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Inside

Nutrient Release from Controlled-Release Fertilizers in Nursery Production Systems

by Donald J. Merhaut, Eugene K. Blythe, Joseph P. Albano and Julie P. Newman

Federal guidelines have been in place since 1972 to mitigate pollutants entering surface water. In addition, the state of California has developed regulations associated with pollutants entering the watersheds. Regulations are based on the pollutants impairing each waterbody or watershed. Of the agricultural pollutants being regulated, nitrate and phosphate are the main fertilizers of concern. Nitrate is the most likely to appear in runoff since it is applied in the greatest quantities relative to other nutrients. Also, nitrate is a negatively charged compound (anion) and, therefore, does not readily bind to the predominantly negatively charged surfaces of soil and substrate particles. Similarly, because phosphate is also an anion, it may leach readily from soil or growing media. Many state water agencies have now implemented regulations to mitigate nitrate and phosphate runoff from agricultural sites and urban greenbelts. Other essential plant nutrients, such as iron, manganese, copper and zinc, are also listed in the Clean Water Act. However, in most regions, these nutrients are not found in quantities that are considered as pollutants for water bodies; therefore, regulations regarding these nutrients have not been needed.

Over the past 70 years, coated fertilizers have been developed that allow a slow release of nutrients into the planting medium throughout the period of crop growth. Most of these controlled-release fertilizers (CRFs) are coated with polymers which release nutrients at a rate that is positively correlated with increasing media temperatures, within a certain range of temperatures. Short-term (less than 4-month) studies have previously shown nutrient release characteristics under controlled environmental conditions. In the following two studies, we monitored nutrient release characteristics from CRFs in a greenhouse environment and an outdoor environment during an

Editors' Note

Nitrate nitrogen in fertilizers is regulated by regional water boards in conditional waiver programs and in watersheds with adopted TMDLs for agricultural runoff. Some of the strictest regulations are being implemented by the Central Coast Regional Water Quality Control Board in their evolving conditional waiver program. Like pesticides, fertilizers are clearly becoming more intensely regulated in California, and the requirements for reporting use are increasing.

This newsletter focuses on mineral nutrition research and information that could help a grower use fertilizers more efficiently. Two feature articles describe some significant research results about nutrient release from controlled-release fertilizers (Don Merhaut and others) and organic fertilizers (Richard Evans). Topics related to mineral nutrition are also covered in the disease focus column and in the regional reports.

With this issue Jim Downer, farm advisor in Ventura County, is providing the regional report from Ventura County and the disease focus column.

♦ ***Steve Tjosvold and Julie Newman***

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11-month production period, a time frame that is typical for production of many woody ornamental plants. Based on these studies, which we summarize below, there are several best management practices (BMPs) that can be adopted when using CRFs so that growers can optimize nutrient uptake into crops while simultaneously minimizing the likelihood of nutrient leaching from the containers. For more details from these studies, please refer to the articles published by the American Society for Horticultural Science listed in the references.

Experiments

Studies were conducted in Riverside, California, a region experiencing rapid growth in wholesale nursery production. The desert climate has summer and winter high temperatures, averaging in the high 90s (°F) and upper 60s to low 70s, respectively. Rainfall occurs during the winter months. The studies were initiated in August and ended in June of the following year.

We tested four fertilizer brands: (1) Multicote 17-5-11 plus minors, (2) Nutricote 18-6-8 Total, (3) Osmocote 24-4-9 plus the addition of Micromax, and (4) Polyon 17-5-11 plus micros. All fertilizers were one-year release formulations; however, release rates of these CRFs are based on different temperature regimes: 80°F for Osmocote and Polyon, 70°F for Multicote, and 70 to 80°F for Nutricote. Elemental concentrations and compounds used in each fertilizer were different (table 1). Since the percentage of nutrients contained in the four fertilizers varied, we normalized fertilizer applications so that all treatments received the same amount of nitrogen.

Both experiments were conducted using growing media in 1-gallon black polyethylene pots. A "no plants" treatment was used in these experiments as a control so that all leachate that drained and was collected from the bottom of the pots would contain essentially all nutrients released from the CRFs as well as some nutrients released from the growing medium as the medium broke down. Containers were irrigated by drip irrigation and leachate was collected immediately after each irrigation. Nutrient concentrations, electrical conductivity (EC) and pH of leachate were measured on a weekly basis.

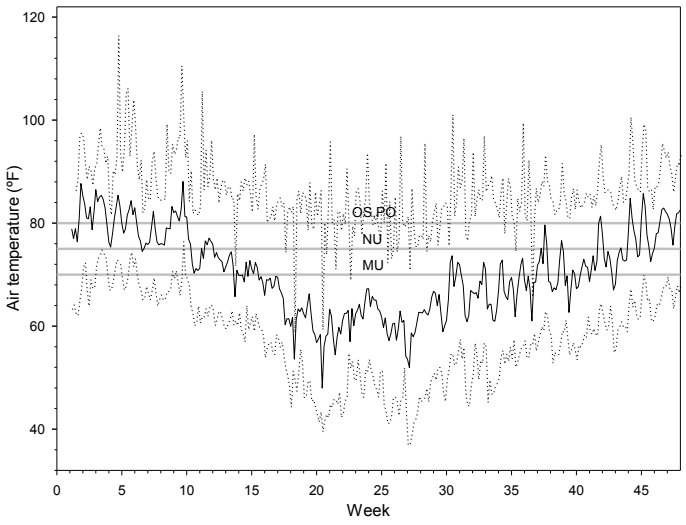

Fig. 1. Daily average (solid line), minimum (lower dotted line) and maximum (upper dotted line) greenhouse air temperatures over a 47-week period (1 Aug. to 27 June), with gray horizontal lines indicating media temperatures for 12-month fertilizer release as specified by the respective manufacturers of Osmocote (OS), Polyon (PO), Multicote (MU), and Nutricote (NU).

Greenhouse Experiment

The indoor study was conducted in a ventilated, unheated greenhouse representing conditions typically used to grow ferns, azaleas and camellias in southern California. An acid growing medium consisting of peat, pine bark and sand was prepared with CRF fertilizer blended into the mix. Fertilizer was added at a low rate, 3.3 g nitrogen per 1-gallon pot, which is an average rate based on recommendations by the four fertilizer manufacturers for these crops, all of which have low nutrient requirements and low tolerance of high salt levels. Air temperatures ranged between 75 to 86°F from the beginning of August to mid-October and again from mid-April to the end of June. From mid-October until mid-April greenhouse temperatures averaged below 70°F (fig. 1).

Table 1. Amount (% by weight) of nitrogen (N), phosphorus (P) and potassium (K) in Multicote 17-5-11 + minors, Nutricote 18-6-8 total, Osmocote 24-4-9, and Polyon 17-5-11 + micros.

Fertilizer	Ammonium-N	Nitrate-N	Urea-N	Total N	Phosphorus	Potassium
Multicote	9.00	8.00	0.00	17.00	2.10	9.10
Nutricote	8.60	9.40	0.00	18.00	2.52	6.62
Osmocote	6.40	5.70	11.90	24.00	1.68	7.44
Polyon	7.30	9.70	0.00	17.00	2.02	8.85

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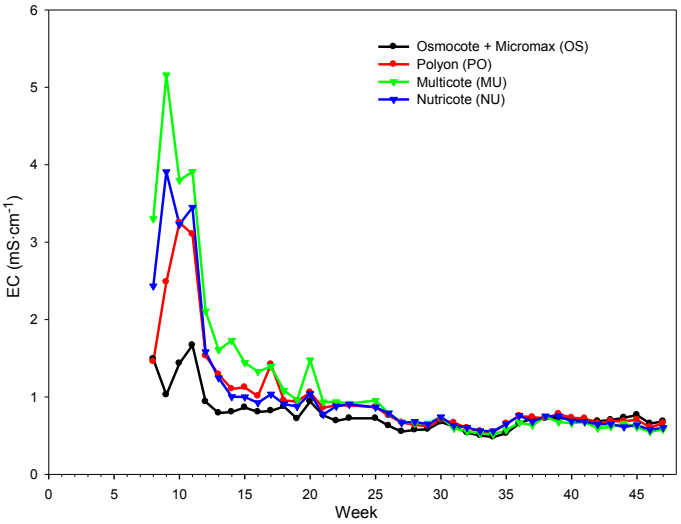

Fig. 2. Electrical conductivity (EC) of irrigation leachates collected weekly during the study period from pots containing one of four different CRFs.

