

# Update

California State University, Fresno

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## Air emissions study targets '10' particles

**A** research program originally established to monitor ammonia from fertilizer applications and other

gases from dairy operations has grown to focus on particles of "much greater" size – up to 10 microns or more.

The new study, featuring a team of Fresno State specialists in air emissions monitoring, has expanded to involve not only dairies, but agricultural field operations that can emit particulate matter (PM) into the air. Particulate matter is much greater in size than a molecule of ammonia, for example, but still smaller than dust and not visible to

### *New sampling, measuring protocols will increase accuracy for establishing emissions standards*

the human eye without magnification. A particle the size of 10 microns measures 10 micrometers or less in diameter. That's 0.0004 inches, or one-seventh the diameter of an average human hair.

Increased levels of 10-sized particles in the air have been linked to health hazards such as heart disease, altered lung function and lung cancer.

One objective of the Fresno State study is to assess the PM-reducing potential of a new misting apparatus that can be attached to a common agricultural disk. The research is being led by Associate Professor Alex Alexandrou along with co-investigator and Professor Charles Krauter and research associates Shawn Ashkan and Diganta Adhikari.

"A significant improvement in air quality for the San Joaquin Valley has been 'attainment' with regard to PM-10 regulations in the past year," Alexandrou said.

However, additional regulations – set by the San Joaquin Valley Air Pollution Control District – will require implementation of management practices that

reduce the PM generated by practices such as land preparation, cultivation and crop harvesting, the researchers noted.

Emissions research led by Krauter over the past 10 years has improved monitoring

accuracy for a variety of emissions such as ammonia and volatile organic compounds (VOCs). That also needs to happen for PM-10 measuring systems in California agriculture, Alexandrou said.

"Commercially available PM-10 samplers are both expensive and cumbersome for use in agricultural environments," Alexandrou said. "They also may present some serious errors when used for sampling in these environments."

In 2006 the U.S. Department of Agriculture and Texas A&M researchers developed and validated a method for measuring agricultural PM. As part of the current project, Texas A&M is providing some monitoring equipment and constructing additional sampling systems for Fresno State. Grant funding also has enabled the purchase of new air sampling equipment that will be tested against the existing equipment.

*See Emissions, Page 8*



Fresno State research associate Shawn Ashkan displays one of six air sampling units recently purchased for air emissions study. The sampler uses a small electric motor to draw air in through the stack on top, then collects particles in the filter being shown inserted, at right.



C A T I



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# Testing soil fumigants

*Research team of biology faculty, students, monitors effects of methyl bromide alternatives*

**A** student research team led by Fresno State biologist Alice Wright is looking for ways to help California's agricultural industry transition from the use of methyl bromide to less toxic chemicals that will still help control unwanted soil organisms.

The team has spent the last three years studying the performance of four alternative chemicals that may be useful to agriculture but less of a threat to the environment.

"Methyl bromide is a fumigant heavily used in California during pre-planting and soil preparation," Wright said. It is especially effective in killing fungi, microorganisms and nematodes, but it also is highly toxic. Methyl bromide is targeted for elimination under the U.S. Clean Air Act because it causes depletion of the earth's ozone layer, she noted.

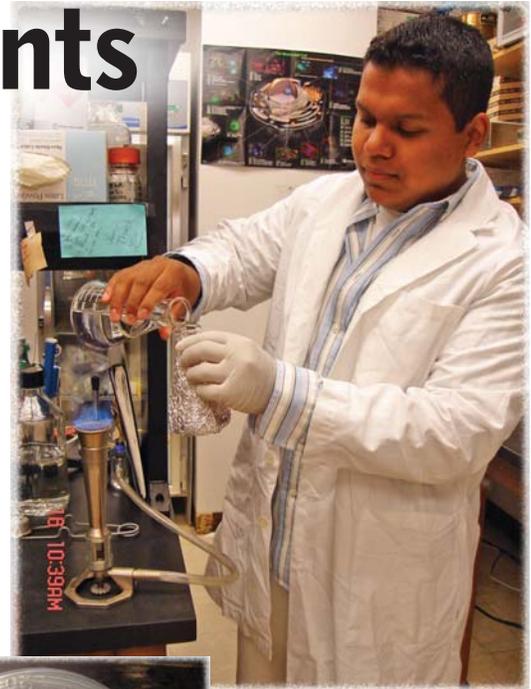
In agriculture, methyl bromide is commonly applied into the ground where certain types of crops are to be planted. It kills soil organisms that could damage plant seedlings or compete for plant nutrients such as nitrogen, which are

