriculture will begin this summer with the design of an Internet website housing safety information.

The project is a combined effort of representatives from the Center for Agricultural Business (CAB), the Agricultural Technology Information Network (ATI-Net), and the agricultural industry.

“The purpose of this project is to design an agricultural safety resource website that will store, display and disseminate safety materials that can be downloaded and used by others,” stated Kimberly Naffziger, project coordinator and head of CAB’s safety program.

This site will be a critical resource for the agricultural community given the increased government regulations regarding safety during recent years, Naffziger noted. For example, agricultural employers are required by law to write and implement an injury and illness prevention plan. The plan must contain detailed information and materials specific to each employer’s business.

While some safety professionals argue that all information necessary for developing and maintaining safety programs is already available to employers, much of it is not that easily accessible, Naffziger said.

“With this project, agricultural safety managers will be able to access this central safety resource site, review the materials, and download what they

“Safety managers will be able to access this central safety resource site, review the materials, and download what they want.”

need,” she said. Everyone using the website will be encouraged to submit his or her proven safety materials for inclusion on this electronic exchange network.”

Development of the website is being funded by the California State University Agricultural Research Initiative. Agricultural safety professionals from the industry already have committed to

serve on the research and design team, Naffziger said. Specialists from California State University, Fresno; the University of California; and the Cal/OSHA Consultation Service also will participate.

“The research team will design a website that will be user friendly to agricultural employers and others,” stated ATI-Net general manager Mike Spiess. It will be hosted by ATI-Net and will include an agricultural safety on-line discussion list with a web interface.

The site will contain documents in various formats for downloading, such as Adobe Portable Document Format (PDF), Microsoft Word and HTML, Spiess said. “Those documents that are designed to be edited by the user will be delivered in MS Word.”

Plans are to begin site design this summer, Naffziger said. Within approximately six months the site will be opened, with “construction” continuing for another six months.

“The long-term benefit, and the true measure of success,” said Naffziger, “will be the reduction to job-related fatalities and injuries as agricultural safety managers learn how to apply these materials in a way that will upgrade their company’s injury and illness prevention program.”

Setting new standards for the ag industry



The first class completing requirements for the California Agricultural Safety Certificate Program hold their certificates, awarded at the 6th Annual AgSafe Conference held in San Luis Obispo, California in February. Back row, from left: Randy Ramey, G.O. Farming; Joe Castellanoz, Nichols Farms; John Barrientos, FELS; Max Curiel, FELS; Roy Edward House, J.G. Boswell; and Mark Ptacek, Eagle Field Ginning. Front row, from left: Cosme Sanchez, Rancho Harvesting; Lorenzo Alvarez, Bolthouse Farms; Jesus Chavez, Betteravia Farms; and Santos Martinez, Salyer American Fresh Foods. Not pictured: Carol Forcum, Klink Citrus.

Upcoming events

July 27 – Modules 1 and 2 presentations for the California Agricultural Safety Certificate Program, at the Veterans Memorial Building in Exeter, California. For details call (559) 278-4404.

Aug. 31 – Modules 3 and 4 presentations for the California Agricultural Safety Certificate Program, at the Veterans Memorial Building in Exeter, California. For details call (559) 278-4404.

Nov. 9 – 19th Annual Agribusiness Management Conference at the Radisson Hotel and Conference Center in Fresno, California. For details call (559) 278-4405.

Center for Irrigation Technology

County officials to address safety in chemigation

The Center for Irrigation Technology (CIT) will host agricultural officials from throughout California this fall in a special training workshop addressing safety practices in irrigation.

Staff members from every county agricultural commissioner's office in the state have been invited. The training will focus on regulations and installation practices for wellheads and related equipment used in agricultural chemigation.

Chemigation involves the injection of chemicals such as fertilizers into irrigation water before it is applied to crops.

The workshops will address new safety regulations established by the federal Environmental Protection Agency to prevent oversupply of chemicals into irrigation water.

Training activities will consist of both lecture and hands-on experience with wellhead protection equipment. Instruction will be provided by CIT staff and representatives of the California Department of Pesticide Regulations, which is helping to sponsor the workshop.

CIT will develop a training manual in conjunction with the workshop. The manual will serve as a dynamic resource for participants, with additional materials to be provided as they become available.

