CORF news

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Floriculture Education from the Kee Kitayama Research Foundation

Active RFID Tags – *a new tool for improving temperature management during the marketing of cut flowers*

by Michael Reid - University of California, Davis and George Staby - Perishables Research Organization, Pioneer CA

Growers, shippers, wholesalers and retailers should all be aware that cut flowers perform better when cooled rapidly after harvest and maintained at the correct temperature until they are placed in the consumer's home. Recent surveys have suggested that retail florists are less concerned with temperature management than they should be, and make little association between proper temperature management and freshness. In a study by Prince and Prince (2007), it was shown that while florists placed great importance on the statements 'my wholesaler delivers the freshest product available' and 'my wholesaler delivers the highest quality cut flowers', they didn't place any importance on two closely-linked statements 'my wholesaler is best at managing the cold chain' and 'my wholesaler delivers via refrigerated trucks'. The lack of appreciation of the importance of the cool chain at the retail level, as well as the increased time that today's flowers spend in marketing channels, are responsible for reduced flower vase life in the consumer's homes. We believe that, in turn, is responsible for the faltering sales of cut flowers in North America.

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Growers Find Changes to Postharvest Handling Improve Bottom Line

by Karen L. Robb, Julie P. Newman and James A. Bethke - UC Cooperative Extension

Various growers throughout California were recently asked what changes they have made to their postharvest handling practices in recent years, and what impacts resulted. Unanimously, growers reported that although changes in their postharvest handling procedures had increased their direct costs, these costs were more than offset by reduced credits.

Postharvest treatments have improved flower longevity and quality for several growers. Obra Verde reports improvements in their postharvest quality as a result of using silver nitrate.

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Removing Buckets from the Postharvest Chain

by Michael Reid, Andrew Macnish and Annemarie de Theije - University of California, Davis

One of the most traditional tools used by commercial flower producers are buckets. Formerly fabricated in wood or metal, these ubiquitous plastic devices are inventoried by the hundreds or even thousands wherever cut flowers are grown. They can be deep or shallow, cylindrical or rectangular. They are used to hold the solutions into which flowers are placed after harvest, during cooling and grading, and for application of pre-treatments. It's not surprising that buckets are such a universal part of the postharvest handling of flowers. Cutting flowers separates them from the water supplied by the mother plant. By placing the cut flower in buckets of water, we provide

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Editor's Note:

This issue of CORF News focuses on postharvest handling practices and their importance in increasing customer satisfaction and floral sales. Michael Reid (UC Davis) and George Staby (Perishables Research Organization) discuss exciting new RFID technology, Michael Reid presents research supporting dry handling as an alternative to buckets, and California growers share their experiences in improving postharvest handling procedures.

Steve Tjosvold, Editor of CORF News, is on sabbatical, but finds he can't hide from the serious light brown apple moth problem in his region! He promises to continue to provide regional reports during his leave.

The University of California is in the midst of hiring a new floriculture and nursery advisor for San Mateo County and a full-time advisor for San Diego/Riverside Counties (Jim Bethke currently is working part-time as Acting Farm Advisor). This means increased UC Cooperative Extension contributions to CORF News in the near future!

-Julie Newman, Acting Editor CORF News

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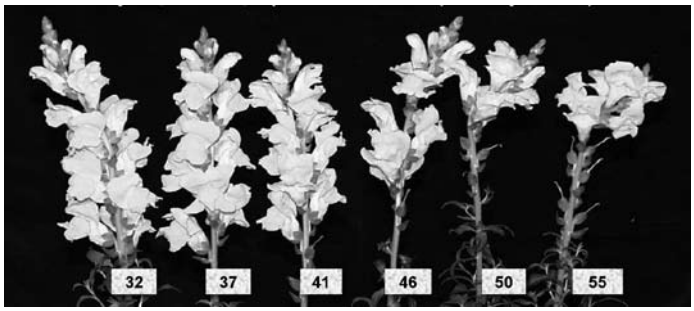
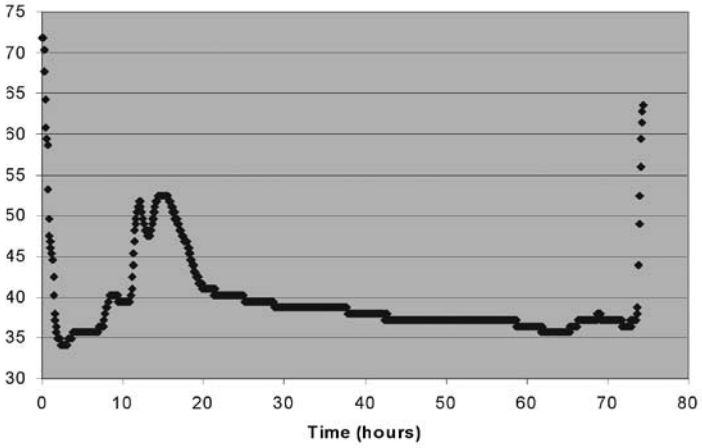
The importance of temperature during marketing is shown clearly below.



The photograph shows snapdragons that were stored for four days after harvest at different temperatures, and then placed at room temperature for a further four days. Clearly, after four days in the vase, the snapdragons that were stored at 32 F were much superior to those stored at warmer temperatures, with better opening of small buds, no 'shatter' and none of the stem bending seen when held at warmer temperatures. An important observation in this experiment was that the effects of higher temperature storage were not obvious when the flowers were removed from storage. Perhaps this is why florists pay little attention to the previous cold-chain history of their flowers – they cannot see the difference between fresh and compromised flowers.

The resurgent market in Great Britain provides an interesting example of what needs to be done to increase floral sales in this country. The major supermarket chains recognized the floral market as a growth opportunity, and also recognized the importance of 'freshness' in ensuring repeat sales in what they have targeted as their primary market – personal sales. They stand behind the freshness of their flowers with a 7- or even 10-day guarantee. To ensure that the flowers meet this freshness standard, they have implemented quality control throughout the marketing chain from the farms (primarily in Kenya) to the retail stores in Great Britain. In combination with aggressive advertising campaigns focused on personal consumption, Great Britain has seen sales of flowers soar, with per-capita consumption doubling in five years, and tripling in ten. Per capita consumption in Great Britain is now more than 8 times that in the U.S.

