CORF News

California Ornamental Research Federation

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Reducing Greenhouse Energy Bills

By Jim Thompson, Biological & Agricultural Engineering Dept., UC Davis

Increased natural gas prices over the last year have hit the greenhouse industry hard. The best way to handle this is to own your own natural gas well, but short of this there are some economical ways to reduce natural gas use. A calibrated, fast response thermometer for measuring air temperature and the following options will guide you to cost-effective ways to reduce energy use.

Best use of existing equipment

Timely maintenance of existing equipment is the fastest and least expensive way to cut energy costs. Identify potential problems by surveying the air temperature at crop height. Temperature variation will be most easily observed in the early morning hours when outside air temperature is lowest and the sun has not begun to influence heating needs. If everything is working correctly, air temperature should be consistent and at the desired level. If the average temperature is higher than needed, reduce the thermostat setting accordingly. Keeping a greenhouse one-degree warmer than needed increases gas bills by 10% to 15% under typical California conditions. One note of caution – if you have been operating the facility with this error for several seasons your production scheduling may be inadvertently based on this higher temperature. Reducing growing temperatures may slow the next crop.

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Changing Cut-flower Rose Timing in Relation to Changing Greenhouse Temperature Set-points

By Dr. Heiner Lieth, Environmental Horticulture, UC Davis

A project at UC Davis is designed to help growers with modification in cut-flower rose crop timing in relation to changes in greenhouse temperature set-points. This has become a critical issue for rose growers as energy prices are forcing growers to make adjustments in greenhouse air temperatures.

Reductions in air temperature need to be made with great caution. Many growers have tried to lower temperature only to find numerous problems, ranging from deformations of flowers, to a total cessation of production, to disease problems. Additionally the production timing is messed up.

Most growers are aware that crop scheduling needs to change when temperatures are changed, but few have a specific accurate method for doing this. A model we developed a few years ago can be used to make specific calculations to assist in making such decisions. While this information has been available for several years, growers have found it

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Growers Suffering Through California Energy Crisis

By Eric Larsen, Executive Director, San Diego Co. Farm Bureau

As Governor Gray Davis and the California legislature wrestle with the failures of deregulation, growers throughout the state are facing up to the reality that costs and supplies of electricity and natural gas will never be taken for granted again. The cause for all of the turmoil can be boiled down to a simple chain of events. Electric deregulation was based on the failed assumption that supply would continue to run ahead of demand and create competition in the marketplace. When supplies ran short and California natural gas dependent power generators had to run overtime, the supply of natural gas also became scarce and expensive. Short term resolution to this crisis will be hard won because so many players are involved. Some manner of consensus will have to be reached between the governor, the legislature, federal regulators, state regulators and the beleaguered investor-owned utilities. When the growing number of lawsuits over energy issues are added to that mix

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Differences between average air temperature and thermostat set point temperature are caused by an error in thermostat calibration or placing the unit in a relatively cold location in the greenhouse. Aspirated enclosures allow thermostats to accurately sample air temperature and reduce error caused by thermostat location. Put a tag on the thermostat indicating the date of calibration and the temperature correction factor.

Air temperatures at crop height should be consistent around the facility. Cold areas are often caused by air leaks. Check weather stripping on doors, lubricate fan louvers and ensure they close tightly, patch holes in covering, check lap seals in glass covered houses, and install seals on ridge vents. Seals cost a few cents per square foot of floor area and are a good investment. Make sure that thermal blanket systems close completely. Poor heating system maintenance can also cause cold areas in the greenhouse. Inspect steam and hot water pipes to be sure they are not accidentally buried in trash and debris. Poor hot air distribution from convection heaters can also cause poor air temperature uniformity. Clean fan blades to get original air output and check jet tubes for leaks.

Air temperature should also be fairly uniform from crop to roof. Higher air temperature near the roof indicates inadequate air movement in the greenhouse. Poor air circulation allows cold air to settle to the floor and warm air to rise to the roof. Most of the heat in a greenhouse escapes through the roof so high air temperature near the roof acts just like an improperly calibrated thermostat to increase energy use. Reducing air temperature near the roof by one degree Fahrenheit may lower fuel use by 10%. Air can be mixed with a horizontal fan system or a jet tube unit.

Heating systems may still effectively heat a greenhouse but suffer from poor efficiency if they are not regularly maintained. Over time, boiler tubes become fouled, soot builds up in furnace heat exchangers, and burners lose proper adjustment. Flush boilers to remove scale and deposits. Check the burner combustion efficiency of unit heaters and boilers with a flue gas analysis kit. Clean heat exchangers with a wire brush and vacuum or with a special cleaning compound. A 1/8 inch layer of soot can increase fuel use by 10%. Repair or replace malfunctioning steam traps. Check insulation on steam and hot water pipes located outside the greenhouse. If you do not have a regular heating system maintenance program in place, work with your equipment supplier to design a program for your specific system.

Purchase Energy Saving Equipment

After maintaining equipment, the next step to reduce energy costs is considering capital investment in new equipment. Most of the options increase the insulating effect of the greenhouse by adding a second or third layer of covering. For example, a polyethylene subroof installed under the roof trusses will reduce fuel use by 20% to 30%. All heating and ventilating systems must operate below the added subroof. Energy savings will repay installation costs in one or two seasons. Thermal blankets that are extended inside the walls and roof at night and can reduce energy use by 35% to 50%. Insulated thermal blankets have even greater potential for savings. All of these systems are expensive and some greenhouses may not be strong enough to support them. Work with commercial greenhouse equipment companies to determine costs and estimated savings. Rigid board insulation applied to the inside of north walls and below bench height on other walls reduces energy use by 5% to 10%.

