CORF News

Floriculture Education from the Kee Kitayama Research Foundation

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Energy Conservation in Cold Storage and Cooling Operations

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

Storage

Energy use in a cold storage facility is affected by the amount of heat the refrigeration equipment must remove and the efficiency of the equipment. The main sources of heat in a facility for long-term storage are transmission through walls, evaporator coil fans, lights, air leakage, and respiration of the stored commodity.

Heat entering a cold storage facility through walls can be minimized by increasing the insulation and by painting the exterior a light color. Doubling the insulation (as measured by R value) reduces transmitted heat by half. Newer facilities use insulation levels as high as R40 in walls and R60 in ceilings. In general, it is advisable to build with more insulation than utility costs may presently warrant, because energy costs are difficult to predict and it is much cheaper to install insulation during construction than after construction is completed.

Sun shining on walls and the roof dramatically increases the effective outside temperature, increasing heat flow into a storage facility. A dark, flat roof can be 75°F (42°C) warmer than the outside air temperature. Painting a south-facing wall a light color can reduce the effective wall temperature by 20°F (11°C) compared with a dark wall. Walls and the roof of a cold storage facility should be painted a light color or shaded from the direct sun.

Fans are used in cold storage facilities to move air through the evaporator coils and to uniformly circulate cooled air around stored commodities. During the initial filling of a storage facility, 100 cfm per ton of product (0.3 $m^3 \cdot m^{-1}$ per ton) stored is needed to remove the residual

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In This Issue

Preparing for a Power Outage

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

California electric utilities will have very limited reserve generating capacity for the next several years. Loss of even small amounts of generating capacity because of equipment failure or a shortage of hydroelectric power may force utilities to shed electrical load. Blackouts are necessary to protect their system and their customers' equipment when there is inadequate generating capacity.

Greenhouse operations must be prepared for power outages. They are predicted to last one to two hours but they could last longer – there are no guarantees. Outages are most likely from noon to 6PM on weekdays and are more likely on hot days when air conditioning loads are high.

All greenhouses should have:

1. A permanently installed engine driven generator with an automatic or manual transfer switch. The generator must be large enough to start and operate all ventilation, cooling, and watering equipment.

2. An uninterruptible power supply (UPS) for office computers, allowing them to be shut down without losing files.

Packing operations must decide whether to remain out of operation during the interruption or purchase standby generation.

Standby generators

A generator is installed near the service entrance (near the meter). When the outage occurs the customer's load is disconnected from the utility, the generator is started and then the

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field heat of the product. However, after the commodity has reached the desired temperature, air movement can be reduced by 60 to 80%. Also during the winter months, the outside air temperature drops and less heat enters through the walls compared to summer or fall conditions.

Lights in the cold storage room should be turned off when not needed. Use plastic flap doors to reduce infiltration of warm outside air during loading and unloading. Seal around openings for pipes and electrical conduits. Heat produced by respiration of the stored commodity can be minimized by keeping the commodity at minimum recommended storage temperatures.

Refrigeration system design has a great effect on energy use. The temperature of the refrigerant fluid after it is cooled in the condenser should be as low as possible. For example, a facility maintaining 32°F (0°C) and a condensing temperature of 125°F (52°C) requires 50 percent more power than one that operates at a condensing temperature of 95°F (35°C). In warm areas, evaporative condensers should be selected over air-cooled units. Utilities often offer rebates to install extra heat exchange surface for the condenser in order to further reduce refrigerant condensing temperature. Maintaining highest possible suction pressure also reduces compressor energy use. Use large evaporator coils and a control system that increases suction pressure as demand on the refrigeration system is reduced. Use a compressor system that operates efficiently over the required range of refrigerant flows. Screw compressors operate efficiently only at flow rates near their maximum capacity. Use several in parallel, shutting down those that are not needed, or consider using reciprocating compressors for peak loads. They operate efficiently over a large range of refrigerant flows.

Initial Cooling Systems

Figure 1 compares the energy efficiency of the five systems based on a number called an energy coefficient. The coefficient equals the cooling work done divided by the energy purchased to operate the cooler. High values represent high efficiency. Vacuum cooling is the most energy efficient followed by hydrocooling, water-spray vacuum cooling, package icing, and forced air cooling. Part of the reason for the high efficiency of vacuum cooling is that it removes heat only from the product being cooled. The other types of coolers remove heat from fans, pumps, infiltration of outside air, heat conducted through exterior walls, lights, forklifts, and people working in the cooler. Table 1 shows a distribution of heat loads for three types of coolers. Nearly all forced air coolers are used for some short-term product storage. This contributes to their particularly low energy coefficient numbers but it is not possible to separate energy use for storage from the total.

The data in Figure 1 show a great difference between the most efficient and least efficient coolers of a given type. For example, a well-operated hydrocooler can operate more efficiently than most vacuum coolers. However, a poorly operated hydrocooler can have nearly as low an energy efficiency as a forced-air cooler. The difference in efficiency between a given cooler and the best cooler of its type represents the potential for energy savings.

Vacuum Cooling

Refrigeration demand varies from zero for the first 10 minutes of a cycle to maximum when product temperature drop actually begins. Many vacuum coolers use one screw compressor. Screw compressors do not operate efficiently at low refrigerant flows. Vacuum cooler energy use can be reduced, however, efficiency can be improved by turning off the compressor when no refrigeration is needed (although this reduces motor life). Operating the cooler with a partial load reduces energy efficiency: a half load of lettuce requires 50 percent more energy per carton to cool than a full load. Cooling products that require long cooling times greatly increases energy use. For example, a load of cauliflower, which cools in 2 to 3 hours, takes three times more energy per pound of product cooled than iceberg lettuce that requires only 20 to 30 minutes.