CIT was selected by the Department of Pesticide Regulations to develop the training material and conduct the workshop because of the center's extensive experience in testing and evaluating chemigation valves.

For information on obtaining a training manual, call CIT at (559) 278-2066.

Canessa commits to building CIT water conservation programs

A registered professional engineer has joined the staff of the Center for Irrigation Technology (CIT) to aid in developing water conservation programs and to bolster educational efforts.

Peter Canessa assumed his duties as an agricultural engineer in June, reported CIT Director David Zoldoske.

"We are very fortunate to have Pete Canessa join our team," Zoldoske said. "We needed an experienced agricultural engineer to help with the numerous projects the center is involved in."

Canessa brings 24 years of experience in agricultural water and energy management to his CIT post. During those years he has been involved in the design, installation and management of irrigation systems, in developing programs for water and energy conservation, and in developing software programs for irrigation system design and scheduling.

His skills in software development are already at work upgrading and expanding CIT's Waterright website, Zoldoske noted.

Waterright serves as both a resource for general irrigation information and as a technical guide for system management and scheduling (see article below).

"It's going to be a real-time tool for growers," Canessa said.

Canessa also has teaching experience at both university and extension levels. That should prove valuable as he helps CIT expand its educational outreach

regarding one of the most important issues facing California agriculture – water conservation.

"Water conservation is an extremely complicated matter, no matter how you look at it," he said. "There are going to be issues of how efficient people are out there. And then we will have to look at the benefits versus cost of

improvements." That must be done not only on an individual grower level, but on district-wide and regional levels as well, he said.

For information on upcoming CIT irrigation workshops or other events, visit the CIT website at cati.csufresno.edu/cit, or call (559) 278-2066.



Agricultural engineer Peter Canessa will begin teaching CIT workshops this summer.

Waterright offers tutorial, guidelines for irrigation

Waterright is an Internet website that provides an educational tutorial on weather-based irrigation scheduling, along with irrigation scheduling guidelines for local sites.

The tutorial utilizes animation and text examples to educate the user on weather-based irrigation scheduling principles and

practices. The program is designed for three audiences: homeowners, Heavy Turf and agriculture.

The program references CIMIS weather stations to develop site-specific guidelines for scheduling irrigations in California. Visit the Waterright website at <http://www.waterright.org>.

Viticulture and Enology Research Center

Library serves as industry resource

New librarian hopes to make information easily available in-house, through Internet

The new librarian for the Vincent E. Petrucci Library is planning some expansion and reorganization over the next few months to help the library become more “user-friendly.”

Alev Akman assumed her full-time duties in June and wants to spend the first few weeks familiarizing herself with existing resource materials, she said. That may take some time, as the library, located at the Viticulture and Enology Research Center, houses more than 700 volumes pertaining to viticulture and enology and maintains subscriptions to more than 30 periodicals in the same fields.

Akman worked at the library at St. Gregory's University in Shawnee, Oklahoma for four years prior to coming to Fresno State. She received her master's in library information sciences at the University of Oklahoma-Norman in 1996.

Akman emphasized the value of the library as a resource for materials in the specialized areas of viticulture and enology. The shelves contain technical

information from the latest research conducted not only in California but in other key grape-growing regions of the nation and the world.

And not only is there “hard-copy” information available. Akman has experience in Internet searching and wants to help library users find additional information via the World Wide Web.

“I like using the Internet, because there is a lot of information that can be accessed,” she said. “But effective searching requires practice. A lot of people think, ‘Oh, the information's out there, and it's free...’”

In fact, specialized information is out there, but it can be hard to find, and much of it is not free. “It is in databases that must be subscribed to. I want to educate people about the different ways of getting this information. It's important to optimize your time,” Akman said.

The new library resource specialist plans to revise some of the indexes and



Alev Akman displays some resources of the Vincent E. Petrucci Library.

shelved materials to make the library more user friendly.

“It has so much potential. There is much we can do,” she said.

The library has work stations for study and for computer searches. Shelved materials do not circulate outside the facility. Library hours are 8 a.m. to noon and 1 to 4 p.m. Monday through Friday. The phone number is (559) 278-5388.

