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Floral Notes Newsletter

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In This Issue

Geoffrey Njue joins UMass Extension

Geoffrey is housed at the Cranberry Station in East Wareham. As a green industry specialist he will be available to work with the greenhouse, nursery and landscaping industry to provide education programs and research based information. Geoffrey has broad experience with Extension and the agricultural and green industry. He worked most recently as commercial horticulture field specialist for South Dakota State University Extension.

He worked with greenhouse and nursery growers and commercial fruit and vegetable growers to identify areas of need, provide educational programs and research based information, and assist with specific production problems. Prior to joining South Dakota State University Extension Geoffrey worked for 11 years at the University of New Hampshire Cooperative Extension as an Agricultural Extension Educator with responsibility for ornamental horticulture in two counties. His responsibility included working with ornamental horticulture clientele and fruit and vegetable growers to provide education programs and research based information. He also coordinated the Master Gardener program and served as County Extension office Administrator.

Geoffrey's education includes a Master's Degree in Greenhouse Horticulture from Wageningen University in the Netherlands and Bachelor's Degree in Horticulture from Egerton University in Kenya.

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Update on Biocontrol on Poinsettias

Tina Smith, UMass Extension & Leanne Pundt, UConn Extension[z]

Start with plants free from pesticide residues

Wholesale stock plants, cutting producers and rooting stations of poinsettias are encouraged to use IPM practices and pesticides that are compatible with biological control agents (BCA) or use BCAs during propagation. This will help customers who are planning to use BCAs during production. It would also be helpful to provide a list of pesticides used on the crop. To find out if a pesticide is compatible, use one of the on-line searchable side effect data bases available from suppliers. Click on "Side Effects" Enter product and natural enemy to search. Biobest (http://www.biobest.be/home/3) Koppert (http://www.koppert.com/)

Note: Last year, Koppert, Canada collected leaf samples of cuttings that arrived at a few rooting stations in Canada. The samples were then sent to a pesticide residue laboratory in Holland. Test results showed that 24 or more active ingredients of insecticides and 20 fungicide residues were detected on the cuttings. See the article recently published in GPN magazine: Whitefly Trouble in Poinsettia Production (http://www.gpnmag.com/whitefly-trouble-poinsettia-production)

If you are buying in cuttings and plan to root them, knowing the pesticide and pest history of your cuttings is crucial to prevent failures using biocontrol due to pesticide residue on cuttings. Pesticide residues can negatively affect BCA's for many weeks after arrival of the cuttings on the rooting benches and plugs on the finishing benches. It is unknown how quickly the misting at the rooting stage washes off non- systemic chemicals that were previously used on stock plants. In the worst case scenario, some long term residual chemical products may alter BCAs establishment on the first generation of whitefly.

Start clean, finish clean

Experience based upon case studies has shown that growers that have initial whitefly populations on less than 5-7% of their plants (total for all stages of development) are more likely to finish the crop with less than 20% infested plants, whether they use biological or chemical controls. Growers that start with more than 5-7% of plants with whitefly are likely to finish the crop with greater than 20% of infested plants. If growers have more than 20% infested plants at finishing, they may need pesticide cleanup treatments before shipment.

Controversy: Dipping unrooted and rooted cuttings

Some Canadian growers are dipping rooted and unrooted poinsettia cuttings using Botanigard WP (**not** ES formulation) plus Rootshield to reduce whitefly infestations and begin their biocontrol program with cleaner plants. The ES formulation of Botanigard is phytotoxic to poinsettias. Both pesticides are labeled for use for dipping (in US) and are safe to use with parasitic wasps for whitefly. The process of dipping plants has been controversial due to the risk of spreading disease and is not advised by plant pathologists. Growers that dip cuttings believe that they can treat for disease more successfully than they can treat for whitefly, which are becoming more and more resistant to insecticides. The reason that growers dip is to get thorough coverage of the material that sprays can miss (ie. lower leaves that are curled under). They try to minimize the risk for spreading disease when dipping by following these guidelines:

- Mix separate solutions and dip separate batches from different suppliers.
- **Never** use left-over dip solution for treating plants.