Hydrocoolers

Energy use can be reduced by protecting the cooler from exterior heat gain and

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Table 1. Distribution of heat input to three types of fruit and vegetable coolers*

	Percent of Total Heat Input		
	Vacuum	Hydro	Forced air
Product	100	54	47
Fans or pumps	0	9	37
Infiltration, startup, conduction	0	37	7
Lift trucks	0	0	8
Lights, people, etc.	0	0	1

*Based on measured or calculated heat input for two or three installations of each type of cooler.

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operating it at maximum capacity. Table 1 indicates that over one-third of the heat input to a hydrocooler is infiltration of warm air, outside heat conducted through walls, and cooling the water reservoir when the cooler is started up each day. Infiltration can be reduced by installing plastic flap doors and by minimizing the distance between the shower pan and the top of the product. Adding insulation and shading the cooler or painting it a light color reduces heat conduction through the walls. Using a smaller water reservoir lowers the amount of startup cooling needed. Placing the cooler in a refrigerated building reduces all sources of outside heat gain and startup losses. Energy use per unit cooled associated with pumps and with removing conduction and infiltration heat can also be reduced by operating the cooler at maximum capacity. These energy uses are dependent on the amount of time the cooler is in operation, not on the amount of product cooled. Energy use per pound of product cooled is reduced when more pounds of product are cooled per hour.

Forced-air coolers

Energy use in forced air coolers can be reduced by all of the techniques mentioned for storage facilities, but fan energy use is the most significant. In addition to their own energy consumption, fans contribute over one-third (and in some coolers, more than half) of the heat that must be removed from an average forced air cooler. Fan energy use can be minimized by turning fans off when not needed, installing evaporator coils with a minimum airflow resistance, using cartons with adequate venting area, and arranging pallets on the cooler to reduce airflow resistance. Variable frequency controls are commonly used to slow fans at the end of a cooling cycle. This reduces heat input without significantly slowing the cooling process.

Package ice

These lose efficiency in two ways. (1) Many operations put about 15 pounds (7 kg) more ice in a box than is needed to cool the product. This allows the product to arrive at destination with about 11 pounds (5 kg) of ice still in the box, but the extra ice is rarely needed to maintain product quality. In a box of broccoli, this extra represents almost half of the total ice used in the cooling process. (2) Ice systems are often poorly insulated and not shaded from the sun.

Other options. Little energy testing has been done with water-spray hydrocooling. All of the recommendations for vacuum coolers should be applicable. Also, consider insulating the cooler, because water in contact with the walls during spraying and water in the reservoir allows outside heat to be transferred into the cooler.

Many cooling facilities are billed for electricity on the basis of not only the amount of energy consumed but also the time of day it is consumed. Electricity is usually more expensive during the afternoon hours, which is usually when most electricity is needed for cooling operations. There are ways to shift the energy demand to hours when electricity is cheaper. Slowing the cooling rate and consequently shifting the cooling work to the night is the least expensive option for forced air coolers. This can only be used if there is excess cooling capacity available at night and if products can withstand some delay in cooling. Electric lift trucks reduce refrigeration demand because they produce less heat than propane lifts.

Thermal energy storage is being used by several cooling operations. This equipment stores ice during the night and then uses it the following day for product cooling. Thermal energy storage is very cost effective if it is designed into the initial refrigeration system, creating a less expensive, small system that operates constantly rather than a large system that must operate only when cooling is needed.

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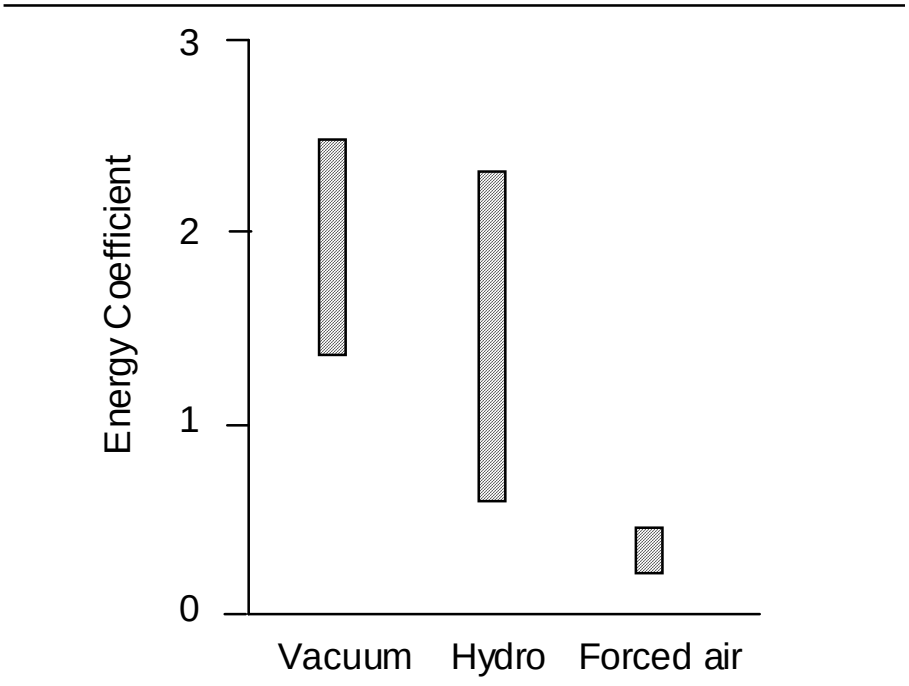
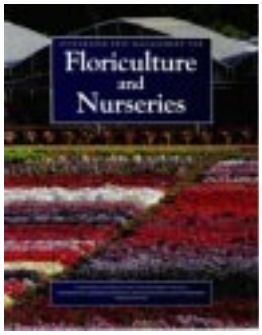


Fig. 1. Typical energy use of various produce cooling systems

New from the University of California: *Integrated Pest Management for Floriculture and Nurseries*

Integrated Pest Management for Floriculture and Nurseries is a new publication from the University of California. Over 80 experts contributed to this comprehensive new manual on the prevention, diagnosis, and management of abiotic disorders, pathogens, insects and mites, nematodes, and weeds. The manual provides information on pests affecting bulbs, cut flowers, potted flowering plants, foliage plants, bedding plants, and ornamental trees and shrubs grown in the field, greenhouse, and nursery. It was written for growers, IPM scouts, pesticide applicators, pest control advisers, and students.



