A Publication of the UMass Extension Greenhouse Crops & Floriculture Program

Floral Notes Newsletter

Volume 26, No. 3 http://extension.umass.edu/floriculture November-December 2013

In This Issue

Stockbridge School Internship Program

A 5-month, full-time internship at a commercial horticulture firm or allied business or organization is a graduation requirement of the 2-year Stockbridge Horticulture Program. The internships generally run from April to August. Shortly, 2-year Stockbridge students will return to UMass for an abbreviated term ending in the middle of March and they will be looking to firm up their internship plans.

Many growers have hosted our interns over the years, for which we at Stockbridge and the interns are very grateful. Most employers are very satisfied with our students and their work. Students can learn a lot at UMass but nothing beats the opportunity to work under commercial conditions and to later reflect on their experience when they prepare the required journal and report.

If you are interested in a having a Stockbridge Intern this year, now is the time to send me a position description because by about March 1st students should have an internship lined up. The description can be as short as a half a page and need not go beyond one page. Given the cost of higher ed nowadays, the money most students earn as interns helps pay for their education.

Please send the job description to me at dcox@umass.edu. I will post it and share it with the students. If you agree to have an intern there is some, but very minimal paperwork, required by Stockbridge. Most of our students have work experience in the industry, but it has been limited to high school summer jobs. The internship is meant to provide a learning experience for the student and a good and productive worker for the employer. We want the students to do the routine sweaty, dirty work involved in horticulture, but the best internships are those where the students work in as many facets of the business as possible.

Growing Spring Crops in Greenhouses

Wednesday, January 15, 2014, 10:00 to 3:00
Cranberry Experiment Station
East Wareham

9:30-10:00 Registration

10:00-10:50 Using Plant Growth Regulators on Spring Crops *Douglas Cox, UMass Extension*

The proper use of plant growth regulators can enhance plant growth, increase plant spacing and contribute to crop profitablility. Learn how PGR's work and how to use them for spring crops.

11:00-11:50 Identifying Nutrient Problems of Spring Greenhouse Crops *Geoffrey Njue, UMass Extension*

Often, nutrient deficiencies present similar symptoms. Geoffrey will provide information to help growers to correctly identify specific nutrient problems with key points that can help sort out problem symptoms of different nutrient elements.

12:00-1:00 Lunch (provided)

1:00-1:50 Managing Thrips, Aphids and Mites *Tina Smith, UMass Extension*

Thrips, aphids and mites can be a challenge on spring crops. Tina will talk about biological and pesticide strategies for managing these three pests on spring crops.

2:00-2:50 The Oomycetes; Phythium, Phytophthora and Downy Mildew
Russ Norton, Barnstable County Extension Service

Pythium, *Phytophthora*, and Downy Mildew are important plant pathogens in the nursery and greenhouse industry. The presentation will cover; why these plant pathogens differ from other common plant diseases, the necessity for proper identification, and the specific management strategies for these pathogens.

Three contact hours for pesticide recertification have been approved.

For more information contact:

Tina Smith, Univ. of Mass, Amherst (413)545-5306

Geoffrey Njue, Univ. of Mass, Cranberry Exp. Station (508)295-2212 ext. 47

Russ Norton, Barnstable County Extension Service (508)375-6692

Event Website: http://extension.umass.edu/floriculture/

Cost: $30 (Includes Lunch)

Reducing Storm Damage to Your Greenhouses

John W. Bartok, Jr.
Extension Professor Emeritus & Agricultural Engineer
University of Connecticut, Storrs

Nature seems to be getting more violent in recent years with frequent earthquakes, increased numbers of hurricanes and record breaking snowstorms. Insurance damage claims have increased considerably. The International Building Code has revised upward its wind and snow loading requirements for some areas of the U.S.

Each year there are reports of greenhouses that have been damaged by weather and natural events. Greenhouse design is different than conventional farm buildings in that the structural profile has to be small to allow maximum light to reach the plants. Most farm buildings are over designed to handle severe weather conditions.

Damage to greenhouses can include racking of the frame, bending of the hoops, broken glass or torn plastic and uplifted foundation posts. Preparation ahead of time can minimize the damage.

Wind loading

Wind forces that act on a greenhouse are influenced by numerous factors including the basics wind speed, building orientation, exposure, height and shape of doors or vents that may be open. The wind passing over a greenhouse creates a positive pressure on the windward side and a negative pressure on the leeward side. These can combine to create a force that wants to collapse or overturn the building. An 80 mph wind can produce a pressure of 16 pounds per square foot (psf). For example, the 10' by 100' sidewall of a gutter-connected greenhouse would have to resist a 16,000 pound force.