Botanigard WP (*Beauveria bassiana*) is a contact biological insecticide. The applied spores infect directly through the outside of the insect's cuticle. Spores adhering to the host will germinate and produce enzymes that attack and dissolve the cuticle, allowing it to penetrate the skin and grow into the insect's body. As the insect dies, it usually changes color to pink or brown, and eventually the entire body cavity is filled with fungal mass. The most common sign of insect death is a discoloration of the larvae or pupae. But, not all infected larvae become discolored.

The biofungicide Rootshield contains *Trichoderma harzianum*, strain T-22 that protects roots from many pathogens such as *Pythium, Fusarium, Rhizoctonia, Thielaviopsis,* and *Cylindrocladium.* The fungus releases enzymes that dissolve the cell wall of many fungal pathogens. RootShield is a preventative biofungicide and only grows on the outside of roots and does not enter the plant tissue. It will not be effective against existing disease.

Ontario Case Study: Whole plant monitoring

Case studies in Ontario of greenhouse poinsettia growers using biocontrols provide some good tips for success. Here's a summary:

Monitoring is best carried out using whole plant observation, not just sticky cards. The underside of leaves should to be carefully inspected for the presence of late instar immature whiteflies or adults. Whole plant monitoring determines the % of plants on which live whitefly are found. If even a single whitefly is found on a plant, it is recorded as an infested plant.

However, sticky cards can be useful for detecting localized infestations, or help to detect where a population of whiteflies originate.

At least 100 plants per acre (more in smaller greenhouses, with a minimum of 10 plants per bay) were inspected in the study. Plants from each variety were monitored. Whitefly may be present in greater numbers on one variety or one shipping date or supplier from very early on. That variety remained a focal point of infestation throughout the duration of the crop.

New England note: Instead of identifying species, some growers have been using a combination of the two parasitoids with mixed success. The immature stages are used to identify the species of whiteflies to be able to choose the most effective parasitic wasp. It is difficult to identify the species of whiteflies on sticky cards. It is best to identify the species and choose the most effective biocontrol agent for that species.

Release rates

In the Ontario project, the primary BCA for control of *Bemisia tabaci* (Sweet potato whitefly, including the Q biotype) was *Eretmocerus mundus*, or *Eretmocerus eremicus* at @ 0.3/ft ^{2}/week for 12 weeks. After 6 weeks the program was assessed to decide whether further introductions were needed for the next 6 weeks. For Greenhouse whitefly, *Encarsia formosa* was introduced at half the rates of *E. mundus* and for the same duration.

Thresholds at time of shipping

The monitoring program was generally finished in the first week of November. At that time, any crop with less than 20% infested plants did not receive pesticide treatments. In most cases, infested plants had only 1-2 whiteflies. If more than 40% infested plants were found, they received cleanup insecticides before shipping. There was a grey area between these two levels, but from observation, most crops with between 20-30% infestation levels, were unlikely to need additional whitefly controls before shipping. Above 30% and it becomes more problematic.

A good summary of the project is available at:
http://www.omafra.gov.on.ca/english/crops/hort/news/grower/2010/02gn10a1.htm

2012 Research - Timing of Introductions, Rate of Introduction and Costs
http://www.gpnmag.com/sites/default/files/05_PoinsettiaResearch_GPN0313%20FINAL.pdf

[z]Input from Sebastien Jacob and Ron Valentin of Biobest and Graeme Murphy, IPM Specialist, Ontario

UMass Soil and Tissue Testing

UMass Extension offers a variety of soil test options.

Greenhouse Soil Testing Submission forms and more info:
http://extension.umass.edu/floriculture/services/soil-testing

For forms for other crops and landscapes see: www.umass.edu/soiltest

Here is a summary of options for commercial greenhouse crops and flower growers:

Soilless Media Test $15.00

Includes pH and lime requirement, levels of available plant nutrients, soluble salts, and micronutrients. Recommendations are written on the report by Dr. Doug Cox and mailed to you.

pH Test $5.00

Soluble Salts Test $5.00

pH and soluble salts tests are the same tests performed as part of the soilless media test.

