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Floral Notes NEWSLETTER

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NEW Resources: UMass Extension Greenhouse Crops & Floriculture

UMass Extension Greenhouse Crops and Floriculture program is now on Facebook. Search for "UMass Greenhouse Crops and Floriculture" on Facebook, "like us" and write a comment!

Each year about 135,000 visit our UMass Extension Greenhouse Crops and Floriculture website. If you are one of them, you may have noticed that the site became a little dated. However, recently we just launched a completely revamped site that is easy to use with much updated content. Check it out! https://extension.umass.edu/floriculture/

CNS Research and Education Greenhouse

New UMass Greenhouses Close to Completion!

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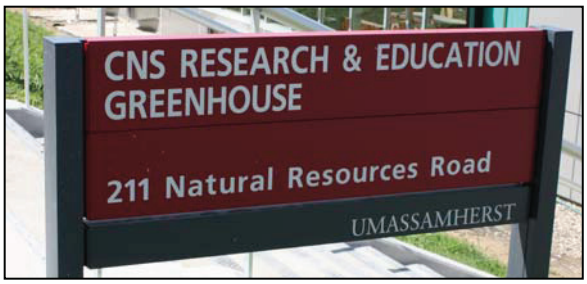

New UMass Greenhouses Close to Completion!

The new College of Natural Sciences (CNS) greenhouse complex will be complete and in use for teaching and research early this fall. About 12,000 ft^2 of new Stuppy guttered-connected greenhouses arranged in two units with a central corridor are currently being fitted out with environmental controls, hot water heat, humidification system, fans and evaporative coolers, mechanical shade, HID lights, and benches. The vents are screened and ventilation is by positive pressure through the small fans visible on the sides and larger fans in the evaporative coolers (one of which can be seen in position in the picture). Maintaining positive pressure will exclude thrips.

A new headhouse is located at the north end of the greenhouse. The headhouse containing two labs, a potting room/classroom, growth chambers, and mechamical support and is connected to the original Bowditch Hall greenhouse by an enclosed walkway. The old greenhouse is being upgraded with new benches, mechanical shade, HID lights, new fans, and motorized vents.

Powdery Mildews of Ornamental Plants

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Powdery mildews are one of the most common diseases of ornamental plants; many nursery, flower, and woody plants are susceptible. Greenhouse crops prone to infection include African violet, *Begonia* , *Dahlia* , gerbera daisy, *Hydrangea* , roses, *Verbena, Kalanchoe*, and poinsettia. Herbaceous perennials particularly susceptible to Powdery mildew include *Aster, Centaurea, Coreopsis, Delphinium, Monarda, Phlox, Rudebeckia, and Sedum.*

The disease is easily recognizable as a **white to gray powdery growth** on leaves and sometimes stems and flowers. Powdery mildew may have little or no affect on the plant (other than aesthetic) or it may cause infected leaves to distort, discolor, wither, and defoliate prematurely. Most Powdery mildews have evolved to avoid killing their hosts because they can only survive in living plant tissue. Symptoms and their severity depend upon the cultivar or species of host plant, the powdery mildew species, environmental conditions, and the age of plant tissue when it first became infected. Powdery mildew diseases are caused by species of fungi such as *Erisyphe, Leveillula, Microsphaera, Podosphaera, Odium,* and *Sphaerotheca,* although each powdery mildew is specialized to infect only hosts in one genus or one family. Infection does not spread to species of plants in other plant families. *Erisyphe* has a wide host range and can infect many plants in the *Asteraceae* family, while *Sphaerotheca pannosa* var. *rosae* is confined to roses.

The distinctive whitish powder on leaves is composed of fine threads of fungal vegetative tissue (mycelium) and light colored mats of asexual spores (conidia). Some Powdery mildews produce conidia on short, erect branches that resemble tiny chains, while others form threads so sparse that the mildew cannot be seen without the aid of a microscope. These spores are easily moved by air movement and water splash. Because Powdery mildews are obligate parasites, they do not require plant stress or injury to infect plants. When spores land upon a susceptible host, they germinate and send a specialized feeding structure into the epidermis and obtain their nutrients from the plants. The infection process may take as little as 3 days or as long as 7 days. The pathogen survives in the greenhouse in weed hosts or on crops. Outside, the pathogen can overwinter as mycelium in infected plant parts or in resting structures (cleistothecia) produced by sexual means and visible as small, dark specks on dying leaves. Powdery mildews, unlike most other fungal diseases, do not need free water to germinate and infect. They are favored by high relative humidity (greater than 95%), moderate temperatures (68°-86° F), and low light intensities. The disease is more prevalent in the spring and fall when large differences between day and night temperatures occur. Temperatures above 90° F kill some Powdery mildew fungi and spores and the presence of free water can reduce spore germination.