Wind can also create a force similar to an aircraft wing that wants to lift the greenhouse off the ground. An 80 mph wind blowing perpendicular to the side of a 28' x 100' hoophouse can create a lifting force of 220 pounds per foot of length or 22,000 pounds of uplift on the whole structure. When you consider the total weight of materials and equipment in the greenhouse is about 6000 pounds, the foundation must have a withdrawl resistance of about 300 pounds each. This is why building inspectors frequently require that the posts be surrounded by concrete.

Although you have no control over the force or direction of severe winds, here are a few tips to help minimize storm damage:

- Check the area for loose objects. Anything that can be picked up and hurled through the glazing should be secured or moved indoors. Metal chimney (stove pipe) sections should be secured with sheet metal screws.
- Inspect for dry or weak tree limbs that could fall on the greenhouse.
- Close all openings including vents, louvers and doors. The effective force of the wind is doubled when it is allowed inside the building. The wind on the outside puts a pressure or lifting force on the structure. The wind inside tries to force the walls and roof off.
- On air inflated greenhouses, increase the inflation pressure slightly by opening the blower's intake valve. This will reduce the rippling effect. Check to see that the plastic is attached securely and that any holes are taped.
- Disconnect the arm to the motor on all ventilation - intake shutters and tape the shutters closed. Then turn on enough exhaust fans to create a vacuum in the greenhouse. This will suck the plastic tight against the frame.
- Windbreaks can reduce the wind speed and deflect it over the greenhouse. Conifer trees (hemlock, spruce, pine, etc.) in a double row located at least 50' upwind from the greenhouse

can reduce the damaging effects of the wind. Wood or plastic storm fencing can be used as a temporary measure.

Snow loading

Snow that accumulates on a greenhouse can put significant weight on the structural members. Snow loads vary considerably from 0 along the southern coastline to more than 100 pounds per square foot in Northern Maine. Local building codes specify the design snow load.

Snow can be light and fluffy with a water equivalent of 12 inches of snow equal to 1inch of rain. It can also be wet and heavy with 3 inches equal to 1 inch of rain. Snow having a 1 inch rain water equivalent will load a greenhouse with 5.2 psf. This amounts to 6.5 tons on a 25' x 96' greenhouse.

The following are a few pointers to consider before the next snow season:

- The foundation piers or posts should be large enough to support the weight of the building including crop and equipment loads.
- All greenhouses should have diagonal bracing to keep it from racking from the weight of the snow or force of the wind.
- Collar ties and post connections should have adequate bolts or screws. This is a weak point in some greenhouse designs.
- Allow 10' to 12' between individual greenhouse for snow accumulation and to prevent sidewalls from being crushed in.
- When building new hoophouses, consider using a gothic design that sheds snow easier. In hoop shaped houses, install 2 inch x 4 inch posts under the ridge every 10' when heavy snow is predicted.
- The heating system should be large enough to maintain 60F to melt snow and ice. It takes 250 Btu/hr per square foot of glazing to melt a wet snow falling at a rate of 1 inch per hour. Heat should be turned on in the greenhouse or under the gutter several hours before the storm begins.
- The plastic should be tight and inflated to at least 0.25 inch water pressure. This can be checked with a monometer. Any cracked or broken glass should be replaced.
- Energy screens should be retracted to allow heat to the glazing.
- A standby generator should be available with adequate fuel for the duration of the storm to power heaters, fans and blowers.

Selection of greenhouses that meet the International Building Code and good construction techniques are important considerations when building new greenhouses. A little preparation before a storm can minimize damage from severe weather events.

Resources for storm preparation and response

USDA Assistance Available to Producers with Losses due to Snow Storm

Massachusetts Emergency Management http://www.mass.gov/eopss/agencies/mema/

Mass. Dept. of Agricultural Resources Farm Emergency Plan Template
http://www.mass.gov/eea/agencies/agr/animal-health/farm-emergency-plan/

Inspection of Storm Damaged Trees http://extension.umass.edu/landscape/news/inspection-storm-damaged-trees-revisited

Mass. Emergency Regulations http://www.mass.gov/dep/service/regulations/newregs.htm#emerg

UMass Extension Storm Preparedness and Crop Safety in the event of flooding.
http://extension.umass.edu/agriculture/index.php/services/storm-prepresponse

Managing Nutrient Problems of Greenhouse Crops

Geoffery Njue
Green Industries Extension Educator
UMass Cranberry Expt. Station
E. Wareham

Checking your plants weekly is the key to managing greenhouse nutrient problems. Check the color and vigor of the foliage and the health of the roots. Even though the foliage is showing nutrient deficiency symptoms, the root problem may be caused by a pest, disease, or water-management problem rather than fertilizer type or concentration. Checking the roots is important because the plant may have a compromised root system due to *Pythium*, a fungus gnat infestation, or be water-logged or a poorly drained media.