Standard Soil Test for (Outdoor) Field Grown Crops $10.00
Includes pH, levels of available plant nutrients and several micronutrients. $5.00 Soil organic matter.

Water pH and EC $8.00

Soil Sampling for Greenhouse Crops

We have a new video available on soil sampling: http://www.youtube.com/UMassFloriculture

Send soil or tissue samples, with a check made payable to the University of Massachusetts, to:

Soil & Tissue Testing Lab
West Experiment Station
682 North Pleasant Street
University of Massachusetts
Amherst, MA 01003-9302
(413) 545-2311

2013-2014 NEW ENGLAND GREENHOUSE FLORICULTURE GUIDE

A comprehensive guide for commercial production of greenhouse ornamentals with information on current pest management and growth regulators. Recommendations include IPM and biological control information for greenhouse crops. This manual is a compilation of input from the members of the New England State University Extension Systems of Massachusetts, Maine, New Hampshire, Vermont, Connecticut and Rhode Island and Raymond Cloyd of Kansas State University

$40 includes shipping -Ordering Information
Call the UMass Extension Bookstore at 413-545-2717 or print an order form to mail at:
http://extension.umass.edu/floriculture/pest-management/new-england-pest-management-guide

Response of 'First Lady' Marigolds to Plant Extract Fertilizers, Granular Organic Fertilizers, and Biochar

Douglas Cox
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In recent years I've have written articles about my work with organic fertilizers as alternatives to traditional water-soluble chemical fertilizers (Cox, 2010; Cox and Eaton, 2011; Cox, 2013; Eaton, et al., 2013). Not surprisingly, because of their differences in the makeup, success in growing acceptable greenhouse crops has been variable. However, one thing does seem clear: organic fertilizer combinations work better than relying on one type alone.

I've worked with several types of soluble organic fertilizers manufactured from extracts of sugar beets and a granular fertilizer made from poultry waste materials. Results were reported in the June 2013 issue of *Floral Notes* (Cox, 2013).

Recently a type of charcoal called "biochar" has caught the attention of soil scientists, farmers, and the environmental community. Biochar may be useful for soil improvement, increasing nutrient retention, and slowing global climate change. Some suggest that biochar in potting media would reduce nutrient leaching, but there hasn't been any research evaluating biochar for use in potting media. If biochar could be used along with organic fertilizers it might prove to be a simple and low cost way of reducing nutrient leaching. In this project biochar was used with several organic fertilizers to determine what effects the treatments might have on growth and nitrogen leaching in potted crops. The project was supported by grants from New England Floriculture, Inc., Massachusetts Flower Growers' Association, and the New England Florist Credit Endowment.

What is biochar?

Biochar is a type of charcoal made from burning organic matter with a minimum of oxygen. Less refined than standard charcoal, biochar is made from agricultural wastes, food processing wastes, and tree trimmings. The biochar used in this study was made by the Ideal Compost Co. of Peterborough, NH from spruce and fir tree trimmings. The burning process effectively ties up ("sequesters") the carbon in a highly stable, complex structure preventing its release as CO_2 to the atmosphere as it would during normal burning or natural decomposition. Environmentalists believe that biochar might be one way of reducing atmospheric CO_2 thus slowing global change. Biochar is not a fertilizer, but nutrient retention is one of its valuable properties.

How the plants were grown

'First Lady'marigold plugs were potted on 30 January 2013 in 4½-inch pots of Fafard 3B soilless mix. Prior to planting, biochar was incorporated in the mix at a level of 20% by volume. Pots were suspended through the lids of larger containers to collect the leachate for ammonium (NH_4-N) and nitrate (NO_3-N) analysis at 10 day intervals as the plants grew.