Monitor crops on a regular basis for Powdery mildew diseases. Epidemics that seem to develop overnight are often the result of undetected low level infections that have spread spores throughout the greenhouse. Rogue infected plants or prune out diseased tissue. Perform this operation when plants are wet or immediately place diseased material into a plastic bag to prevent spores from spreading. The use of resistant cultivars or species is a good management tactic. Although few ornamental crops have been bred for resistance, cultivars of African violet, *Begonia,* rose, pansy, *Zinnia, Monarda,* and *Phlox* with resistance are available. Avoid overcrowding of plants and provide good air movement. Keep relative humidity levels low in the greenhouse by a combination of heating and venting in late afternoon and early morning. Clean greenhouse thoroughly between crops, eliminating all weed hosts and volunteer plants. Unlike most fungi, powdery mildews only colonize the surface of plants making chemical eradication possible. It is not necessary to use fungicides to prevent Powdery mildews. Fungicides with the active ingredients propiconazole (Banner Maxx), myclobutanil (Eagle, Systhane), triadimefon (Bayleton, Strike), fenarimol (Rubigan), thiophanate

methyl (Cleary's 3336), potassium bicarbonate (Armicarb, MilStop), or sulfur are registered for Powdery mildew control on ornamentals. Sulfur may cause plant injury if applied when temperatures are high (greater than 85° F). Because the genera and species of fungi causing Powdery mildews are diverse, there may be some variation in fungicide effectiveness across crops. The Powdery mildew fungi can develop resistance to any of the fungicides, except sulfur, listed above so be sure to alternate fungicide applications among chemical classes.

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Insect-killing Nematodes and Thrips Control

Many different species of insect-killing nematodes are available for soil dwelling pests. (Insect killing nematodes are very sensitive to ultra-violet light and desiccation). Growers have been successfully using *Steinernema feltiae* (Nemasys, Nemashield, ScanMask) as a drench against fungus gnat larvae, especially in propagation areas. *S. feltiae* also attacks the pupal and prepupal stages of western flower thrips that are primarily found in the growing media. (However, some thrips may also pupate in chrysanthemum flowers).

Nematodes have been promoted for controlling the above ground stages of thrips. Cut chrysanthemum growers in Canada and the UK have successfully used *S. feltiae* against thrips with weekly sprays. Special precautions are taken to help reduce potential desiccation: use of a non-ionic wetting agent, spraying in the late afternoon or evening, and the use of black cloth.

Although all stages were susceptible to infection, Buitenhuis and Shipp (2005) (see links below) found that the prepupae and pupae stages were most susceptible to infection by *S. feltiae.* During the weekly sprays, a significant number of nematodes reached the growing media via runoff from the foliar sprays. Nematodes are very short lived on the foliage (significant reduction after one hour) but may persist for several weeks in the media.

In this study, significant kill of the 1st and 2nd instar larvae, was only obtained at very high rates of application (~13 to 26x the recommended rate used for ornamentals in greenhouses), which may not be cost effective. The mobile adults and larvae may escape infection. Immobile adults were killed.

Grower feedback has been variable, with some observing very good results and others less so. Efficacy will be variable depending upon the relative humidity, and temperature in your greenhouse, dose applied, frequency of application, and life stage of the thrips. Applying the nematodes as a heavy surface spray or "sprench" to young, incoming plant material will have an added benefit of targeting any incoming fungus gnats in the media as well as thrips pupae.

Nematodes also need to be alive in order to be effective. Place a small quantity of the nematodes into a shallow container, add a few drops of water, and look for the actively moving nematodes, which will have a slight 'T' curvature. Place the container against a black background, so it is easier to see the nematodes.
Leanne Pundt, University of Connecticut

Organic Fertilizer Use Leads to Different Growth Response, Nutrient Use, and Nitrogen Leaching by Marigold 'First Lady'

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Some organic fertilizers are suitable for greenhouse crops and can also fit the current ways of applying fertilizers commercially. However, not much information is available on plant response, nutrient supplying power, or the environmental impact of nutrient leaching with organic fertilizers. Not surprisingly, because of their differences in the makeup, levels of success in growing acceptable greenhouse crops with organic fertilizers can be quite variable (Cox, 2010).

The organic fertilizers in this study were fish fertilizer, Daniels Pinnacle, and alfalfa pellets. Most growers are somewhat familiar with fish fertilizer and its characteristics. Daniels Pinnacle is a less well known water-soluble fertilizer; it's unique because its nutrients are derived from oilseed extract and sodium nitrate ("Chilean nitrate"). Biernbaum (2006) tried alfalfa meal as a fertilizer on bedding plants with some success. In this study I used alfalfa pellets (similar in appearance to wood pellets) commonly used for animal feed or outdoor soil improvement.