Although we know that temperature management is critically important, it is not unusual for flowers to be subjected to undesirable temperatures during marketing. The graph shows the changes in temperature for flowers over time during transportation, which we term a 'time/temperature profile'. The data are quite typical of the temperatures during transport of flowers from a large California producer to a wholesaler on the East Coast. The grower cooled the flowers, but early during their transport (just after they were placed in the long-haul truck), the flowers warmed up to greater than 50 F. This is the result of the long-haul truck being loaded with flowers from a number of growers, some of whom had delivered warm flowers to the truck dock. The cool flowers that we were monitoring warmed up because they were placed near warm flowers and thereby essentially cooled the other flowers in the load! The result of this temperature change would certainly have been accumulation of condensation on the cooled flowers, and potential for development of *Botrytis* infection. Obviously the grower, shipper, and wholesaler each has an interest in knowing when events like this occur, and we have been testing a range of options to permit routine monitoring of temperatures during cut flower marketing.



The temperature recorders that we used to generate the graph shown here are relatively small and straightforward to use. However they are expensive and it is necessary to retrieve them from the box in order to download the time/temperature data using a computer interface.

Pilot trials of temperature and vase life monitoring using active RFID chips were carried out with these prototype CD-sized tags.

We are working with Infratab Inc., in Oxnard, CA, developers of an active Radio Frequency Identification (RFID) tag, to conduct pilot trials on the use of these devices for monitoring temperatures during the transportation of cut flowers. Enthusiastically endorsed by a major retail chain, RFID tags are already widely used in the hard-goods business. The first generation of RFID tags are passive devices, tiny integrated circuits with antennae that can send and receive radio signals that activate the tag, and print and read information into the chip's memory. These will likely replace the widely used UPC bar code for product identification.

Active RFID tags are a new generation of these devices that include a battery so that they do not depend on incoming radio signals to provide power, and can remain 'on'. They can thus monitor time, temperature, and location information throughout the transportation chain. Initial tests of these experimental devices with a small group of California growers shipping to a major east coast wholesaler were very promising.

In a trial last year with cooperating members of the Wholesale Florist and Florist Supplier Association (WFFSA), we demonstrated the effectiveness of active RFID tags in reporting the effect of temperature abuse during

Active RFID Tags cont. on page 11

Postharvest Handling Improve cont. from page 1

Mellano and Company have resumed the use of STS for their products and CallaCo reports success using FloraLife.

Improvements in cooling flowers have been a major focus for many growers. Alvaro Sanchez, who has worked for seven years at CallaCo (Moss Landing, CA), reports that they switched from uncooled trucks to cooled trucks in the field three years ago. From these cold trucks, the flowers are taken directly to 34 F coolers and are placed overnight in FloraLife solution until ready for processing.

CallaCo has observed huge impacts from changes in temperature management during processing which includes recutting and bundling the flowers into ten stem bunches. Alvaro Sanchez shared "We used to process the flowers in a greenhouse, which got very hot, about 85-90 F. Since we currently process in a cooler warehouse at 50-60 F, employee production has increased dramatically, from about 35 bunches to 130 bunches per hour."

After processing, the flowers at CallaCo continue to be kept cool and are stored in FloraLife until shipped. Keeping the flowers cool from the field through shipping has resulted in increased vase life of the flowers, increased customer satisfaction and reduced credits.

Mike Anthony Mellano (San Luis Rey, CA) reports that improvements in temperature management at Mellano and Company has included the addition of a new 1000 sq ft cooler. They have also cooled the 2000 sq ft packing area. Mike reports "The packing area is run 'cool' at 45 F, but at holidays and times of product overflow it can be run at 33 F. We stage the product to be packed first thing in the morning in the packing area, and then after it's been packed, we turn the thermostat up to 45 F. As a result, we've been able to cut down on the need to rent refrigerated trailers at the holidays. Temperatures are much more stable."

According to owner Hans Brand, the most important postharvest change at B & H Flowers (Carpinteria and Watsonville) came with their recent certification by VeriFlora™. VeriFlora™ is a sustainability certification program for fresh cut flowers and potted plants. The "VeriFlora™ Certified Sustainably Grown" program guarantees that flowers and potted plants have been produced in an environmentally and socially responsible manner and meet the highest standards for freshness and quality. It includes the establishment of cold chain management and plant hygiene requirements intended to ensure product quality. Hans Brand says "As a result of this program, we have been carefully monitoring temperature in our boxes and in incoming trucks. We have found the quality and vase-life of our products has improved."

Dan Vordale, Vice President of Sales and Marketing at Ocean View Flowers in Lompoc, says that their postharvest program has been in a constant state of flux over the past five years because the management is always evaluating the program and making refinements. "We have to be sure that we are using the best postharvest products, that we are using the right products for each crop, that we are dosing correctly, and that we are on top of the cold chain process."

Postharvest Handling Improve cont. on page 11

UC Agricultural Natural Resource Publications

Spanish Translation of Pesticide Safety Manual Available

To better serve Spanish-speaking people working in California agriculture, the University of California's Statewide Integrated Pest Management Program has released a Spanish translation of *Pesticide Safety: A Reference Manual for Private Applicators.*

The newly updated manual, *Seguridad en el manejo de pesticidas Manual de referencia para aplicadores privados SEGUNDA EDICIÓN*, is the study guide for the California Department of Pesticide Regulation certified private applicator examination and a handy reference for wholesale commercial nurseries.

Growers, foremen, managers and employees will find this manual useful with its instructions on how to read pesticide labels, how to mix and apply pesticides, how to avoid pesticide hazards, and how to handle emergencies involving pesticides. The appendix includes a pesticide application checklist, resource lists, sample training forms for pesticide handlers and fieldworkers, and information on avoiding heat related illness. Review questions and answers are included for each chapter.

For farm operators, the Farm Profile section is a useful tool to identify health and environmental safety procedures that must be followed when using pesticides.

To order, contact your local UCCE office or UC Agriculture and Natural Resources Publications, 1-800-994-8849, (**www.anrcatalog.ucdavis.edu**). Ask for publication 3394. Cost is $7.

The English version (publication 3383) was released in April 2006 and is available from the same sources.❖

Removing Buckets cont. from page 1

an alternative source to prevent desiccation. That's the theory, and it makes sense, but we have been re-examining this long-held practice with some of the flowers that are most susceptible to desiccation. There are some potential negative features of handling flowers in water. These include:

- The cost of buckets, and the labor involved in their routine cleaning and refilling.
- Contamination of freshly cut stems with bacteria from dirty buckets or solutions.
- The continued growth and development of flowers held in water after harvest.
- The damage that occurs when fully turgid flowers are packed for transportation.
- The psychological effect of placing flowers in water – staff no longer see the need for speedy transfer to cool conditions.
- Reduced efficacy of postharvest solutions applied to already hydrated flowers.