Outdoor Experiment

The outdoor study was conducted on raised benches in full sun and ambient temperatures. A neutral-pH medium consisting of composted forest products, sand and pine bark was prepared and fertilizer was added a higher rate, 6.6 g nitrogen per 1-gallon pot, an average rate based on recommendations by the four fertilizer manufacturers for plants that have higher nutrient demands. Outdoor air temperatures (data not shown) fluctuated in a manner similar to the greenhouse study, but outdoor summer highs and winter lows were more extreme.

Results

Only data from the greenhouse study is presented, since trends were somewhat similar with the outdoor experiment. During the first 10 weeks of both studies, the EC was relatively high (fig. 2). EC was somewhat higher in the outdoor experiment since fertilizer rates were twice that of the greenhouse study. EC of leachates is associated with both the leaching of salts already present in the media and the release and leaching of nutrients from the fertilizer prills. The high EC during the first two months of the studies occurred during the period when air temperatures were relatively high, so one would expect a greater release of nutrients from the fertilizer prills since release characteristics are temperature dependent. Leachate concentrations of total inorganic nitrogen (ammonium and nitrate) (fig. 3) and total phosphorus (fig. 4) were relatively high and fluctuated somewhat during the first 20 weeks of the study. Nutrient concentrations of leachates then decreased and remained relatively stable throughout the last 27 weeks of both studies.

Conclusions

There are several important points to be gathered from these studies:

Nutrient release from CRFs increases with increasing temperature. Nutrient release from CRFs in container growing media can be relatively high (at least for the products tested) if planting is done during hot summer months.

Electrical conductivity (EC) of leachate is not directly correlated with nutrient content. Nonessential salts such as sodium, as well as other breakdown products of the growing medium, will contribute to the EC of the leachate. In addition, some fertilizers, such as urea, have a low salt index; therefore, assumptions cannot be made that EC is directly associated with the concentration of any one particular element (compare fig. 2 [EC] with fig. 3 [inorganic nitrogen] and fig. 4 [phosphorus]). However, with experience and use of long-term records of fertilizer types used, type of growing media and environmental conditions, EC can be used as a general guideline for estimating nutrient levels.

Measurements of chemical characteristics of leachates from pots of growing media will vary from week to week and from container to container. Even in controlled studies, such as the studies described here in which no plants were used, EC and nutrient concentrations of leachates fluctuated within a given treatment, especially during the first half of the study period. Therefore, if collecting

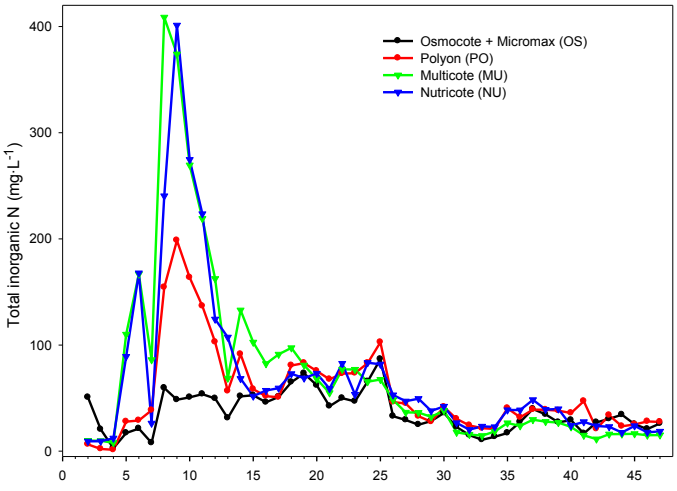

Fig. 3. Inorganic nitrogen (nitrate + ammonium) concentrations in irrigation leachates collected from one gallon containers weekly during the experiment.

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samples and making cultural management decisions based upon leachate data, it is important to collect leachate samples from several containers (rather than a single container) for testing. Sampling and testing should also be done on a regular basis and a record of the results should be maintained so that changes over time can be used to make cultural management decisions.

Best Management Practices

Based on these conclusions, several BMPs should be considered when using CRFs.

BMP1: Canning. Prepare growing media and plant crops in the cooler periods of the year when possible. This will allow roots to develop throughout the container. As temperatures warm, nutrients released from CRFs will be taken up by the already present root system.

BMP2: Irrigation and weather. Minimize water runoff from containers by avoiding excessive irrigation volumes during each irrigation event. This is especially important during warm or hot weather, when the rate of nutrient release from CRF prills is higher.

BMP4: Irrigation and new plantings. Newly planted crops (plugs or liners transplanted into larger containers) have special water and fertilizer needs. Until root systems become established in containers, any water and nutrients in excess of that needed by the plants will end up as runoff.

BMP5: Media storage. If CRFs are blended into the growing media, prepare only enough media for immediate use. The CRF prills in any unused media will begin releasing nutrients, especially if the pile of planting mix is large and heats up (like a compost pile).

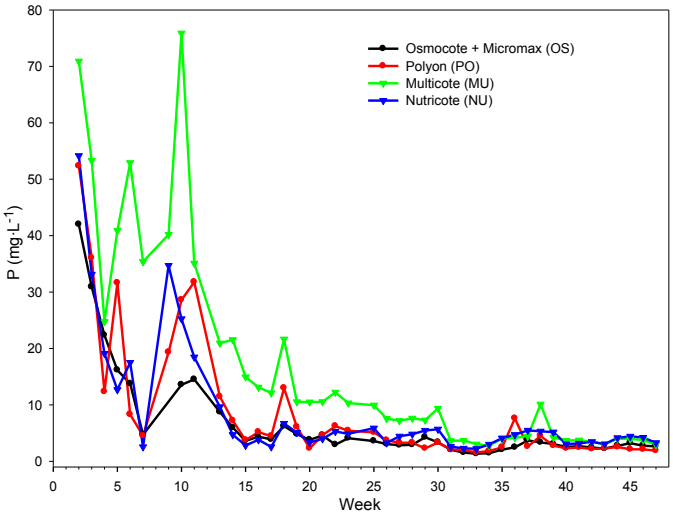

Fig. 4. Total phosphorus concentrations in irrigation leachates collected from one gallon containers weekly during the experiment.

BMP6: Fertilizer storage. Always store unused CRFs and other solid fertilizers in a dry, cool location.

BMP7: Electrical conductivity. EC is not well correlated with nutrient concentrations. Use EC only as a general guideline for troubleshooting, not for direct estimation of specific nutrient levels.

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Organic Nitrogen Fertilizers for Container Substrates

by Richard Evans

It has been half a century since organic fertilizers were widely used as sources of nitrogen in container mixes, but there has been a resurgence of interest in them in recent years. In large part, the new interest is the result of the niche market created by a demand for "green," organically-grown plants, but organic nitrogen fertilizers have another attractive feature as well. Organic nitrogen is insoluble, so it serves as a storage form that reduces the likelihood of nitrogen losses from the pot due to leaching and runoff.

The nitrogen stored in organic fertilizers becomes available when chemical or microorganism activity converts it to soluble forms through a process called mineralization. The first breakdown product is ammonium. Microorganisms can also convert ammonium to nitrate, which is the normal end product of mineralization. The conversion process is affected by several factors, including the population of microorganisms; soil temperature, moisture content and aeration; and the type and amount of organic matter. Organic fertilizers are usually ineffective at temperatures below 40°F, and the conversion of ammonium to nitrate is particularly sensitive to temperature.