IPM for Floriculture and Nurseries is profusely illustrated with more than 300 high quality, professionally taken photographs. It contains 164 line art illustrations and tables. Detailed crop tables at the back of the book list over 120 flower and ornamental nursery crop species or genera and the specific pests attacking each of them. Use this manual in combination with pesticide recommendations in the latest *UC IPM Pest Management Guidelines: Floriculture and Ornamental Nurseries*, available online at www.ipm.ucdavis.edu.

This 422 page manual (ANR Publication 3402) can be purchased for $45 a copy plus tax and shipping, with discounts available for purchases of 10 or more copies. The new guide is available at some local UC Cooperative Extension offices, directly from ANR Communication Services (6701 San Pablo Avenue, 2nd Floor, Oakland, CA 94608-1239), or by phone (800-994-8849), fax (510-643-5470), and online at http://anrcatalog.ucdavis.edu/.

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IPM Update

In late 2000, the California Department of Pesticide Regulation (DPR) released a list of products that can be used for pest control but are exempt from registration or reporting. DPR has determined that the active ingredients of the pesticides covered by this new regulation will not pose unreasonable risks to public health or the environment. In addition, the product must not include any false or misleading statements, make any claims to control or mitigate microorganisms that pose a threat to human health, including but not limited to disease transmitting bacteria or viruses, or claims to control insects or rodents carrying specific diseases. The full text of the announcement can be found at http://www.cdpr.ca.gov/docs/canot/ca00-6.htm.

The following is the list of Exempted Pesticide Products that would be of interest to the ornamental plant production industry.

I. Products consisting of foods that are used to attract pests and which contain no active ingredient(s).

II. Products containing the following active ingredients alone or in combination with other substances listed below provided that (1) the pesticide includes only those substances listed in the U.S. Environmental Protection Agency's most current List 4A "Inerts of Minimal Concern" as inert ingredients and (2) each product containing the substance must bear a label identifying the name and percentage (by weight) of each active ingredient and the name of each inert ingredient.

Castor oil (U.S.P. or equivalent), Cedar Oil [1], Cinnamon, Cinnamon oil [1], Citric acid [1], Cloves [2], Clove oil [1, 2], Corn gluten meal, Corn oil, Cottonseed oil, Dried blood Eugenol [1, 2], Garlic, Garlic oil [1], Geraniol [2], Geranium oil [2], Lauryl sulfate[1], Lemongrass oil [1], Linseed oil, Malic acid [1], Mint, Mint oil [1], Peppermint [2], Peppermint oil[1, 2], 2-Phenethyl propionate (2-phenylethyl propionate)[1], Potassium sorbate 1, Putrescent whole egg solids, Rosemary [2], Rosemary oil[1, 2], Sesame (includes ground sesame plant), Sesame oil, Sodium chloride (common salt), Sodium lauryl sulfate [1, 2], Soybean oil Thyme [2], Thyme oil [1, 2], White pepper [1], Zinc metal strips (consisting solely of zinc metal and impurities), Citronella and Citronella oil.

[1] Products containing 8.5% or more of this active ingredient in the formulated product must at a minimum bear the signal word "CAUTION," the phrase "Keep Out of Reach of Children," appropriate precautionary language, and a requirement for appropriate protective eyewear and gloves.

[2] Products containing this active ingredient intended for topical application to human skin must at a minimum bear the signal word "CAUTION," the phrase "Keep Out of Reach of Children,"a dermal sensitization precautionary statement, a prohibition against application to the hands of children, and use directions requiring adult supervision during application to children.

Reference: Section 12803, Food and Agricultural Code and http://www.cdpr.ca.gov/docs/inhouse/calcode/25.htm ❖

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

Legislative News.....

Greenhouse growers could receive direct payment from the USDA to help offset high natural gas and propane costs. Sen. Jeff Sessions, R-Ala., introduced a bill (S. 568) that would allow the USDA to use money already appropriated from the Commodity Credit Corp. CCC's budget totals $30 billion. If passed, the USDA will decide how to distribute funds. Congressional Budget Office estimates costs could reach $7 billion, but Sessions' press secretary Michael Brumas said the Senate does not expect the numbers to reach that high. Sen. Thad Cochran, R-Miss., co-sponsored the bill and chairs the Senate Ag. Appropriations Subcommittee. Similar legislation (H.R. 396) has been introduced in the House by Rep. Chip Pickering, R-Miss. Action on the bill is expected this year.

- from GMPRO greEn Mail, David Kuack, editor

Regional Report

San Mateo & San Francisco Counties

Water, Water, Everywhere

One of the major issues that growers will continue to address over the next decade will relate to water quality and water protection. In some areas of California, growers are already implementing and/or preparing practices to comply with the Clean Water Act. Elsewhere, growers are just starting to develop formal plans that address protection of groundwater, surface water, and adjacent watersheds.