Wright developed a protocol for testing the effects of four chemicals that have been developed or are under consideration for use as soil fumigants. They are methyl iodine, chloropicrin, propargyl bromide, and dichloropropene.

The protocol involved applying different formulations of the fumigants to soil samples with typical bacterial and fungal populations, then monitoring the samples for up to 36 weeks to determine microorganism mortality rates.

The researchers used molecular study techniques to characterize changes in the soil microbial communities after each treatment application.

"Based on the analysis of DNA levels in the soil, we found that the number of microbes in the soil was severely decreased after the application of the



Fresno State biology student Antonio Toribio completes one of several laboratory treatments required to characterize the degradation of pesticides in soil samples. The plate at left contains a "super-bug" bacteria, one that degraded all the methyl bromide alternatives.



of the fumigants is lasting. Examinations at 36 weeks indicated that the soils had returned to normal condition in terms of microorganism repopulation.

Another phase of the study was to isolate and monitor soil microbes that showed resistance to the fumigants and actually helped to degrade them by metabolizing fumigant molecules into water and carbon dioxide. Several bacteria species were found capable of aerobic degradation of the fumigants, Wright reported.

One of the fumigants, propargyl bromide, showed promise in initial testing. However, because of the chemical's unstable nature, it is unlikely that product companies would pursue its manufacture and sale, Wright said.

Wright and several of her students presented study results at the Annual International Research Conference on

*See Fumigants, Page 7*

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***"Our goal in this research was to develop pest management practices that are environmentally friendly and still allow sustained or improved crop production."***

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added to stimulate plant growth.

"Methyl bromide is very effective. That's why it's so popular," Wright said. "However, with its elimination on the horizon, our goal in this research was to develop pest management practices that are environmentally friendly and still allow sustained or improved crop production."

pesticides, suggesting that most, but not all, of the microorganisms were killed by the fumigants," Wright said. One fungal pathogen, however, was still found to be thriving one week after fumigation, she noted.

Long-term soil monitoring indicated no significant increase of microorganisms after three weeks, suggesting the impacts

## Center for Agricultural Business

# Economists to compare environmental codes

**T**he Center for Agricultural Business (CAB) plans to seek input from California agricultural producers on how government regulations affect their production operations.

The information will be used in a broad study comparing air, water and other standards in California with those in other states. Leading the project is CAB Director Mickey Paggi. He is joined by Jay Noel, director of the California Institute for the Study of Specialty Crops (CISSC) at California Polytechnic State University, San Luis Obispo. Also assisting in the work is CAB senior research economist Fumiko Yamazaki.

The research effort was prompted by a growing sense in certain segments of the agricultural industry that California is perhaps no longer the best place to do business.

“California growers, processors and distributors must comply with a myriad of rules from local, state and federal levels, regardless of the type of farming, ranching or agriculturally-related business they operate,” Paggi said. And it seems other states have taken note. For example, at the World Ag Expo in Tulare, one of the major annual agricultural events in California, states such as Texas, South Dakota, Idaho, Iowa and Oregon have sponsored booths in the dairy exhibit area.

“They are hoping to draw California’s capital and labor-intensive dairies to their ‘farmer-friendly’ states. Lower regulatory costs are a key selling point,” Paggi noted.

The CAB research team believes that policymakers at all levels should be made aware of the effects of regulations on producers’ profit margins. If a tipping point of cost versus profit is breached, California may lose

## *Study will seek to determine impacts of federal and state regulations on specialty crop profit margins*

those producers, along with their valuable contributions to the state’s economy.