Much of the research on mineralization of organic nitrogen in soilless mixes was done by UC researchers in the 1950s. The group responsible for the UC Manual 23, *The UC System for Producing Healthy Container-Grown Plants*, published useful information about the availability of nitrogen from organic fertilizers in soilless mixes (Baker 1957). For example, table 1 here presents their data describing the effect of temperature and organic fertilizer type on nitrogen mineralization. The authors concluded that blood meal or hoof and horn meal would be the best organic nitrogen fertilizer for container-grown crops because they released nitrogen more slowly, which would make them effective for a longer time.

The UC Manual group tested its organic fertilizers on bedding plant crops, which it chose because the short cropping period for bedding plants meant they could get quick results. Later research showed that mineralization of organic nitrogen sources ends too soon to sustain the growth of most container-grown plants. For example, Williams and Nelson (1992) tested several organic nitrogen sources, including sewage sludge, poultry manure sludge, bonemeal, pine needles, and poultry feathers, and found that all ceased releasing sufficient nitrogen after six to seven weeks. Hartz and Johnstone (2006) reported that the nitro-

Table 1. Nitrogen available from mineralization of organic nitrogen sources in steam pasteurized and unpasteurized soilless media. Data from Baker (1957).

			Available N (ppm)				
Storage temperature (ºF)	Treatment	Rate (lb/yd^3)	Castor pomace	Cottonseed meal	Fish meal	Blood meal	Hoof and horn meal
50	Steamed	4.5	60	54	60	25	25
		6.5	100	75	92	48	37
	Unsteamed	4.5	93	108	80	47	47
		6.5	128	116	130	60	63
70	Steamed	4.5	73	60	66	45	50
		6.5	132	98	114	60	60
	Unsteamed	4.5	160	95	104	63	70
		6.5	160	140	160	105	95
	Average Steamed		91	72	83	45	43
	Average Unsteamed		130	115	119	69	69

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gen in seabird guano, fish powder, feather meal and blood meal was mineralized within six to eight weeks. These results, and others like them, indicate that the common organic fertilizers cannot sustain most container-grown crops unless they are supplemented with liquid fertilizers or subsequent top-dressing with solid fertilizers.

The organic nitrogen sources discussed above are waste products. We recently tested a promising new source of organic nitrogen that isn't technically a waste product, but is treated like one: dried jellyfish. Jellyfish populations have expanded rapidly over the past couple of decades, probably because climate change has warmed oceans and water pollution and overfishing have removed their predators and competitors. Exploding populations of jellyfish are wreaking havoc with commercial fisheries and, surprisingly, nuclear power generators. For example, a few years ago, the *USS Ronald Reagan*, the world's most advanced aircraft carrier at the time, was completely disabled because it sucked thousands of jellyfish into the cooling system of its nuclear engine. Recently several nuclear power plants that are cooled with ocean water have been in the news because of shutdowns caused by jellyfish clogging the cooling water intake lines. Some power plants must remove as much as 150 tons of jellyfish each day. It is costly to deal with the jellyfish, but it is possible that some of the cost could be recouped if dried jellyfish could be sold as fertilizer. It seems to hold promise, since dried jellyfish contains 14% nitrogen by weight.

We conducted a greenhouse experiment to test whether the mineralization rate of organic nitrogen in the dried jellyfish is sufficient to meet the nitrogen demand of 'Golden Gate' chrysanthemum grown in a soilless mix. We incorporated either dried jellyfish or a conventional controlled-release fertilizer into the mix at a rate of 1.9 grams of N per 6-inch pot.

No treatment differences were apparent during the first six weeks. Leaf color (assessed with a SPAD chlorophyll meter) and growth rates were normal for both treatments. After seven weeks, however, we noticed slight yellowing of older leaves and a slower growth rate of plants fertilized with jellyfish — both signs of incipient nitrogen deficiency. At the end of the experiment the dry weight of plants fertilized with jellyfish was lower (37.2 grams) than the dry weight of plants fertilized with controlled release fertilizer (44.6 grams). Therefore, like organic fertilizers made from waste products, the jellyfish fertilizer was able to meet the nitrogen demand of chrysanthemum for the first several weeks after planting, but was not sufficient to satisfy the nitrogen requirement for the whole cropping period.

Thus far, efforts to extend the release period of organic nitrogen fertilizers have been unsuccessful. For example, plants produced in a potting mix containing a pelletized organic nitrogen source did not grow as well as those that received a conventional fertilizer (Mikkelsen 2003). For now, at least, organic production of container plants must depend on supplemental applications of fertilizer after planting.

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DISEASE FOCUS: Effect of fertilizers on plant diseases

by Jim Downer

Ornamental plant growers understand that minerals are absorbed mostly by roots as ions, and are essential for plant growth and development. Some, required in parts per hundred, are macro-nutrients while others, only required in parts per million or parts per billion, are considered micronutrients. As long as enough of the 18 essential minerals are available, plants grow and reproduce in a healthful way. When not enough of one of the essential elements is supplied, a deficiency occurs and plants may present symptoms. Mineral nutrient symptoms are considered abiotic disorders. There are, however, cases where excess or deficiency of elements can be predisposing to disease caused by pathogens. While not common, some mineral elements do have a role in the development of disease caused by some pathogens.

Soil-borne pathogens are perhaps most affected by minerals dissolved in soil solution. Minerals can act in specific ways (specific ion effects) or as total ion effects (osmotic strength or concentration) having direct effect on pathogenic propagules or on the host itself. If we utilize the plant disease tetrahedron and think of all the implications ions could have in a biological disease relationship there are several possibilities:

- Specific ions harm or favor the pathogen.
- Specific ions harm or support the host.
- Ionic strength changes the root environment making the host weak and susceptible.
- Ions change the pH of the soil solution making it more or less fit for a pathogen or the host.
- Ions change the soil physical environment making it more or less fit for a pathogen or the host.

While it is often espoused that the well "fed" or fertilized plant is resistant to disease, it is rarely borne out in published research. Keeping a good nutritional level in nursery stock will not necessarily protect plants from many of the virulent pathogens that are capable of causing disease. Nitrogen fertilization can produce succulent growth that will lead to exacerbation of such diseases as powdery mildew (Powell and Lindquist 1997). Excess mineral nutrients may result in luxury consumption by the fertilized plant or may lead to other problems. It is well known that seedling diseases caused by *Rhizoctonia solani* are more severe with increased salinity in media (Baker 1957), and it was later discovered by Jim MacDonald and others

Early onset root rot in bedding plants. Photo by Jim Downer.

(1984) that salinity increases susceptibility of ornamental plants to *Phytophthora*.

Plant mineral nutrition has effects on two basic mechanisms of disease resistance: (1) formation of mechanical barriers (cell wall strengthening) and (2) synthesis of defense compounds that protect against pathogens (Spann and Schumann 2010). The role of specific elements and their compounds is complicated and unique to each disease/host system. Certainly deficiencies of molecules such as calcium and potassium can interrupt either of these defense mechanisms.

Root rot is a disease of thousands of ornamental plants and a serious problem in many nurseries. Root rots caused by *Phytophthora* spp. occur in a range of nutritional and pH environments. While some studies have implicated nitrogen compounds in the control of *Phytophthora* diseases, these probably involve the release of ammonia which is also toxic to plant roots (Zentmeyer 1963). Lee and Zentmeyer (1982) later showed that both ammonium and nitrate reduced disease caused by *P. cinnamomi*, but that low levels of nitrate stimulated production of sporangia. Most studies have found no relationship of nitrogen source to root rot disease development. Zentmeyer's early work also suggested a role for calcium in disease reduction caused by *Phytophthora* root rots. Calcium cations increase disease resistance to root rot in avocado (Duvenhage and Kotze 1991). While it is understood that calcium has direct effects on plant membranes, root cell membrane leakage, cell wall thickness and many other host factors, Messenger (2000) later showed that the calcium ion also has direct effects on *Phytophthora*,

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reducing its sporangia size and zoospore mobility. When soils and soiless media are low in soluble calcium, when calcium is easily precipitated out of solution, or when the pH is high and limestone minerals decrease the availability of calcium, conditions are conducive to *Phytophthora* root rots. Sodium in soils and soiless media can also affect *Phytophthora*.