Installing moveable benches reduces energy costs per plant produced by increasing the number of plants that can be grown in a greenhouse. Bench space often occupies about 65% of total greenhouse area, the rest of the area is devoted to aisles. Moveable benches allow access to plants but increase useable bench space to about 85% of the greenhouse area, cutting energy use by 30% per plant sold.

The 2001 heating season is now about half over for most growers, but there is still plenty of time to maintain the greenhouse and heating equipment. Now is also the time to plan the major capital improvements needed for next season. ❖

Greenhouse Growers Seriously Impacted by Energy Crisis

By Karen L. Robb, Julie P. Newman and Steven A. Tjosvold

We asked growers in our respective areas about the impacts of the energy crisis on their operations. From the media reports, we had expected that power availability would be a greater concern in the northern areas -and cost in the south. However, it turned out that growers in all the areas responded similarly.

Greenhouse growers have been hit by gas prices at least 2-3 times last years' as well as colder weather. In addition to these direct costs, growers are also finding that other energy- requiring materials used in production-, such as fertilizer, are also going up. .

Growers have responded by lowering greenhouse nighttime temperatures or not heating at all if they are not producing temperature sensitive crops. However, lower temperatures can seriously reduce

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Rose Timing

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difficult to make the calculations. I am currently developing a software tool to make this easier.

Although it is likely to take several months before a final version of this software is ready, we are making a preliminary version available to growers because of the urgency of the situation. The testing of the software suggests that it is making accurate calculations, but growers who use it will find ample room for improvement. So the results should be used with caution.

If you are interested in this software, then you are welcome to go to the web site:http://lieth.ucdavis.edu/Research/HU/RoseTime/ and download the software. The content of the web site will change as improvements are made.

The software (Fig 1) works as follows: the grower selects a particular cultivar from a list, enters the prevailing greenhouse air temperatures, and selects a particular crop stage that is to occur on a particular date. Click on "calculate" and all other dates related crop production are calculated. The crop development stages that it deals with are Bud Break (BB), Visible bud (VB), and Harvestable (HV = reflexing sepals on the flower). Growers can enter lower or higher temperature values to see what that does to the various key dates in the production cycle.

One major drawback is that each rose variety has a different rate of development. This means that a different set of parameters are needed for each variety. Getting such parameter estimates is called "model calibration". Unfortunately, we have the model calibrated for only 3 varieties; we are currently getting the numbers for 4 other varieties (thanks to Don Howell at Pajaro Valley in Watsonville who is lending us fully-grown plants and Miss Carola Gonzalez, a visiting scientist from Spain who is collecting the data as a volunteer).

If you are a grower and wish to use the preliminary version, then you will need to try to calibrate the model based on your production records. This is done as follows: dig through your records for timing data for a variety that is similar to one of the ones in the software (E.g. Kardinal). For a particular pinched crop, find the pinch date, the bud break date, visible bud date, and harvest date. Find the temperature data that went with this and calculate the average temperature.

Now run the software and select one of the varieties (e.g. Kardinal), adjust the temperature panel so that the average temperature is the same as what your plants had, select the pinch date (CT) as the one to be locked in and select the date on which this occurred. Now hit calculate. At this point the various dates (other than the date you locked in) are likely to be wrong. Look on the screen and find the line, just below the database display, of parameter value entries for the selected varieties being used in the calculations. You should now adjust these numbers until you have a set that to what seems to represent your plants well, as follows.

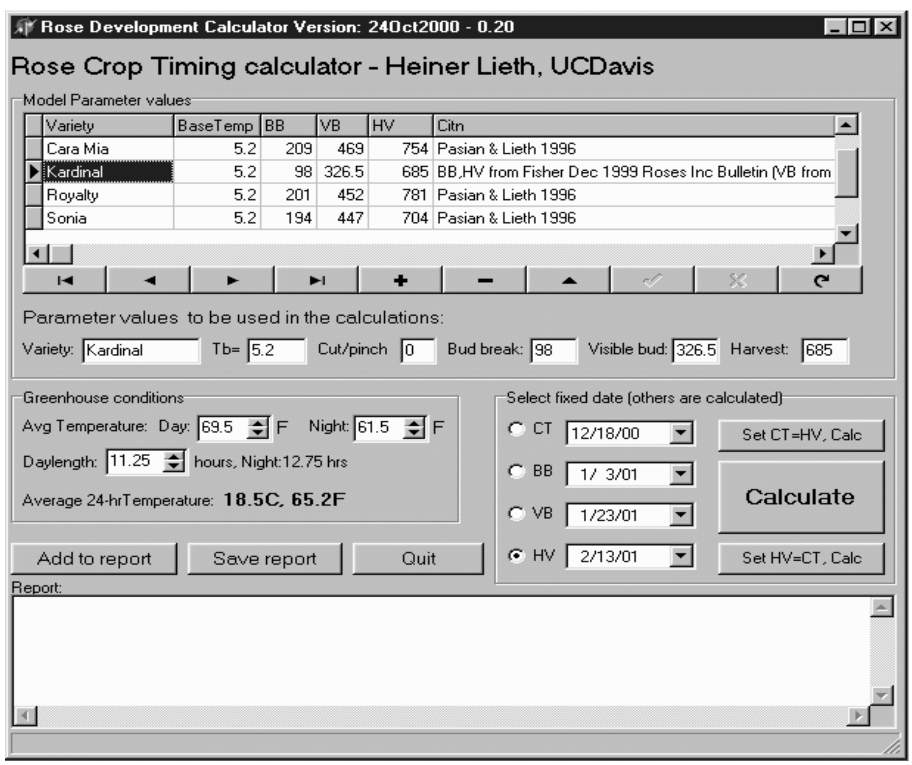
Starting with the Bud Break change the parameter value for this: make it larger if the calculated date for BB is earlier than your records indicate; smaller if it is too late. Hit Calculate. Repeat this with different estimates for the Bud Break parameter until the calculated BB date is the date in your production records.