1. Farm Bureau's "Agricultural Water Quality Program"

The San Mateo County Farm Bureau has taken a pro-active stance in assisting growers, ranchers, and landowners develop land management plans to protect water quality and surrounding watersheds. The Farm Bureau has established several "Watershed Working Groups," each of which includes local landowners who are developing plans to further protect adjacent watersheds. One of the goals is to develop management practices that reduce nutrient, sediment, and/or pesticide movement from farmlands, *if* this is occurring within each watershed.

Farm Bureau is working in partnership with the Monterey Bay Marine Sanctuary and other agencies to implement programs that identify and reduce sources of agricultural nonpoint pollution. Assisting in the program are the Natural Resources Conservation Service (NRCS), the San Mateo County Agricultural Commissioner, the Regional Water Quality Control Board, and the University of California Cooperative Extension (UCCE).

Growers and landowners should watch for a series of training workshops to be held this summer in the Half Moon Bay/ Pescadero area, sponsored by Farm Bureau, NRCS, and UCCE. These workshops will be invaluable in helping growers learn how to develop Farm Action Plans, and establish best management practices to assure water quality protection.

Tim Frahm, Agricultural Water Quality Program Director, and **Jack Olsen**, Executive Director, both of the San Mateo County Farm Bureau, along with the board of directors, are doing a terrific job in establishing and implementing this program. It should serve as a model for other counties who are starting to address water quality issues.

2. What is "TMDL"?

With enactment of the Clean Water Act in 1972, states were required to establish and meet quality standards for water bodies. In addition to identifying point source pollution (discharges from factories, for example), states were also required to identify nonpoint source pollution, such as runoff from farms, forestry operations, and urban areas. States must also establish total maximum daily loads (TMDLs) for impaired water bodies. TMDLs define how much of a pollutant a water body can tolerate on a daily basis and still meet the relevant water quality standards. All pollutant sources (point and nonpoint sources) within a watershed must not exceed the total limit.

This legislation will have a tremendous impact on agriculture. Growers and landowners need to familiarize themselves with the legislation, and to develop best management practices (BMPs) that assure compliance with TMDL legislation. For this reason, CORF is co-sponsoring several workshops this year to help the floriculture industry become familiar with TMDLs and other water regulations.

The first one-day workshop was held in March in Irvine, California. It was an excellent program, coordinated by Julie Newman, Don Merhaut, Darren Haver and John Kabashima, all of U.C. Cooperative Extension. Topics covered included pest management, cultural practices, and soil/ fertilizer/irrigation management. The program also included a tour of two nurseries with innovative water management systems. According to Don Merhaut, the tour showed that BMPs (best management practices) can be environmentally beneficial, while simultaneously reducing production costs.

A second Nonpoint Source Pollution/ TMDL Workshop will be held in Watsonville, on September 13. This will be a day-long seminar, with a tour. Topics include the regulations and mitigation practices related to this issue, along with cultural practices, best management practices, fertility/media management, irrigation management, and interpretation of soil & plant analyses. Flower growers and nurserymen are encouraged to enroll in this workshop to learn about TMDLs and compliance issues. Call the CORF office for more information on the workshop, at 707-462-2425. In addition to these workshops, CORF is sponsoring Irrigation Practices to Reduce Runoff – Workshop and Nursery Tour in Ventura on September 11. (See the program insert for details)

(*Some of the technical information in the first paragraph came from "TMDLs: The Revolution in Water Quality Regulation," by Jennifer Ruffolo, April 1999.*)

3. Ground Water Protection Areas

I attended a UC symposium in March on **Ground Water Protection Areas (GWPAs)**, the new terminology that will replace the current Pesticide Management Zones (PMZs). **Larry Schwankl**, who coordinated the program at UC Davis, provided information noting that the Department of Pesticide Regulation:

1. Will require, by the end of 2001, well-head protection and backflow protection on all agricultural wells associated with application of a "labeled" chemical.

2. Is designating Ground Water Protection Areas (GWPAs) in many counties, based on soils, depth to groundwater, chemical detection in wells, etc.

3. Will require irrigation water management training, record keeping, etc. for growers in the GWPAs — all phased in over the next few years.

To learn more about GWPAs, check the Calif. Dept. of Pesticide Regulation's web site: www.cdpr.ca.gov/docs/empm/ gwp_prog/gwp_prog.htm

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Regional Report

Santa Cruz & Monterey Counties

Sudden Oak Death: A New Problem for the Nursery Industry?

Sudden Oak Death (SOD) is the name given to a complex of biological and environmental factors involved in the death of oak trees in California. It has been reported in Sonoma, Napa, Marin, San Mateo, Santa Clara, Santa Cruz, and Monterey Counties. The syndrome was first observed in 1995 in tanoaks and later in California live oaks. The hardest hit areas are in parts of Marin and Santa Cruz counties. The primary cause of the disease appears to be a recently discovered *new* species of the fungus *Phytophthora*. The fungus apparently infects oak and tanoak through the trunk, initially from the soil-line up to about 6 feet above the soil-line. In native vegetation, the fungus is infecting coast live oak, black oak, Shreve's oak, tanoak (*Lithocarpus*), and huckleberry (*Vaccinium ovatum*). This winter, the fungus was found infecting rhododendrons in a commercial nursery in Santa Cruz County. The SOD *Phytophthora* infects the leaves of *Rhodododendron* and *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. The fungus, therefore, is now known to infect two plant families, the oak family (Fagaceae) and the heath family (Ericacae).

Although not officially reported, the fungus has been observed infecting commercial *Rhododendron* nurseries in Germany and the Netherlands as early as 1993. Given the pattern of occurrence in California, one might suspect that this is an introduced pathogen rather than a native pathogen. The movement of the fungus from Europe on infected *Rhododendron* stock to California is a significant possibility.