Wilt diseases have also been studied in relation to disease occurrence. Keim and Humphrey (1984) showed that nitrogen source reduced the incidence of wilt cause by *Fusarium oxysporum* f.sp. *hebe* in veronica. In their system, ammonium sulfate promoted disease and calcium nitrate prevented *Fusarium* infections. In later work on the *Fusarium oxysporum* wilt disease of Canary Island date palm, Downer and others (2012) found no effect of fertilizer source on disease development (2013). Every disease system must be considered independently to determine if nutrient relationships are part of that system.

While it is easy to see a role for essential elements in plant defense, non-essential elements may also play a role in some systems. Silicon increases resistance of plants to powdery mildew (Kauss and others 2003), root roots (Cherife et al. 1994) and to stress in general (Ma 2011). Silicon is implicated not only in strengthening cell walls but in defense protein production in plants (Faufeux et al. 2006). Not all plants are capable of utilizing silicon, so its role in plant defense is limited to those species capable of metabolizing it. Much more study is necessary to understand silicon's role with ornamental plant-pathogen systems.

Nutrient exchange in container media is complicated — it is mediated by the substrate, water chemistry, temperature and the applied ion sources as well as by plants growing in the media. Growers are well served to apply fertilizers that can supply a constant nutrient charge. Supply of extra soluble calcium may be helpful in managing root rots. Preventing salt build up or high salinity situations that can occur when media dries out will also help plants avoid infection by root rot organisms.

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INSECT HOT TOPICS: Emerald ash borer update and rose rosette

by James A. Bethke

The emerald ash borer has been moving westward at a relatively slow pace, and when I first mentioned it in this article in 2012, it had reached the eastern end of Kansas. Recently, however, a colleague notified us that a significant population was confirmed in Boulder, Colorado. He commented that it couldn't have picked a worse place. Why? Because it was found smack in the middle of the biggest contiguously growing population of ash trees in the state. What's worse is that it landed in an area where the folks are pesticide averse, and due to all the hubbub with systemic insecticides and honeybees, it is a white hot flash point. This is very important since the systemic insecticides are university proven, preventative treatments (see the web address below). If systemic insecticides aren't used, the result will be tree death and removal, or in landscape settings, tree fall. I pass by a great number of newly planted ash trees every day because it was the tree of choice by the landscapers at the Operations Center in San Diego County. I feel it is highly likely that this bug will make it to California some time in the near future and it would pay to be prepared. For more information, see http://www.emeraldashborer.info/files/Multistate_EAB_Insecticide_Fact_Sheet.pdf.

The second issue I would like to address in this article is the increased incidence of rose rosette, which is sweeping the nation with fury. Everyone should be aware of the threat. The causal agent of rose rosette is not a new pest and it is not an insect. It is a virus that is transmitted by an eriophyid mite, *Phyllocoptes fructiphilus*, a North American native. The mite has either historically or recently been observed widespread in the United States and in Canada. In addition to the mite, the virus disease can spread by infected hand tools, grafting and in infected roots.

The symptoms of rose rosette are not subtle and may have a witch's broom-like appearance. Symptoms include excessive thorniness, rapid stem elongation, leaf distortion, leaf reddening, leaf chlorosis with a mosaic pattern, abnormally narrow leaflets, thickened stems and premature lateral buds (fig. 1). Unfortunately, there is no cure for rose rosette, and as everyone knows, eriophyids are tough to clean up. Therefore, plant removal and preventive applications of effective miticides to avoid infection will be necessary. Rose plantings downwind of an infected plant, even in outdoor nurseries, are more likely to become infected because eriophyid mites can be blown by the wind or carried by flying insects.

Fig. 1. Rose rosette symptoms in the landscape in Ohio. Photo taken by Denise Ellsworth, director of Ohio Agricultural Research and Development Center's Honey Bee and Native Pollinator Education Program.

Multiflora rose (*Rosa multiflora*) is extremely susceptible and infection in other rose types has been seen including climbers, hybrid teas, floribundas, miniatures, antique or "old-fashioned" roses, knockouts and carpet rose. Mite populations are most abundant from June through July with the peak occurring in September, and most infection symptoms appear in July and August.

Since the disease can be mechanically transmitted, disinfecting hand tools will prevent contamination. Additionally, rose rosette can be spread or transmitted by grafting. Infected shoots may express the disease as much as 18 months later and serve as an inoculum source. The virus may also be present in the roots of multiflora roses, which means that the remaining roots after the removal of an infected plant may still infect a new planting for an extended period.

Chemical control of eriophyids can be attained using abamectin (Avid), fenproximate (Akari), carbaryl (Sevin) and spiromesifen (Judo). These products can only be used as a preventive measure, not as a curative, and should be rotated to avoid or delay any chance of resistance. If the risk is high in your area, it may pay to make preventive applications.

INSECT HOT TOPICS-

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The American Nursery and Landscape Association (ANLA) has recently developed an informative web page, which is listed below along with a few other sites that you may want to view.

http://anla.org/knowledgecenter/ticker/index.cfm?view=detail&colid=123&cid=378&mid=5698

http://anla.theknowledgecenter.com/OnDemand/index.cfm?view=category&colid=143&cid=377

http://www.greenhousegrower.com/article/32859/reducing-the-spread-of-rose-rosette-disease

http://www.ars.org/about-roses/rose-care-articles/rose-rosette-disease-sadly/

http://www.clemson.edu/extension/hgic/pests/plant_pests/flowers/hgic2109.html

http://entoplp.okstate.edu/pddl/2012/PA11-5.pdf

http://pubs.ext.vt.edu/450/450-620/450-620_pdf.pdf

James Bethke is Farm Advisor for Nurseries and Floriculture, UC Cooperative Extension, San Diego and Riverside Counties.

REGIONAL REPORT: News related to Central Coast water quality

by Steve Tjosvold

The State Water Resources Control Board issued a Water Quality Order (State Order) for the Central Coast region on September 24, 2013 which requires farmers or coalitions of farmers to prioritize drinking water sampling and assessment for nitrate and notify well users if those nitrate levels exceed public health standards for drinking water. The Order further requires some farmers to report the amount of nitrogen they apply to crops. Pursuant to the Order, the Central Coast water board revised the Annual Compliance Form (ACF) on October 22, 2013. Growers with Tier 2 and Tier 3 farms must submit Section C of the ACF, Groundwater Nitrate Loading Risk Determination, by January 15, 2014. The final Order the Central Coast water board acted on and a sample ACF with instructions is posted at: http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/index.shtml.

The Central Coast water board has recently awarded ALBA (Agriculture and Land-Based Training Association, http://www.albafarmers.org/) a grant to provide technical assistance in the greater Salinas Valley region so that growers can implement water quality improvement practices in accordance with the current Agricultural Order requirements. The bilingual assistance will be given to limited-resource growers in the Lower Salinas, Bolsa Nueva and Elkhorn Slough areas/watersheds. Contact Nathan Harkleroad at (805) 234-0546 or nathan@albafarmers.org for more information.

REGIONAL REPORT: Santa Cruz and Monterey Counties, continued from page 10

FIELD OBSERVATIONS: Diagnosis of a poinsettia problem

Ahhh, poinsettia season! It is usually a grower's nightmare crop. If everything is going well with your poinsettia crop, then you better start to worry. Case in point is a recent observation of a very interesting problem with a poinsettia crop — an experience for all of us to learn from.

"Wondering if you ever saw nematode on poinsettia?" I asked UC nematologists in a late afternoon email that accompanied the picture of roots of the potted poinsettia that I received at my office from a grower earlier that day (see fig. 1). After some email discussion between 5:50 and 10:32 that night (what else do nematologists do?), the conclusion was that the root galling really did not look quite like root knot nematode. One nematologist noted, "A nematode, probably root knot, was a major problem in southern California in the '70s." Another nematologist commented, "*Meloidogyne* spp. (root knot nematodes) are the only nematode pathogens listed infecting poinsettia by APS (American Phytopathological Society) and the root galls look funky." (Funky is a nematologist's term used when the root galls don't really look like they are caused by nematodes.)