The idea of eliminating the use of water after harvest is not new – some growers have successfully used this practice for years with certain crops. However, it is far from common practice, and particularly not with roses - flowers that are considered particularly susceptible to desiccation.

We recently conducted several experiments to test the effect of dry handling on the postharvest quality and vase life of roses grown in California and Colombia. Bunches of flowers were harvested from commercial production and placed in buckets that were either dry or contained the grower's normal postharvest solution. The bunches were then transported following normal commercial practice to the postharvest handling area.

Results from an experiment conducted with a large rose grower in Colombia are shown in the table below. The study was conducted with several rose varieties, which were harvested at a location at the furthest end of the farm; it took nearly one hour for the harvested flowers to arrive at the postharvest area. The flowers were dipped in a fungicide solution, cooled (in or out of water) for three hours, then graded, bunched, and packed prior to precooling in a room held at 35 F and shipped to Miami in the normal fashion. Flowers were weighed regularly during this process.

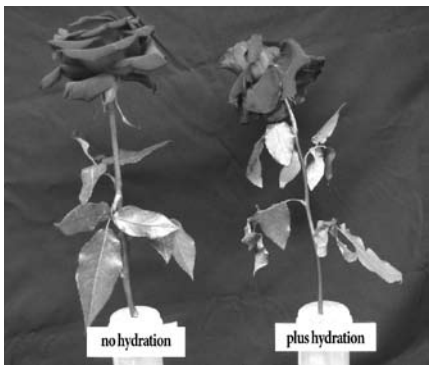


Figure 1. Photograph on day 6 of vase life of 'Black Magic' rose flowers that were either hydrated or not hydrated at the farm prior to shipment.

On arrival in Miami, some of the flowers were examined for damage and the remainder were precooled, shipped by refrigerated truck to Watsonville, CA, and then by automobile to Davis. On arrival in Davis, the flowers were re-weighed, rehydrated (overnight at 32 F), weighed again, then placed in vases for evaluation of vase life. Important findings of the study were:

- Handling the flowers in water resulted in more than a 10% increase in weight.
- Greater weight was reflected in increased head size and higher packing weights.
- Larger and more turgid flowers showed significantly more damage on arrival in Miami and Davis.
- The weight loss during prolonged transport was less than 12%.
- Quality (Fig. 1) and vase life of the dry handled flowers was at least as good, and often better than that of flowers handled in the traditional fashion. We have observed similar results with roses grown in California.

Of course, dry handling is not for every producer or every crop. But our data suggest that we may be able safely to reduce costs and labor while improving postharvest quality in a range of crops by eliminating buckets from the greenhouse and packing area. In previous studies, it has been shown that as long as flowers lose less than 12-15% weight, their vase life is not compromised. Accordingly, monitoring of weight loss during postharvest handling would be a good tool to monitor this alternative postharvest strategy. Rapid reduction in temperature is an excellent tool for reducing water loss of dry-handled flowers, and has the additional benefit of maintaining freshness and vase life without the need for water.

Treatment	Wet handled	Dry handled
% weight change during transport to the postharvest area	+4.45%	-1.63%
% weight change (compared to initial weight) after fungicide dip and cooling	+11.75%	+4.43%
Bruised petals per flower on arrival in Miami	2.9	1.4
% weight loss during transport for 10 days (air to Miami, refrigerated truck and car to Davis)	4.47%	3.03%
Bruised petals per flower on arrival in Davis	2.6	1.1
% weight gain during re-hydration	2.15%	6.12%
Mean vase life ('Vendela')	15.3	13.8
Mean vase life ('Black Magic')	3.3	6.7

We thank the American Floral Endowment for financial support and The Elite Flower company for supplying flowers for experiments. ❖

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CORF
Floriculture education from the Kee Kitayama Research Foundation

ABC's of IPM (Integrated Pest Management)

Escondido	**Ventura**	**Watsonville**
Wednesday, Sept. 19	Thursday, Sept. 20	Wed., Sept. 26

ABC's of IPM (Integrated Pest Management)

Our goal is to instigate positive changes in growers' IPM programs by reviewing or introducing critical pest management practices that they can incorporate in their operations. This full day program will cover all aspects of IPM in floriculture: chemical, cultural, physical, and biological controls. In addition, IPM would not be complete without a discussion about monitoring. The topics covered: Introduction to IPM in Ornamental Horticulture; Cultural, Physical and Mechanical Control and Monitoring; Biological Control; Chemical Pest, Weed, and Disease Management. CEU and CCN units are being requested.

ESCONDIDO; Sept. 19	***VENTURA; Sept. 20***	***WATSONVILLE; Sept. 26***
San Diego County Farm Bureau	UCCE Office	UCCE Auditorium
1670 E Village Parkway	669 County Square Dr	1432 Freedom Blvd
Escondido	Ventura	Watsonville
Hours; 8:00 am - 4:30 pm	Hours; 8:00 am - 4:30 pm	Hours; 8:00 am - 4:30 pm

This program has been generously sponsored by: UCCE, CAFG&S, CCFC, Syngenta, OHP, Romeo Packing Company, Target Specialty Products and Western Farm Service. *(If you would like more information on being a CORF sponsor, please contact the office at 831-479-9724.)*

Registration Fees: Prices listed are per person. Early registration rates apply up to 5 days before the seminar. **Late Registration:** Late and at-door registration will be accepted only if space is available and meals cannot be guaranteed. A confirmation will be faxed to registrants whose registration is received up to 5 days prior to the seminar. **Refund Policy:** For refund requests received 5 days prior to the event, registration fees will be refunded minus a $10 processing fee. Refund requests must be received in writing (fax & email is acceptable). **For more information please call the CORF office at 831/479-9724. (FAX: 831-603-4092) (email: jwills@corf.org)**

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If possible, provide us with your fax & email address so that we may send you important meeting information.