Plants were fertilized with 250 ppm N from Plantex (20-2-20) chemical fertilizer or Espartan (2.7-3.03-2.6) plant extract fertilizer (fermented sugar beet molasses). In another treatment, Sustane (8-4-4) granular fertilizer (aerobically composted turkey litter, hydrolyzed feather meal, and potassium sulfate) was incorporated in the growing mix of one-half the pots in each fertilizer treatment prior to planting at a rate of 7.6 gm/pot (0.27 oz./pot). Also, Espartan was applied in combination with Sustane. In this treatment Espartan was applied at every other watering. The same amount of

nitrogen (N) was supplied by all fertilizer treatments. In the combination treatments one-half of the N was supplied Espartan and the other half by Sustane. Plants in all treatments were irrigated with the same amount of fertilizer solution or plain water during the experiment.

Plant height and first flower diameter were measured and the plants were harvested for shoot dry weight determination 4 April, 60 days after transplanting.

Results

Plant appearance and growth. In general, plants in all treatments were normal in appearance. Plants fertilized with Espartan were darker green and the leaves had a slightly wilted appearance, however the leaf chlorosis exhibited by seed geraniums in an earlier experiment (Cox, 2013) did not occur on marigolds.

The tallest plants with the greatest dry weight were those fertilized with Plantex while those plants fertilized with Espartan were the shortest and had the least dry weight (Table 1). The Sustane treatments and Espartan alone had the smallest flowers. Combining Espartan and Sustane produced larger plants than Espartan alone. Overall Biochar had no effects on the growth parameters measured in this study (Table 2).

Table 1. Growth of 'First Lady' marigold as affected by different types of fertilizers.

Fertilizer	Plant hgt. (cm)	Flower dia. (cm)	Dry wt. (gm)
Plantex 20-2-20	25.1a	8.5a	16.8a
Plantex + biochar	25.1a	8.4a	16.5a
Sustane 9-4-4	22.9b	7.9b	13.4bc
Sustane + biochar	23.8b	7.6b	13.8bc
Espartan 2.7-3.0-2.6	21.0c	7.5b	10.5e
Espartan + biochar	21.6c	8.2a	11.5de
Espartan + Sustane	22.4b	8.2a	12.7cd
Espartan + Sustane + biochar	23.5b	8.4a	14.4b

Table 2. Growth of 'First Lady' marigold as affected by biochar in the growing medium.

Biochar	Plant hgt. (cm)	Flower dia. (cm)	Dry wt. (gm)
No	22.9	8.0	13.4
Yes	23.5	8.1	14.0
Significance	ns	ns	ns

Water use and nitrogen leaching. Since the same volume of fertilizer solution and water was applied to each treatment the total leachate volume is an indicator of water use by the plants in each treatment (Table 3). Leachate volume was lowest with Plantex and the combination of Espartan + Sustane with biochar. This result is a reflection of the fact that plants had greater dry weight than plants in the other treatments. Presumably more water was absorbed by these plants and less was available for leaching.

Fertilizer treatment had a great effect on N leaching. The least amount of total N (NH_4-N + NO_3-N) leached occurred with Plantex. The largest amount of total N leaching occurred with Espartan alone with or without biochar followed by the Espartan + Sustane combination with or without biochar. NO_3-N leaching was greatest Plantex while NH_4-N leaching was greatest with Espartan with or without biochar.

Overall, biochar significantly reduced NO_3-N leaching by 35%. However, adding biochar to the growing mix had no effect on leachate volume, total N leached, or NH_4-N leached.

Table 3. Water use and nitrogen leaching by 'First Lady' marigold treated with different types of fertilizer.

Fertilizer treatment	Total leachate vol. (ml)	NH_4-N (mg/pot)	NO_3-N (mg/pot)	Total N (mg/pot)
Plantex 20-2-20	600.4c	8.6d	90.5a	99.2d
Plantex + biochar	548.1c	7.3d	38.4cd	45.9e
Sustane 9-4-4	1317.7a	67.7c	44.6c	112.3cd
Sustane + biochar	1123.1b	58.8c	28.4d	87.2d
Espartan 2.7-3.0-2.6	1400.3a	177.9ab	60.9b	264.5a
Espartan + biochar	1393.9a	217.1a	54.5bc	271.7a
Espartan + Sustane	1070.4b	91.2bc	57.5b	148.6b
Espartan + Sustane + biochar	745.3c	81.8c	46.4c	128.1bc

Table 4. Water use and nitrogen leaching by 'First lady' marigold as affected by biochar in the growth medium.