Repeat this for VB and HV until you have dates that match what you observed. Now write the parameter values down on a piece of paper. These are your very own parameter values for your particular plants. You can put these into the Model Parameter Values Database (the grid at the top) by clicking on the "plus" button and entering all the information in the new record. Use the correct variety name. Under "Citn" type the location of the plants that you used and your name. When you are done click the "check" button. To verify that everything worked, select this record that you just created by clicking on it; then calculate. Everything should be correct.

You will need to repeat this for each variety that you have in your greenhouses. Once the model is calibrated for your situation, you should be able to use it. Please let me know if something is not working right of if the estimations are not working for your particular situation.

If you have suggestions or comments, then please send these directly to me, preferableby e-mail to jhlieth@ucdavis.edu. . ❖

Figure 1. Rose Crop Timing Calculator



Growers Suffering

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it is becoming apparent that the courts will also play a decisive role. Some growers, however, are not waiting idly for an outside agency to decide their fate. They are using their organizations to seek some manner of relief in the marketplace.

The California Floral Council has entered into an agreement with a natural gas consultant to advise its members on the best course to take in securing natural gas supply contracts. In Carpinteria a small group of growers formed the Nursery Power Cooperative to collectively purchase natural gas. In San Diego County the Farm Bureau is in the investigative stages of creating an energy cooperative for pooling its members' purchasing power of electricity, natural gas and propane. Despite these efforts the reality of the market is inescapable and as simple as the first lesson in Econ. 101; when demand exceeds supply, prices will rise.

On an individual basis growers throughout the state are retooling their practices and reevaluating their choice of crops to make certain every penny is squeezed out of their energy dollars. High on the list of priorities for each grower should be a call to the local utility to make certain every available discount program is in place. This can include meter reclassification as well as time-of-use rates and incentive programs for those who are able to go off-line on demand.

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IPM Update

Welcome to the first column in *CORF News* to specifically address new research and information related to integrated pest management for ornamental crop production. By way of introduction, I am an IPM Farm Advisor with the University of California Statewide IPM Project. I am based out of the University of California Cooperative Extension's San Diego County office. I have degrees in Horticulture and Botany but, nearly all of my work experience and research projects before starting my position as an IPM Advisor were in some area of plant protection/pest management.

The latest blow to many greenhouse growers has been the rising cost of electricity and natural gas. Some growers may decide to save some money by reducing the temperature to below the optimal for their crop. Not only does this directly impact production costs, there are more subtle impacts that growers need to consider in the area of pest management. The most obvious is the physiological effect of lower temperatures on crop growth. However, lowering the average daily temperature in a greenhouse also affects plant disease development, insect development and pesticide efficacy.

Plant growth and development: Most non-mammalian organisms, e.g., insects, plants, have an optimal temperature for growth and development that is genetically determined. Some plants develop better when temperatures are relatively cool and some better when temperatures are warmer. Plants will often develop satisfactorily in a temperature range surrounding the optimal. However, when exposed to temperatures outside of that range, plants become stressed and can even die. When plants are stressed, they are more susceptible to infection by some plant pathogens or may be more severely injured by insect attack.

Plant diseases: Recalling that a suitable environment is one of the three factors that are necessary for a disease to develop (the other two are the presence of a susceptible host and an infective pathogen), changes in temperature can contribute to the occurrence of a disease outbreak. For example, *Pythium* is more prevalent under cooler temperatures, as is botrytis blight. Powdery mildew is optimized under cool temperatures and high humidity. Due to the electrical cost of running fans, greenhouses may not be as well ventilated as they could be and the result may be an outbreak of powdery mildew. It is important to ventilate the greenhouse as the temperature drops since warm air holds more moisture than cool air. The water in the air will condense on the plants and these wet leaves are a conducive environment for many pathogens.

Arthropod pests and beneficials: Many insects and mites develop faster at warmer temperatures than under cool conditions. However, the difference is species specific and also depends on the life stage of the arthropod. For example, some thrips species can complete their life cycle in as little as 14 days under warm conditions but it may take as long as 30 days if subjected to cooler temperatures. Other pests such as cyclamen mite develop fastest at 60°F and somewhat slower at high temperatures. The effect of temperature should be considered when planning your spray schedule, particularly if the pesticide is most effective at specific life stages of the pest.

Another factor to consider is temperature effect on beneficial arthropods. These may develop more slowly than the targeted pest at cooler temperatures. The result may be a greater lag time before the pest is under control. This effect must be considered when scheduling beneficial organism releases.

Pesticide efficacy: Temperature can affect the activity of a pesticide or how well a pest takes up the material. If insects are not as active due to cool temperatures, they may be more susceptible to control by contact insecticides but less so by pesticides that must be ingested since the pests may be eating less. It is probably a good idea to re-read your pesticide labels for see if there are phases such as "Do not apply if temperatures are less than XX°F" or "Apply when temperatures are between XXX and YYY".

Cheryl Wilen, Area IPM Advisor , Ornamentals,UC Statewide IPM Project

San Mateo & San Francisco Counties

Reducing Greenhouse Energy Costs

In this time of extremely high fuel costs, growers are searching for any method to reduce greenhouse heating costs. Short of costly major renovations, there are a number of approaches that can help with reducing energy use.

