A Publication of the UMass Extension Greenhouse Crops & Floriculture Program

Floral Notes NEWSLETTER

Volume 24, No. 2 www.umass.edu/umext/floriculture September-October 2011

In This Issue

Greenhouse Fact Sheets in Spanish Language Now Available

Several of our popular fact sheets are now available in Spanish thanks to UMass workstudy student helper, Daniel Pacaur. Dan translated to Spanish, the following fact sheets: *Diagnosing Plant Diseases, Fungus gnats and Shore flies, Managing Weeds in and Around the Greenhouse, pH and Fertility Review for Vegetatively Propagated Annuals*. *Thrips Management* is also available in Spanish. These fact sheets are available free on the UMass Extension Greenhouse Crops and Floriculture website. Visit http://extension.umass.edu/floriculture/en-espanol

New Videos on UMass Floriculture YouTube Channel

Many growers are either using biological control or are thinking about it. To help get you started, watch our two new videos on UMass Floriculture's YouTube Channel (http://www.youtube.com/user/UMassFloriculture) about using beneficial nematodes and beneficial mites to manage pests in greenhouses. A special thank-you to Kerri Stafford and Cavicchio Greenhouses for their participation on this project.

Access the UMass Floriculture Website Using Your Smartphone

Visit http://extension.umass.edu/floriculture/ by scanning the QR symbol shown here.

Plant Nutrition for Greenhouse Crops

University of Massachusetts Extension Greenhouse Crops and Floriculture Program

November 1, 2011 9:30 AM – 4:00 PM
Sturbridge Host Hotel, Sturbridge, MA

9:00 – 9:30 Registration and Coffee

9:30 – 10:15 Understanding the Chemistry of Plant Nutrition: Nutrients, pH, Soluble Salts *Brian Krug, University of New Hampshire*

10: 15 – 11:00 How Water Quality Relates to Fertilizer Selection and Soil Fertility *Fred Hulme, Everris*

11:00 – 11:15 Coffee Break

11:15 – 12:00 Water Soluble Fertilizers *Douglas Cox, University of Massachusetts*

12:00 – 1:00 Lunch – On your own

Concurrent Sessions

1:00 – 1:45 Nutrient Management for Organic Greenhouse Tomatoes and Greens Grown in the Ground *Vern Grubinger, University of Vermont*

1:00 – 1:45 Nutrient Management for Spring Ornamental Crops: Soilless Mixes Using Chemical Fertilizers *Douglas Cox, University of Massachusetts*

Concurrent Sessions

1:50 – 2:50 Nutrient Management for Organic Ornamentals in Pots and Paks *Douglas Cox, University of Massachusetts*

1:50 – 2:50 Nutrient Management for Greenhouse Tomatoes and Greens: Soilless Mixes Using Chemical Fertilizers *Dan Jacques, Sungro Horticultures*

2:50 – 3:00 Break

3:00 – 4:00 Identifying and Correcting Nutritional Disorders *Brian Krug, University of New Hampshire* *1 Pesticide Credit Approved for this Session

For more information contact:

Tina Smith, University of Massachusetts, 413-545-5306, tsmith@umext.umass.edu
Paul Lopes, University of Massachusetts, 508-295-2212 ext. 24, lopes@umext.umass.edu

Register by using the form on the last page or online with a credit card
http://extension.umass.edu/floriculture/

Sustainable Approaches to Greenhouse Crop Fertilization

Douglas Cox
Plant, Soil, and Insect Sciences
University of Massachusetts
Amherst

Nitrates and phosphates from fertilizer are potential environmental hazards if they enter groundwater or surface water by runoff or leaching. Some greenhouse practices or common materials used in plant production may lead to the creation of nutrient-enriched effluent. First, most potting mixes have little ability to supply or retain nutrients in amounts to sustain plants without application of fertilizer. Second, many irrigation practices, especially overhead watering with a hose, are very inefficient in terms of water and nutrient loss. Third, water-soluble fertilizers are often used at rates in excess of the plants' needs without regard for volume applied and frequency of application.

