

CORF News

Floriculture Education from the Kee
Kitayama Research Foundation

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CO₂ Enrichment in Roses Under Winter Conditions

By Soo-Hyung and J. Heinrich Leith, Dept. of Environmental Horticulture, UC Davis

Rose growers use CO₂ enrichment over the course of the year. During the winter when temperature and light levels are lower, many growers supplement CO₂ in the hope of boosting production for Valentines Day. The idea is that higher CO₂ concentrations result in more rapid movement of CO₂ into the leaves so that the plant is able to make more use of the light that strikes the leaf.

Recently, energy costs have driven growers to try to reduce heating costs in their greenhouses by lowering thermostats. We were interested in seeing what effect this would have on the CO₂ enrichment strategy that rose growers currently use.

One catch is that for many plants the positive effect of high CO₂ concentration on photosynthesis is greatly diminished when temperature is low because all the processes in the plant are slowed down. Approximately 20% of ambient air is O₂. The oxygen competes with CO₂ to enter the photosynthetic pathway (this is called

photorespiration). When the temperature is high, that competition is high too. Thus, raising the CO₂ concentration can suppress the oxygen activity effectively, resulting in increased photosynthesis. When temperature is low, however, the competition is already low so that the effect of extra CO₂ is low also.

Our results show that providing extra CO₂ would not make much difference below 15 °C (59 °F) (Fig. 1). There is virtually no improvement in photosynthesis by increasing CO₂ up to 1200 ppm from ambient CO₂ level (370 ppm) at 15 °C (59 °F), which suggests that keeping CO₂ at ambient levels would be adequate to sustain production. On the other hand, CO₂ concentrations below 200 ppm result in reduction in photosynthesis even at 15 °C. This suggests that while elevating CO₂ concentrations above the normal ambient levels would result in virtually no benefit at or below 15 °C; it is worthwhile to maintain levels at ambient

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EthylBloc - An Exciting New Tool for Preventing Ethylene Damage in Specialty Cut Flowers

By Michael S. Reid, Linda L. Dodge and Fisun G. Celikel, Dept. of Environmental Horticulture, UC Davis

The damage caused to cut flowers by ethylene exposure is well known to specialty cut flower growers, shippers and users. Premature wilting, shattering of petals or florets, and yellowing and loss of leaves are all symptoms of exposure of sensitive flowers to barely detectable concentrations (as little as 0.1 ppm) of this gas. Ethylene is commonly found as an air pollutant because ripening fruit, motor vehicles, and unvented heaters produce it. The ethylene problem is easily understood when you know that flowers may be damaged by exposure to as little as 0.5-1.0 part per million parts (ppm) of ethylene and that the air in supermarkets commonly contains at least that much. Exhaust gas from an automobile contains as much as 500 ppm of ethylene.

Overcoming ethylene effects

A number of strategies are available for overcoming the negative effects of ethylene, and they can be divided into two categories – keeping ethylene away, and enhancing the resistance of the flowers to ethylene.

Keeping ethylene away

Isolating ethylene-sensitive commodities from ethylene sources during handling and shipping to avoid exposure is the easiest way out but it is not always practical. If you're marketing flowers in a supermarket or in a downtown area with lots of vehicle traffic you can expect

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CO₂ Enrichment

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levels (350-400 ppm).

The light level (PAR of 1500 Fmol m⁻² s⁻¹) used in the experiment (Fig. 1) is the highest level obtainable during the summer. Light conditions are lower during the winter and during overcast weather. Even when light conditions are poor, a positive effect of CO₂ enrichment is expected as long as temperatures are above 15 °C. It should, however, be noted that under lower winter light conditions, the CO₂ enrichment will have only moderate benefits. The take-home message here is: if you are going to be dropping winter greenhouse air temperatures below 15 °C, then don't bother to use CO₂ except to keep it around the ambient levels (i.e. to avoid starvation).



Figure 1: Effect of temperature on photosynthesis of rose leaves at various CO₂ concentrations under high light conditions (PAR of 1500 Fmol m⁻² s⁻¹)



EthylBloc

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the flowers to be exposed to ethylene. Ethylene can be removed from packing areas and cool rooms with a simple ventilation system that exchanges the air in the room once each hour with ethylene-free air (usually taken from above the building, where pollution levels are lower). Chemical oxidation can remove ethylene from the air and filter systems using potassium permanganate are very effective if the room air is forced (again, one air exchange per hour is effective) through the permanganate bed. Sachets containing granules of activated alumina coated with potassium permanganate are often touted as a solution, but are of doubtful value. A new system using UV lamps and a titanium dioxide catalyst may soon be available for commercial removal of ethylene.

Making the flowers resistant to ethylene

An approach that offers great promise but will take some time to realize is the development of cut flower varieties that are resistant to ethylene. This may be achieved by conventional or molecular breeding. To date, plant breeders have paid little attention to developing ethylene tolerance but we have identified cultivars of kalanchoe, carnation, begonia and miniature rose that are relatively insensitive to ethylene and could be starting points for breeding programs. Researchers have already demonstrated the effectiveness of molecular breeding approaches that allow them to make cut flowers resistant to ethylene.

Chemicals for preventing ethylene action

The best technique for preventing ethylene damage in cut flowers is based on the discovery of chemicals that inhibit the action of ethylene in plants. We have known since the 1970s that silver is one such chemical. Allowing flower stems to take up silver in the form of a solution of silver thiosulfate (STS) at an early point in the postharvest handling process increases their vase life by at least 100%. This treatment has become standard for many ethylene-sensitive flowers and has resulted in the formulation of several silver-based postharvest products. Those growers and shippers who have made use of STS products over the years have experienced

beneficial effects. There are a few drawbacks to using STS, including the extra step in the postharvest process to allow for uptake by cut flowers, the precise timing of uptake necessary to prevent phytotoxicity and the proper disposal of spent solutions. Although several systems are available for removal of silver from used STS solutions, their use and necessary transport to silver recovery facilities have not been adopted to a great extent. Because of recent concern over regulatory issues, all but one manufacturer has withdrawn their STS products from the marketplace.