Close the Doors!!

In visiting commercial greenhouses, one of the most common problems I encounter is open doors in greenhouses, with heat pouring out. I know that workers are busy and that it takes time to close the doors, especially when moving equipment and carts, but the few seconds taken to close greenhouse doors can significantly reduce heating costs. Encourage (or mandate) your employees to keep the greenhouse doors closed whenever possible. This can result in significant savings, while the cost input is almost nothing.

Greenhouse & Heater Maintenance

Another inexpensive approach is to maintain the equipment associated with heating and heat loss. Some suggestions:

Seal leaks in the greenhouse. Focus especially on holes in the greenhouse structure, and leaks around vents, doors, and other openings. Use weather stripping on doors and vents, and lubricate and/or seal the ventilation louvers for tight closure.

Heater maintenance: Regular maintenance of the heating system can reduce fuel consumption by 10-20% (NRAES-3 publ.). Furnaces and heaters should be cleaned and adjusted every autumn. This includes removing soot from the furnace, changing fuel filters, using correct fuel nozzles, checking all valves, thermostats, and ignition mechanisms, lubricating oil bearings on motors and pumps, flushing steam boilers, repairing leaks on pipes and tubes, and several other practices.

Distribute the Heat (with Horizontal Air Flow)

If air flow in the greenhouse is inadequate, then the heat will gather at the greenhouse roof, where it is not useful to the plants. Installing inexpensive horizontal air flow fans encourages heat distribution throughout the greenhouse.

Not Yet Using Computer Controls?

If you are not using computer-controlled systems to turn on/off heaters, fans, open/close vents, pull thermal screens, etc., you may want to think about investing in these tried-and-true systems. Large and small operations have found them to be very cost-effective, despite their initial installation cost and learning time to make them work for you. Systems are not too expensive (compared to other renovations), and with high energy costs, there is little reason to avoid using computers to help reduce energy consumption.

Use Thermal Blankets

Thermal blankets are not cheap to install, but the savings in nighttime heating are considerable, and usually well worth the investment. Again, the retrofit costs can be considerable, but growers should consider thermal blankets wherever possible. Thermal blankets can increase humidity levels at night, which means a potential for diseases, so management practices to control humidity may need to be used.

Heat only the Plants

If you grow on benches, you should consider retrofitting to heat under the benches, so that the heat is in the plant growing area. There are pros and cons to bench heating, and the retrofit costs may be considerable, depending on your greenhouse design and current heating system. But why heat the entire volume of air in the greenhouse, when only the plants need to be heated? Okay, worker comfort is a factor, but it really is not necessary to heat above six feet from the ground in a greenhouse, as long as plants are not grown in that space.

Maximize Growing Space

Just a reminder that heating unused greenhouse space is an extra cost. Make sure that you maximize plant spacing, and that turnaround time between crops is minimal. In benches with greenhouses, you may want to consider rolling benches or movable benches, which can increase the growing area by 15 to 30 percent. In some greenhouses, hanging baskets can be grown above the main crop, to increase production in a given area.

Change the Crop or the Cultivar

If all else fails, and you cannot afford to grow your current cultivars, you may need to change to crops that require less heat. There may even be other cultivars of the same crop that require lower temperatures for production, resulting in less energy use.

Watch Out for Humidity and Ethylene

Two drawbacks to "tight" greenhouses are increases in relative humidity at night, and the subsequent potential for diseases, and the potential for ethylene accumulation, especially when heating equipment is not maintained properly.

To avoid high relative humidity in a closed greenhouse at night, periodic venting and reheating may be necessary to reduce humidity levels. Horizontal air flow (HAF) fans, mentioned above, can reduce the buildup of high humidity pockets, and can greatly help reduce airborne pathogens such as botrytis and powdery mildew.

Ethylene can occasionally become a problem in tightly closed greenhouses when heaters are unvented, or not working properly, or when propane forklifts are used in the greenhouse. Idling engines from trucks in a loading area can also cause ethylene problems. Equipment maintenance is a "must" in these situations.

Publications

For more information, get copies of the publications **Reducing Energy Costs in California Greenhouses** (University of California), and **Energy Conservation for Commercial Greenhouses** (NRAES) (see the separate article on *Energy Publications* for their availability).

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Regional Report

Santa Cruz & Monterey Counties

Lower Night Temperatures May Result in Flower Abnormalities

Some growers have experienced the acute effects of minimizing or eliminating heating this winter season. Plant disorders are sometimes profound and immediately obvious: the chilling or freezing of flower petals and leaves resulting in wilting and the "water soaking" death of the plant parts. Other effects, if not extreme, can even be desirable. Flower color can be intensified and leaves can become darker and firmer. Sometimes chilled leaves exhibit a purplish tinge.

The most obvious effect of lower than optimum night temperatures will be a slower production cycle. The grower may find that controlling crop timing becomes extremely difficult because the grower's experience with crop timing is based on what they learned from past experiences with optimum day and night temperatures. This could result in missed markets.

Flower imperfections can be very noticeable in some crops exposed to low temperatures and can show up many days or weeks after the chill has taken place. In greenhouse cut roses, "bullheads" may be formed in some cultivars exposed to low temperatures. Bullheaded flowers have shorter, broader petals, and a larger number of petals than normal flowers. Exposure of the tiny flower buds to low temperature at or before floral organs are fully developed will cause this disorder. Low temperatures can also cause petal "darkening"of red cultivars by increasing the purplish pigments, anthocyanins. Sometimes the darkening can become undesirable but the effected outer petals can often be removed and still be saleable. In California another disorder, called "blackening", occurs in late winter or early spring. It is a much more severe and complicated phenomenon than the darkening disorder. In some red cultivars many petals of the bud become black and then necrotic. This disorder seems to be more severe with cooler night temperatures, but there are clearly other factors that are involved such as poor calcium metabolism in the bud.