The disease is beginning to be an important problem for some sectors of the nursery industry. This year, Canada and Oregon have placed emergency quarantines covering plants, plant parts, and associated soil of any plant species found to be susceptible to SOD *Phytophthora*. The importance of these quarantines or the potential of additional quarantines from other states or counties seems dependent on the nursery location and what ornamental or native species the nursery grows. The host range of this *Phytophthora* is still not completely defined, so other native and ornamental plants might be included as hosts and therefore subject to quarantines by Oregon or Canada. In early April the California Department of Forestry established a SOD Zone of Infestation. This opens up the possibility that other non-infested counties or states could more easily establish quarantines on movement of susceptible hosts from infested counties.

Information on the biology, host range, and management of SOD *Phythophthora* is changing very rapidly. Printed literature is usually not completely accurate within just a few weeks of publication! Therefore I recommend that the following well-maintained websites be accessed for current information:

UC Center for the Assessment and Monitoring of Forest and Environmental Resources:

http://camfer.cnr.berkeley.edu/oaks/

California Sudden Oak Death Task Force

http://www.suddenoakdeath.org/

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Field Observations

Leaf Smut on Greenhouse Sunflower

Early this winter, greenhouse grown sunflower seedlings were found severely infected with leaf smut, *Entyloma polysporum*. With a casual observation of the leaf symptoms, one might think that the leaves were infected with a powdery mildew. The light-colored spores occur in dense masses called sori that cover the leaf surface. Older sori form discolored circular to irregular lesions on the leaf surface. At my first observation, most seedling leaves (cotyledons) were completely covered with the fungus. Many of the first true leaves were also completely covered with the fungus, but many were, uniquely, infected at the leaf tips. The disease did not kill plants. In fact, much of the crop developed sufficiently to produce flowers. The affected lower leaves could be stripped off for shipment. However, in many cases, every leaf on the stem was diseased, and the flower was discarded. Subsequent crops were also diseased and, since minimal control was achieved by fungicides, the subsequent crops were destroyed. Commercial treatments with Heritage or Bayleton were not significantly effective.

The first economic loss by this disease was noted in southern California in 1996. At first the disease was not of economic significance so no attempt was made to identify the causal agent. However, with continuous cropping of sunflowers, significant losses were observed on seedlings. In the literature, *Entyloma australe*, was controlled in culture with mancozeb. However, in the field, this fungicide was not effective on the fungus which causes leafspot on husk tomato. Triadimenol and copper oxychloride were effective. *Entyloma* leaf spot on blue thistle caused by *Entyloma erynggi* was controlled with the protective fungicide mancozeb or more efficiently with the systemic ergostereol-inhibiting funcicides cyproconazole and difenoconazole.

I can email digital images of infected plants to anyone who is interested.

Field Observations

I have recently received numerous inquiries concerning water and nutrient runoff in nurseries and ways to reduce this problem. There are certainly signs of increased regulations related to runoff coming down the pike in both Santa Barbara and Ventura Counties. For example, in the County of Santa Barbara Carpinteria Greenhouse Plan, any future expansion of greenhouses shall include a water quality management plan in which information on nutrient delivery systems and wastewater disposal methods will be specified. If this plan is passed by the Board of Supervisors, growers will need a flow diagram of the proposed water system to be used, including average and maximum daily flows. In addition, the diagram will need to show the location and type of treatment and disposal facilities for irrigation, wash water, boiler blowdown, water softener regeneration brines and retention basins. A complete listing and quantity of chemicals that are expected to be used in the greenhouse operation will also be required.

In Ventura County, impaired water bodies have been identified by water regulatory agencies. Although currently the Regional Water Board is only looking at chlorides, nitrogen and pesticide monitoring are planned in the future. This will certainly impact agriculture since runoff often contains fertilizers, chemicals and sediment in quantities that exceed federal and state water quality standards. Currently Richard Evans and Don Merhaut are working with me on a project funded by Hansen Trust to improve water and nutrient efficiency in nursery crops. We plan to extend information from this trial and other best management practices at the CORF Irrigation Practices to Reduce Runoff Workshop and Nursery Tours in Ventura County on September 11.

Regional Report

Ventura & Santa Barbara Counties

Carpinteria Greenhouse Plan

New greenhouse construction over 20,000 square feet has required a Conditional Use Permit (CUP) in Carpinteria since 1998. Now growers are facing possible new county regulations that could curtail development significantly. If approved, land would be rezoned to create two new zones specific to agricultural lands in the coastal zone of the Carpinteria Valley. One zone district would allow measured future greenhouse expansion and development of greenhouses within existing clusters of greenhouse development. The other zone district is the Carpinteria Open Field Agriculture Zone District. This zone, which is significantly larger, would permit only open field and orchard agriculture, although existing greenhouses would remain unaffected unless expansion or reconstruction is planned. Growers who purchased land in this zone with the intent of building greenhouses or related structures over 20,000 square feet, will not be allowed to do so. The intent of The Carpinteria Open Field Agriculture Zone District is to provide a buffer between more intensive agricultural uses associated with greenhouse development and surrounding urban land uses, while allowing existing greenhouse operations in this district to remain.

The proposed program also includes a greenhouse and related development cap of 2.75 million square feet that will further limit the amount of future development. In addition, new standards are proposed for greenhouse development including greater setbacks from greenhouses on interior lots. Specific development standards are to be followed to protect sensitive coastal resources.

The Carpinteria Valley program was developed to address such issues as aesthetics, land use compatibility, truck/ delivery traffic, night lighting, noise, water quality, etc.