According to Paggi, specific objectives of the study will be to compare standards that affect California agricultural businesses with the standards in other states that have similar specialty crop production. The researchers will develop case study reports of compliance costs for selected California specialty crops and compare them to like crops in the other states.

Specific codes to be examined include those addressing air quality, water quality, workers’ compensation, and pesticide application.

The current study is a follow-up to work that CAB and CISSC already have done in this area. Last year the center published a report addressing the effects of state regulations affecting California citrus producers. Among other things, that study found that producers’ estimated time spent addressing compliance issues rose from

7.31 percent in 1999  
to 10.27 percent

in 2004, a 40-percent increase. That same study also showed direct costs of code compliance rising, in some cases significantly.

The current study will provide the latest information available and should be a useful tool for regulators, Paggi said.

“We want to make the findings of this study widely available to the public, to agricultural producers and producer organizations and to policymakers in order to provide more complete information for policy development regarding these issues for California agribusiness,” he said.

The researchers anticipate approximately 15 months will be needed to gather, organize and analyze all the data. Results will be disseminated next summer through CAB, the California Agricultural Technology Institute (CATI), and the California State University Agricultural Research Initiative (ARI), which provided funding for the study.

For more information or details about participating in the study, contact Paggi at [mpaggi@csufresno.edu](mailto:mpaggi@csufresno.edu).

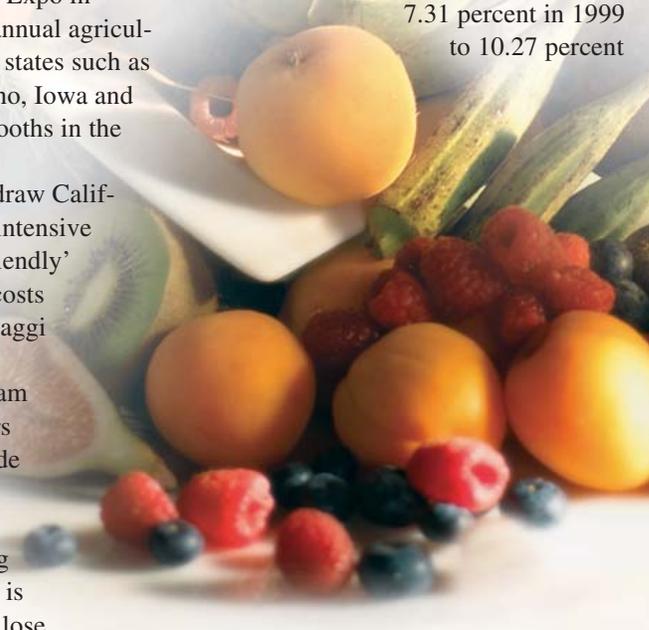
## Reports on website

The latest in agribusiness information published or sponsored by the Center for Agricultural Business (CAB) is available on the CAB website at <http://cati.csufresno.edu/cab>.

CAB special publications include a recent report on the effects of state government regulations on California citrus growers and an analysis of farm models for California specialty crops.

The site also includes links to other organizations that are working with CAB to help bolster California’s agricultural and agribusiness communities.

For more information regarding CAB programs or research call 559-278-4405.



## Center for Irrigation Technology

# From one desert to another...



### *Israeli irrigation specialists tour dry Central Valley; visit prompts talk of research partnership*

**A** delegation of top irrigation engineers from Israel exchanged information on water technology issues with representatives of California's agricultural and irrigation industries during a recent visit to Fresno State and the Central Valley.

The eight-person group was hosted by Pegasus and Greenleaf Orchards, a local agricultural firm in the Madera area, and Fresno State's California Water Institute (CWI).

"The purpose of the visit was to provide opportunities for water scientists, engineers, area legislators and others to discuss common challenges and share technologies and management techniques," reported David Zoldoske, director of CWI and the Center for Irrigation Technology (CIT).