Calyx splitting of carnation occurs when the day and night temperatures fluctuate greatly. Flowers split more frequently at night temperatures of 40° F. than 50 ° F. Low temperatures increase the number of petals, and sudden drops in temperature causes the production of extra growth centers within the carnation flower resulting in increased petals and petal-like structures. Carnation buds one-eighth to one-quarter inch in diameter are most susceptible to the effects of chilling. The manifestation of damage will be evident weeks after the buds are exposed to low temperatures.

Some chrysanthemum cultivars will not adequately initiate flower buds with low temperatures and consequently form a crown bud and then "bypass" shoots. A "quilling" of petals result from low temperatures during flower development of some cultivars. The florets are partially or wholly rolled lengthwise which gives the flower a ragged, uneven appearance, and flower heads are often flat.

Other environmental factors may be responsible or contribute to the development of flower abnormalities such as toxic levels of mineral nutrients, air pollutants, or pesticide overdose. Prevention of low temperature induced plant disorders start with good temperature monitoring (knowing the history of temperatures in the greenhouse), a good heating and air circulation system, and proper thermostat calibration and placement in the greenhouse.

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Field Observations

Flower and leafspots on *Tweedia*

Tweedia caerulea (*Oxypetalum caeruleum*) an unusual light-blue flowered plant used as a cut flower has been found in a Watsonville nursery with flower and leafspots. Effected flowers and leaves had necrotic areas the size of pinpoints or larger and were surrounded by purplish halos. *Botrytis* was found sporulating in the necrotic areas but it was not clear whether the *Botrytis* was the principal problem or just a secondary infection. No other fungi were isolated other than some secondary organisms. No viruses were found. Apparently these symptoms occur with some regularity and throughout the year. More monitoring and sampling will be needed to identify the problem.

A Winter Cold Front hurts some sensitive crops:

The Monterey Bay area was hit with freezing or near-freezing temperatures on the nights of January 14 and 15. Crops in unheated greenhouses were vulnerable to damage. In one unheated Salinas greenhouse, most cultivars of Alstroemeria wilted but recovered in a few days. Some cultivars, however, were damaged. In those sensitive cultivars, the succulent growing tips and immature flowers wilted and eventually rotted.

Fusarium oxysporum* on *Lisianthus

Finding *Lisianthus* infected with *Fusarium oxysporum* in California greenhouses could help the research conducted by Bob McGovern, a plant pathologist at the University of Florida. I'm looking for infected plants to send to Bob. Look for older plants that are wilting or dying, particularly if the symptoms occur on one side at first. Younger infected plants usually die early and may not be infected on one side at first. Plants infected with another disease caused by *Fusarium avenaceum* might have similar symptoms. Plants infected with Botrytis may have the "gray mold" on lesions on the lower stem. Please contact me if you see any of these symptoms associated with the *Fusarium* diseases.

Field Observations

Chrysanthemum white rust, *Puccinia horiana*, was confirmed in a chrysanthemum field on 'Red Regan' in Carpinteria by CDFA and by Heather Scheck, Santa Barbara County Agriculture Commissioner Plant Pathologist. Identification of the disease was in November 2000, following a rejection of a box of flowers bound for Hawaii. By the time the Agriculture Commissioner was notified, the field had been disked and fumigated with methyl bromide. The grower also fumigated all the stakes and wires under the tarp. The pathogen was found in some flower stubble.

How the disease got to the field is still a mystery. Chrysanthemum white rust is an obligate parasite with very fragile spores. The only realistic way it can move around is on plants or cut flowers. It is endemic in Europe, Asia and probably Mexico, but currently there are no known locations in the USA with the disease. It seems likely that some garden chrysanthemums near the flower fields may be have been infected, although, if so, the source has yet to be identified.

Shortly after the first incident, a second shipment to Hawaii from another Carpinteria nursery was also rejected. However, this proved to be a false alarm, and the flowers were released to the customer in Maui. In addition, an inspection of the grower's field did not show any white rust. It is likely that due to the first incident, there was heightened awareness of white rust, and that Hawaii was simply being cautious.

CDFA directed the Santa Barbara County Agriculture Commissioner to do a county wide survey for chrysanthemum white rust. This is currently underway at all commercial nurseries that produce cut and potted chrysanthemums. Thankfully, no further findings have been reported.

Regional Report

Ventura & Santa Barbara Counties

Evaluation of Reduced-Risk Miticides

Many new reduced-risk materials labeled for ornamental use have recently come on the market, while older pesticides face an uncertain future due to mandated safety reviews. Three new reduced-risk miticides were recently evaluated in an 80,000 ft^2 greenhouse in Carpinteria containing bent cane 'Kardinal' fresh cut roses. There were 16 bays within the greenhouse located on either side of a central walkway. Counts were made by randomly selecting 10 plants, uniformly distributed along the center bed in each bay. The first five-leaflet leaf above the bend in the crown area of each plant was examined, and all motile stages of two spotted spider mites (TSSM, *Tetranychus urticae*) were counted. In addition, one plant with mites in each bay was tagged, and five leaves were examined on each of these "indicator" plants.