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ABC's of IPM……**$50** **$75** **$_____**

Escondido, Sept. 19 Ventura, Sept. 20 Watsonville, Sept. 26

Total registration fees enclosed **$ _____**

Payment by Check: Mail this form and your registration fees, made payable to CORF, to CORF, PO Box 2172, Dublin, CA 94568-2172

Credit card payment: Mail your registration to the CORF address above or fax in your registration to 831/603-4092 **Payment by Credit Card:** Please charge my ___ VISA ___ Master Card

Card # _____ Exp. date _____

Cardholder Name _____ Signature _____

Minimizing Damage to Fresh Cut Eucalyptus

by James A. Bethke - UC Cooperative Extension, San Diego

Now that I am actually looking for it, it's rare here in southern California to see flower arrangements that contain fresh cut baby blue eucalyptus without chewing damage caused by the leaf feeding beetle, *Chrysophtharta m-fusca*. (It doesn't have a common name yet, but some of the growers here want to call it the "Tasmanian devil beetle.") *Chrysophtharta* was introduced several years ago and quickly became a Q-rated pest for the CDFA, but several other more serious pests were introduced at the same time that required more attention. Therefore, *Chrysophtharta* was down graded to a B-rated pest, which means it is too widespread to eradicate and now just needs to be controlled by the growers. Growers rarely treat baby blue eucalyptus. However, *Chrysophtharta* causes serious damage to the growing commodity, losses are substantial, and in desperation, growers desired a quick answer or many would be out of business. Indeed, many of the smaller growers that took no action in 2006 suffered 100% losses, and larger growers that were relying on the smaller growers to fill in their orders also took losses.

In an effort to provide the growers with some measure of protection, we began efficacy trials against the beetle in 2006 and are continuing in 2007. Trials were conducted in fields at a cooperating commercial grower in northern San Diego County. Two widely separated growing fields were used in the study. A field with plants mature enough to harvest was used in a trial testing drench applications of selected pesticides. These plants were watered via a drip system making the treatment applications easier. A second field with new emerging growth was used in a trial testing foliar applications. These plants were overhead watered, and a tractor pulling a hydraulic sprayer was used for treatment applications.

In short, the Marathon II® (imidacloprid @ 2.0 oz/30" cumulative DBH) and Celero® (clothianidin @ 1.9g of product/inch DBH) drench applications took the beetle adults, larvae, and egg masses to extinction one month following application and continued throughout the trial. Other treatments were not significantly different from the control on any date. The foliar application of Orthene® was most likely effective against live beetle stages during the first month following application. After that, however, Orthene® performed poorly and was not significantly different than the control for any date and would need repeated applications to be effective. Treatments that significantly reduced the number of beetle adults, larvae, egg masses and the subsequent damage were Sevin® (carbaryl @ 6.4oz/100 gal), Celero® (clothianidin @ 2 and 4oz/100 gal) at both rates, and Decathlon® (cyfluthrin @ 12oz/100 gal). In addition, products that caused a reduction in the numbers of beetles also caused a notable and significant reduction in damage to the cut commodity.

Our study demonstrates that long-term control of *Chrysophtharta* and significant reduction in damage to eucalyptus can be obtained with drench applications of Marathon II® or Arena®, or with foliar applications of Decathlon®, Celero®, or Sevin®. Additionally, many of the growers have their treatments applied by aircraft, and the results from this trial have provided them with effective treatment options. ❖

Observations

Diaprepes Update

Diaprepes Root Weevil *Diaprepes abbreviatus (L.) (Coleoptera: Curculionidae).*

Great progress has been made in eradication efforts against the Diaprepes root weevil in San Diego County, but we are still early in the battle. There are an enormous number of traps placed in the quarantine areas both by CDFA and by UC Cooperative Extension, and we are still finding emerging adults in all areas. However, all areas have been treated, and we are encouraged by the fact that there have been no new find sites or expansions of quarantined areas. So far, only one nursery has been deemed a find site and two nearby nurseries are affected by the quarantine. Protocols have been written by CDFA so that quarantined nurseries can treat and ship, but as expected, they are restrictive and costly. Recently, a grower unloaded a truckload of palms from Florida, but they were not inspected until the next day when they found a single live adult Diaprepes. This posed the question of how to treat nurseries that are not in a quarantined area and have a find on site from an incoming shipment. What should be treated on site, and how far should the treatment extend? A new protocol is being written for this situation and should be available by the time this article is published. In addition, a protocol is being developed that will allow nurseries to pre-treat potting media so that if found within a quarantine, their plants will be available for shipping in a reasonable period of time. That's good news for the industry.

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Light Brown Apple Moth

by Steve Tjosvold - UC Cooperative Extension, Santa Cruz and Monterey

Light Brown Apple Moth adults – male (left), female (right).

The light brown apple moth (LBAM) was first detected in the continental United States in the San Francisco Bay Area in February 2007. At the time of this writing (early June), this serious pest of over 250 known fruit, vegetable, and ornamental hosts has been detected in a total of 9 California Counties: Alameda, Contra Costa, Marin, Monterey, Napa, San Francisco, San Mateo, Santa Clara, and Santa Cruz. If left uncontrolled, it is expected to spread to natural areas, gardens, and to important fruit and ornamental crops. It will also cause significant damage to California's agricultural industry. Federal and State quarantines are established and prohibit the movement of all nursery stock and host fruits and vegetables from retail and production nurseries in the quarantine region unless shipments are certified as free from the pest. Several other states have imposed requests for pre-shipment notification of regulated hosts. Mexico prohibits the entry of regulated hosts and plant material from LBAM-infested counties.

Another Newly Introduced Pest

The LBAM (*Epiphyas postvittana*) is a native of Australia but also occurs in New Zealand, New Caledonia, Hawaii, the United Kingdom and Ireland. It is a tortricid leafroller moth similar to Pandemis moth, orange tortrix and fruit tree leaf roller which already occur in the Central Coast. It is often difficult to distinguish the leaf-rolling characteristics of the LBAM larvae from other common leaf roller moth larvae ("worms") such as the garden tortrix or omnivorous leaf roller found in Central Coast greenhouses. It can also be confused with the common "worms" such as beet armyworms, tomato fruit worms or cutworms. There is a specific pheromone lure available for trapping the adult male LBAM for monitoring purposes.