I broke into several galls on the roots with the aid of a stereomicroscope, but could not find the glistening, roundish, female nematodes that can normally be seen with root knot nematode infestations. I placed some of the galled roots into a petri plate and sprayed with deionized water and the next morning nematode larvae were swimming in the water surrounding the roots. The plot thickened! I sent samples to UC Riverside where another nematologist cultured the nematodes out of the root and soil tissue for identification. The plot flops! These were saprophytic nematodes, not pathogenic nematodes. (Yikes, if only I had made the time to look at my nematodes in a light microscope to search for the stylet mouthparts that pathogenic nematodes use to puncture and feed on plants!)

And now for the rest of the story…There were aboveground symptoms that were actually more problematic for the grower than the root nodules. Younger leaves were cupped upward, with edges almost folded in the worst cases, and chlorotic. There was an overall loss of vigor (see fig. 2). Leaf distortion was apparent in less than 1% of all pots and with no obvious patterns of distribution in the greenhouse, but when it was occurring, all 3 plants per pot were affected. When there were strong aboveground symptoms, there was also root galling to some extent. Cycocel growth regulator (chlormequat chloride) and a drench of Distance insecticide (pyriproxyfen) was applied earlier in the crop. The growing points and leaves did not have any broad or cyclamen mites. No other diseases were seen.

Found on page 8 of the Distance label (2010-DIS-0001) was the following:

> *Drench Application to Individual Pots of Poinsettia: In a few instances, malformation of roots and newly expanded leaves (i.e. cupping) has been observed on certain Poinsettia varieties (i.e. Freedom Bright,*

Fig. 1. Poinsettia roots with soil removed showing root galls and stunting. Photo by Steve Tjosvold.

REGIONAL REPORT: Santa Cruz and Monterey Counties, continued from page 11

Fig. 2. Poinsettia leaf cupping and distortion on newest growth. Photo by Steve Tjosvold.

> *Freedom Bright Red, Winter Rose, and Jingle Bells) following drench application of Distance. Leaf malformation was more commonly observed on plants exposed to high air temperatures and on plants whose soil media was allowed to dry out following application, such as those along walkways or near doorways…*

So we will never know for sure. The variety affected was 'Prestige Red' so, in this case, it was not listed specifically on the label. All of the plants received Distance, but maybe the low incidence and nonuniformity of symptoms might be explained by a small percentage of the plants being predisposed by one of the soil moisture or high air temperature triggers. Maybe plants got a bit too dry before the hand application — and inherently nonuniform — soil drench of Distance.

A representative of Valent, the manufacturer of Distance, said they had some experimental evidence that the EC formulation might be causing the occasional problem and not the active ingredient in Distance. They did not know the mechanism.

Interestingly, I was listening to Don Merhaut of UC Riverside speaking at a recent UCNFA meeting about calcium deficiency symptoms. Don noted "Calcium deficiency can cause leaf deformation and root malformations among other symptoms, and this can be accentuated by irregular watering…" Yes, the plot thickens again! Could this be an induced calcium deficiency? Unfortunately, the grower had previously sent a soil and tissue sample in for laboratory nutrient analysis and found that "all mineral nutrients fell into normal ranges." So does the plot flop again? Maybe not, because there was no sample analyzed for healthy tissue or healthy plants, only plants with symptoms. Even though we sometimes have standardized normal ranges, as for poinsettia, there is a lot of variation in the analysis due to sampling and laboratory procedures. It is best to have at least one composite sample each of healthy and unhealthy plants when diagnosing nutritional disorders. Talk to your laboratory to make recommendations on which leaves to sample. In this case, the laboratory was recommending "recently matured leaf tissue" to sample.

So why is the mechanism of action here so important? Well, for one thing Distance is a valuable and unique pest management tool for poinsettia production and if we understand the mechanism of this toxicity, then we might be able to better control it without changing the formulation. For example, if we find calcium or calcium metabolism is the real culprit of the distortion symptoms, then maybe we could focus on reducing that factor, such as how growers do for blossom end rot in tomato or upper leaf scorch in oriental lilies, both caused by calcium deficiency.

At the time of this writing, samples from healthy and unhealthy plants will be analyzed for mineral content. So we will see. I hope these observations illustrate how the diagnostic process can be imperfect and the steps the grower and I must take to improve our chances of pinning down a proper diagnosis and management strategy.

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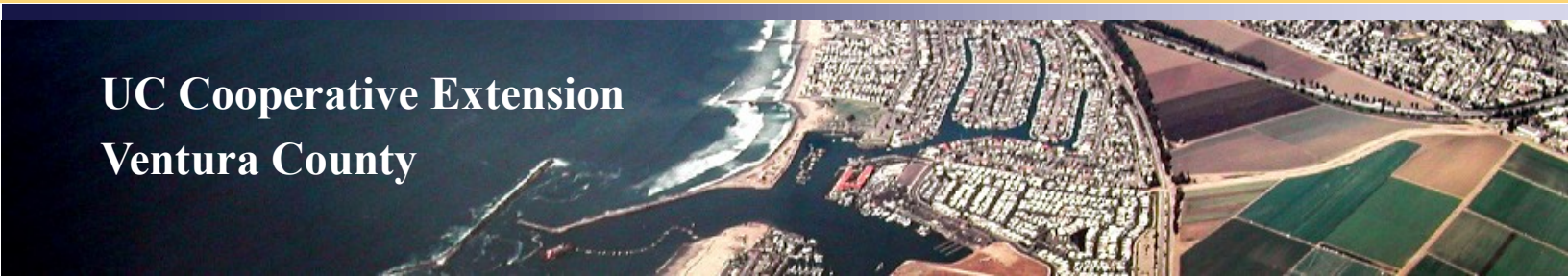

REGIONAL REPORT: A comparison of organic fertilizers

by Jim Downer

The "organic" movement in the United States has gained considerable momentum over the last ten years. Greenhouse and nursery growers are showing increasing interest in "organic" and "sustainable" growing practices, including the use of organic fertilizers. Although the number of commercial certified organic fertilizer products is limited, there are a plethora of products for sale in retail nurseries for gardeners; yet, efficacy testing of these products is largely missing. While organic fertilizers are generally believed to be "slow release," there is potential for nutrient loss from containers because organic fertilizers tend to be applied at higher rates or more frequently than soluble fertilizers.

Staff Research Associate Anna Howell and I evaluated several retail organic fertilizer products and two experimental products on the quality, growth and chlorophyll content of vegetables, flowers and an herb. We also examined nitrate leaching.

Fig. 1. Greenhouse container setup using broccoli transplants, control (left) vs. Gro Power Solid (right). Photo by Jim Downer.

Methods

Greenhouse container studies were set up using basil, petunia, broccoli (fig. 1) and snapdragons. The container media was a peatmoss: perlite mix (50:50 vol/vol), without added fertilizer. Fertilizers were suspended or dissolved in 100 ml of water and applied every two weeks at rates calibrated to supply 300 ppm of actual nitrogen to each container. Fertilizer treatments we evaluated and the specific rates for each treatment are shown in table 1.

The following were recorded every two weeks:

1. Quality, rated as a visual index from 1 = dead to 10 = perfect florist quality.
2. Number of flowers (petunia and snapdragon).
3. Chlorophyll content measured in petunia and broccoli using the SPAD meter (Minolta Inc.).
4. Nitrate content of leachate caught from each container and measured using a nitrate meter (Horiba Ltd.).

Flowering and Plant Quality Responses

Several products for snapdragon, including Espoma and Gro-Power solid, promoted flower bloom (fig. 2). While all products stimulated some response, the Scott's experimental "AP" and "PC" products appeared to evoke the greatest number of flowers and higher quality levels in the petunia; basil quality was largely unaffected by treatment (data not shown).

The organic fertilizers supplied N, P and K as well as other minerals but at very low concentration requiring frequent applications. While all the fertilizer treatments performed well, the Scotts and Gro-Power products were most effective in our trials (data not shown).