Bays were ranked from low to high density TSSM populations. Four bays were assigned to each treatment, so that each treatment included a mix of low and high-density blocks. There were four treatments: bifenzate (Floramite WP, Uniroyal), bifenzate (Floramite SC, ***not currently registered***), pyridaben (Sanmite, BASF), and an untreated control. Labeled rates were used for each treatment with a spreader-sticker (Break Through, 2 oz. per 100 gal).

Four weekly evaluations were made after treatment. Even though the Floramite WP contained the highest initial populations of TSSM over-all, there was complete control after the first week that was maintained throughout the monitoring period. The Floramite SC formulation was not as effective. However, it reduced the TSSM population 66% after the first week, and by the third week, TSSM was 100% controlled. In contrast, the pyridaben was less effective than the control. Although after the first week there was over a 50% reduction, by the fourth week the population had doubled from the pre-treatment level.

Initially, we were puzzled that the Sanmite did not perform as well as the untreated control, even though good results have been reported by others. The explanation seems to be due to a contamination of the predator mite, *Phytoseiulus persimilis*. In the control plots, this contamination eventually decimated the TSSM populations. A similar contamination was observed in the pyridaben treatment. However, these predator mites did not thrive, presumably because the pyridaben was toxic to them. Similar trends were found in the indicator plant data. Even though the TSSM population in the indicator plants was initially highest in the control, the contamination of predator mites effectively controlled TSSM after 4 weeks, compared to the pyridaben.

Results from this research indicate that Floramite WP was the most effective reduced-risk miticide for control of TSSM in roses. However, the use of other miticides such as Sanmite are recommended. Insecticide resistance is an even greater risk with many reduced risk pesticides, compared to conventional materials, which is why their use must be limited on each crop. Because these materials are 'softer,' they may not be as efficacious as conventional materials. It is imperative that applicators use as many IPM tools as possible to prolong the effective life of reduced-risk pesticides and to accommodate the lower efficacy of some of these products.

In other research we have conducted on roses, bifenzate was compatible with the use of *Phytoseiulus persimilis*, and could be used to reduce TSSM populations before releasing predator mites.

This research was sponsored by the Department of Pesticide Regulation, Uniroyal, BASF, and United Horticultural Supply.

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Regional Report
San Diego County

Aerial Applications for Control of Glassy-winged Sharpshooter

Glassy-winged sharpshooter is a serious pest for container nurseries wanting to ship into Northern California or other states. This is especially true for nurseries located next to citrus groves, which are a preferred host plant.

Jim Bethke and Dr. Rick Redak, Entomology Department at UC Riverside, have tested numerous pesticides for control of glassy-winged sharpshooter. Many of these materials are efficacious for an extended time in laboratory trials.

The purpose of this experiment was to see if materials could be effectively applied via helicopter to large areas in a container nursery. Ideally, these materials would remain effective for several weeks.

Methods used

The materials were applied by helicopter 10/20/00. In addition to a water control, we looked at three pyrethroids, Tame, Talstar, and Astro, and two neonicotinoids, Marathon II and Acetamiprid. The materials were applied in the morning, as soon as a heavy fog lifted, so the foliage was wet during the application. After the materials were applied, it was discovered that the neonicotinoids had not received the full label rate of material.

Three days after the application, adult glassy-winged sharpshooters were collected at the cooperating nursery and placed in nylon cages. Ten adults were confined per cage. Within 45 minutes of collecting the adults, the cages were placed over single branches of photinia. Branches with new and old growth evident were chosen for the cages. The caged sharpshooters were left in place for 24 hours. After 24 hours, the cages were removed and the number of live, dead, or dying adults was recorded. The same procedure was repeated 17 days after application of the pesticides.

Results and Observations

Three days after application, the pyrethroids provided significant control of glassy-winged sharpshooter. Talstar had 100% control, Tame had 90% control and Astro had 77.5% control. The two neonicotinoids did not perform as well, providing only 27.5% control (Marathon II) and 17.5% control (Acetamiprid). The water check treatment had only 2.5% mortality.

The unusual occurred in San Diego County - we actually got some rain in October. When the caging was repeated seventeen days after treatment, there was virtually no mortality in any treatment. This may have been due to one or more factors. The rain may have washed off the pesticide residue. In addition, since new growth was included in the cage, the sharpshooters may have been able to avoid the pesticide residues. As mentioned previously, the rates for the neonicotinoids were too low, which probably accounts for their poor performance in this trial.

We plan to repeat this trial this spring, and may expand it to include other materials. This trial was conducted in cooperation with Buzz Uber of Crop Inspection Service.

A Note to San Diego County Growers:

There are numerous rate classifications for energy users. Contact Linda Lukerchine at SDG&E, 619-441-3930, to make sure that you are classified for the lowest rate possible.

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Field Observations

Palm Leaf Skeletonizer

Palm Leaf Skeletonizer, *Homaledra sabalella*, has been found on landscape palms in San Diego County. This is a major pest of palms in Florida. It only attacks plants in the family Palmaceae, such as *Phoenix canariensis, P. reclinata* and *Washintonia robusta*. It is only damaging in the larval stage, when it feeds on both the upper and lower surfaces of palm fronds. The leaf folds become packed with reddish frass and the leaves turn brown. Although the palm is rarely killed, the aesthetic quality of the plant is greatly diminished when infected with palm leaf skeletonizer.

There are multiple generations per year. The adult female moth lays 12-23 eggs on the underside of the leaf. The eggs hatch in 9–25 days. The larva spins a silken web for protection and pupation occurs within the webbed galleries. Current control recommendations are removal and burning of infected leaves.