Sustainable practices should promote the efficient use of fertilizer and reduce nutrient loss by maximizing the amount of nutrients used by the plant or retained in the plant container for potential use. Growers should attempt to meet three goals in developing a greenhouse crop fertilization program, they are:

> **Goal 1.** Match fertilizer application with plant nutrient needs as the plant grows.
>
> **Goal 2.** Stop or limit the loss of nutrients from the plant container during overhead watering in an open system.
>
> **Goal 3.** Stop or limit nutrient and water loss from irrigation and leaching by containing the effluent.

Goal 1. Match fertilizer application with plant nutrient needs.

It would be very useful when developing fertilizer programs to know the specific nutrient requirements of greenhouse plants both in amount and in time. Unfortunately information of this type is very limited for greenhouse crops.

Nutrient balance sheets. One approach to studying nutrient needs is to construct a "nutrient balance sheet" showing where the applied element(s) go and where improvements in fertilizer efficiency can be made. Fertilizers or fertilizer programs can be compared as in the example of 4-inch seed geraniums (Table 1). Here the plants received the same amount of N and water as they grew and where the fate of the N was kept track of until flowering. The balance sheet shows that the largest amount of N was recovered by the plants fertilized with ammonium nitrate; N leaching was greatest with ammonium sulfate and calcium nitrate; unaccounted for N (presumably lost as ammonia gas) was highest for ammonium sulfate and urea; and the amount retained by the potting mix was about the same for all N sources. The balance sheet clearly shows the magnitude of N loss by leaching and the importance of N source in maximizing fertilizer efficiency. Interestingly, about 1.0 gram of N was required to grow the geraniums in this study; a level very close to estimates made for other floriculture crops.

Complete balance sheets for floriculture crops are rare because the research needed to construct them is expensive and time-consuming.

Nutrient uptake patterns. Plant nutrient requirements change as the plant grows and enters new developmental stages (e.g., vegetative vs. reproductive). Ideally fertilizer should be applied during periods of highest demand and reduced or stopped at other times. Using this approach could reduce runoff and prevent harmful nutrient deficiencies or excesses. Some plants such as chrysanthemum and marigold have distinct vegetative and reproductive phases of growth and they show a pattern of increasing N uptake during vegetative growth and a leveling off or decline following the appearance of

visible buds. Nitrogen is most critical during the vegetative phase and fertilization can be reduced after visible bud. On the other hand, New Guinea impatiens, which do not have distinct vegetative and reproductive phases and they show a continuous, gradual increase in N uptake as they grow. New Guineas do best with low fertility early on and fertilization becomes more critical as the plant gets older and larger.

Nutrient uptake patterns have been determined for only a few crops, but some information is already available for you to use to enhance postharvest longevity and reduce nutrient runoff by reducing fertility in the latter stages of growth (Table 2).

Table 1. Nitrogen balance sheet for 4-inch seed geranium.[z]

	Percentage (%) of applied N			
N Fertilizer	Plant	Medium	Leached	Unaccounted for
Ammonium sulfate	27	19	43	11
Ammonium nitrate	47	18	32	3
Calcium nitrate	33	18	46	3
Urea	37	19	21	23
Osmocote 14-14-14	38	26	30	6

[z]Cox, D.A. 1985. *HortScience.* 20:923-925.

Table 2. Fertilization recommendations for improved postharvest performance of selected greenhouse crops.[z]

Crop	Nitrogen recommendation
Ageratum, marigold, petunia	Cut nitrogen rate in half at visible bud stage.
Celosia	Cut N rate in half 1-2 weeks before sale.
Snapdragon	Reduce fertilization when flower spike starts to elongate.
Begonia	Reduce fertilizer rate at the end of the production period.
Poinsettia	Stop fertilizing 2 weeks before sale to reduce leaf drop.
Potted chrysanthemum	Stop fertilizing at visible bud, or use 150 ppm for entire production (instead of 450 ppm) to increase postharvest life 7-14 days.
Easter lily	Stop fertilization prior to marketing of lilies are to be stored at 35°F. This will improve postharvest foliage color.
Azalea	Stop fertilizing 2-4 weeks before cooling to reduce leaf browning.
Exacum	Reduce fertilizer levels during production to increase postharvest longevity.