LBAM Biology

The adult is about 0.4 inch (10mm) long, with a 0.75 inch (18mm) wingspan. This moth is yellowish brown, with forewings darker brown towards the outer edges. It stays sheltered in the foliage during the day, and flies after sunset and before daybreak. The eggs are pale white to light green and are laid slightly overlapping each other as an egg mass or a raft on the upper surface of the foliage. Newly hatched larvae are pale yellow-green. Mature larvae are light green with a light brown head. The larvae are active, and grow to 0.6-0.75 inch (15-18mm) in length at maturity. They wriggle violently when disturbed. After emerging, the larva builds a silken shelter by rolling a leaf lengthways and webbing its edges together. Leaves may also be webbed together or joined to fruit. The LBAM does not diapause, and may overwinter as larvae in leaf litter, other plant material, or bore out buds on fruit trees.

Management

Other leaf rollers have been effectively controlled through a combination of biological controls, cultural controls (i.e. thinning of fruit clusters) and the proper selection and timing of pesticide applications that control the pest and minimize the effect on beneficial parasites and predators. However, additional control measures for this pest may be needed on crops that currently receive few insecticide sprays. The LBAM is predicted to have multiple generations per year in California (2 along the central coast and 3-4 in the central valley and southern California). The LBAM also requires excellent spray coverage because it rolls leaves or hides in clusters of fruit, making it difficult to contact with toxic levels of insecticide. Australian sources indicate most spray materials effective for codling moth control will control LBAM. Chlorpyrifos (Dursban®) is currently recommended for eradication when found in nurseries.

Regulatory Action

Under the Federal Order, all California shipments of host articles originating from nurseries within 1.5 miles of a LBAM detection must be visually inspected and certified as free of the pest prior to movement. Outside of the 1.5 mile area, but still within the quarantined counties, host-article nurseries must undergo a one-time visual inspection and be certified as free of LBAM before moving their products outside of the quarantine area. The order also requires survey trapping, nursery treatment applications, and precautionary production practices be implemented within quarantine areas to mitigate the risk of LBAM infestation. Because the situation is in flux, it is best to check with your local agricultural commissioner's office for the latest regulatory information.

The official California Department of Food and Agriculture web site is **http://www.cdfa.ca.gov/phpps/pdep/lbam_main.htm**. This site has up-to-date shipping information, many color images of LBAM, and quarantine maps. ❖

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STS Disposal

by Julie P. Newman - UC Cooperative Extension, Ventura and Santa Barbara

Pretreatment of potted Christmas cactus plants with STS prevents loss of florets during shipping.

Protecting Water Quality

Nursery runoff often contains pesticides and other toxic chemicals. These pollutants degrade our watersheds causing impairment. Even trace amounts of agrochemicals present in surface streams can pose hazards to aquatic organisms. Contamination of groundwater is also a human health concern, as groundwater is the main source for drinking water in California.

To protect our water quality, a number of federal and state laws were enacted. In addition, in recent years, California growers have faced increased local water quality regulations, such as agricultural conditional waivers and implementation of TMDLs. It is critical that nursery handlers of agrochemicals understand why and how these materials can contaminate surface water or groundwater. Each nursery should implement a strategic educational program to train handlers on what can be done to reduce the potential risk related to the use of these chemicals.

Use of STS

The ethylene blocker silver thiosulfate (STS) is a postharvest treatment that is used on cut flowers and flowering plants as a plant growth regulator. Plant growth regulators are classified as pesticides, even though they are not used to control pests. STS was developed as a postharvest pre-treatment to overcome premature senescence and abscission due to exposure to ethylene gas in sensitive floral crops. Ethylene is produced in small quantities by naturally ripening fruit and by floral crops as they age. The gas is also present in the atmosphere from sources that include gas heaters and internal combustion engines.

STS was widely used in the floral industry until problems with registration and environmental concerns temporarily led to the lack of commercial STS-containing products in the United States. Recently, however, an STS product (Chrysal AVB®, Pokon & Chrysal, USA) was registered for use on cut flowers.

STS persists in soil and water for long periods and may pollute drinking water. When absorbed by the body, it can accumulate and at toxic levels, affects the nervous system. STS is very toxic to aquatic organisms, including fish and plankton.

When using STS for treatment of ethylene-sensitive cut flowers, care should be exercised. Do not allow the product to reach ground water, surface water ways or sewage systems. Residuals should be neutralized before disposal following manufacturer instructions.

Alternative Use of 1-MCP

An alternative product is 1-methylcyclopropene (1-MCP, EthylBloc®), another growth regulator registered for use on cut flowers, potted flowers, bedding, nursery and foliage plants. It is approved for use only in enclosed spaces, such as greenhouses, store rooms, coolers, enclosed truck trailers, and shipping containers. There are no expected risks to the environment because 1-MCP is approved for use only in indoor spaces, and is quickly diluted when released to open air. Toxicity tests show that 1-MCP is not expected to be harmful to living organisms or the environment. The effectiveness of 1-MCP or STS may vary with specific species or type of inflorescence. For some crops, STS may be more effective than 1-MCP, but there are no disposal issues associated with 1-MCP. ❖

Observations

Freeze Damage

Nurseries in Ventura County are still feeling the impact from the January freeze. Nursery stock sustained the heaviest agricultural crop losses in the county. The Ventura Agricultural Commissioner estimates damage of $85.4 million. Nursery crop value has significantly increased in recent years and was ranked the second leading county crop in 2005. This hit, however, is sure to take a bite out of the 2007 estimated annual gross value. Santa Barbara nurseries fared better with a loss of about $3 million. Total loss for agriculture in Ventura County was $281 million and was $20.2 million in Santa Barbara County.

Chrysanthemum White Rust Quarantine

Another Chrysanthemum White Rust (CWR) find was reported in February on resprouts from a harvested field of outdoor mums in Carpinteria by the County Agriculture Commissioner/CDFA/USDA-Plant Protection and Quarantine (PPQ). This find followed a quarantine established earlier in February subsequent to reports of CWR in two nurseries in San Diego County. The good news is there have been no other findings in San Diego or Santa Barbara counties since then.

Mildews on Larkspur and Delphinium

Downy mildew caused by *Peronospora ficariae* was recently found on larkspur in Lompoc. This disease is a problem in Santa Cruz County on delphinium, and was first reported in California in the spring of 2003 by Tjosvold and Koike. Growers are already battling severe powdery mildew problems on larkspur and delphinium. See the winter 2004 *CORF News* edition for an article on powdery mildew management on delphinium.

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Get Cultured

Postharvest and Plant Production

by Donald J. Merhaut - Department of Botany and Plant Sciences, Riverside

Sunflower seedlings.