Eriophyid Mites on Palms

Eriophyid mites are apparently responsible for deforming palm trees in southern California. These tiny mites are found in the growing tips of the palms. The fronds exhibit a characteristic ‘crinkled’ deformation and the palm trunk begins to bend over as a result of the mites. Dr. Perring, Department of Entomology, UC Riverside, has a graduate student working on this problem.

Internet Sites

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

There is a lot of information on the web regarding the heating of greenhouses. Unfortunately, much of the information pertains to the heating of smaller greenhouses used by hobbyists. During the last energy crisis of the 70's, the Internet did not exist. Therefore, the lessons learned at that time were not placed on the web. I am sure as the energy crisis continues, we will be overwhelmed with new information on the Internet highway.

Many of the websites available list information about solar heating, discussing the different types of materials that can be used to absorb solar radiation. Other information is given regarding the do's and do not's for heating greenhouses.

www.ext.vt.edu/departments/envirohort/factsheets2/landsnurs/apr94pr2.html - This site is from the Virginia Cooperative Extension program. The factsheet discusses the use of different wall materials to absorb solar radiation during the day, which is then used to heat the greenhouse at night.

www.caddet-ee.org/nl_html/992_05.htm - This site reviews the different sources of energy used to heat greenhouses in Finland. It outlines the cost and efficiency of different energy sources such as gas, oil, wood, solar, electricity, peat, coal, etc. The authors of this site also discuss the energy consumption of greenhouses made from different types of materials.

http://edis.ifas.ufl.edu/AE015 – This is a factsheet published by the University of Florida. The article reviews different heating systems such as solar heaters, space heaters, steam heaters, and hot water systems. Information is also provided regarding greenhouse construction in relation to improving heat storage.

www.attra.org/attra-pub/solar-gh.html - This site is provided by the Appropriate Technology Transfer for Rural Areas. The site provides a list of books, articles and websites associated with solar greenhouses. There is also a list of greenhouse and solar heating suppliers.

www.jademountain.com/solgrnhs.html - A brief overview is given on ways to improve the efficiency of solar heating. There are also links for equipment to utilize alternative energy sources such as sun, wind and water.

The following is a list of sites for heating systems and greenhouses.

www.palgal.co.il/green.html

www.ibiblio.org/Intergarden/permaculture/general/1/msg00040.html

www.envirocept.com/gh_page.htm

www.growitgreenhouses.com/equipment/heating/heat.html

Campus News & Research Updates

Submitted by Julie Newman, Farm Advisor UCCE

Campus News

UC RIVERSIDE. The Ornamental Horticulture Continuing Conference (OHECC) will be held March 20-22, 2001 at the UCR Extension Center. Four UC DANR Workgroups concerned with environmental horticulture issues, including the Floriculture and Nursery Workgroup, will be meeting at this conference. The objective is to plan, coordinate, and share research and extension activities in environmental horticulture between farm advisors, Cooperative Extension Farm Advisor and specialists, and campus personnel. The Floriculture and Nursery Workgroup meetings will include training for farm advisors on greenhouse energy issues and salinity management, and coordination of extension efforts for growers related to these issues. Following OHECC**, CORF will sponsor a TMDL training meeting at the South Coast Research & Extension Center in Irvine on March 23 (see Calendar of Events).** This meeting will also serve as training for Floriculture and Nursery Workgroup advisors. The OHECC Planning Committee includes **Drs. David Burger** (UCD), **Cheryl Wilen** (UCCE, San Diego County), **Heather Costa** (UCR) **Don Merhaut** (UCR), and **Antoon Ploeg** (UCR). **Dr. Heiner Lieth** is Chair of the Floriculture and Nursery Workgroup.

UC DAVIS. **Dr. Heiner Lieth** received the Henry E. Heiner Award from the Joseph H. Hill Memorial Foundation, affiliated with the **International Cut Flower Growers Association (ICFG, formerly Roses Inc),** during their annual meeting in Santa Barbara. The award is for outstanding research in support of the fresh cut rose industry. Lieth was recognized by the ICFG for his research on modeling of rose productivity, his participation in educational programs, and his work as an advisor to several association committees. Past recipients of this award include **Ray Hasek** and **Francis Aebi.**

Heiner Lieth is hosting **Carola Gonzalez** from Spain, a researcher who plans to work on the effects of temperature on timing of cut rose crops. Also joining the Lieth lab group is **Fritz-Gerald Schroeder** from Germany. Dr. Schroeder's research interests include greenhouse management and closed hydroponic systems. Visitors to **Michael Reid's** postharvest lab include **Shimon Meir** from Israel, **Fisun Celikel** from Turkey, and **Mingfang Yi** from China.

Dr. Richard Evans recently returned from Barcelona, Spain, where he spent a short sabbatical leave with **Robert Savé.**

Research Updates

Awards. The California Cut Flower Commission recently announced research awards by the Kee Kitayama Research Foundation, as recommended by the CCFC Board of Commissioners. The following grants were awarded to UC: $20,000 to **Dr. Donald Merhaut**, UC Riverside, for *Improving Crop Quality and Minimizing Nitrate Leaching Through Manipulation of Ammonium Nitrate Ratios of Fertilization Programs;* $15,000 to **Dr. Karen Robb**, UCCE, San Diego County, for *Best Management Practices for Compliance with 1987 Clean Water Act – A Model Project;* and $18,374 to Dr. Karen Robb, UCCE San Diego County, **Julie Newman**, UCCE Ventura County, and **Dr. Diane Ullman**, UC Davis, for *Management of Tospovirus in Floriculture Crops.*

Richard Evans, Extension Specialist for Environmental Horticulture at UC Davis, and **Don Merhau**t, Extension Specialist for Ornamental and Floriculture Crops at UC Riverside, are collaborating on two grants in the coming year. The Hansen Trust, a UC foundation funding agriculture research beneficial to Ventura County, has awarded them, along with Farm Advisor **Julie Newman,** $16,000 to study water and nitrogen use efficiency in woody ornamental nurseries. The CDFA's Fertilizer Research and Education Program (FREP) has awarded Evans and Merhaut $50,000 to examine water and nitrogen use during production of a large number of woody nursery crops.