[Z]McAvoy, R.J. 1995. *Connecticut Greenhouse Newsletter*, Issue 184, February/March.

Goal 2. Stop or limit the loss of nutrients from containers during topwatering in an open system.

The term "open system" refers to crop systems which allow any effluent from irrigation and leaching to escape from the pot to the greenhouse floor. "Closed systems" are those which contain the effluent for

treatment or reuse (e.g. an ebb and flood subirrigation bench). Most growers in New England use an "open system" to grow plants, but many greenhouse operations have adopted subirrigation systems including bench systems and flood floors.

Controlled-release fertilizers. The major advantage of using controlled-release fertilizers (CRFs) is that the loss of nutrients from spills during fertigation is completely eliminated. However, improper product selection and high application rates can lead to nutrient leaching from containers as high with CRFs as water-soluble fertilizers.

Most of the excess nitrate leaching with CRFs occurs right after planting during the early stages of growth. CRFs are best used at low or medium rates according to the manufacturer's label. Also, research has shown that topdressing a portion of the CRF several weeks after planting rather than incorporating all of it prior to planting can reduce nutrient leaching.

Stop or limit leaching. This is tough to achieve when overhead watering with a hose because it requires precise control of the volume of irrigation solution applied. Traditionally the recommendation has been to water until about 10-15% of the volume applied drains from the pot to avoid excess soluble salts. In today's terminology this is described as a 0.1-0.15 "leaching fraction" (LF). Many growers probably exceed this LF; probably LFs of 0.4-0.6 are more common. The goal is to achieve a LF of zero, but for many getting the LF down to the recommended range of 0.1-0.15 would be a big step in reducing greenhouse runoff.

The best way to stop or limit leaching in an open system is by the use of a carefully-controlled spaghetti-tube irrigation system with drip emitters. Irrigation solution should be applied slowly and in small volumes for the best results. Also, researchers have found that "pulse irrigation" - brief periods of fertigation - is best for efficient application of water and nutrients. Achieving 0 LF with a hose is probably impossible, but reducing LF is possible if the waterer takes the time to observe how much water is applied or how much time passes before leaching begins as each pot is watered.

It is important to remember that if LF is reduced or there is no leaching, more fertilizer will stay in the pot and soluble salts could increase to a harmful level. So, soluble salts should be monitored more frequently when leaching is stopped or cut back.

Low phosphorus fertilizers. Most researchers agree that the typical greenhouse fertilizer program provides significantly more P than crops require. There are several fertilizers with low P analysis (e.g., 15-0-15, 20-1-20, 20-2-20) on the market which could be included in a routine fertilizer program to reduce P enrichment of effluent. Also, incipient P deficiencies can have a desirable growth-retarding effect on many bedding plants without any foliar symptoms or major delay in development. Like chemical growth retardants low P has the greatest growth inhibiting effect during the early stages of vegetative growth.

Organic fertilizers. Use of organic fertilizers is an important sustainable practice currently being tried by some growers. According to recent research at UMass both liquid and dry organic fertilizers can have significant effects on the amount of nutrient leaching. Unfortunately, low nutrient leaching sometimes reflects a lack of adequate nutrient release for the plants. In some cases more nutrient leaching occurs with organic than chemical fertilizer. The cause is probably poor growth response and less nutrient uptake by the plants fertilized with organic fertilizer. Best growth results and lowest leaching occur when plants are fertilized by two different organic fertilizers on an alternate schedule.

Goal 3. Stop or limit nutrient and water loss from irrigation and leaching by containing the effluent.