Grape Day 2000 set for August 8

Grape growers will have an opportunity to hear the latest in viticulture research results at the upcoming Grape Day 2000 field day at California State University, Fresno on Tuesday, Aug. 8.

Research scientists from the Viticulture and Enology Research Center will present information on partial rootzone drying (PRD), the newly-released Melissa table grape, pruning and girdling techniques, methods of preventing Pacific mite outbreaks, and detecting crop stress by remote sensing. The event will include field presentations, commercial exhibits and lunch.

The program will open at 8 a.m. and conclude after lunch. Preregistration fee (received by Aug. 5) is \$15. Walk-in registration is \$20. For registration details, call (559) 278-2089. For sponsorship information, call (559) 278-7135.

IPM researcher Mayse succumbs to cancer

Fresno State professor and long-time viticulture research specialist Dr. Mark Mayse died June 17 following a lengthy battle with cancer.

Mayse was a professor of entomology in the Department of Plant Science and had served the university 18 years as an instructor and researcher. He led the university's integrated pest management (IPM) research program for more than 10 years and had authored a number of research publications for the California

Agricultural Technology Institute.

His research focused on innovative management systems for arthropod populations in California vineyards. He has been recognized locally, regionally and nationally as an outstanding teacher, scholar, researcher and mentor. He published 35 refereed articles, wrote three book chapters and mentored a significant number of graduate students.

He is survived by his wife, Anne, and 14-year-old son, Evan.

JULY 2000



CIMIS

California
Irrigation
Management
Information
System

Resource book consolidates CIMIS information

The proliferation of the Internet and especially of the World Wide Web has eased access to high-technology irrigation information. For example, information on evapotranspiration (ETo) and irrigation water management is available on many irrigation-related websites.

Additional information may, however, be required to facilitate the establishment of an effective irrigation water management program. Often the programs include a water budget irrigation scheduling technique that relies on ETo and/or soil moisture. Although some agencies have all the information needed to establish a water budget irrigation scheduling technique, others may be interested in obtaining such information.

Four years ago, CIMIS published an agriculture resource book specifically for agencies that are new to CIMIS or to the water budget irrigation scheduling concept. The CIMIS agriculture resource book has recently been updated to include

Visit the CIMIS home page at the following address:

www.dpla.water.ca.gov/cimis.html

CIMIS information on the web.

Information in the book is grouped into five major sections. Section one, the "Introduction," describes CIMIS, how it works and how to get CIMIS information. It has a list of weather station siting criteria and CIMIS cooperators.

In section two, three basic steps necessary to establish a CIMIS-based irrigation management program are provided.

Section three, "Success Stories," contains summaries of articles that illustrate how CIMIS has been used, any benefits derived from its use, and whom to contact for further information.

"Basic CIMIS Information" is the title of section four. It includes local and regional access point for CIMIS ETo and a map of current CIMIS weather stations.

The last section, "Further Information Sources," has a list of state and local government contacts, publications that can be used in conjunction with CIMIS, consultants, irrigation software, mobile irrigation laboratories, and irrigation training classes. The addresses, email addresses and telephone numbers of appropriate Department of Water Resources personnel who can provide further information are listed in this section.

It is hoped that information contained in the resource book will enable water agencies to include CIMIS in their water management programs. The "Examples" section is particularly important; the many examples show how CIMIS can be used and the benefits that can be derived from it. For more information on the resource book, call CIMIS at 800-922-4647.

For more CIMIS information...

CIMIS information is published quarterly in the CATI *Update* newsletter. Articles are provided by the California Department of Water Resources, CIMIS program staff.

For more information about CIMIS or its programs, contact any of the following representatives at these offices:

Northern District
Eugene Pixley
(916) 529-7392
pixley@water.ca.gov

Central District
Mark Rivera
(916) 227-7603
mrivera@water.ca.gov

San Joaquin District
Kent Frame
(559) 230-3334
kframe@water.ca.gov

Southern District
Sergio Fierro
(818) 543-4652
sergiof@water.ca.gov

If you are unable to reach a CIMIS representative near you, call the CIMIS Helpline at 1-800-922-4647.