EthylBloc - a promising alternative to STS

Dr. Ed Sisler of North Carolina State University has spent his professional career studying ethylene and the means for controlling its effects on plants. During his research in the 1980s, Dr. Sisler discovered a compound called 1-methylcyclopropene (1-MCP) that has a structure similar to that of ethylene but inhibits the effects of ethylene on carnations. Like ethylene, 1-MCP is a gas

at room temperature, which provides interesting opportunities and some challenges in commercial use. The chemical has been formulated as a powder, 'EthylBloc' that releases the gas when combined with water, and is now registered for use with cut flowers and potted plants.

How effective is EthylBloc?

When we treat ethylene-sensitive flowers with EthylBloc and then expose them to ethylene, the effects of the treatment are dramatic. An example of these spectacular effects is shown in the photograph. Ethylene causes rapid shattering of florets from flowers of yellow loose-strife (*Lysimachia*). This effect is inhibited in flowers that have been pre-treated with EthylBloc.

How long does it last?

Because EthylBloc is a gas, and unabsorbed EthylBloc disappears once treatment has been completed, its effects

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Flowers pretreated with EthylBloc (left) are protected from the effects of exposure to ethylene (1ppm, 2days)

EthylBloc

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are not as durable as those of STS which remains in the plant tissue and continues to be active over a long period. In our experiments we find that flowers typically become sensitive to ethylene again after 4 to 7 days at room temperature. However, this 'recovery' of ethylene sensitivity depends on the flower. In some flowers (for example *Cymbidium* orchids) the beneficial effect is very long-lasting. In others (for example *Pelargonium* flowers) the benefits of EthylBloc are ephemeral, lasting only a day or so. If the flowers are held at cool temperatures, the anti-ethylene effects of EthylBloc last much longer.

Flowers on cut stems of *Bouvardia* open better and last longer when they are protected from ethylene, which is the natural cause of senescence and shattering in these flowers. Protection with STS lasted longer than protection with EthylBloc.

A trial on the effects of these two anti-ethylene treatments on *Bouvardia* flowers (see graph A) demonstrated the different effects of anti-ethylene treatments. Wilting and shattering of *Bouvardia* flowers is initiated by ethylene produced by the flowers themselves. Preventing the action of ethylene increased the life of the individual flowers and prevented shattering, resulting in a greater number of open flowers in each inflorescence. The effect was relatively short for EthylBloc-treated flowers, and longer for those treated with STS.

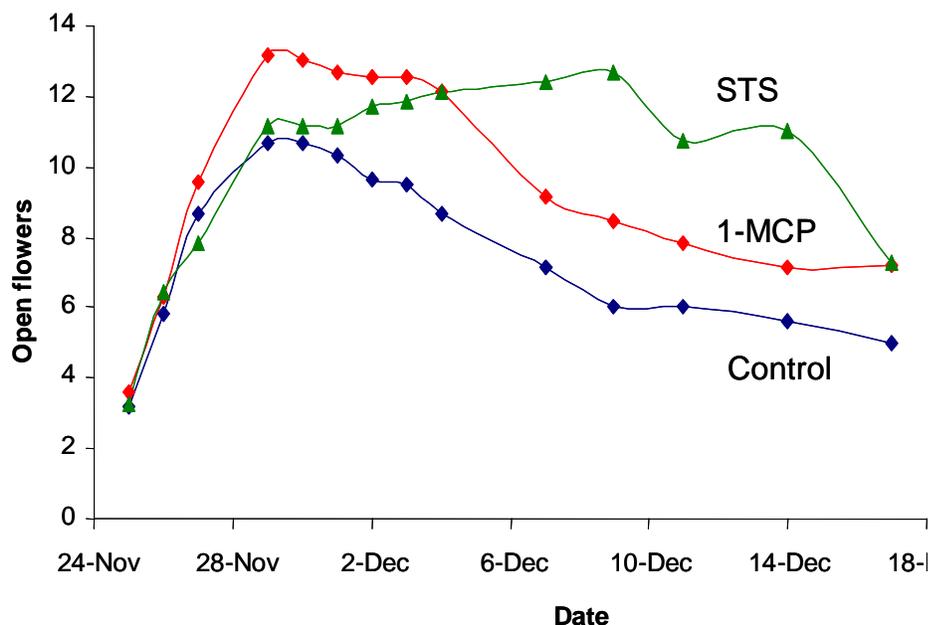
We have also found that buds on flowers like gypsophila that open in the vase are not protected by a postharvest EthylBloc pretreatment. We suspect that new ethylene 'binding sites' are produced as the buds open, and that this is why the opened bud is sensitive to ethylene.

Is it safe to treat flowers more than once?

Our experiments have shown that cut flowers can be treated repeatedly with EthylBloc with no ill effects. This means that flowers treated at the wholesale level could also be treated at the retail store to ensure continued protection from ethylene.

What does it mean commercially?

We have conducted a number of pilot trials with EthylBloc, and the results demonstrate that EthylBloc makes a huge



Graph A: Flowers on cut stems of *Bouvardia* open better and last longer when they are protected from ethylene, which is the natural cause of senescence and shattering in these flowers. Protection with STS lasted longer than protection with EthylBloc.

difference for flowers distributed in supermarkets. The floral merchandising manager for one supermarket chain commented: "This experiment has convinced me to require all vendors serving our distribution facility to use EthylBloc...for all crops." (*Editor's note: We do not encourage the indiscriminate use on non-ethylene sensitive species.*)

Commercial use of EthylBloc

EthylBloc, available from by Biotechnologies for Horticulture (Walterboro, S.C.), is a white powder that releases 1-MCP gas when put in contact with water or a special mixing solution (a common detergent) provided by the manufacturer. For practical use of EthylBloc, growers and shippers will require the following:

- A sealed space.
- A system for releasing EthylBloc from the EthylBloc powder.
- Information on how much EthylBloc to use.