In working with organic fertilizers I have wondered whether fertilizer combinations might work better than one type alone. So I included several combination treatments in this study to try to take advantage of the best chemical and physical characteristics of each fertilizer. For example, perhaps the combination of soluble fish fertilizer and slow nutrient release alfalfa pellets might be a better choice than either alone.

The objective of this project, supported by a grant from New England Floriculture, Inc., was to learn more about the effects of organic fertilizers on the growth, nutrient uptake, and nitrogen leaching by a typical potted greenhouse crop.

How the plants were grown

Plug seedlings of 'First Lady' marigold were potted on 15 January 2010 in 4-inch pots of Fafard Organic Formula (FOF #30) soilless mix. 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 water-soluble Plantex (20-2-20) chemical fertilizer, Daniels Pinnacle (3-1-1), Neptune's Fish Fertilizer (2-4-1), or alfalfa pellets (5-1-2). Also, some fertilizers were applied in combination: Daniels + fish (alternating), Fish (at every 4th watering) + alfalfa pellets, or Daniels (at every 4th watering) + alfalfa pellets. The water-soluble fertilizers were applied at 175 ppm N during the first 30 days after transplanting and then 225 ppm N to finish. The alfalfa pellets were incorporated with the mix prior to planting at a rate of 30 gm (~1.0 oz.)/pot.

On 18 March, 62 days after transplanting, plant height, plant diameter, and terminal flower bud diameter were measured and the plants were harvested for shoot dry weight determination and recently-matured leaves were sampled for nutrient analysis.

Results

Plant appearance and growth. Plants fertilized with Plantex and Neptune's Fish were normal in appearance with dark green foliage associated with this type of marigold (Figure 1). Daniels Pinnacle and alfalfa pellets resulted in chlorotic foliage suggestive of N deficiency and a marked reduction in plant size in the case of Daniels Pinnacle. Plants grown with fertilizer combinations (Daniels + Neptune's Fish, alfalfa pellets + Neptune's Fish, or Daniels + alfalfa pellets, not pictured) were similar to those receiving Plantex or Neptune's Fish.

Figure 1 (Left to right). 'First Lady' marigold fertilized with Plantex 20-2-20, Neptune's Fish Fertilizer 2-4-1, Daniels Pinnacle 3-1-1, and alfalfa pellets 5-1-2.

Height of plants in all treatments, except Neptune's Fish, was about the same (Table 1). Plants getting fish fertilizer were slightly, but significantly, shorter. Plantex, Neptune's Fish, alfalfa pellets, and all combination treatments produced plants with similar plant and flower bud diameter. Plantex produced the greatest shoot dry weight. The smallest flower buds, smallest plant diameter, and the least dry weight resulted from the use Daniels Pinnacle.

Table 1. Growth of 'First Lady' marigold with chemical fertilizer or different types and combinations of organic fertilizers.

Fertilizer	Plant hgt. (cm)	Plant dia. (cm)	Bud dia. (cm)	Shoot dry wt. (gm)
Plantex 20-2-20	30.1a	37.5ab	7.1a	19.9a
Daniels 3-1-1	30.6a	29.3c	4.7b	8.5d
Alfalfa pellets 5-1-2	30.7a	35.1b	6.6a	14.7c
Fish 2-4-1	28.3b	36.7ab	7.5a	16.0bc
Fish + Daniels	30.9a	34.5b	7.3a	16.4bc
Pellets + Daniels	31.0a	35.4a	6.8a	15.0c
Pellets + Fish	31.1a	37.7a	7.6a	17.5b

Nitrogen leaching. Fertilizer material had a great effect on N leaching (Table 2). The largest amount of N leached with Neptune's Fish, mostly in the form of NH_4-N rather than NO_3-N. Lesser amounts of N leached with Plantex and Daniels Pinnacle, mostly as NO_3-N, and the Neptune's Fish + Daniels

combination as NH_4-N. The least amount of N leached with alfalfa pellets alone or in combination with Daniels Pinnacle or Neptune's Fish.

Table 2. Nitrogen leaching by 'First Lady' marigold treated with chemical fertilizer or different types and combinations of organic fertilizers.