Weekly ETo Comparisons for Fresno Fresno: 3/01/00– 5/31/00

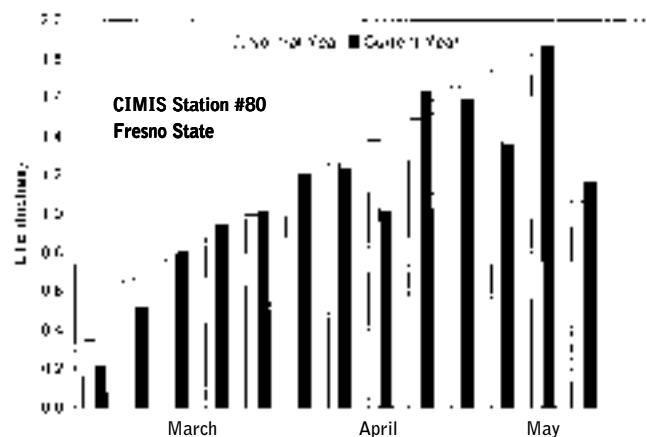


Chart shows ETo variation from normal over last three months.

Promise: PRD reduces vine vigor but not yield

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treatment nor the amount of water applied.

Following harvest, wines were made from the grapes from each treatment. Sensory tests showed no significant differences in the wines.

Although first-year results are considered preliminary, the treatment shows promise in three areas, Gu said. "First it provides a way to save water. Environmentally speaking, that's a good thing. Secondly, it reduces vine growth and pruning weight. The open canopy makes the vines more manageable.

"Thirdly, PRD is easier to manage than deficit irrigation," Gu explained. "With deficit irrigation you need well-trained personnel to monitor and decide when to apply water. With PRD you do not have to think about those things. You just turn on one side, then the other."

PRD is projected to be most effective on grape varieties with vigorous canopy growth. "Do not use on vines with low vigor," he said.

Details from the first-season trials are in a report entitled, "Effect of Partial Rootzone Drying on Vine Water Relation, Vegetative Growth, Mineral Nutrition, Yield, and Fruit Quality in Field-grown Mature Sauvignon Blanc Grapevines." The report will soon be available on CATI's Internet website (cati.csufresno.edu). To request a printed copy, use the order form at right.

Work is continuing on this project. Funding has been provided by the California State University Agricultural Research Initiative, the American Vineyard Foundation, and the California Competitive Grant Program for Research in Viticulture and Enology.

Precision ag course to be offered through Internet

Three California universities have joined forces to develop an all-new, on-line instructional course in precision agriculture.

Teaching team members will come from California State University, Fresno; California Polytechnic State University, San Luis Obispo; and University of California, Davis. Site development work will be overseen by CATI's Agricultural Technology Information Network (ATI-Net).

Precision agriculture, sometimes called site-specific farming, encompasses a number of technologies such as Global Positioning Systems (GPS), Geographic Information Systems (GIS), yield monitoring, Variable Rate Technology (VRT), and remote sensing. Precision agriculture technologies allow for data collection and management of small areas within the field to achieve better utilization of applied materials and to improve crop yield.

The course will be offered in fall 2000 via the Internet and on two Saturdays for some "hands-on" experience. A website (<http://www.precisionag.org>) is

being created to house curriculum materials for the class. It will also contain registration information.

The course will be conducted over 12 weeks. The materials on the website will be open to the public and available for instructional use. Participants may join on-line discussions among themselves and instructors at CalPoly, UC Davis, and Fresno State. The course will focus on new technologies and how best to apply them to California agriculture. The Internet portion of the course will be offered in an asynchronous fashion, meaning that there are no set meeting times.

Continuing education credit for pest control advisors will be available (a fee applies). Participants will need an Internet connection, email, and a current web browser in order to participate in the class. Additional information is available at the web site.

The U.S. Department of Agriculture Challenge Grant provided initial funding for the project, and the California State University Agricultural Research Initiative has provided additional support to offer a course to California agriculturists.

Publications available

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(These publications may be viewed in their entirety on CATI's World Wide Web pages, located at cati.csufresno.edu. Single copies are also available by mail at no charge)

- Effect of Partial Rootzone Drying on Vine Water Relation, Vegetative Growth, Mineral Nutrition, Yield, and Fruit Quality in Field-grown Mature Sauvignon Blanc Grapevines**, by Sanliang Gu, et al. Pub. #000702.
- Determination of Temperature Reduction Rates in Freeze Processing Peaches in Bulk Containers**, by Tony Au, et al. Pub. #000703.