Biochar	Total leachate vol. (ml)	NH_4-N (mg/pot)	NO_3-N (mg/pot)	Total N (mg/pot)
No	1097.2	86.4	63.4	156.2
Yes	952.6	91.3	41.0	133.2
Significance	ns	ns	**	ns

Conclusions: What does it all mean?

Plant growth, flowering, and dry weight were similar for all treatments, but clearly the largest plants resulted from Plantex. The Espartan plants were darker green than plants treated with other fertilizers and had a slightly wilted appearance. In my opinion, this is probably due too much ammonium which is a characteristic of fish emulsion and plant extract fertilizers. This “ammonium toxicity” is supported by the large amount of NH_4-N in the leachate of Espartan plants. For this reason it’s best to use Espartan or any other soluble organic fertilizer be rich in NH_4-N with another fertilizer like Sustane which has a slower nutrient release rate. No chlorosis occurred on the marigolds unlike the seed geraniums in the earlier study (Cox, 2013).

Biochar reduced NO_3-N leaching by 35%, but did not affect growth parameters, leachate volume or N leaching. From my point of view the reduction in NO_3-N leaching is quite important, but I’ve done experiments similar to this one with biochar and the effects on NO_3-N leaching have been very inconsistent with reductions ranging from <5 to 40%. I think this inconsistency is mainly due to plant growth rate as it is affected by daylength and greenhouse temperature. Rapidly growing plants under increasing daylength and greenhouse temperature of the spring probably take up NO_3-N fast

enough to limit NO_3-N leaching and the effect of biochar on leaching isn't as apparent compared to slower growing plants in the late fall and winter period. Since biochar doesn't seem to have any other positive effects on the growth of plants, I can't recommend it at this time for containerized greenhouse crops. Biochar isn't free since it takes heat energy to make it and it's probably the most dusty material I've ever used in the greenhouse. If you plan to try biochar you need at least a dust mask and you should do mixing outdoors or in a well-ventilated environment where nothing can be hurt by fine particulates.

References

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Cox, D.A. 2010. Calibrahoa response to chemical and organic fertilizers. *Floral Notes*. 23(1):2-4.

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Clean-up of Two-spotted Spider Mites

It is important to clean up two-spotted mite infestations prior to fall to minimize infestations next spring.

Two-spotted spider mites (TSSM) multiply fast during warm temperatures and are common on greenhouse tomatoes, garden mums and on perennials. It takes about 28 days to develop from egg to adult at cool temperatures (50-68F) but only about 8 days at 77-95F. For example at 60F, one spider mite female can result in 20 mites after one month, at 70F there will be about 12,000 mites and at 80F 13,000,000 mites! Since they can develop very quickly, it is important to monitor crops and treat early.

Do not allow infested weeds, unsold plants and greenhouse crops to remain in the greenhouse. The mites in your greenhouses now will be the same ones you will have on spring crops.

Two-spotted spider mites enter hibernation (diapause) in the fall when day-length shortens and evening temperatures drop. During diapause, the mites change color, turning orange to orange-red and walk off plants to hide in cracks and crevices in the greenhouse. As soon as temperatures are favorable in the spring, they slowly come out of diapause and move to the nearest plants. This is the reason that growers have a mite problem beginning in the same areas each year. In a diapause state, spider mites are more resistant to chemicals and are not as attractive to most beneficials. To reduce TSSM populations next spring be sure to clean up greenhouses and manage mites now. When removing infested plant material from greenhouses, be sure that cull piles are located far away from greenhouses as possible.

See: 2013-2014 New England Greenhouse Floriculture Guide. The guide can be ordered from the University of Connecticut or University of Massachusetts.

New England Vegetable Guide: Greenhouse Tomatoes – Insect Section: http://nevegetable.org/crops/insect-control-25