Sealed space

Because EthylBloc is a gas, the treatment needs to be applied inside a sealed space. We have treated plants and cut flowers inside plastic tents taped to the floor with duct-tape, inside coolers (without the refrigeration turned on) and with the doors taped shut, inside trucks (with the door duct-taped), and even in a room with the doors and windows taped shut. In large spaces, there should be a fan inside the space to circulate the air and ensure rapid and uniform distribution of the EthylBloc. The manufacturer provides directions for application of EthylBloc in greenhouses, storage rooms, coolers, truck trailers and shipping boxes with open vents. They also include instructions for building dedicated EthylBloc treatment chambers for plants or cut flowers using 4-6 mil polyethylene.

A system for releasing 1-MCP from the EthylBloc powder.

EthylBloc is released from the powder by adding water or the mixing solution provided by the manufacturer. For small

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EthylBloc

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spaces (pallet cover, small tent) simply dripping cold water onto the powder in a tray or jar will be sufficient. You'll need to find a simple way to add the water - we use a cheap disposable hypodermic syringe to inject water through the wall of a tent into a container holding the powder.

If you're treating product in a large space, the amount of powder required will be considerable, and you may need more than water to ensure efficient release. The manufacturer includes a mixing solution to ensure complete release of EthylBloc. An ingenious system to allow treatment of large spaces or refrigerated trucks is provided by the manufacturer - the EthylBloc powder is packaged in a water-soluble pouch that is dropped into a bucket of mixing solution before closing the treatment space. The pouch dissolves in water, allowing release of the 1-MCP gas into the sealed room.

How much EthylBloc should I use?

Since the treatment is most effective at temperatures above 75° F, the best procedure is to treat before cooling. At room temperatures, you can use a good deal less EthylBloc than at cooler temperatures. We have shown experimentally that lower concentrations and shorter treatment times can be effective, but recommend commercial use of the rates recommended on the label. With product being treated at temperatures from 35-55° F and a minimum treatment time of 10 hours, the manufacturers recommend that you use 1.5 scoops of EthylBloc® to treat 100 cubic feet.

The bottom line

For relatively small cost, and little additional labor, producers of specialty cut flowers now have a treatment available that will improve the postharvest life and quality of their products. We think that there are many exciting opportunities for the use of this material, and look forward to seeing it adopted by the industry.

Acknowledgments: Our research is conducted with the assistance of funding from the American Floral Endowment, the California Cut Flower Commission, and Biotechnologies for Horticulture Inc. ❖

IPM Update - Pesticide Stewardship

During the month of June, I read of two instances where improper pesticide application or drift resulted in fines and/or changes in pesticide regulations. In the first one, a lemon grower in Ventura County was barred from spraying part of his crop within 200 feet of a school during school hours. This was due to two incidents where drift from the pesticide (Lorsban) presumably caused students at a nearby school to become sick. While the immediate action affected the grower, the incident may result in limitations on the use of all nonrestricted pesticides used on farms within ¼ mile of schools.

The other incident involved the use of Nematicur, a nematicide used for cotton, peanuts, and some fruits and vegetables. The label for the granular formulation of this product clearly states that it is toxic to birds and granules must be covered or picked up. Apparently, the applicator did not heed these warnings and 400 birds died from pesticide poisoning. This incident resulted in a \$67,000 settlement as well as stricter guidelines for the use of the

product.

These instances serve as reminders to growers who want to continue to use pesticides and keep them registered. Although the ornamental plant industry is huge in California, to most agricultural chemical companies, it is a small source of income. Where products are not used safely and according to the label, the liability to these companies can be greater than their return. An important component of integrated pest management is not only to know when to apply a pesticide but also how to apply it safely. When pesticides drift or are ingested by non-target organisms, the pesticide is used incorrectly often to the detriment of the environment and the health and safety of humans. When applying pesticides, try to use the most target specific product and those that have the least toxicity to non-target organisms. ❖

*Cheryl Wilen, Area IPM Advisor
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Thanks to these Sustaining Sponsors of CORF Educational Programs



Field Observations

Fungus Gnats and Shore Flies

Fungus gnats and shore flies continue to be a problem in potted plant nurseries where conditions are warm and moist. Growers should use yellow sticky traps to monitor for both adult pests, and potato slices to monitor for fungus gnat larvae.

One problem I still see frequently in greenhouses is freestanding water under benches, with weeds and algae in the wet areas. This is an ideal breeding area for fungus gnats. Growers should eliminate freestanding water in the greenhouses, and try to get better drainage under benches. Algae on and under the benches should also be eliminated with a disinfectant.

Growers that want to use the bacterial insecticide Gnatrol, parasitic nematodes, or *Hypoaspis* predatory mites, should make sure that they are used **as soon as fungus gnats are present** – hence the need for regular, proper monitoring with yellow cards and potato disks. Growers can be successful with these materials, but they need to be applied regularly and used with a regular monitoring program.

In situations where fungus gnats are already established, growers should carefully select the control method. Dan Gilrein at Cornell notes good fungus gnat control with the insect growth regulators Citation, Adept, Distance, Precision, and Azatin XL when the growing medium was already infested with fungus gnats. Insect growth regulators are effective only on the larval stage, so proper soil application is necessary to contact the larvae in the growing medium.

Many other materials are also available for fungus gnat and/or shore fly control – as always, use them according to the label.