When it comes to postharvest, many things that are done before shipment can have a major impact on the longevity of cut flowers or cut foliage. Postharvest quality can be impacted by 5 main cultural practices:

1. Cultivar Selection - Some plant cultivars grow better and/or have better shelf life than other cultivars of the same species. A grower should ideally select only cultivars that exhibit superior growth in the environmental conditions present in their region, and demonstrate superior shelf life characteristics.

2. Seedling/Plug/Liner/Bulb Viability - The quality of the material being planted should be healthy, free of pests, and stored under the proper conditions for that particular crop. With seedlings and rooted liners, check for quality root development. If the crop is produced from bulbs, rhizomes or roots, be sure that the plant material was preconditioned and stored according to crop specifications.

3. Plant Establishment - Young plants require different care than established plants. Young fleshy roots and shoots are more susceptible to irreversible insect and pathogen damage. In addition, young fleshy shoots of many plant types are more vulnerable to environmental stresses such as high heat and drought. This is because the stomates of many plant types are not mature on younger leaves and do not have fully developed epidermal layers. Therefore, younger plants will require shorter, but more frequent irrigation events until a deeper and more extensive root system is established.

4. Environmental and Cultural Conditions - There are several cultural practices that can be done to 'harden off' plants. Some plant types will benefit from some form of mechanical stress such as air movement or light brushing of the foliage to thicken and strengthen stem development. Some plants grown in humid greenhouses can be more susceptible to desiccation after harvest. Some nutritional disorders, such as calcium deficiency, may be more likely in humid greenhouses since calcium uptake and translocation is dependent on the transpiration rates of the developing tissue. Blossom end rot of greenhouse-grown tomatoes is often associated with lack of sufficient transpiration rates from the developing tomato even when sufficient calcium is available in the soil. Therefore, decreasing humidity in the greenhouse may be beneficial for some of the crops sensitive to these types of nutritional disorders.

5. Fertilizer Management - As discussed in 'Science to the Grower', too much of an essential nutrient, especially nitrogen, will cause problems both during production and during postharvest conditions. When it comes to plant nutrition, moderation is always the key to proper plant development. A fertilizer program containing a balance of all essential plant nutrients is important. There is a level of fertilization at which plants will not show increased growth nor show signs of nutrient toxicity. This zone is often referred to as the zone of luxury consumption. This zone is also where plants may be more susceptible to some diseases and pests which thrive on succulent growth. Therefore, knowing the fertility requirements of specific crops and following that program will optimize postharvest shelf life of crops. Secondly, a balanced nutrient formulation is important since many nutritional deficiencies are often the result of excess application of other essential nutrients.

Nonessential Elements - Recently an article appeared in *Floriculture International Magazine* (April, 2007) on the benefits and use of silicon in flower production. There are other nonessential elements that can be used by the plant, but research using these products on different crops in different growing environments is still needed. ❖

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Active RFID Tags cont. from page 2

transportation and the value of respiration-temperature models we have developed to predict the effect of temperatures on the potential vase life of flowers.

In this trial, 11 cooperating wholesalers sent tags to their suppliers, comprising of 48 domestic and offshore growers. These growers placed the tags into flower boxes during packing, which were then shipped to the wholesalers. On arrival, the transit time/temperature data was read from each tag using a radio-frequency antenna, and a respiration-temperature model was used to predict vase life of the flowers. The results of the study were very instructive. For example, the average transit time for the flowers from grower to wholesaler was 5 days. The minimum was 1 day for an air shipment from California; the maximum was 12 days for a sea-container shipment from Colombia. The average temperature during transport was a balmy 50 F, with the lowest recorded temperature being 28 F (close to the freezing point for flowers), and the highest being a toasty 95 F. Application of our time-temperature model to the time/temperature histories of the different flowers predicted an average loss of vase life during transport of 14%, with a minimum of 3% and a maximum of 41%.

In our opinion, this small pilot trial is a dramatic demonstration of the importance of monitoring temperatures during transport of cut flowers. There surely is no traditional or mass-market florist who would not like to know that the flowers they are receiving had been subjected to temperatures of 95 F, or had only half of their potential vase life remaining, or might have been frozen. Mass production of the active RFID devices is expected to reduce the price from the $12 per device of the examples used in our trials, to less than one dollar!

In the future, we expect that RFID manufacturers will include additional capabilities, including relative humidity, vibration, and perhaps even ethylene sensors. Armed with the information that these devices offer, it is our expectation that the floral industry will be able to provide the final consumers with the flowers that they want – so fresh that they will easily last a week in the vase. This will result in increased per capita consumption, especially for personal use. ❖

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Postharvest Handling Improve cont. from page 4

Recently, Ocean View Flowers has implemented Best Management Practices, including postharvest practices, as part of the certification process with VeriFlora™. Another change has been the use of third party inspections to verify that the nursery is in compliance with standards set by supermarket customers. Inspections of quality assurance occur in the nursery as well as in the distribution centers. This quality assurance program has had some major impacts. "It has helped to reduce our shrink, increase crop quality, and has resulted in less credits and happier customers," stated Dan Vordale.

With all the attention on improving cooling capacity and cold chain management, growers haven't forgotten the basic sanitation requirements that are essential to postharvest handling. As Alvaro Sanchez stated, "With all of this, we have not forgotten the importance of sanitation, we use a bucket washer machine with disinfectant to clean daily with hot (95-100 F), soapy water to kill bacteria.

Growers were also asked if the increased costs of fuel were affecting their postharvest production practices. Each grower acknowledged that fuel costs were up, but felt that they were a direct cost to the company, and that the benefits from the improved postharvest handling practices far offset any additional energy costs required for these postharvest procedures. These benefits included improved postharvest quality and longevity, increased customer satisfaction, fewer credits, better pricing, and improved employee productivity. ❖

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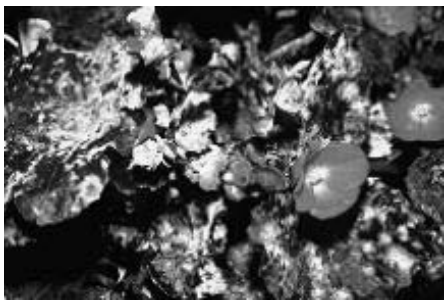
Science to the Grower

Are your plants sick of what you feed them?

by Richard Y. Evans, UC Cooperative Extension, Department of Plant Sciences, UC Davis

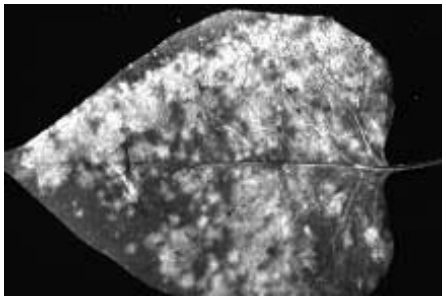


Powdery mildew on begonia leaves.