The project was first initiated by the County of Santa Barbara Planning Department in 1998, and the Final Environmental Impact Review was approved in March 2000. The Planning commission held a total of seven hearings during 2000 and received extensive public comment on the proposed program. Hearings at the Board of Supervisors were scheduled on February 20 and on March 19, 2001. The County Board of Supervisors is planning one more meeting on April 24. If the plan is approved at this meeting, certification by the Coastal Commission is projected by this summer.

The project was developed with input from the City of Carpinteria and Preserve Rural Carpinteria. The Santa Barbara County Flower Growers Association has been intensely involved in the process from the beginning and has been working to block this proposed project. They levied an assessment to members to recoup the cost of the services of a land use attorney and a land use consultant. The California Cut Flower Commission has also committed their attorney, and other county agricultural associations have joined in the crusade to stop these proposed regulations.

If this plan is passed it could set a precedent for other counties with significant greenhouse development to follow. In fact, it is possible that this may be the first time in California that greenhouses have been examined as potentially separate from the rest of agriculture within zones designated in the Williamson Act Agricultural Preserves. It is indicative of the struggles the floriculture industry faces with urban encroachment.

Further information about the proposed program can be found at the Santa Barbara Co. website at www.sbcountyplanning.org.

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Regional Report

San Diego County

Clean Water Program Update

Dave Shaw, Valerie Mellano and I are conducting a Clean Water Program to assist growers in complying with the 1987 Clean Water Act through a voluntary program rather than having mandatory 'one-size-fits-all' regulations imposed by municipalities.

An onsite assessment is the first step when growers enroll in our program for individual consultation. This includes noting the type of equipment (all of it) and often mapping the location. Identifying the crop(s) and where the roots are in the growing media. The following step is to turn on the irrigation system and look for leaks and obvious problems.

Hardware maintenance, more specifically, lack of hardware maintenance is generally a major issue. A common problem is missing emitters/spaghetti tubing. The resulting holes produce a striking water show with each irrigation event, in addition to a significant loss of water. Another common problem with potted plants is that when a plant is removed from the bench, either due to spacing, plant death or harvest, the emitter is left to hang below the bench and below the pipe. As a result, when the irrigation is complete, water drains out of the system at this low point. Not only is water lost due to drainage, but the entire system has to recharge, so emitters at the end of the system will deliver less water than emitters closer to the main. Addressing both of these situations involves educating the workers about the importance of repairing leaks as well as the need to keep emitters at or above the level of the pipe. Another option is to replace the current emitters with ones having low pressure check valves.

The next step in our program is to conduct an irrigation uniformity evaluation. What is irrigation uniformity? It is the term used to describe how evenly water is applied to a crop. It is an important consideration in this program because growers will water to the driest plant/pot. If the irrigation uniformity is poor, growers will overwater most of their plants in an effort to adequately water some of their plants.

Distribution uniformity is probably the most common uniformity statistic because it is easy to calculate. Distribution uniformity can be measured using catch cans or other volumetric containers. Twenty (or more) measurements are taken by; a) quantifying the time it takes each emitter to deliver a certain volume, or b) quantifying how much water is delivered by each sampled emitter for a given time. After making the measurements, the average is calculated by adding the measured amounts and dividing by the number of measurements. The average of the 'low quarter' is determined next by identifying the lowest 25% of the measurements. If 20 measurements were used, then the low quarter consists of the five smallest measurements.

The Distribution Uniformity value is calculated as:

DU = 100 X (Average of the 'Low Quarter'/ Average of All Measurements)

Ideally, we would like to see irrigation uniformity ranges of 80 – 90%. Typically in a greenhouse with a drip system, we encounter irrigation uniformity values of 40% or less.

In the next issue, I will discuss what growers can do to improve irrigation uniformity.

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Field Observations

Our latest alien encounters…

Two species of rust were recently discovered in San Diego County. This represents the first time *Puccinia distincta* has been observed in the United States. It was found on *Bellis perennis,* but will also attack *Calendula officinalis, Felicia bergeriana,* and *Senecio cruentus*. This rust looks similar to many of the rusts we are familiar with, such as geranium rust or snapdragon rust. For a picture of this rust, check out http://www.bioimages.org.uk/. This is a different rust than the rust isolated from *Bellis* in north.

Puccinia hemerocallidis was discovered on *Hemerocallis* for the first time in California. This rust is established in some of the southern states and will also attack *Hosta* and *Patrinia*. This rust also exhibits what I consider 'classic' rust symptoms. For more information on this rust, see http://doacs.state.fl.us/~pi/enpp/pathology/daylily-rust.html.

Both of these finds are isolated instances and it appears that the plants were already infected with the rusts when they were moved into San Diego County. The take home message here is: CHECK YOUR PLANTS WHEN THEY COME IN! We have enough pest problems without bringing in additional diseases, insects, weeds, etc.

On the positive side, there were no finds of Chrysanthemum White Rust in San Diego County in 2000 and none to date in 2001!

In general, rust diseases are favored by moderate temperatures. Water is required for short periods (6-8 hours or less) for germination of spores and infection to occur. Once infection has occurred, water is no longer needed for development of the disease. Continued development, infection and spore production will continue for the life of the leaf.

Cultural control methods include not replanting crops in the same soil season after season and avoiding overhead irrigation.

Internet Sites - Best Management Practices

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

Water quality is at the forefront of issues regarding both agricultural and urban horticulture. While sometimes we may feel that the extra management practices may make production more costly, I feel that in the long run, production systems will be more economical, since water and fertilizer use efficiency will be improved. A good example of this is water recycling. More nurseries are successfully recycling irrigation water, which has reduced fertilizer and water costs.