Regional Report

San Mateo & San Francisco Counties

Developing your Own 'Farm Water Quality Plan'



Several articles have appeared in *CORF News* in the past year related to water quality. In addition, CORF is

planning and has held several workshops on water quality. Water quality is an issue that will not go away, so all growers should prepare their own Water Quality Plans.

The University of California Cooperative Extension and the USDA NRCS, under the leadership of Mary Bianchi (Farm Advisor, San Luis Obispo County), have developed a short course on "Farm Water Quality Planning." The third short course (four half-day classes) was held in Half Moon Bay in June (co-sponsored by the San Mateo County Farm Bureau and UCCE). This was the first of the three short courses that has specifically addressed the needs of flower growers.

Growers who attend the short course get:

- 1) A useful binder full of "fact sheets" on all different aspects of farm water quality
- 2) Terrific presentations on all subjects related to water quality on the farm
- 3) The opportunity to develop their own "Farm Water Quality Plan"

By developing a Farm Water Quality Plan, growers can take a pro-active stance in addressing issues such as the Clean Water Act and TMDL (total maximum daily loads) regulations. The Water Quality Plan can also be used in conjunction with agencies such as the Regional Water Quality Control Board. Once a Water Quality Plan is in place, the information can be used to seek funding for on-farm improvements related to water quality (such as funding through the NRCS).

What's In a Water Quality Plan?

The template plan that is used in the short course allows growers to document pertinent information such as:

- Farm/ranch property information & mapping
- An initial water quality assessment

- A nonpoint source pollutant checklist
- Farm/ranch goals, facilities, resources, operations, land/road use
- A nonpoint source self-assessment
- Monitoring
- Farm management practices checklists

During the short course, the growers and landowners are walked through the blank plan, and are assisted in completing the information for their individual plans. The Farm Bureau and UCCE will conduct follow-up visits with growers to assist in plan completion.

Confidentiality?

Water Quality Plans belong only to the grower or landowner, and release of the information is optional. In San Mateo County, the Farm Bureau is working with landowners to develop several local watershed working groups. The information that the working groups use in developing water quality plans is also confidential, and association with the watershed working groups is voluntary.

Growers in areas who have not yet addressed water quality issues should consider forming working groups, or develop other methods to address water quality. Training programs and assistance are available through agencies such as UC Cooperative Extension, Farm Bureau, and the Natural Resources Conservation Service (USDA). Taking a pro-active stance, and developing your own Water Quality Plan will prepare you for existing and upcoming legislation addressing water quality protection.

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Regional Report

Santa Cruz & Monterey Counties

Emergency Quarantine on Nursery Plants Susceptible to *Phytophthora* That Causes Sudden Oak Death (SOD) Disease



The California Department of Food and Agriculture issued emergency regulations May 17, 2001 that restrict the movement of certain living plants, unprocessed wood, and wood products from counties infested with Sudden Oak Death (SOD). Plants that have been found naturally infected in forests and nurseries with SOD *Phytophthora* are covered by these regulations. Hosts include: coast live oak, black oak, Shreve's oak, tanoak, rhododendron (except azaleas), California bay laurel, madrone, huckleberry, and arrowwood. The regulations establish a seven-county control area consisting of the Counties of Marin, Monterey, Napa, San Mateo, Santa Clara, Santa Cruz, and Sonoma.

Agricultural commissioners in each of the seven known infested counties will assist with enforcement. The regulations are part of a statewide oak mortality management program consisting of exclusion, delimitation and detection survey, control, scientific support, research, and outreach. The United States Department of Agriculture (USDA) is expected to issue parallel domestic and international regulations aimed at preventing the spread of the SOD pathogen outside of California and preventing importation from Europe (Germany and the Netherlands are known to have the SOD *Phytophthora* on rhododendrons and arrowwood, *Viburnum x bodnantense*).

Sudden Oak Death is a disease caused by a previously unknown species of *Phytophthora* that has killed large numbers of oaks and tanoaks in some areas of central coastal California. The name Sudden Oak Death is used because of the rapid color change of leaves from green to brown. The disease was first observed in 1995 in tanoaks and later in California liveoaks. However, it was only last year that the causal agent was discovered. In native forests and woodland, the fungus is infecting coast live oak, black oak, Shreve's oak, tanoak (*Lithocarpus*), madrone (*Arbutus menziesii*) and huckleberry (*Vaccinium ovatum*). This winter, the fungus was found infecting *Rhododendron* in a commercial nursery in Santa Cruz County. The SOD

Phytophthora infects the leaves of *Rhododendron* and huckleberry (*Vaccinium*) and causes a leafspot and branch dieback. Some cultivars of *Rhododendron* appear to be exceptionally good hosts in a suitable environment, with profuse sporulation occurring within days after infection.

There is concern, on a national and international level, that this new pathogen might move into new areas and infect native forests and some agricultural crops. Of particular concern is the threat to other native oaks. Cranberry and blueberry (both *Vaccinium* species) are potentially significant commercial hosts. The known host range is expected to grow. Already, three families of plants are known to be susceptible to this fungus.

Plants and wood products (such as firewood) associated with the hosts are prohibited from movement within or from the regulated area. As of this writing in mid-June, there were no specific management guidelines released. But the official advisory stated that there would be important exceptions. There will be exceptions for nurseries that have regulated crops that are "produced and maintained in an area that has been surveyed ... and found to be free of the disease," and "produced in a manner..... to prevent infestation by the pathogen," and "tested to detect the pathogen and found to be free of the pathogen." If the article or commodity does not meet the stated conditions, other specific conditions could be specified such as what commodity would be covered, where the commodity could move, how it was handled, utilized or processed. Also, the article or commodity can move from outside the regulated area through a regulated area "by direct route and without delay."

For more information, see CORF News, Spring issue, 2001 and www.suddenoakdeath.org.