The relationship between nitrogen consumption and disease has interested me ever since my hamster Cedric succumbed to monosporascus root rot (*Monosporascus cannonballus*). It's too late for Cedric, but there have been some interesting papers on this topic in recent years. For instance, a group in Holland investigated the relationship between root and leaf nitrogen concentration in greenhouse tomato and susceptibility to three diseases, bacterial speck (caused by *Pseudomonas syringae*), fusarium wilt (caused by *Fusarium oxysporum*), and powdery mildew (caused by *Oidium lycopersicum*).[1]

The plants were grown hydroponically for about 2 to 3 weeks in a complete nutrient solution. Nitrogen (N) was supplied as potassium nitrate at three exponentially increasing rates of addition, according to a method developed by Swedish researchers Ingestad and Lund,[2] so that leaf nitrogen ranged from about 1.8% to 3.8%. Plants were then inoculated with the pathogen and grown for about another week, after which disease incidence was compared with uninoculated control plants. Tissue nitrogen concentration did not affect the incidence of fusarium wilt, but the incidence of both bacterial speck and powdery mildew increased as tissue nitrogen increased. The authors conclude that the effect of nitrogen fertilization on disease incidence may depend on the pathogen. They speculate that the balance between two factors affected by nitrogen application - nutritional value of the plant to the pathogen and production of compounds by the plant that defend against disease - may be important.

The susceptibility of Hiemalis begonias (*Begonia* x *Hiemalis*) to powdery mildew also is affected by nitrogen nutrition.[3] The authors fertilized begonia cultivars 'Hilda' and 'Renaissance' with 30, 120, or 240 ppm N, then inoculated half of the plants at each fertilizer level with *Erisiphe cichoracearum*. High rates of applied N tended to increase susceptibility to powdery mildew late in the production cycle, but not much at earlier stages. It is also worth noting that the crops grew as well at 120 ppm N as they did at 240 ppm. The authors conclude that fertilizing at 120 ppm N should limit powdery mildew incidence without causing yield reductions.



Powdery mildew on lilac leaf.

This year, another group studied the effect of applied N on susceptibility of begonia (*Begonia* x *tuberhybrida*) and new guinea impatiens to gray mold (*Botrytis cinerea*).[4] The applied nitrogen ranged from 25 ppm to an ungodly 800 ppm. Plant growth was generally best when given 100 ppm N. Begonia susceptibility to botrytis increased dramatically when fertilized with 400 ppm N or with higher concentrations. The authors conclude that several plant responses to applied N, such as leaf orientation and energy content of leaves, may affect susceptibility to disease.

The good news these reports offer to growers is that moderate levels of N fertilization, in the range of 100-120 ppm, do not increase the incidence of common diseases like powdery mildew and botrytis. ❖

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2007
CORF Program Calendar

SEPTEMBER 2007

19 CORF ABCs of IPM (Integrated Pest Management) Practices

Escondido

20 CORF ABCs of IPM (Integrated Pest Management) Practices

Ventura

26 CORF ABCs of IPM (Integrated Pest Management) Practices

Watsonville

Websites Associated with Postharvest

Below is a list of several websites and on-line journal articles related to postharvest management of floricultural crops. Some provide a general list of postharvest handling of flower and foliage crops, while others include information on specific flower crops.

http://Postharvest.ucdavis.edu/Produce/ProduceFacts/#ornamentals. This site, hosted by the University of California, contains a list of 36 fact sheets for specific cut flower and foliage crops.

http://www.horticultureresearch.net/3148.htm. You must subscribe to this journal to download the entire article. However, the article does have a short summary describing the effects of nitrogen rate and plant spacing on flowering, flower quality and vase life of gladiolus.

http://www.oznet.ksu.edu/library/hort2/mf2261.pdf. This site is hosted by Kansas State University and presents general guidelines on postharvest handling of cut flowers.

http://www.ces.ncsu.edu/depts/hort/hil/hil-800.html. This site is hosted by North Carolina State University. Most of the information is about environmental conditions required for optimal flower storage.

http://www.uvm.edu/pss/ppp/coh29ph.htm. This site, hosted by the University of Vermont, provides general guidelines regarding the postharvest handling of field cut flowers. They also provide a list of ethylene-sensitive flowers.

http://flowers.hort.purdue.edu/web/cutflowerguides.htm. This site is hosted by Purdue and provides several links to articles related to postharvest management of cut flowers.

http://smallfarms.ifas.ufl.edu/crops/flowers_and_foliage/index.html. This site is hosted by the University of Florida and contains several links related to production and postharvest of cut flowers and foliage.

http://chainoflifenetwork.org. This website is maintained by a private organization dedicated to educating the industry on flower postharvest care.

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Campus News & Research Updates

submitted by Julie P. Newman - UC Cooperative Extension, Ventura and Santa Barbara

Campus News: UC Davis

Michael Parrella Receives Rutgers Award and AFE Grant

Michael Parrella receiving the Emma Lausten Horticulture Award. Parrella (right) and Mark Robson.

Michael Parrella received the Emma Lausten Horticulture Award from Rutgers University, New Jersey last March in recognition for his extensive contributions to Integrated Pest Management (IPM) programs in floriculture crops. Parrella is associate dean of agricultural sciences at the UC Davis College of Agricultural and Environmental Sciences and is professor of entomology and environmental horticulture.

Parrella was nominated for the award by the executive director of the Interregional Research Project No. 4 (IR-4), which is headquartered at Rutgers. The IR-4, a federal program established in 1963, seeks safe and effective pest management solutions for food and ornamental crops.

The focus of Parrella's research is IPM strategies on ornamental plants with an emphasis on biological pest control. His work is aimed at reducing pesticide usage through safe and effective alternatives, which significantly helps flower and nursery growers.