The Near-East delegation kept a robust schedule during their one-week stay in central California. Their agenda included a visit to Paramount Farms in Bakersfield to discuss water supply issues, a tour of the Fresno manufacturing plant of Netafim Irrigation, a visit to John Diener's Red Rock Ranch near

Five Points to observe irrigation research plots, and a stop at the Ted Sheely Farm in Lemoore for a briefing on West-Side salinity issues by CIT research scientist Florence Cassel Sharma.

Several of the delegation represented Mekorot, the national water company of Israel and one of the world's technological leaders in desalination, water reclamation, water project engineering, water safety and water quality.

Other delegates represented the Volcani Institute, part of the research arm of Israel's Ministry of Agriculture and Rural Development. The institute leads research aimed at improving existing agricultural production systems and introducing new products, processes and equipment, helping to bolster Israel's agricultural industry.

The Israeli group joined local water and irrigation specialists and several Fresno State faculty one morning for a mini-conference discussing the future of California agriculture. During session exchanges, delegation members explained that Israel, a normally dry region, is facing perhaps even more grave water shortages than California –

*Israeli delegation members take a lunch break along the California Aqueduct near Huron during a tour of the San Joaquin Valley's West Side. Stops included ranches of two West-Side growers partnering with Fresno State researchers.*

with water challenges exacerbated by a prolonged five-year drought. Currently, the Israeli populace is surviving on about one-third of the expected supply, the representatives reported.

Zoldoske stressed the importance for California water leaders to learn lessons from those parts of the world that are experiencing even greater water shortages than here.

"While many ideas have been exchanged, the overall goal of the visit is to establish a long-term relationship where common water issues can be identified and jointly researched," Zoldoske said. The latest in technology and ideas will be shared and evaluated in light of the similar environmental conditions their country shares with the San Joaquin Valley, he added.

Following a "rest-day" trip to Yosemite National Park, the group traveled to Sacramento to meet with state legislators, with representatives from the California Department of Water Resources, and to attend a groundwater salinity conference, prior to returning to Israel.

## Viticulture and Enology Research Center

# Making a way for mechanized thinning

### *VERC viticulturalist teams with Oxbo in tests of new pruning heads*

**A** research team from Fresno State's Viticulture and Enology Research Center (VERC) has joined with an international agricultural equipment manufacturing company to improve mechanized pruning for wine grapes in California's San Joaquin Valley.

Leading the project is assistant Professor Kaan Kurtural, who holds the Bronco Wine Co. Viticulture Chair at VERC and the university's Department of Viticulture and Enology.

"As hand labor is becoming more expensive and scarce in the Central Valley, growers are turning more towards mechanization to reduce costs and to increase efficiency and sustainability of their wine grape operations," Kurtural said in outlining the research.

Mechanized pruning of wine grapes is not new, having been introduced in California more than 10 years ago, Kurtural noted. But manufacturers have focused mainly on equipment for high



Cabernet Sauvignon grapevines at the Fresno State University Farm are mechanically pruned during recent trials featuring new pruning and thinning heads developed by Oxbo International.

quality wine grapes grown on vertically-shoot-positioned or lyre trellis systems in areas such as the central coast.

More recently, companies such as Oxbo International have developed and refined systems designed not only for pruning, but also for shoot and cluster thinning. Key objectives of the current partnership is to test mechanical systems for shoot and cluster thinning on the type of trellis system most commonly found in San Joaquin Valley wine grape vineyards – the California "T," also known as the California Sprawl.

"The majority of the wine grape acreage in the valley is trained to the California Sprawl due to its initial low cost of installation," Kurtural said. Growers who have tried to adapt existing mechanized pruning equipment to that system have encountered an assortment of problems because of the way the vines grow along that type of canopy, however. Problems include

over-shading of clusters, non-uniform shoot and fruit distribution, uneven fruit ripening, delayed flavor development and over-cropping.

"If we are to remain competitive in the domestic and international wine market, the adoption of mechanical canopy management needs to increase from its current level of 15 percent across California," Kurtural said.