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Field Observations

New Bacterial Disease on Manzanita

A *Xanthomonas* bacterium was discovered causing a leafspot disease on containerized manzanita (*Arctostaphylos densiflora* 'Howard McMinn'). A preliminary literature search by Steve Koike, UCCE plant pathologist, has indicated that this may be a newly described disease for manzanita. The bacterium causes a black leafspot. As the disease progresses, the leafspots coalesce, leading to yellowing and necrosis of the leaves. Eventually the leaves fall off and the shoots die back. Diseased plants were commercially unsaleable.

Presently we are investigating whether there could be other hosts, particularly manzanita but also other plants in the Ericaceae. Please call me if you see any manzanita or other plants in the Ericaceae that show similar symptoms. Bacteria are difficult to control but usually it helps to keep foliage dry. Of course, this is usually easier said than done.

Brown Ambrosia Aphid on Yarrow

A massive infestation of aphid was discovered on field grown yarrow (*Achillea* sp.). The aphid was found colonizing the dense foliage in the mid to lower portions of the plant. It was almost undetectable until harvest. At harvest the aphids' soft burgundy red bodies would crush, leaking out body fluids that stained the harvester's hands. This would be a highly undesirable situation if these insects made it to a vase of flowers over a white dinner table cloth!! The insect was identified as the brown ambrosia aphid (*Uroleucon ambrosiae*). This aphid makes its home on weeds and crops of the Compositae (sunflower) family. Known weed hosts are ragweed, wild lettuce, poverty weed, cone flower, and wild sunflower. Here is a situation where adequate chemical control is virtually impossible because of the location of the pest on the plant and the density of the foliage that make spray coverage very difficult. In this case, early control of Compositae weeds nearby and in the production bed makes good sense.

Field Observations

Several rose growers who have been successfully using *Persimilis* (*Phytoseiulus persimilis*) to control twospotted spider mite (*Tetranychus urticae*) have run into a new mite problem. The exact identity of the mite is yet to be determined. It has been called Lewis mite (*Eotetranychus lewisi*) because it closely resembles it. However, one sample that was sent to UCR was identified as *Eotetranychus frosti*, and two different samples sent to CDFA were identified as 'near *deflexus*' (meaning that was as close as the mites could be keyed out). These new mites are difficult to identify and males are required for keying. In the field, they are not easy to distinguish from twospotted spider mite (TSSM). They are smaller and faster moving, but young TSSM can be fast moving too. Females this time of year have four spots instead of two, but TSSM can be almost completely dark with spots too. Usually if you are using *Persimilis* and you still have mite problems, it's not TSSM. However, samples from Nipomo treated with *Persimilis* sent to the Agriculture Commissioner were identified as TSSM, not the new mite. One Carpinteria grower tried using several other species of predatory mites. So far he reports the best results with *A. cucumeris*. Another grower had better results with Floramite, but you are limited in the number of times it can be used. Avid also may be effective. We are hoping to evaluate control of this new mite, and are looking for test sites to set up trials. In reality, this *Eotetranychus* mite isn't really a new mite. In the past, use of sulfur and other miticides easily controlled it. The pest is "C" rated, common.

Regional Report

Ventura & Santa Barbara Counties CORF Meetings in the Central Coast Area



Nipomo/SLO Grower Tour. There were 68 participants at the 19th Annual CORF Grower Tour and Research Demonstrations meeting held on June 7. An energy workshop kicked off the event at Cal Poly, San Luis Obispo. Environmental Horticulture students and **Jim Thompson**, Extension Agricultural Engineer at UC Davis, presented energy information and cost-effective ways to reduce energy use. The workshop was followed by greenhouse tours and Cal Poly research demonstrations. Posters concerning UC research projects funded by **Kee Kitayama** and other sponsoring organizations were also on display. After leaving Cal Poly, participants toured **Glad-A-Way Gardens, Clearwater Nursery, Koch** and **All Seasons Flowers**. UC Research projects were presented at Koch Nursery and at Nipomo Regional Park. These included two presentations found in the Research Updates of this issue: 'Weed, nematode and soil pathogen management with propargyl bromide' and 'Evaluation of soft pesticides for control of plant parasitic nematodes.' If you missed this meeting, but would like to order a copy of the proceedings (available for \$20), contact the CORF office at (707)462-2425.

Management Training for Spanish Speaking Supervisors. This meeting, held in Carpinteria on July 18 from 12:30-3:45 pm, presented by UC Farm Labor Advisor **Gregorio Billikopf**, is a "must" for all Spanish speaking foremen. See insert for details.

Irrigation Practices to Reduce Runoff: Workshop & Nursery Tour. This information-packed workshop and tour on September 11, sponsored by **AgroDynamics, Argus Control Systems, Coastal Pipco and McConkey Co.** will be held at the Ventura County CE office and at three commercial nurseries: **Pyramid Flowers, Coast Nurseries, and Bordiers Nursery**. San Diego and Orange County growers are not the only California growers affected by current legislation to curtail

nursery runoff. The planned nitrate monitoring of the Santa Clara River in Ventura County, the Santa Barbara County Carpinteria Greenhouse Plan, the Carpinteria Creek Proposal, and proposed state regulations regarding ground water and wellhead protection are all indications that growers in central coast counties can expect increased legislation regarding nursery runoff in the near future. Besides preparing for this eventuality, plan to attend this workshop if energy expenses have driven your production costs sky high, and if plant quality is important to you. Saving water and fertilizer can help reduce overall production costs, and proper application timing will improve plant quality. This meeting will provide an overview of irrigation systems used in the ornamental production industry, from bedding plants and container nursery stock, to cut flowers and potted greenhouse plants. Irrigation equipment and best management practices will be demonstrated at nursery sites. In addition to seeing the many things smaller operations can do to control irrigation and reduce runoff, we will observe a state-of-the-art recycling system being constructed at the new Bordiers facility in Somis. Workshop presentations and hands-on demonstrations will be provided by **Dr. Heiner Lieth**, Dept. Environmental Horticulture, UCD; **Don Merhaut**, Dept. Botany and Plant Sciences, UCR; **Dave Shaw**, UCCE Advisor, San Diego County; **Ben Faber** and **Julie Newman**, UCCE Advisors, Ventura County; **Larry Davis**, Coastal Pipco Irrigation; **Willem VerKade**, Agrodynamics and **Gary Leonard**,

McConkey. Growers' perspectives will be provided by **Sterling Nursery** and **Hollandia Flowers**. See insert for further information and registration details. Also, contact the CORF office concerning sponsorship of this event.