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Chlorophyll Content and Nitrate Losses

A brief summary of other findings are reported here (data not shown). Petunias fertilized with soluble sources gave significantly higher SPAD readings than other treatments; SPAD readings on plants with organic treatments were not different than untreated plants. However, chlorophyll content was not associated with plant quality as several treatments in petunia with high SPAD readings did not have high quality ratings for the same date.

Nitrate losses from plants fertilized with the soluble fertilizers were high initially but dropped rapidly. As organic treatments mineralized, nitrate readings increased, especially in Scott's experimental product "PC" and the retail Miracle-Gro Organic Choice. Most other materials had similar nitrate loss rates, which were not significantly different than unfertilized containers.

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Table 1. Organic fertilizer products and application rates.

Product	Manufacturer	NPK analysis	Rate (g/L or ml/l)
Ammonium sulfate	Various	21-0-0	1.6 g
Miracle-Gro All Purpose Plant Food	Scotts Miracle-Gro Inc.	24-8-16	1.2 g
Espoma Garden Tone	Espoma Co.	3-3-4	13.3 g
Whitney Farms Organic and Natural All Purpose	Rod McLellan Co	4-2-3	10.0 g
Dr. Earth All Purpose	Dr. Earth Co.	4-4-4	10.0 g
Miracle-Gro Organic Blood Meal	Scotts Miracle-Gro Inc.	12-0-0	3.3 g
E.B. Stone All Purpose	EB Stone and Sons Inc.	5-5-5	8.0 g
Jobes Organic All Purpose	Easy Gardener Products Inc.	4-4-4	10.0 g
Miracle-Gro Organic Choice All Purpose	Scotts Miracle-Gro Inc.	7-1-2	5.7
Organic Rx Vegetable	Organics Rx	5-1-3	8.0 g
Organic Rx Plant Food	Organics Rx	5-1.3-3	8.0 g
Scotts AP	Experimental		11.0ml
Scotts PC	Experimental		12.0 ml
Organic Rx Plant Food +Sea Kelp 100	Organics Rx	5-1.3-3 0.2-0-0.2	8.0 g 7.8 ml
Organic Rx Vegetable + Sea Kelp 100	Organics Rx	5-1-3 0.2-0-0.2	8.0 g 7.8 ml
Miracle-Gro Organic Choice (Liquid)	Scotts Miracle-Gro Inc.	8-0-0	6.7 ml
Gro-Power All Purpose (Liquid)	Gro Power, Inc.	4-8-2	13.4 ml
Gro-Power All Purpose (Solid)	Gro Power, Inc.	4-8-2	8.0 g
Untreated	--	--	--

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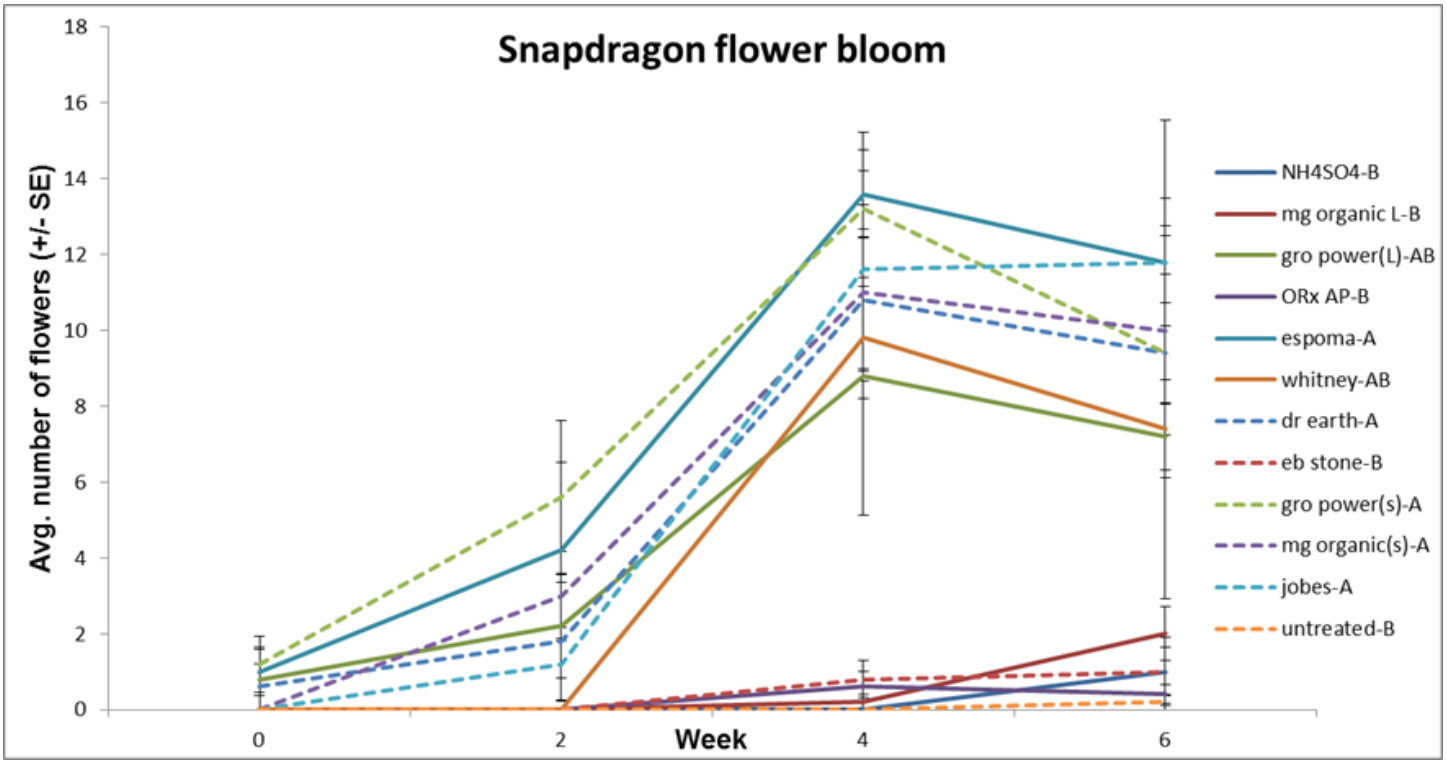

Fig 2. Snapdragon flower production over time.

Best Management Practices (BMPs) for multiple pests in California nursery and floriculture operations: A new online tool

The California nursery industry is challenged every day with exposure to invasive pests and pathogens covered under quarantine regulations that exist in various regions of the state. Excluding quarantine pests and pathogens is based on minimizing the risk of introduction and implementing preventive controls to the establishment of the pest or pathogen within the nursery. Voluntary, industry-developed, Best Management Practices (BMPs) have been created to assist nursery crop producers in developing an effective preventive action and monitoring plan to reduce the risk of introducing California quarantine pests and pathogens into their operations.

This online tool allows growers/shippers to create a set of BMPs unique to their nursery based on county locations and the pests/pathogens under quarantine or of concern in those counties. A grower/shipper can easily access the BMPs that are a common denominator for the above-mentioned pests/pathogens, as well as those specific BMPs that are unique to the specific pests/pathogens in the county they operate in, buy-in product from and/or ship product to.

How to Use the BMPs Online Tool

The BMPs Online Tool can be found at this link: http://ucanr.edu/sites/UCNFA/CANGC_Unified_BMPs_Project/Pests/. In the form on that web page, select the county where your nursery is located in the first dropdown list. Select all California counties in the second list to which you ship product. Select all California counties in the third list from which you purchase buy-ins (unrooted cuttings, plugs, finished goods). Click the "Get Pests" button to generate a list of quarantined pests/pathogens or pests of concern in your selected counties and the BMPs pertaining to those pests/pathogens. BMPs identified with an asterisk (*) indicate those that are effective for preventing all the pests/pathogens in the generated list. For more information on any BMP, click on its title.