For this project, the research team is evaluating new mechanical pruning, shoot thinning and cluster thinning machine heads that Oxbo has designed for use on the California Sprawl. The project will feature three treatments: conventional hand pruning and thinning, mechanical pre-pruning followed by hand pruning and thinning, and mechanized pruning and thinning.

Last summer was the first season of the four-year project, and results look promising, Kurtural said.

*See Thinning, Page 7*



Oxbo viticultural specialist Greg Berg adjusts a California-Sprawl head of a mechanical pruner. The head features flat, circular rotary bar pruners in the center and vertical sickle bar pruners along the outside of the head.

## Upcoming events

**April 16** – 7th Annual Vino Italiano Event at the Fresno State Winery. Wine tasting features Italian varietals produced by Fresno State students. Call 559-278-2089 for details.

**May 21** – Annual Viticulture and Enology End-of-Year Dinner for Fresno State students, faculty, staff, alumni, and members of the grape and wine industry. For location and details, call 559-278-2089.

**June 7** – A Celebration of Wine from 3 to 6 p.m. at Rancho Vista del Rio in Madera, California. Annual wine tasting fundraiser is for the Vincent E. Petrucci Library. For tickets, call 559-244-5741 or visit <http://www.acelebrationofwine.com>.

**June 23-26** – American Society of Enology & Viticulture 60th Annual Meeting in Napa, California. For info and registration details, visit <http://www.asev.org>.

APRIL 2009



# CIMIS

California  
Irrigation  
Management  
Information  
System

## Schwarzenegger calls for wider use of CIMIS

Citing that California is in its third year of drought and stressing that 2008 was the driest spring and summer on record, Governor Arnold Schwarzenegger proclaimed a state of emergency on February 27, 2009 and ordered immediate actions to manage the crisis.

In the proclamation, the Governor directed the Department of Water Resources to “offer technical assistance to agricultural water suppliers and agricultural water users, including information on managing water supplies to minimize economic impacts, implementing efficient water management practices, and using technology such as the California Irrigation Management Information System (CIMIS) to get the

greatest benefit from available water supplies.”

The governor also directed DWR and the Department of Food and Agriculture to “recommend, within 30 days from the date of this proclamation, measures to reduce the economic

impacts of the drought, including but not limited to, water transfers, through-Delta emergency transfers, water conservation measures, efficient irrigation practices, and improvements to CIMIS.” For details, please visit <http://gov.ca.gov/proclamation/11557/>.

### ***CIMIS recognized by California Irrigation Institute***

At its 47th annual conference, the California Irrigation Institute (CII) recognized CIMIS as irrigation person of the year for its 25 years of outstanding public service. CII is a nonprofit organization and one of the oldest independent forums for irrigation and water.

Manucher Alemi, acting chief of the Office of Water Use Efficiency and Transfers, received the group award on behalf of CIMIS and the Department of Water Resources (DWR). Dr. Alemi thanked CII for the timely recognition and promised that the DWR will do all it can to improve the CIMIS program and provide much needed data to California’s irrigators. He reported that CIMIS is currently undertaking many upgrades that will improve the accuracy, availability, and accessibility of its data.

CIMIS program manager Kent Frame said the recognition would facilitate the CIMIS objective of serving as many users as possible throughout the state.

Visit the CIMIS home page at  
<http://www.cimis.water.ca.gov>

## 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  
Mark D. Rivera  
(530) 529-7301  
[mrivera@water.ca.gov](mailto:mrivera@water.ca.gov)

Central District  
Jan Carey  
(916) 376-9630  
[jcarey@water.ca.gov](mailto:jcarey@water.ca.gov)

San Joaquin District  
Steve Ewert  
(559) 230-3334  
[sewert@water.ca.gov](mailto:sewert@water.ca.gov)