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Regional Report

San Diego County

Improving Irrigation Uniformity



The last issue of *CORF News* described methods for determining Irrigation Distribution Uniformity (DU), which is the first step in our Clean Water Program in San Diego County. Since irrigation systems are run long enough to meet the needs of the driest plant, improving DU helps to reduce runoff by minimizing the number of plants receiving excessive water when all plants are adequately irrigated. Good uniformity is a result of proper system design, installation, and maintenance. We have found the following maintenance practices useful in improving uniformity and reducing runoff from nurseries.

Irrigation System Improvement/ Maintenance Practices

Major system maintenance or improvements should be performed before the crop is in place and the system should be checked periodically during the crop cycle.

Leaks. We frequently observe leaks in the connections in irrigation systems during site assessments. Another common site for leaks is at the ends of drip tape or feeder lines. Fixing these leaks removes a constant source of water runoff and reduces flow within the system, thus reducing friction loss and pressure differentials in lines.

Disconnects. Geysers erupt with each irrigation from unplugged holes in the feeder line. These disconnects result when spaghetti tubing is removed from the line or the installer has difficulty inserting the tubing or relocating the hole. These water displays also arise when there is no emitter at the end of the spaghetti tubing. The remedy for this is proper installation of components and regular inspection of the lines and plugging the geysers.

Clogged lines/emitters. Algae and calcification both can clog lines and filters and have a dramatic affect on DU. Filters are important in preventing clogging. Follow the manufacturer's directions for cleaning and maintenance of the drip system. For algae problems, the system can be cleaned with approved algaecides.

Removal of calcification requires an acid treatment and should only be undertaken when there are no plants present.

Misplaced or mismatched emitters. Mismatched emitters have different flow rates, so some plants receive more water than others do during the same irrigation cycle. Incorrect placement of some emitters can also affect how much water is wasted, versus reaches the plant; for example, if the fan spray is directed partially out of the pot.

Incorrect insertion of spaghetti tubing in feeder line. Spaghetti tubing can be inserted too far into the poly laterals thus filling the supply tube with spaghetti, which increases friction loss and reduces the flow capability.

Drainage of system through 'low' emitters after each irrigation. Ideally, unused emitters should be shut off. If unused emitters are left to dangle below the feeder line, the line will drain after each irrigation event. Not only is water wasted through this drainage, but also the system must be recharged with water before all emitters are operational, so plants closer to the water source receive more water than plants at the ends of the irrigation system. This is especially important when growers are utilizing short, frequent runtimes ("pulsing" irrigation).

Incorrect or lacking elevation compensation on slopes. Without pressure compensation for slopes, plants at the bottom of the slope will receive more water due to increased water pressure in the system compared to plants at the top of the slope.

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Field Observations

Rattlesnake season is upon us...

Rattlesnakes are the only venomous snakes in California. Rattlesnakes are heavy-bodied with a broad triangular head, slender neck and vertically elliptical eye pupils. The rattle at the end of the tail is not present on any other snake species. When disturbed, rattlesnakes vibrate the rattle, but they do not always rattle before striking.

There are several precautions one can take to avoid being bitten by a rattlesnake. Most snakebites are on the lower leg or foot, so it's a good idea to wear heavy socks and high boots with pant legs outside the boots. Make it a habit to look carefully before stepping, jumping, sitting or lying down. Look before stepping from bright areas into shade. Don't reach into rodent burrows, hollow logs or other openings that might contain snakes. If you hear a rattlesnake, stand still until you are sure of its location. Avoid running or jumping blindly; snakes will usually retreat if given a chance.

Don't handle venomous snakes unnecessarily, even when a rattlesnake's head is severed from the body, the head can bite and inject venom by reflex action up to an hour or more after death. If you kill a rattlesnake, sever and bury the head to avoid this hazard.

If you are bitten by a rattlesnake, call 911 immediately. It is imperative that you receive medical attention as soon as possible. Do not waste time lancing the bite and attempting to remove the venom yourself, with or without the aid of a snake bite kit; do not use a tourniquet. These efforts are ineffective and actually increase the risk of secondary problems.

New Publications

Submitted by Ann King, UCCE Farm Advisor, San Mateo & San Francisco Cos.

'**Simple Solutions: Ergonomics for Farm Workers**' is a new publication from NIOSH. It has practical ideas and lots of photographs. The section on "lifting" is bilingual English/Spanish. To order a **free** copy, send an e-mail to NIOSH Publications <pubstaff@cdc.gov>, and give them your U.S. mail address so that they can send it to you.

The new revised version of EPA's pesticide poisoning handbook, '**Recognition and Management of Pesticide Poisonings**', is available. It is available for free online (<http://www.epa.gov/oppfead1/safety/healthcare/handbook/handbook.htm>), or can be ordered from EPA (e-mail: pesticide-safety@epa.gov).

'**Labor Law Summary**' in Spanish (**Resumen De trabajo De la Ley**) is available online at www.fels.org (link to Free Resources, link to Employment Resources). This FELS site has a lot of useful information.