Conducting regular testing of media pH and EC is vital. pH affects the availability of nutrients and EC gives you the overall concentration of fertilizer salts in the media. For plugs, test 2-3 times per week because their smaller media volumes are more susceptible to changes than bigger volumes. For flats and 4-inch pots, test once a week, and for containers 6-inches or larger, every 2 weeks. Select one method and stick to it. Establish a target range depending on your crop.

For iron-inefficient crops (also referred to as the petunia group) which include petunia, calibrachoa, pansy, nemesia, bacopa, dianthus, snapdragon, verbena, and vinca, the acceptable pH range is 5.4 – 6.2. For iron-efficient crops (geranium group) which include seed and zonal geranium, marigolds, New Guinea impatiens and lisianthus; the acceptable pH range is 6.0 – 6.6. For other crops such as impatiens, ivy geraniums, poinsettia, chrysanthemums the acceptable pH range is 6.0 – 6.4. Therefore a range of 6.0 – 6.2 would be acceptable to most crops.

Easy testing methods to do in the greenhouse

Pour-through. Irrigate the crop 1 hour before testing. Then select 5 pots and place plastic saucers under them. Pour distilled water on the surface of the media. The amount of distilled water depends on the size of the pot: For cell packs and 4-inch pots, pour 50 ml (1.7 oz), for 6-inch pots, 75 ml (2.5 oz), and for 61/2 - 8 inch pots, pour 100 ml (3.3oz). Collect the leachate and test pH and EC as soon as possible. For plugs, place containers under the plugs, then press on top of the plugs' media to collect leachate.

1:2 method. Randomly select 5 pots and collect a small amount of root media from the lower 2/3 of the pot. Mix thoroughly and remove any slow-release fertilizer capsules to avoid inaccurate EC values. Add distilled water twice the volume of soil. Mix thoroughly and allow to sit for 30 minutes before testing EC and pH of the slurry.

The acceptable EC ranges depend on the testing method:

EC (mS/cm)	Pour thru method	1: 2 method
Acceptable range	1.0 – 6.0	0.30 – 1.50
Low	1.0 – 2.5	0.25 – 0.75
Normal	2.6 – 4.5	0.76 – 1.25
High fertility range	4.6 – 6.5	1.26 – 1.75
Can cause root damage	> 8.0	>2.5

Troubleshooting nutritional problems in the greenhouse

Symptoms may be caused by other problems such as root rot diseases, insects or poor drainage in the root media. To confirm that the symptoms are nutritional you have to rule out all other causes. You also need a soil test to confirm the nutrient element causing deficiency or toxicity symptoms.

Symptom	Possible problem	Solution
Color of entire plant is light green to yellow.	Sulfur deficiency	Use $MgSO_4$ (Epsom salt) at 0.25-0.5 lbs/100 gallons of water in the water soluble fertilizer. (Do not mix in the same tank with fertilizers containing $CaNO_3$).
Growing tip is lost, many growing tips develop, young leaves elongate and are brittle.	Boron deficiency	Lower humidity levels in the greenhouse to increase boron uptake. Use a regular drench of borax at 0.75 oz/100 gallons water or solubor at 0.43 oz/100 gallons of water.
Growing tip alive, but young leaves are distorted. Leaf edges may become necrotic.	Calcium deficiency	Lower humidity levels in the greenhouse to improve calcium uptake. If this doesn't work use foliar sprays with calcium chloride at 1 lb/100 gallons of water weekly.
Youngest leaves start to show interveinal chlorosis progressing to yellow to white.	Iron deficiency	Check media pH, lower pH by adding acid fertilizer (NH_4). Use supplemental iron chelate drenches (Sprint 330 or Sprint 139 at 5 oz/100 gallons of water).
Older leaves show bronzing coloration with necrotic spots (especially in iron efficient crops like geranium or marigolds).	Iron/manganese toxicity	Check media pH. Switch to nitrate based fertilizers (e.g. 13-2-13 or 15-0-15. If within a week pH has not gone up drench with potassium bicarbonate at 2 lbs/100 gallons or flowable (liquid) lime at 2-4 qts/100 gallons water.
Older leaves become chlorotic over the entire leaf	Nitrogen deficiency	Check EC of fertilizer solution. Check to see if your injector is working properly. Reduce leaching.
Older leaves turn purple, top of the plant may be dark green.	Phosphorus deficiency	Check if P was incorporated in root media before planting. Check P levels in your fertilizer. Drench with fertilizer containing P at 50-100 ppm.
Older leaves have interveinal chlorosis or gray-green coloration	Magnesium deficiency	Check for Mg levels in root media. Single drench with $MgSO_4$ at 0.5 lb/100 gallons will solve problem. Include dolomitic lime in the media.
Older leaves show edge burn which may progress towards the center.	Potassium deficiency	Check K levels in fertilizer. Check if injector is working properly. Increase K levels in fertilizer by adding KNO_3. Reduce leaching.