It is imperative that growers remain updated on the policies regarding water runoff and nutrient runoff. Unfortunately this is easier said than done. However, we have listed a few sites that will get you going – especially regarding Best Management Practices (BMPs). Many of the practices listed in these sites are common sense while others are very creative. Others are also more related to agronomic crops rather than horticultural crops, but I have inserted them anyway, since they are also concerned with nutrient runoff into surface water and nutrient percolation into the groundwater. *Special Note:* Please pay attention to the locations that the BMPs are being written for.

Local sites: www.corf.org - CORF website, http://danr.ucop.edu - This site provides information to the current programs and extension personnel available to address specific questions. Within the site (http://danr.ucop.edu/news/Jan-June2001/Floriculture.html) is the information about the new Floriculture and Nursery manual, which also contains a plethora of information regarding every aspect of floriculture production. Information for ordering the manual is also listed.

BMP sites specific to nursery production

http://www.okstate.edu/ag/agedcm4h/pearl/e951 -This site is provided by the Oklahoma Cooperative Extension Service. They have a very good water quality handbook for nurseries that can be printed out. This is one of the best references I have found on the web thus far, but I am still reviewing sites.

http://www.cdpr.ca.gov - This is the site for the California Department of Pesticide Regulations. This is a good reference for updates on new pest management issues in the state of California.

http://www.extension.uiuc.edu - This site is hosted by the University of Illinois. There are general guidelines on all aspects of Nursery and Greenhouse production processes. However, some of the sites within this are still being developed.

http://www.oda.state.or.us/ - This site is hosted by the Oregon Department of Agriculture. In addition to general BMP information, this site also contains a list of links to other universities.

http://ohioline.ag.ohio-state.edu/aex-fact/0464.html and 0465.html - This is very general information taken from a USDA bulletin. 0464 is titled *Nonpoint source pollution: Water Primer* and 0465 is titled *Surface Water Quality BMP Summary Guide.*

http://www.nal.usda.gov/wqic/Bibliographies/qb9501.html - This site lists 171 different abstracts related to water quality. This is a good site for Advisors and Specialists, but is also for those that want all the little details regarding BMPs and water quality issues.

Campus News & Research Updates

Submitted by Julie Newman, Farm Advisor UCCE

Campus News

CAL POLY, SLO

Plans are underway for the ***2001 CORF Grower Tour & Research Demonstrations*** on June 7. We will tour several nurseries in the Nipomo/Santa Maria area. We have not yet finalized all the stops, but Clearwater Nursery, All-Seasons and Glad-A-Way Gardens are confirmed. The program will include campus presentations by Cal Poly professors and students on 25 years' worth of energy research since the energy crisis of the 70s. UC research and poster presentations will include results from projects funded by the CCFC/Kee Kitayama Research Foundation. See newsletter insert for registration details.

The ***4th Annual Environmental Horticulture Integrated Pest Management Conference*** will be hosted on the campus June 12 and 13. The conference is designed to provide growers, pest control advisors, pesticide applicators, and landscape and turf maintenance professionals with current information on pest management in the environmental horticulture industry. The conference is one of the few conferences nationwide which concentrates specifically on IPM in the environmental horticulture industry. This year's conference features a detailed seminar on mildew diseases and their control presented by ***Dr. Ann Chase*** of Chase Research Gardens; an application equipment symposium with the opportunity to try out all the latest application equipment for landscapes, nurseries, and greenhouses; and a turf management symposium featuring ***Dr. Joe Vargas*** from Michigan State University. The program and enrollment form can be accessed by clicking on the IPM Conference link at the EHS Department home page (www.calpoly.edu/~envhort) or by contacting ***Dr. Bob Rice*** at rrice@calpoly.edu, phone: 805 756 2830, FAX: 805 756 2869.

UC DAVIS

The era of the Environmental Horticulture department as a self-contained unit is coming to an inevitable close. Plans are underway for the construction of a convention center and hotel on what are now experimental field plots and a semi-famous buffalograss volleyball court. The south campus area is being developed into a showplace for the arts and major meeting facility. Environmental Horticulture will be given a tract of land west of campus where other plant science departments also have field facilities. This is the first step in a process that may result in Environmental Horticulture eventually moving to central campus.

Research Updates

Methyl Iodide Eliminates Nematode Pests Harbored in Old Roots

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Methyl iodide is potentially a very effective soil fumigant against a wide range of soil-borne pathogens and pests. At equal molar rates its efficacy is superior to methyl bromide against soil-dwelling larvae and eggs of various plant parasitic nematodes. However, one of the major advantages of methyl bromide compared to most other nematicides is its ability to penetrate plant residues such as old roots and eliminate pests living within those plant tissues. Roots of perennials in orchard replant sites may remain relatively intact for years after plant removal. If these roots harbor viable plant parasitic nematodes or their eggs, the organisms are then greatly protected against environmental hazards, their natural enemies as well as nematicides. They emerge from those roots under favorable conditions and re-infest the planting site. In soil container experiments we compared the efficacy of methyl iodide to methyl bromide by exposing buried lesion nematode-infested rose roots to various concentrations of the soil fumigants. The data confirmed the excellent efficacy of methyl iodide. It penetrated the root tissues effectively and eliminated the lesion nematode at lower concentrations than methyl bromide.

Becker, J.O., C.M. Hutchinson, J.F. Karlik, and J.J. Sims. 2000. *Efficacy of methyl bromide and methyl iodide against Pratylenchus spp. harbored in rose roots.* Fungicide and Nematicide Tests 55, 315.

Ethylene and Postharvest Performance of Potted Kalanchoë

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Kalanchoë blossfeldiana cultivars are popular potted flowering plants due to their brilliant colors and long display life. The flowers are very sensitive to ethylene gas, which causes inrolling of petals and premature senescence. Because ethylene is produced by many fruits and vegetables during ripening, kalanchoë plants displayed in supermarkets often lose quality and are not salable. M. Serek (Royal Veterinary and Agricultural University, Denmark) and M. Reid used time-lapse videography to study the effects of ethylene on the flowers of several kalanchoë cultivars.