Heiner Lieth recently received $90,000 from USDA to develop mathematical models that describe the variables involved in greenhouse and nursery crop production systems. The three-year study will focus on how greenhouse crops use water and fertilizer nutrients. Developing models for these variables will enable growers to optimize fertilization, irrigation and run-off management practices.

Glassy-winged Sharpshooter Research

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In addition to conducting biological studies against the glassy-winged sharpshooter such as: survivorship, host plant preference and performance, and temperature development, our laboratory has conducted more than 15 greenhouse pesticide screening trials using over 35000 insects, many times using over 1000 insects a week. The CAN and NGA have funded much of our research effort in this area. Our pesticide trials confirm that the glassy-winged sharpshooter adult is susceptible to a number of classes of insecticide. Outstanding results were obtained with the registered compounds Marathon II, Talstar NF, and Tame. Greater than 90% control was obtained for four weeks under greenhouse conditions using Marathon II, Talstar NF and Tempo/Decathlon. We observed greater than 90% control against nymphs for four weeks using Marathon 60WP and 1G, and Flagship. Other products such as the common pyrethroids require further testing. Glassy-winged sharpshooter eggs are the most difficult to control. Indeed, no product tested so far has ovicidal effects. However, two pesticides cause 100% mortality to the emerging nymphs, Marathon II and Tame. There are two additional pesticides that need further registration, but are very effective against all stages of the glassy-winged sharpshooter, Acetamiprid and Mesurol.

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Greenhouse Growers

Continued from page 2

quality and affect timing of temperature sensitive crops (see Regional Report by Steve Tjosvold for more information on this). Growers who have chosen not to lower temperatures have raised prices on their crops about 3% or have increased packing and shipping costs. However, growers can't raise prices to the point needed to compensate for extra energy costs and still market their product in this global marketplace. For at least a few growers, this has been the final straw, and they are going out of production.

Groups of growers throughout the state have been forming or investigating the possibility of forming cooperatives for better leverage in obtaining reliable energy at reduced prices. Some are examining the benefits of using back-up electrical generators or co-generation in bargaining for reduced gas prices. Other growers are investing in energy-conserving strategies, such as solar shade cloths etc. Most of these types of strategies will not be in place until next season, however.

One approach adopted by growers has been to cut back on production for this heating period, which has also impacted the work force in some cases. Other growers are switching to burning diesel instead of natural gas. Diesel does have its drawbacks and switching boilers from natural gas to diesel can be problematic. Growers should discuss their rate classification with their suppliers to ensure that they are getting the best price possible.

Although the situation looks very bleak now, most are optimistic that they will be able to ride the storm.

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Campus News & Updates submissions can be directed to:

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Energy Related Publications

Compiled by Ann King, Farm Advisor UCCE

1. The publication **Reducing Energy Costs in California Greenhouses** (publ. #21411; date 1985), from the University of California, is no longer available for sale, nor is it available on-line, but it is a very useful publication for greenhouse growers. Contact your local Cooperative Extension office or Farm Advisor to see if they have a copy that you can borrow or photocopy.

2. Another very useful publication is **Energy Conservation for Commercial Greenhouses** (NRAES-3), from the Natural Resource, Agriculture, and Engineering Service. It, too, is a little out-of-date (last updated in 1989), but is perhaps the most widely available source of focussed and useful information. It is designed to help growers manage their options and reduce greenhouse costs. It is 42 pages, with many diagrams, and is only $6.00 (+3.75 handling). Contact NRAES, Cooperative Extension, 152 Riley-Robb Hall, Ithaca, NY 14853-5701; (607) 255-7654; www.nraes.org.

These two publications are a "must" for every greenhouse dealing with energy costs.

3. Many standard greenhouse textbooks have good information on energy conservation. Check with other growers, your Farm Advisor, or your nearest agricultural library to see if they have copies of such books as **Greenhouse Operation and Management** (5th ed.) by Paul Nelson, **The Greenhouse Environment** by John Mastalerz, or other similar textbooks.

CORF

Floriculture education from the Kee Kitayama Research Foundation

CORF News is the quarterly publication of CORF, the California Ornamental Research Federation, a statewide partnership of growers, floriculture associations, allied industry and research/educators whose mission is to identify and meet the research and educational needs of the California floriculture industry.

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Calendar of Industry Events

March
7-10 .... WF&FSA Annual Convention, Las Vegas,410/573-0400
8 .... CORF Container Media, Half Moon Bay, 707/462-2425
20-23 .. Bouquets to Art, San Francisco
23 .... CORF TMDL & Best Management Practices, Irvine, 707/462-2425

April

May
TBA ... CORF Growers' School: Alstroemeria, San Diego

June
7 .... CORF Grower Tour, Nipomo/Cal Poly SLO, 707/462-2425

July
11 .... CORF Labor & Risk Management, Carpinteria, 707/462-2425
18-22 .. Fun 'N Sun Weekend, Monterey, 831/722-2424

August
1 .... CORF Growers' School: Container Perennials, San Diego
10-12 .. CSFA Retreat, Cal Poly SLO, 916/448-5266
23 .... CORF Labor & Risk Management, San Diego, 707/462-2425

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