Michael Parrella is the founder of a pest management alliance for fresh cut roses in California. The IPM program that he developed, along with farm advisors, other UC scientists, growers, and allied industry, has resulted in dramatically reduced volumes of pesticides sprayed in California greenhouses. This project was recently described in the April-June 2007 issue of the *California Agriculture* journal. This article can be found at **http://californiaagriculture.ucop.edu**. Parrella is also the founder of a pest management alliance group for cut gerbera with on-going research and extension efforts.

In addition to the Emma Lausten Horticulture Award, Parrella was recently awarded a three-year grant for $150,000 from the American Floral Endowment (AFE) entitled "Advancing the Adoption of Pest Management Strategies on Cut Flowers Produced in the United States and Colombia. This project, which begins this summer, involves cooperative efforts of UC Davis, Texas A&M, two Colombian universities, and two private manufacturers of biorational pesticides in Colombia: Ecoflor and Live Systems Technology. The project will evaluate the efficacy of biorational pesticides in controlling pest problems. The data will be used to support registration of the best products in the United States.

New Director for California Center for Urban Horticulture

Dave Fujino is the new director of the California Center for Urban Horticulture (CCUH). CCUH is a partnership of the UC Davis Arboretum and the Department of Plant Sciences. The Center supports scientific research and the exchange of science-based information on a range of people-plant interactions. It contributes to public horticulture education and assists horticulture, landscape and nursery professionals.

Fujino, who received a Ph.D from the Department of Environmental Horticulture, has been a horticultural consultant with the nursery industry and spent 18 years in leadership positions with Hines Horticulture. He has held many other leadership positions within the California horticulture industry, and is currently chair of the executive committee of the California Association of Nurseries and Garden Centers, and chair of the California Department of Food and Agriculture's Nursery Pest Advisory Task Force.

Weed Science School 2007

Mark your calendars for a short-course offering in weed science to be held September 24-26, 2007 at UC Davis. The Weed Science School 2007 is an intensive course focusing on the mode and mechanism of herbicide activity in plants and the fate of herbicides in the environment. Participants will also tour the UC Davis Center for Plant Diversity. The course is designed for those involved in consulting, research, development, or sales of agricultural chemicals in either the private or public sector.

The course fee is $550 if received by 9/10/07 and $575 if received after 9/10/07, which covers all course materials and lunch each day. A comprehensive handbook of materials is included. Accommodations are not included, but convenient lodging can be found at **www.davisvisitor.com**.

Class size is limited to 60, so early enrollment is suggested. An online agenda and registration form can be accessed through the Weed Research and Information Center Web site at **http://wric.ucdavis.edu**. For further information, contact Gale Perez, (530)752-1748 (wric@ucdavis.edu).

Campus News cont. on page 15

Campus News cont. from page 14

Western Center for Agricultural Health and Safety Seminar Webcasts

Webcasts of the 2006-07 UC Davis Western Center for Agricultural Health and Safety (WCAHS) monthly seminars are available at **http://agcenter.ucdavis.edu/seminar/webcast.php**. Examples of the seminar series video webcasts of interest to nurseries include: Immigration Reform and its Implications for Farmers and Workers; Ergonomics versus Bionomics for Injury Prevention, and Housing Conditions and the Health of Mexican Migrant Farm Laborers in California.

Research Updates: UC Riverside

Nematodes in Roses Grown in Rockwool.

by Antoon Ploeg - Department of Nematology - UC Riverside

Plant parasitic nematodes can cause serious problems in roses. Nematodes found in roses most frequently are root-lesion nematodes (*Pratylenchus spp*.) and root-knot nematodes (*Meloidogyne spp*.) Both these types of nematodes comprise a large number of different species, but only few appear to infect roses. Root-lesion nematode species that are found in roses usually are either *Pratylenchus penetrans* or *P. vulnus*. The former generally prefers slightly cooler conditions than the latter. The nematodes invade the roots, and continually move through the root tissue, destroying the cells and providing points of entry for secondary pathogens such as soil-borne fungi and bacteria. Symptoms are generally not specific, but brown lesions may develop on the roots.

The root-knot nematode in roses usually is the "Northern root-knot nematode" *Meloidogyne hapla*. This species also prefers cooler conditions and causes small galls on the roots. Small new roots often develop from the galls giving the root systems a "bearded" appearance. Both lesion and root-knot nematodes may cause stunting, yellowing, fewer stems per plant and a decline in production. In field-grown roses, and greenhouse roses grown in soil, *Pratylenchus vulnus* appeared a more serious problem than *M. hapla*.

To control nematodes, soil fumigants proved to be an effective strategy. Increasing restrictions on the use of nematicides required different approaches to avoid soil-borne diseases and parasites. Steaming of soil in greenhouses can give good results, but is expensive. The greenhouse cultivation of flowers in substrates such as rockwool also eliminated the need for soil disinfection using soil fumigants. However, in the last few years we have observed several infestations of roses grown in rockwool with the root-knot nematode *M. hapla*, sometimes in very high numbers.

Very few studies have addressed the occurrence of nematodes in soilless media but in one study from the Netherlands published in 2004, problems with *M. hapla* in roses grown in rockwool were also reported. Approximately 90% of the rose acreage in the Netherlands is grown in hydroponics, and it was estimated that 10% of this acreage (160 acres) is infested with *M. hapla*. Unlike in soil where the lesion nematode *P. vulnus* was most prevalent in roses, about 90% of nematode infestations in rockwool-grown roses were *M. hapla*. According to the Dutch researchers, the source of nematode infestation came from other infested areas within the same operation, from the water basins used for irrigation, or from planting infested material. Consequently, sanitation and preventing introduction of nematodes with plant material are the most effective methods to avoid problems. For example, heating or UV radiation of recirculating irrigation water proved effective in eliminating the nematodes from irrigation water.

In a study at UC Riverside *M. hapla* multiplied to high levels on host plants grown in rockwool substrates indicating that the nematodes can move and reproduce effectively in this substrate. Eliminating the nematodes from the infested root systems with post-plant nematicidal products such as Vydate®, DiTera®, Ornazin®, and Avermectin®, proved difficult without damaging the plants. It remains unknown if other types of nematodes can move and multiply equally well. Also unknown is if all types of soilless media support nematode movement and reproduction.

Thus, although the use of soilless media provides a nematode-free start, it also provides an effective way for the nematodes to spread throughout a large area when non-treated recirculating water is used. ❖

Literature cited: J.J. Amsing (2004) *Root-knot nematode problems in greenhouses* [in Dutch]. Gewasbescherming 35, #5, September 2004, pp. 260-262

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