Ordering Information:

Check the publication(s) desired and mail or fax form to:

CATI
California State University, Fresno
2910 E. Barstow Ave. M/S OF115
Fresno, CA 93740-8009
Fax: (559) 278-4849

Name _____

Company _____

Mailing Address _____

City _____

State _____

Zip _____

Research: University, industry partnerships established

from Page 1

Projects will be led by scientists from California State University, Fresno; California State Polytechnic University, Pomona; California State University, Chico; and California Polytechnic State University, San Luis Obispo. Researchers

from the University of California, the U.S. Department of Agriculture and other agencies also will participate.

Administrative oversight of all ARI funds is through CATI, which is located on the Fresno State campus.

Following are summaries of more

than 20 "first-round" ARI projects being conducted with Fresno State's portion of ARI funds, which totals nearly \$1 million. Additional ARI projects funded through the CSU system will be outlined in the next issue of *Update*, slated for publication in October.

ARI projects – California State University, Fresno – 1999-2000

- Professor Alice Wright of Fresno State's Biology Department will study soil microorganisms exposed to the chemical agent 2,4-D to determine how efficiently they metabolize compounds from the pesticide.
- Biology professor James Prince will conduct studies to determine which specific genes in pepper plants control resistance to isolates of the phytophthora fungus, which causes severe root and stem damage.
- Viticulture research scientist Sanliang Gu will conduct studies to determine if a new method of vineyard irrigation called partial rootzone drying (PRD) will enhance grape production and wine quality.
- In another project, Gu will study the influence of training systems, pruning practices and soil type on the incidence and severity of a destructive fungal disease, *Eutypa Dieback*.
- Chemistry professor Barry Gump will lead a research team studying methods for analyzing nitrogen content in grape juice.
- Animal science professor Scott Williamson will feed swine experimental diets containing mechanically reclaimed swine solid waste material.
- Biology professor Ethelynda Harding will compare the nitrogen-fixing effectiveness of a bacterium called *Rhizobium* with different clover species.
- Food science and nutrition professor Erin Dormedy will test ozone as a food processing disinfectant for fruit and vegetables and meat and poultry.
- Biology professor David Grubbs will study food-gathering habits of the fisher, a cousin of the weasel, to help the U.S. Forest Service develop a management plan for the animal.
- Animal science professor Anne Rodiek will seek to develop an equine glycemic index that can be used to measure and compare blood glucose levels generated by different feeds.
- Industrial technology professor Matthew Yen will test new computer software that could reduce image processing time in "remote sensing," the thermal imaging of crops.
- Biology professor Frederick Zechman will conduct a "biotic survey" of several San Joaquin Valley aquatic habitats to determine the range of species of algae and cyanobacteria.
- Winemaker and research scientist Ken Fugelsang is testing steel containers equipped with small nozzles that inject compressed oxygen into wine during the aging process.
- Research scientist Dave Goorahoo will explore the effects of adding hydrosulfuric acid to dairy effluent as a means of reducing pH levels.
- Biology professor Brian Tsukimura will explore the use of a natural hormone, methyl farnesoate, to inhibit reproductive development the tadpole shrimp, a serious pest in rice.
- Safety education specialist Kimberly Naffziger of the Center for Agricultural Business will develop a new agricultural safety website to help companies enhance safety programs.
- Center for Irrigation Technology (CIT) Director David Zoldoske will team with researchers from the University of California to test new turf irrigation strategies.
- James Ayars, a research scientist with the U.S. Department of Agriculture, will test an integrated approach to irrigation and drainage management on cotton grown on the western side of California's San Joaquin Valley.
- Plant physiologist David Bryla of the U.S. Department of Agriculture will evaluate new orchard management practices, including the use of microirrigation systems on young trees.
- Crop science specialist Michael Costello of California Polytechnic University at San Luis Obispo will lead a project integrating soil and irrigation management practices into a viticulture pest management program.
- USDA soil scientist Gary Banuelos will test a supplemental strategy of West Side water management using microbial activity to reduce selenium in drainage water.

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