Flowers of different maturities reacted similarly to ethylene exposure, beginning to inroll after about 8 hours and completely senescing by 30 hours. Flowers exposed to 1 ppm ethylene for 8 hours or less showed very little inrolling during a subsequent four-day period. Those exposed for 24 hours inrolled but recovered somewhat 2 days after exposure. Flowers exposed to ethylene for 32 hours or more experienced irreversible wilting.There were dramatic differences in ethylene sensitivity among cultivars, one showing little response to as much as 10 ppm.

These differences should be exploited in future breeding programs. Pretreatment of plants with the ethylene antagonist, 1-MCP, protects flowers in the presence of ethylene but does not extend flower longevity in ethyl-ene-free environments. This suggests that ethylene does not play any important role in the natural life of the flowers.

Serek, M. and M.S.Reid. 2000. *Ethylene and postharvest performance of potted kalanchoë.* Postharvest Biology and Technology 18:43–48.

Campus News & Updates submissions can be directed to:
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Energy Conservation

Continued from page 1

generator is connected to the load. This procedure can be done automatically or manually.

Manual transfer can be done with a double throw switch or some other kind of break-then-make switch. The operator then starts the generator and when gauges indicate that the generator is operating at the correct speed, the greenhouse load is connected to the generator. A manual transfer switch is less expensive than an automatic switch and has the advantage of allowing individual circuits to be connected sequentially to the generator. Circuits with the largest demand are started first. This allows the generator to be sized smaller than one used with an automatic transfer switch.

If greenhouses have a number of independent connections to their utility (each connection is a separate meter), then it may not be advisable to use manual transfer switches. It is risky to depend on staff to turn off all equipment, start generators for each service, and dependably reactivate all cooling and ventilation equipment.

Automatic start generators are sized to provide the wattage needed to simultaneously start all motors. Motors draw approximately four times more wattage during start up compared with their running power demand. This means that automatic start generators are several times larger than manual systems that are adaptable to sequential reactivation of circuits.

The standby system is sized by taking an inventory of all electrical equipment in the operation. List the number and size of all motors, number and wattage of lights, and any other equipment. Also indicate the priority of the equipment. For example, exterior lighting has a low priority during blackouts that will usually occur during daylight hours. With this information a standby equipment supplier can recommend a correctly sized unit for your operation. Generator choice and installation design will also depend on equipment availability, over limit capacity of particular models, choice of transfer equipment and details of your specific operation.

The cost of new engine-driven generators varies with generator size. A 100 kW unit costs about $150 to $200 per kW. Smaller units cost more, a 30 kW unit may be priced at $400 per kW. Installation and transfer switches are additional costs. A qualified electrician following local codes and utility regulations for interconnection should do equipment installation. This is not a do-it – yourself installation.

Transfer switch

During an interruption the transfer switch isolates your equipment from the utility. This prevents feeding back power to the utility and accidentally injuring a utility worker. It also prevents utility power reenergizing your circuits while the generator is operating, resulting in damage to your equipment.

Air Pollution Permit

Air pollution control districts require an operating permit for standby generators. They are usually allowed 200 hours of operation per year and can only be operated for testing and powering your own facility in an electrical interruption.

Fuel supply

The fuel tank should be large enough to supply the generator between fuel deliveries assuming maximum hours of operation per day. Some fuel suppliers have indicated that outages may affect their delivery schedule because of their inability to pump fuel from their tanks during the outage. Talk with your supplier about scheduling this summer.

Diesel engines consume about 0.4 pounds of fuel per hour per output horsepower. A 100 kW generator requires a 200 horsepower engine. If the engine operates at 50% out put, it will consume 40 pounds (about 5.6 gallons) per hour.

Maintenance and testing

The generator should be run at least once per week under at least half load to test for readiness. Follow manufacturer's recommendations for preventive maintenance.

Alarms

Even automatic systems fail to start and occasionally shut down because of accidental overloads. Automatic start systems must be equipped with an alarm system that phones or pages several individuals. Regularly monitor the generator when it is operating. Check and record voltage, engine temperature, oil pressure, etc.

Useful information sources on the web

http://www.gov.on.ca/omafra/english/engineer/facts/99-005.htm ❖

Special Thanks to these Sustaining Sponsors of the 2001 CORF Grower Education Programs...

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.

A Word of Gratitude to these Sponsors of CORF Grower Education Programs

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Calendar of Industry Events

May
29 ..... CORF Growers' School: Alstroemeria, San Diego, 707/462-2425

June
6 ..... CAPCA Nursery/Greenhouse Seminar, 760/522-8349
7 ..... CORF Grower Tour, Nipomo/Cal Poly SLO, 707/462-2425

July
14 ..... ICFG Greenhouse Cut Flower Symposium II, 517/339-9544
18 ..... CORF Management Training for Spanish Speaking Foremen, Carpinteria, 707/462-2425
18-22 .. Fun 'N Sun Weekend, Monterey, 831/722-2424

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 Foremen, San Diego, 707/462-2425

September
11 ..... CORF Irrigation Practices to Reduce Runoff - Workshop & Nursery Tour, Ventura, 707/462-2425
13 ..... CORF Non-Point Source Pollution; TDML & Best Management Practices Seminar & Tour, Watsonville, 707/462-2425

October
2 ..... CORF Growers' School: Snapdragons, Ventura, 707/462-2425
6-17 .... CORF Grower Tour to Australia, 707/462-2425
25 ..... CORF CA Insect & Mite Symposium, Watsonville, 707/462-2425

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