Learning Spanish? Gregorio Billikopf (UC Farm Advisor) notes that a team is building a **Spanish Agricultural Dictionary**. They want **your help** in telling them what words and short expressions are useful to you. To submit information, or download the dictionary (still in progress), log on to <http://danr.ucop.edu/ag-labor/>

'**Integrated Pest Management for Floriculture and Nurseries**' (publ. #3402) is a new University of California publication that was noted in the last issue. The manual is for growers, IPM scouts, PCAs, and students. With 422 pages, 300 photos, and 164 illustrations, it is a great reference. Available for \$45 plus tax & shipping from ANR Communication Services at (800) 994-8849, or <http://anrcatalog.ucdavis.edu/>

In a recent issue, we noted that the publication '**Reducing Energy Costs in California Greenhouses**' (UC publ. #21411), was no longer available. It is available online at <http://ohric.ucdavis.edu/> (link to "UC Publications").

Internet Sites

Compiled by Dr. Donald Merhaut, Extension Specialist, Nursery and Floriculture, UC Riverside

Growth regulators are often used to improve certain characteristics of plant quality. As production practices change due to economic constraints (energy costs) or environmental constraints (nitrate leaching), growth regulators may be needed to improve aesthetic characteristics of certain crops, especially if the environmental conditions are less than optimal (i.e. cooler air temperatures and/or lower fertility levels). The following websites provide a general review of plant growth regulators and their use in floriculture crops. Most sites also contain links to other websites if more information on specific topics is needed.

Local Sites: www.corf.org - CORF website, <http://danr.ucop.edu> - This site provides information on the current programs and extension personnel available to address specific questions.

Growth Hormone and Growth Regulator sites:

www.ces.ncsu.edu/depts/hort/floriculture/cfr - This site is presented by North Carolina State University. It contains a list of downloadable leaflets on many aspects of flower and bedding plant production. Some of the leaflets are crop-specific, while others are general guidelines regarding cultural practices, irrigation and fertility management.

<http://hortweb.cas.psu.edu/courses/hort420/growth.html> - This site is presented by Pennsylvania State University. It is part of a lecture series. General information is presented on the effects of different growth regulators on all agricultural crops

<http://www.orst.edu/extension/mg/botany/hormones.html> - Presented by Oregon State University. Very brief information is provided regarding plant growth hormones and growth regulators. This site is a simple summary of plant growth hormones but does not offer any information on application recommendations.

<http://www.sna.org/research/99proceedings/99resprocsec07.pdf> - From the Southern Nurserymen's Assoc. Research Conference in 1999. There are several abstracts regarding chemical plant growth regulators and photoselective greenhouse covers.

<http://ohioline.ag.ohio-state.edu/~flori> - This is a general site available through Ohio State University. Information is available regarding growth regulators as well as various other cultural programs related to floriculture production. This site will also provide links to other university agricultural programs.

<http://www.nvo.com/hortfyi/door/> - This site provides links to universities for the information needed on any aspect of floriculture production. Links are also provided for many agriculturally related industries including chemical companies, equipment manufacturers and distributors.



Campus News & Research Updates

Submitted by Julie Newman, Farm Advisor UCCE

Campus News

UC DAVIS. *Dave Burger* finished his term as Chair of the Environmental Horticulture Department on June 30, after serving in this role since 1995. During this period he was responsible for starting **OHRIC** (<http://ohric.ucdavis.edu/>). OHRIC is an extremely valuable University of California Cooperative Extension resource that provides research, news, and information on the California horticulture industry. It is located at the Department of Environmental Horticulture at UC Davis and is a cooperative project among many people. They include UC Extension specialists, county advisors, and Experiment Station faculty. The goal is to assist industry, government agencies, and the general public with ornamental horticulture problems. Not only did Dave's leadership provide the impetus to establish OHRIC, but since its inception, he has served as director. Dave was also responsible for turning a department newsletter, **Growing Points**, from an occasional publication to a professional quarterly publication featuring Department research, teaching and extension program highlights and related information from other sources. Both Growing Points and OHRIC are extremely valuable contributions to the floriculture industry, and these years of service to the Department have been very fruitful. Dave's successor is expected to be announced soon.

UC RIVERSIDE. Chancellor *Ray Orbach* announced on May 3 that *Steven Angle* has accepted the invitation to become dean of the College of Natural and Agricultural Sciences (CNAS) on a permanent basis. Angle had been interim dean since last July, when *Michael Clegg*, who had served as dean for six years, stepped down to return to full-time teaching and research. Angle joined UCR in 1986 as an assistant professor of chemistry. He was promoted to full professor in 1994 and served as associate dean for physical and mathematical sciences from 1997 to 2000. He received graduate and undergraduate degrees from UC Irvine and UCLA, and was a

postdoctoral fellow at the University of Wisconsin before joining the UCR faculty. He was named a fellow of the American Association for the Advancement of Science in 1999 and was an Alfred P. Sloan Research Fellow from 1993 to 1997.

Research Updates

Evaluation of 'Soft' Pesticides for the Control of Plant Parasitic Nematodes in Cut Roses.

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The Northern root-knot nematode *Meloidogyne hapla*, and the lesion nematode *Pratylenchus vulnus* are the most important plant-parasitic nematodes in roses. These nematode are generally found in sandy/loamy soils. Both these nematodes are endoparasites that enter into the root tissue of the rose plants. Population levels in the roots of plants may increase rapidly as most rootstocks appear excellent hosts for these nematodes. Infestations may initially remain unnoticed, but over time infected plants may become stunted, and production (number of stems / plant, stem length, flower size) decreases. Once infested, it is very difficult to eradicate the nematodes. The goal of this study was to test if a number of products that can be applied post-plant, control these nematodes. Nematode infested soil was collected from a commercial greenhouse operation and used to fill pots in a greenhouse at UC Riverside. Rose plants (Black Magic on Natal Briar) were planted in the infested soil, and later treated with the test products. Abamectin at 2 ppm and 20 ppm reduced the infestation of the rose roots with root-knot and lesion nematodes compared to the non-treated control, but not as effectively as Oxamyl. The other products did not reduce the nematode infestation.