Fertilizer	NH_4-N (mg/pot)	NO_3-N (mg/pot)	Total N (mg/pot)	Total leachate vol.(ml)
Plantex 20-2-20	20.7de	51.5a	72.2b	511d
Daniels 3-1-1	15.0e	45.2b	60.2bc	2215a
Alfalfa pellets 5-1-2	13.8e	13.5cd	27.3d	1178bc
Fish 2-4-1	184.8a	7.1d	191.9a	1298b
Fish + Daniels	67.3b	12.3cd	79.6b	886c
Pellets + Daniels	17.8e	21.5c	38.3cd	1168bc
Pellets + Fish	33.6cd	7.3d	40.9cd	726cd

Nutritional factors. Fertilizer type led to some dramatic differences in nutritional factors which could affect the growth of marigold and other greenhouse plants (Table 3). Fertilizing with Plantex and Neptune's Fish resulted the highest growth medium EC (soluble salts level) while the other treatments resulted in low to moderate EC and one, Daniels Pinnacle, had an EC near deficiency. Growth medium pH ranged between 5.0 and 5.9 in all treatments except Daniels Pinnacle alone and in combination with alfalfa pellets where pH was unusually high at 7.4 and 6.9, respectively.

Table 3. Some nutritional factors associated with 'First Lady' marigold treated with chemical fertilizer or different types and combinations of organic fertilizers.

Fertilizer	EC (mmho/cm)	pH	N (%)	Ca (%)	Fe (ppm)
Plantex 20-2-20	1.48a	5.1d	5.70a	1.90d	233a
Daniels 3-1-1	0.69d	7.4a	3.17d	1.67e	78c
Alfalfa pellets 5-1-2	0.90cd	5.9c	2.37e	2.24c	65c
Fish 2-4-1	1.30ab	5.0d	5.44a	3.64a	101bc
Fish + Daniels	1.10bc	5.9c	4.49b	2.71b	108b
Pellets + Daniels	0.88cd	6.9b	2.46e	2.13c	61c
Pellets + Fish	0.88cd	5.7c	3.70c	2.57b	90bc

Many significant differences in the accumulation of nutrients in the plant leaves occurred between fertilizer treatments and some are shown in Table 3. Leaves of Plantex and Neptune's Fish plants contained much more N than the other treatments while Daniels Pinnacle, alfalfa pellets, and their combination were the lowest in N and close to N deficiency. Plants getting Neptune's Fish contained significantly more Ca and more P, Mg, Zn, Mn (not shown) than the other treatments. Iron (Fe) was highest in Plantex-fertilized plants and lowest in plants fertilized with Daniels, alfalfa pellets, or the combination.

Conclusion: What does it all mean?

Use of Plantex chemical fertilizer or Neptune's Fish Fertilizer resulted in the best growth of 'First Lady' marigold. Nutrient levels in the leaves of plants receiving these fertilizers were normal and well above deficiency levels for marigold. However, P, Ca, Mg, Mn, and Zn levels were significantly higher with Neptune's Fish than Plantex and all other fertilizers and Fe was highest of all fertiizers in the leaves of Plantex-fertilized plants. Another major difference between Plantex and Neptune's Fish was the level of N leaching. A great deal more N leached with Neptune's Fish and mostly in the form of NH_4-N.

These differences between the two fertilizers, even though they were applied at the same rate of N, demonstrate that different types of fertilizers can result in greatly different levels of nutrient accumulation in the plant and in nutrient leaching from the pot.

Plants fertilized with alfalfa pellets or Daniels Pinnacle were chlorotic and Daniels plants produced significantly less shoot dry weight and had slower flower development as measured by flower bud diameter) than all other fertilizers. What was the cause of the chlorosis and the reduced growth? In the case of alfalfa pellets, low N in the leaves indicates that the plants did not get enough N from the pellets, while the Daniels results might be due to the higher growth medium pH, a possible cause of lower Fe in the leaves, and/or N deficiency. Each of these effects with Daniels was observed with calibrachoa in an earlier study (Cox, 2010) and they were accompanied by extreme chlorosis suggesting Fe deficiency. It would be interesting to see if supplemental Fe or N, or acid acidification of the growth medium, might prevent what appears to be deficiency symptoms and improve the growth of calibrachoa and marigold when Daniels Pinnacle is applied.

I'm convinced that growers trying organic fertilizers might get the best results by using a combination of two different fertilizers as I did in this study. Some organic fertilizers seem to be "unbalanced" in a sense and positive, complementary effects may result from using two different types. For example, fish fertilizer provides lots of N and other elements but it could be too rich in NH_4-N for some plants, while alfalfa pellets provide too little N to carry heavily watered potted plants to finish. However, alfalfa pellets can supply enough nutrition for about the first 4-5 weeks after planting, after this time the fish fertilizer could be used once weekly to finish the plants without N deficiency. In this study, the three combination treatments produced plants similar in size and development to Plantex-fertilized plants without nutrient deficiency and with some enhancement of nutrient levels in the leaves and lower N leaching compared to Daniels or Neptune's Fish alone.

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