Acknowledgements

Development of the BMPs Online Tool was funded by a grant from the 2010 California Department of Food and Agriculture's Specialty Crops Block Grant Program awarded to the California Association of Nurseries and Garden Centers (CANGC).

REGIONAL REPORT: Do insects proliferate in response to better plant nutrition?

by Jim Bethke

Lots of folks believe that the more fertilizer you add to a plant, the more attractive the plant is to pests and the more plant pests will proliferate. Unfortunately, this theory is not proven in the scientific literature because there are studies that provide evidence in both directions. As such, the goal of one of our research projects, conducted in a greenhouse at UC Riverside, was to investigate the effects of two different levels of water and three different levels of nitrogen fertilizer on whiteflies, thrips, aphids and leafminers on six different cultivars of poinsettias, chrysanthemums and gerbera daisies.

The plant physiological effects we observed were somewhat predictable and are summarized here (although specific data are not shown). The responses of each cultivar of the three plant species were variable, but plants fertilized with the low nitrogen rate or irrigated at the deficit level were generally shorter with lower leaf and stem dry mass and less leaf area; in some cases the leaves had reduced soluble nitrogen. Plants fertilized with the low level of nitrogen were commercially unacceptable. Chrysanthemums fertilized with the high rate of nitrogen had reduced soluble protein, likely due to the increase in EC values observed in the potting media.

Effects of the treatments on the insects were also somewhat expected, but they were mixed. Plant hosts stressed by low levels of nutrients and water significantly reduced survivorship and development rate of whiteflies on poinsettias (data not shown) and supported fewer adult or nymph thrips on chrysanthemums (table 1). In addition, cultivars with the lowest soluble protein content supported the lowest number of thrips, and cultivars with the highest protein content supported the greatest number of thrips (data not shown). This agrees with the hypothesis that high concentrations of soluble protein are associated with increased preference of these plants to phytophagous insects.

In aphids on chrysanthemums, nitrogen and irrigation rates did not affect insect longevity but the host cultivar did (table 1). Another important cultivar effect on aphids was the intrinsic rate of increase (performance) and

Table 1. Responses of thrips and aphids to different levels of fertilizer and irrigation and to cultivar of chrysanthemum.

Regimen	No. of Thrips/cm² foliage			
Nitrogen Fertilizer	Adults	Immatures	Aphid Longevity	Aphid Intrinsic Rate of Increase
80PPM	0.017b	0.050b	12.8a	0.218a
160PPM	0.021ab	0.097a	13.1a	0.221a
240PPM	0.027a	0.115a	9.8a	0.171b
Irrigation				
Deficit	0.024a	0.090a	11.9a	0.208a
Sufficient	0.019b	0.084a	11.8a	0.218a
Cultivar				
White Diamond	0.018ab	0.103ab	14.2ab	0.182a
Fontana	0.029a	0.109a	9.3bc	0.189a
Iridon	0.014b	0.062b	5.4c	0.158b
Pink Lady	0.031a	0.141a	13.5ab	0.193a
Splendor	0.018ab	0.081ab	15.6a	0.224a
White View Time	0.021ab	0.061b	9.1bc	0.180a

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population doubling times, which were the highest in 'Iridon'. In addition, the highest level of nitrogen applied (240ppm) adversely affected aphid performance. This follows, since we also found that high rates of fertilizer were related to adverse effects on the physiology of the plants, including reduced soluble protein levels, as stated previously.

Physiologically, the best plant comes from a well-fed plant, but overfeeding the plant can adversely affect it, although this doesn't necessarily make it more susceptible to pests and can actually cause adverse effects on the insect. We can also conclude that much of the pest population effects are associated with soluble protein levels, which are associated with the cultivar and the fertilizer level. Our final conclusion from these experiments was that the most significant reductions in pest population could be achieved by simply making good decisions on cultivar selection rather than by plant growth and cultural techniques.

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FIELD OBSERVATIONS: Recent insects from Florida

There has been a rash of insect pests intercepted on plant material from Florida in the last couple of weeks (see below). I have received an average of one call per week about a new pest interception that San Diego County officials need to deal with. I think the regulators have been exceptionally fair with the local growers who have the interceptions. There are two important points to make here. First, the growers in Florida need to do a much better job of cleaning their product before they ship to California. Second, if the product comes to your facility, it is incumbent on you to get a little tougher with your suppliers and not with the regulators who have the very tough job of protecting California agriculture. It makes very little sense to allow a potentially serious agricultural pest into the state and claim that it can be cleaned up with a little pesticide. That's not always the case and with many of these pests, complete elimination is highly unlikely. As always, the ornamental industry is constantly implicated in moving pests worldwide. Why take the chance and exacerbate the problem?

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Pests Detected in Shipments from Florida in the last four weeks in San Diego County.

Pest Common Name	Pest Scientific Name	Plant Species Harboring Pest
Jack Beardsley Mealybug	*Pseudococcus jackbeardsleyi*	*Aglaonema* sp.
Magnolia white scale	*Pseudaulacaspis cockerelli*	*Phoenix roebelenii*
Red wax scale	*Ceroplastes rubens*	*Aglaoenema* sp.
Shield bug	*Pentatomidae*	*Hygrophila corymbosa*
Florida wax scale	*Ceroplastes floridensis*	*Dypsis* sp.
Magnolia white scale	*Pseudaulacaspis cockerelli*	*Dypsis* sp.

CAMPUS RESEARCH UPDATE: National consortium at NORS-DUC studies Sudden Oak Death in quarantine nursery facility

by Karen Suslow

The National Ornamentals Research Site at Dominican University of California (NORS-DUC) is the only established field research facility in the country designed to study regulated plant pathogens in a secure environment. Funded by the USDA Farm Bill, NORS-DUC focuses on systems approaches for nursery production and on developing science-based best management practices and risk mitigation to exclude, contain and control the regulated pathogen *Phytophthora ramorum*, causal agent of Sudden Oak Death, from the nursery production chain through investigations conducted by a national consortium of experts. Research outcomes will be used to develop appropriate standards and procedures to advance best management practices for *P. ramorum* and to provide viable options for the nursery industry to remediate contaminated soil in retail, wholesale or landscape environments. To facilitate improvements in plant trade, nursery managers and growers will continue to receive training for appropriate control measures to advance industry safeguards for production at the state and national level.

Phytophthora ramorum is a pathogen on track to impact the nursery industry's national and international market beyond that of any other plant disease. NORS-DUC offers an unparalleled opportunity to study the epidemiology of *P. ramorum* diseases of ornamentals in a nursery setting that has not been accomplished previously. Thus, research at NORS-DUC realistically addresses the threats of this pathogen to specialty crops which cannot be accomplished in this manner with this disease anywhere else in the United States.

Research successes at NORS-DUC are the direct result of the development of a sophisticated, quarantine facility where realistic nursery studies are possible and where well-designed, successful research projects are being conducted by expert scientists. NORS-DUC is on target to contribute substantial impacts to the nursery industry and enhance plant trade. For the past eleven years, *P. ramorum* has been impacting US nursery trade. Just within the first two and a half years of active NORS-DUC research, two green technology *P. ramorum* soil remediation deliverables have been researched, developed and approved by USDA APHIS and are viable options for contaminated nurseries (on a case-by-case basis) in order to eliminate or kill *P. ramorum* in the soil substrate. Both technologies (steaming and the use of a biological control agent) have been successfully tested at a contaminated retail nursery and at a contaminated wholesale nursery in California. Success has led to the release of the wholesale interstate shipper from the Sudden Oak Death federal quarantine.

Technology transfer of these NORS-DUC successes to a wider national nursery audience is underway in a multi-state Farm Bill proposal spearheaded by Oregon Department of Agriculture, Washington State Department of Agriculture, Washington State University and California Department of Food and Agriculture. This multi-state proposal has been accepted to establish proof of concept in nursery settings under varying climatic conditions and varying soil types. Additionally, a third green technology research project for soil decontamination using soil solarization appears highly promising, and NORS-DUC researchers and staff continue to address those specific priorities. The nursery industry had identified the remediation of the contaminated soil substrate as the number one priority for the industry nationwide.