Subirrigation and reuse. This is the best method for eliminating runoff from the greenhouse and increasing water and fertilizer efficiency because all of the liquid is contained in the system by a water-tight growing area or in a supply tank. Unfortunately this is also the most expensive approach. Since no

leaching occurs fertilizer rate and EC must be monitored to prevent excess soluble salts. Fertilizer rate should be about 25-50% less than conventional topwatering in an open system.

Water and fertilizer are lost during fertigation from overhead systems as the hose or boom moves between pots. These "spills" may account for as much as 60% of the water and nutrient loss during topwatering. Large improvements can be made here at relatively low cost.

Container spacing. Take some empty round pots and space them pot to pot. Even at this spacing there is a lot of space for irrigation solution to spill as the pots are watered. Some improvement can be made by staggering the rows of pots. Much greater improvement can be made by using square pots and tray to tray spacing of bedding plants. But, did you ever grow poinsettias pot to pot all the way to flowering? Probably not! So, while close spacing reduces water and fertilizer loss, there are only certain crops that will end up of acceptable quality when spaced pot-to-pot.

Saucers and trays. Various types of saucer or collection tray systems can be used to reduce loss from spills between pots and the use of saucers is also an inexpensive way to learn about subirrigation. Some saucers are designed to cover most of the space between the pots, channel the water to the base of the pot, and capture leachate. Simple round saucers hold leachate but are much less effective at capturing spills. Round saucers could be filled with fertilizer solution for subirrigation.

Fertilizer rate (ppm) and/or application frequency should be reduced in saucer and tray systems because whatever is held in the saucer can be absorbed or reabsorbed by the pot as the growth medium dries. Also, plants could become overwatered if the solution stands in the saucer for too long.

Capillary mats. These have been used for many years for watering and fertilizing plants by subirrigation. They may also be used to irrigate potted plants amended with CRF. A slightly different use would be to topwater the plants and rely on the capillary mat to soak up and hold any spills or effluent from the pots. Of course cap mats can absorb only so much water before they start to drip, so watering must be done carefully. Perhaps this is a way of learning to efficiently apply water with a hose and reduce LF.

Many of the methods of reducing greenhouse runoff proposed here require some adaptation to new methods of growing plants, varying amounts of capital investment, and certainly more attention to detail than current practices. However, there is still time to experiment and learn and in the long run a proactive, incremental strategy will be the least difficult way of implementing sustainable fertilizer practices.

Reference books

Two books will help growers control greenhouse and nursery runoff and provide general guidance in the use of fertilizer and water in greenhouse and nurseries, they are:

Water and Nutrient Management for Greenhouses**,** NRAES-56, Cooperative Extension, 152 Riley-Robb Hall, Ithaca, NY, $20. http://www.nraes.org/

Greenhouse and Nursery Water Management Practices to Protect Water Quality. Pub. 3508. Agr. Nat. Resources, Univ. of Calif., Oakland, CA. $20. http://anrcatalog.ucdavis.edu/Items/3508.aspx

Literature Cited

Cox, D.A. 1985. Nitrogen recovery by seed geranium as influenced by nitrogen source. *HortScience* 20:923-925.

McAvoy, R.J. 1995. Managing nitrogen in greenhouse crops: Nitrogen sources, crop fertility, and water quality. *Conn. Grnhse. Newsletter* 18

2011 MassHort Elm Bank Trial Gardens

The Massachusetts Horticultural Society in cooperation with the Massachusetts Flower Growers Association, the Massachusetts Master Gardeners and volunteers have grown another beautiful trial garden this season. With entrees from Ball Seed, Ball Floral Plants, Ball Selecta, Pan American Seed, Kieft, Pleasant View Gardens and Bejo Seed. Also we thank Griffin Greenhouse Supply and The Scotts Co., Farfard, and Daniels Plant Food. Again this year we are trialing perennials from Terra Nova, Pleasant View Gardens, Blooms of Bressingham, Ken James Greenhouse and Darwin Perennials. We have over-wintered our first set of perennials and have another in the beds to evaluate this season.