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

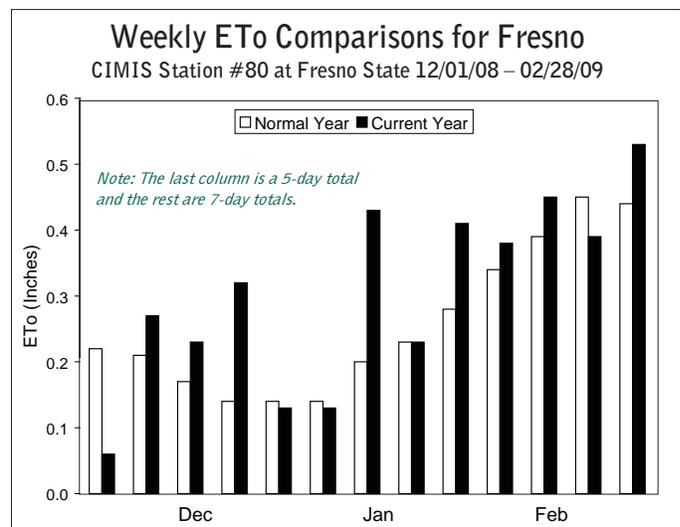


Chart shows ETo variation from normal over last three months.

## *Thinning: First season results look promising*

from Page 5

“We saved close to a quarter per vine in costs, and we did not lose anything in yield or quality,” he said. At 21 cents per vine, 600 vines per acre, that amounts to \$126 per-acre savings using a completely mechanized system.

The study is being conducted on Fresno State’s university farm on Cabernet Sauvignon grapes on Freedom rootstock. The vines are trained to a bilateral cordon at 54 inches height with a foliage support wire at 66 inches on a two-wire vertical trellis.

Treatment analysis includes measurement of fruit yield, cluster numbers, average berry size, percent total soluble solids, juice pH, titratable acidity, and anthocyanin and phenolic concentrations. Crop load and leaf area to fruit ratio also will be calculated based on yield and pruning weight per vine.

Confirmation of the positive results over several years of study “would have the potential for having a relatively rapid impact on grape and wine industries in the San Joaquin Valley,” Kurtural said.

Assisting in the project for Oxbo is viticulturist Greg Berg, working out of the company’s Kingsburg, California sales and service office. Oxbo, which has manufacturing plants in Washington and Wisconsin, has provided funding to help fund the research as well as engineering expertise in the development of custom pruning and thinning heads. Also supporting the research is Bronco Wine Co.

For details on this project, Kurtural may be contacted by email at [kkurtural@csufresno.edu](mailto:kkurtural@csufresno.edu).

## Fumigants: New technologies aim to reduce dust plumes

from Page 2

Methyl Bromide Alternatives and Emissions Reductions.

“It was the first report of microbial degradation of some of the alternative pesticides and the first to show that the biodegradation process could be significant in soils,” Wright said. This raised concerns about soils becoming “immune” or resistant to the pesticides, she noted. “However, our further testing shows that the initial treatment kills most microbes, even the degrading ones. Furthermore, soils return to a normal microbial community structure after 36 weeks.”

According to Wright, 12 Fresno State students worked on various aspects of the research over its duration. Several conducted their work while in master’s degree programs, and four have continued on to doctoral programs at top

national universities based on their work on microbial degradation.

Details of this work are available on the website of the California State University Agricultural Research Initiative (ARI), which funded a portion of the research along with several other public agencies and private agricultural industry groups. The ARI web address is <http://ari.calstate.edu>. The project title is “Methyl Bromide Alternatives,” ARI Project No. 03-1-012.



Biology Professor Alice Wright (left) stands with Fresno State student Lori Orosco after Orosco presented her poster on pesticide degradation at the International Meeting for Microbial Ecology. Based on her work, Orosco was accepted to a Ph.D. program at Johns Hopkins University.

## ARI/CATI on the Web!

The California State University Agricultural Research Initiative (ARI) oversees applied agricultural, agribusiness and natural resources research on behalf of California agriculture. For information on our research and project results, visit our website at <http://ari.calstate.edu>.