Ploeg, A. and S. Tjosvold. 2001. Evaluation of 'soft' pesticides for the control of plant parasitic nematodes in cut roses. In: Proceedings for the 19th Annual CORF Grower Tour and Research

Demonstrations, Nipomo and Cal Poly, June 7, 2001. CORF, Ukiah, CA. p.14.

Weed, Nematode and Soil Pathogen Management with Propargyl Bromide

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Weeds, nematodes and soil-borne plant pathogens are a major deterrent for productive field and greenhouse grown ornamentals in California. Methyl bromide has been used as a preplant fumigation for the control of multiple organisms to assure crop growth and production. Methyl bromide has also been used to follow the final harvest of bulb crops to kill the bulbs and prevent carry over of pathogens and nematodes to the following plantings. Plant pathogens that are not easily controlled in bulb crops include *Fusarium oxysporum*, *Rhizoctonia solani*, *Sclerotium rolfsii*, *Erwinia* sp., and *Phytophthora* sp. Weed species controlled with methyl bromide but not with current alternatives include yellow and purple nutsedge, creeping yellow field cress, and many winter and summer annual weeds. Weeds not readily controlled include field bindweed, little mallow and clovers. With the phase-out of methyl bromide there is a need for alternative treatments to control the organisms that affect ornamental production. Our objectives were to evaluate propargyl bromide as a weed and soil pathogen fumigant to determine efficacy on the major weeds and pathogens of ornamentals, and to compare propargyl bromide to a standard treatment of methyl bromide and metham for efficacy. We also evaluated iodomethane, another likely replacement candidate for methyl bromide if registration can be obtained and the application methods can be refined. Propargyl bromide gave excellent nematode and soil pathogen control at rates as low as 25 lb/A. Uniform control was achieved in different soils on the nematodes and pathogens at 75lb/A

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or higher when applied as a single site of injection treatment. Propargyl bromide did not control all weed species, but when applied at 75 to 100 lb/A it was equivalent to methyl bromide/chloropicrin at 325 lb/A. Iodomethane at the lower rate of 150 lb/A did not give control equivalent to the methyl bromide/chloropicrin, however at the rate of 235 lb/A they were equivalent. Metham when applied as a single site injection was not effective through the soil profile. When metham was injected at three levels, then the control increased and was similar for nematode and *Fusarium sp.* However, it gave less control than methyl bromide for weeds and bulbs. There are differences in results with different soil types and the locations. It seems that the greatest differences exist between heavy clay and sandy soils. This needs to be further resolved with additional research that includes a new propargyl bromide formulation and additional field tests.

Summary from: Elmore, C. L., J. MacDonald and I. Zasada. 2001. *Weed, nematode and soil pathogen management with propargyl*

bromide. In: Proceedings for the 19th Annual CORF Grower Tour and Research Demonstrations, Nipomo and Cal Poly, June 7, 2001. CORF, Ukiah, CA. pp. 11-13.

EC Monitoring in Growing Media Using a Modified Suction Probe

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The monitoring of EC in media during growth of ornamental container crops is important as an indicator of nutrient status and to determine the need to leach salts from the root zone. Conventional methods for measuring EC involve collecting a media sample, extracting the liquid from it, putting the liquid in contact with a conductivity cell and recording the level of conductivity. The device we developed uses the ceramic cup of a high-flow tensiometer and an EC cell combined into a probe that can be placed in a pot containing a growing plant. A pressure head forces the medium solution into the probe and past the EC

cell. The conductivity is recorded periodically on a computer connected to the EC meter. The system was calibrated against the conventional method of EC measurement to determine the correct pressure head to use. This system for continuous EC measurement is nondestructive and can reveal how nutrients added during fertigation interact with the container medium, the rate at which plants take up water and nutrients and when nutrients begin to accumulate in the root zone. Readings could be integrated with irrigation controllers and fertilizer injectors to automate fertigation management.

Eymar, E., Oki, L.R. and Lieth, J.H. 2001. *Continuous measurements of electrical conductivity in growing media using a modified suction probe: Initial calibration and potential usefulness.* Plant and Soil 230: 67-75. ❖

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Calendar of Industry Events

July

- 18 CORF Management Training for Spanish Speaking Foremen, Carpinteria, 707/462-2425
18-22 .. Fun 'N Sun Weekend, Monterey, 831/722-2424
18 KKRF Endowment Dinner, Monterey, 831/724-1130

August

- 1 CORF Growers' School: Container Perennials, San Diego 707/462-2425
10-12 .. CSFA Retreat, Cal Poly SLO, 916/448-5266
23 CORF Labor Management Training for English Speaking Supervisors, San Diego, 707/462-2425
23-25 .. Ornamentals Northwest Seminars, Portland, 800/342-6401
24-25 .. Farwest Show, Portland 800/342-6401

September

- 11 CORF Irrigation Practices to Reduce Runoff: Workshop & Nursery Tour, Ventura 707/462-2425
13 CORF Improving Crop Production Practices to Minimize Nutrient & Pesticide Runoff Workshop & Tour, Watsonville, 707/462-2425
19-22 .. SAF Annual Convention, Maui, Hawaii, 800/336-4743

October

- 2 CORF Growers' School: Snapdragon Culture & Marketing, Ventura, 707/462-2425
5-7 CSFA Annual Meeting & Top Ten Competition, Ventura 916/448-5266
6-17 CORF Grower Tour to Australia, 707/462-2425
25 CORF California Insect & Mite Symposium, Watsonville 707/462-2425

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