Remember that the Trials at Mass Hort need your participation and we need you to stop in and see the trials and to show that they are important to the Green industry here in the northeast. We want the trials to grow and to have the top breeders and growers to send us their newest and best plants to trial here to see how they take our environmental conditions. This will only happen if you use our trial gardens and tell your suppliers that you saw the plants here. Thank you again for giving us the opportunity to showcase the New England Trial Garden here at the Massachusetts Horticultural Society Gardens at Elm Bank.

We started sowing seed in early February and they were transplanted into 4" pots and into 4 packs around the 2nd week of March. We planted all with a new Farfard Mix called TT, new to us and we had good results with it. Thanks again to Matt Hemmel and Farfard, Syngenta for their mix. A soil test was done and compost and lime were added and tilled in. May was a tough month in the greenhouse with a lot of botrytis. We only got 30% of total sunshine in the month and colder than normal. June was very up and down in temperature and rainfall also very humid conditions and plants were affected.

For information about the Trial Gardens contact David Fiske at (617)835-6365 or dfiske@masshort.org

2011 Top Plants at Elm Bank

Perennials (overwintered)

Sedum	Chocolate Drop	Terra Nova
Coreopsis	Crème Brulee	Blooms of Bressingham

Perennials

Hypericum	Hypearls Olivia	Blooms of Bressingham
Verbena	Vervain Lillipop	Blooms of Bressingham
Echinacea	Double Scoop Bubble Gum	Darwin
Echinacea	Hot Coral	Darwin
Helianthus	Gold Lace	Terra Nova
Coreopsis	Salsa	Proven Selections

Annuals

Osteospermum	3D Silver	Ball Selecta
Geranium (Zonal)	Allure True Red	Ball FloraPlant
Petunia	Supertunia Raspberry Blast	Proven Winners
Petunia	Supertunia Sangria Charm	Proven Winners
Begonia	Whopper Red Green leaf	Ball Seed
Coleus	Wasabi	Ball FloraPlant
Lantana	Luscious Lemonade	Proven Winners
Ipomoea	Sweet Caroline Raven	Proven Winners
Verbena	Superbena Royal Iced Cherry	Proven Winners
Verbena	Superbena Coral Red	Proven Winners

Registration for Plant Nutrition for Greenhouse Crops Program

Registration deadline is October 28, 2011. Registration includes coffee breaks and handouts.

Names_____

Firm _____

Email address_____Telephone _____

Make check payable to University of Massachusetts and mail to Tina Smith, Greenhouse Plant Nutrition Program, 203 French Hall, Univ. of Massachusetts., Amherst, MA 01003

Tree Production for Landscapes: Preliminary Research Result for Planting Methods

October 20, 2011

9:00 AM - 12:00 PM

Amherst Nurseries, 199 Belchertown Rd (Rte. 9), Amherst, MA

Join us for a tour of Amherst Nurseries where Dan Lass, UMass Isenberg School and Cathy Neal, Extension Nursery Specialist, UNH will discuss research results of three different tree production methods: field grown (B&B or bare root trees), pot-in-pot, and in-ground fabric containers. Trees will be harvested and roots processed to compare the three different methods of tree production. In addition to the trials, planting cost differences and summaries of survey results will be presented. A survey of landscape and nursery professionals was conducted this year to assess current attitudes and demand for trees being grown using the three different methods.

Register by contacting Tina Smith, UMass Extension by phone (413)546-5306 or email tsmith@umext.umass.edu

This program is sponsored by a *grant from the USDA National Institute of Food and Agriculture in cooperation with University of Massachusetts Isenberg School of Management, University of New Hampshire Extension and University of Massachusetts Extension Agriculture and Landscape Program*
details see: http://extension.umass.edu/floriculture/

Contact UMass Floriculture Extension Staff

Douglas Cox Floral Notes Editor dcox@pssci.umass.edu
Tina Smith Outreach Educator tsmith@umext.umass.edu
Paul Lopes Outreach Educator lopes@umext.umass.edu