NORS-DUC continues to identify, prioritize, facilitate and conduct research related to pests and diseases of nursery stock while safeguarding plant health and the environment. The current *Phytophthora ramorum* research successes at NORS-DUC illustrate NORS-DUC's potential to provide long-term solutions for *P. ramorum* and demonstrate NORS-DUC's capability to address regulated plant pests and pathogens that threaten the nursery trade. NORS-DUC is laying the foundation for future work on pests of quarantine significance nationally. The NORS-DUC is a flexible, state-of-the-art lab and nursery research facility that is capable of adapting to the needs of the nursery industry to address pests of concern.

Karen Suslow is Program Manager and Principle Investigator, National Ornamental Research Site at Dominican University of California. You can reach Karen at *karen.suslow@dominican.edu*.

CAMPUS AND COUNTIES NEWS

Julie Newman and Steve Tjosvold receive CANGC Research Awards

By Cheryl Wilen

UC Cooperative Extension farm advisors and *UCNFA News* founders Julie Newman and Steve Tjosvold earned the 2012 and 2013 Research Awards from the California Association of Nurseries and Garden Centers (CANGC). They were honored at the California Nursery Conference in Etiwanda on October 9th.

Julie Newman was a UC Cooperative Extension Farm Advisor for Floriculture and Nursery Crops in Ventura and Santa Barbara. After 28 productive years, Julie retired last July. Julie worked closely with the nursery industry to help growers implement integrated pest management programs, meet regulations for improving water quality through irrigation improvements and nutrient management for which she and her team won a Western Extension Directors' Award of Excellence for a state program in 2008 and a 2006 UC Cooperative Extension Teamwork award for collaboration on the California Ornamental Research Federation (CORF) which eventually led to the establishment of UCNFA. The educational programs offered by CORF/UCNFA provide information on critical agricultural and environmental issues in English and Spanish.

She was also honored by the Ohio Florists' Association with the 2007 Alex Laurie Award for the most outstanding floriculture research paper published in a refereed journal during a calendar year. The 2007 award was presented for a series of four papers on nutrient release from controlled-release fertilizers published in the June and December 2006 issues of HortScience where Julie was a co-author.

Julie showed strong leadership by developing and serving as the editor of the book *Greenhouse and Nursery Management Practices to Protect Water Quality* and the soon to be published book *Container Nursery Production and Business Management Manual*.

Julie is a also a regular contributor to Greenhouse Management magazine as well as numerous UC publications.

Steve Tjosvold started out as a Farm Advisor Intern from 1980-83 in Alameda, Orange, and San Bernardino counties and started as Farm Advisor in Santa Cruz and Monterey counties in 1983. Steve has worked in important projects with positive impacts for the nursery industry. These include numerous training programs such as scouting and improving spraying systems. His research in sudden oak death and light brown apple moth has helped growers understand these pests and take action to reduce their impact on production systems.

Steve is also well-known for his symposia on control of diseases and insects in the highly competitive cut flower and nursery industries. He is a respected authority on greenhouse rose culture and pest management. He contributed two chapters to the world's most comprehensive publication on the subject, *Encyclopedia of Rose Science*.

Steve has been recognized by his peers with 3 distinguished service awards for outstanding teamwork (1997, 2004, and 2006) and one for outstanding extension (2004) as well as the 2008 Western Extension Directors' Award of Excellence: Farm Water Quality Planning Project.

Over the past 30 years Steve has produced 86 peer-reviewed journal publications and 172 other publications.

From left to right: Fred Ceballos (EuroAmerican Propagators), Steve Tjosvold, Julie Newman, and Cheryl Wilen (UCCE Area IPM Advisor)

Deb Mathews retires from UC Riverside

By Julie Newman

Dr. Deborah Mathews, who wrote the Disease Focus column of *UCNFA News* and also contributed several feature articles and campus news and research updates over the last few years, has announced her retirement from UC Riverside.

A native of Riverside, she spent 31 years on the UC Riverside campus — starting as an undergraduate student, continuing after graduate school with a research appointment, and then working the last six years as a faculty member and Cooperative Extension specialist in the Department of Plant Pathology and Microbiology. While she specialized in viruses of plants, Deb also participated in many collaborations over the years on various pathogens and diseases as needs arose.

Deb will be moving to the Sierra foothills in northern California next year to build her dream home and is looking forward to a life of leisure.

New Publications from UC Agriculture and Natural Resources

Compiled by Steve Tjosvold

Glyphosate Stewardship: Maintaining the Effectiveness of a Widely Used Herbicide

Glyphosate (Roundup) is very effective against weeds, but you can't use it just any old way or you'll end up encouraging the development of resistant weeds. Learn how to find the best timing, mix and application method, and complementary control methods.

Author: T. Miller et al.

Publication Number: 8492

http://anrcatalog.ucdavis.edu/pdf/8492.pdf

Selection Pressure, Shifting Populations, and Herbicide Resistance and Tolerance

A good herbicide will control the current population of weeds, but also create a powerful "selection pressure": any weeds that survive its effects will go on to thrive, immune to any further applications. Learn how to keep selection pressure in check.

Author: B. Hanson et al.

Publication Number: 8493

http://anrcatalog.ucdavis.edu/pdf/8493.pdf

Fungus Gnats: Pest Notes for Home and Landscape

This is a recently updated Pest Note. Fungus gnats occur around damp, decaying vegetation, algae and fungi. These flies can appear in large numbers in or around buildings and also can be a problem in greenhouses, nurseries and interior plantscapes.

Author: J.A. Bethke, S.H. Dreistadt

Publication Number: 7448

http://www.ipm.ucdavis.edu/PDF/PESTNOTES/pnfungusgnats.pdf

UCNFA Proposed Grower Educational Programs for 2014

ABCs of Horticulture (English/Spanish)
March 19 and 20, 2014 San Marcos

2014 Biological Control in Ornamental Plant Production Symposium
April 2014 San Marcos
Trade Show Vendor Opportunity

Water Treatment Conference
June 2014 San Marcos
Trade Show Vendor Opportunity

ABCs of Fertilizers (English/Spanish)
August 2014 San Marcos

Water Quality Program
Fall 2014 Watsonville

ABCs of Nursery/Greenhouse Pests
TBD Gilroy, Watsonville or Salinas

Other Upcoming Horticultural Events

Society of American Florists Pest and Production Management Conference
http://www.safnow.org/pest-production-management-conference
Feb 20-22, 2014 San Diego

UCNFA awarded CDFA Specialty Crops Block Grant for developing web-based grower educational materials

UCNFA was recently awarded funds from the California Department of Food and Agriculture's Specialty Crops Block Grant Program to develop online learning modules in English and Spanish on basic horticultural topics to serve the continuing educational needs of the ornamental specialty crops plant production workforce. For 20 years, UC personnel have presented the "ABCs" workshops on subjects such as fertilizers and plant nutrition, biology and control of insect pests and diseases, and botanical principles related to ornamental plants. These in-person workshops have occurred all over California especially in counties with large numbers of ornamental plant growing operations. In participant evaluations, growers have always highly rated these workshops for improving their on-the-job skills and efficiency.

During the recent economic downturn, growers reduced their workforce to levels that do not easily allow time for attending off-site training workshops. UC faculty and Cooperative Extension (CE) personnel have fewer resources to allocate to these in-person workshops. Of the current 324 CE advisors and specialists, 50% are estimated to retire in the next 6-8 years, creating an interim gap in personnel with expertise in the California nursery and floriculture specialty crops industry. Finally, the UCNFA website metrics indicate that the industry is turning to the Internet for information making this an opportune time to put more educational content online. Since 2010, visits to the UCNFA website have increased from 300 per month to 600 per month in 2013.

We plan to address these timely issues by leveraging technology to adapt workshop content to a web-based format to reach a broader grower audience within the demands of their work schedules. Current ABCs presentations will be updated with narration from current UC experts and maintained as learning modules on the ANR Online Learning System website with quizzes to measure subject retention and participant evaluations to assess workshop value and potential for improvement.

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