The California Agricultural Technology Institute (CATI) administers ARI funding and oversees additional applied agricultural research. For more information about CATI and its research centers, visit us at <http://cati.csufresno.edu>, or at our centers:

Center for Agricultural Business (CAB) – [cati.csufresno.edu/cab](http://cati.csufresno.edu/cab)

Center for Food Science and Nutrition Research (CFSNR) – [cati.csufresno.edu/cfsnr](http://cati.csufresno.edu/cfsnr)

Center for Irrigation Technology (CIT) – [cati.csufresno.edu/cit](http://cati.csufresno.edu/cit)

Viticulture and Enology Research Center (VERC) – [cati.csufresno.edu/verc](http://cati.csufresno.edu/verc)

Agricultural Technology Information Network (ATI-Net) – [cati.csufresno.edu/atinet](http://cati.csufresno.edu/atinet)

# Emissions: More accurate data sought

from Page 1

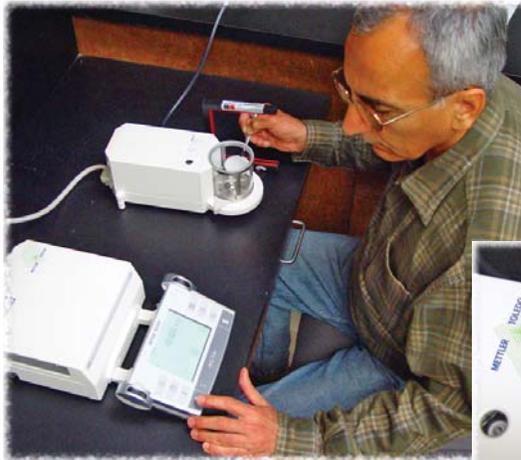
Monitoring devices include filter units that can be placed around a field to record the amount and size of particles raised by certain types of field work. During PM monitoring, a state-of-the-art mobile weather station is used to record wind velocity, direction and other weather related variables to ensure data is collected under equivalent conditions.

“A weather station is very important for modeling purposes. It ensures that the data which feed the model are accurate,” research associate Diganta Adhikari said.

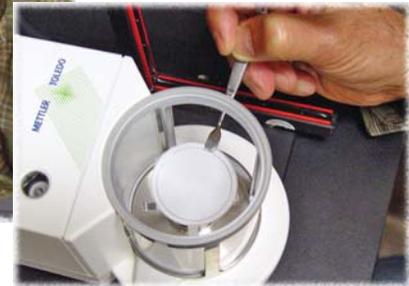
New technologies are being developed to reduce dust plumes generated by vineyard and orchard disking, the researchers noted. One involves spraying a mist of water behind a disk to reduce the plume of heated air that launches PM. Thus the research will actually involve multiple studies, Alexandrou said – of both plume reduction techniques and protocols used to measure the dust levels.

In one phase of the study a conventional practice will be monitored for dust emissions using the newly developed monitoring equipment. Following that, a new practice will be conducted in the same field under the same environmental conditions, with PM emissions measured again.

“These evaluations will enable a



Fresno State research associate Shawn Ashkan uses a Mettler-Toledo model MX5 micro scale (top unit in left photo) to weigh collected particulate matter. Unit on his left calculates weight and other information.



more realistic estimate of PM emissions from these commercial practices and their possible alternatives,” Alexandrou said. Factors that must be uniform for the tests to be credibly compared include soil type, wind speed and direction, humidity, and location of monitoring equipment.

Accurate monitoring of emissions is critical to any regulatory system that is applied to the industry, the researchers said.

“Inappropriate regulation of crop production and dairies due to inaccurate emission factors could drastically affect the agricultural industry in the San

Joaquin Valley,” Alexandrou said. “Improved emissions information would allow for the application of appropriate control measures, resulting in both improved air quality and more productive farming.”

Initial funding for this project is for three years. Financial support comes from the California State University Agricultural Research Initiative (ARI) and the California Association of Resource Conservation Districts.

For details, contact Alexandrou at [aalexandrou@csufresno.edu](mailto:aalexandrou@csufresno.edu).

In the event of incorrect address information or extra copies to your workplace, please return this address label by mail or fax with your requested changes. CATI fax number is (559) 278-4849.

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Publications Editor: Steve Olson

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California State University, Fresno  
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