References

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Whipker, B.E. et al. 2001. Plant root zone management. North Carolina State University.

Fisher P.R. and W.R. Argo. 2001. "Iron-Out": A nutritional program for geraniums and other crops prone to iron and manganese toxicity at low media-pH. University of New Hampshire.

Argo W.R. 1998. Root medium chemical properties. HortTechnology 8(4).

Rearing Nematodes: Do-it-yourself Guide

Heidi Wollaeger, Michigan State Univ. Ext. and Fred Warner, MSU Diagnostic Services, Dept. of Plant, Soil & Microbial Sciences. Posted on October 28, 2013.

Species of entomopathogenic nematodes, or round worms, have been shown to be beneficial for controlling many types of greenhouse pests, including fungus gnats, shore flies, and some control of western flower thrips. In the nursery, nematodes can provide some control of root weevils, wireworms, cutworms, and spotty control of Japanese beetle grubs. In the same manner that these nematodes invade their soil-borne hosts, nematodes can be bred in *Galleria mellonella* wax worms. Rearing them yourself can save you money and prevent repeat ordering with your supplier.

What you will need:

- 2 and 3.5-inch Petri dishes
- Filter paper
- *G. mellonella* wax worms from your local bait and tackle shop
- De-ionized water **or** boiled tap water
- Aquarium with bubbler **or** numerous shallow live culture flasks
- Microscope

Numerous species of entomopathogenic nematodes can be reared with *Galleria* wax worms, including *Heterorhabditis bacteriophora*, *Steinernema carpocapsae*, *Steinernema feltiae* and *Steinernema riobrave*. First, place five live wax worms in a Petri dish with approximately 100 live nematodes, or 20 nematodes per host worm, with a few drops (0.5 mL) of de-ionized or boiled tap water. The juvenile nematodes will enter and infect insects through their natural openings. Endosymbiotic bacteria carried within the nematodes are released after they penetrate their hosts. Toxins produced by the bacteria cause blood poisoning of the insects usually resulting in their death within 72 hours. The nematodes consume the bacteria and complete one to three generations before they emerge from the dead insects seeking other hosts.

Store Petri dishes for six days in a dark place at room temperature. After six days, check worms for infection. The cadavers of the wax worms successfully infected will appear beige to dark red, depending on the species of nematode used for infection (Figures 1-2).

Figures 1-2. (Left) Wax worms post-infection from *S. carpocapsae*. Successfully infected wax worms will be beige in color. (Right) Wax worms post-infection from *H. bacteriophora*. Successfully infected wax worms will appear brick red. Photo credit: Heidi Wollaeger, MSU Extension. Special thanks to MSU's Matt Grieship and Joe Tourtios for specimens.

Upon successful infection, place Petri dish containing nematodes, worms and filter paper within another larger Petri dish. Fill the outer Petri dish halfway with de-ionized or boiled tap water and cover with an

opaque lid for three weeks. Infective juvenile nematodes will emerge from the host and swim into the water within one to three weeks. Verify that the nematodes are still alive – wiggling and swimming – under a dissecting microscope. Dead nematodes will be straight and still.

Add solution that contains nematodes to a live culture flask, a shallow dish or an aquarium with an air bubbler. Nematodes can be stored in darkness in a container that provides a sufficient amount of air to nematodes by using shallow containers or an air bubbler for approximately one month.

Michigan State University Extension recommends that a minimum of a half of a million nematodes be applied to every square meter in the greenhouse to provide fungus gnat and shore fly larvae control. In the nursery or field, concentrations should be at least double of that in the greenhouse. A mixture of species of nematodes may prove to be beneficial since nematodes of different species are more effective on some greenhouse pests than others. *S. feltiae* infects fungus gnat larvae while *S. carpocapsae* infects shore fly larvae.

To learn more about the nematode lifecycle and how to apply them in the greenhouse or the nursery, visit the University of Massachusetts biological control websites: Biological Control: Using Beneficial Nematodes and Beneficial Nematodes.

This article was published by **Michigan State University Extension**. For more information, visit http://www.msue.msu.edu. To contact an expert in your area, visit http://expert.msue.msu.edu, or call 888-MSUE4MI (888-678-3464).

Upcoming Events!

December 17-19 New England Vegetable & Fruit Conference

January 29, 2014 Winter Flower Growers Program

February 5-7 New England Grows

July 2014 Summer Field Day

November 5-6 Northeast Greenhouse Conference

UMass Greenhouse Crops and Floriculture Extension Program

Douglas Cox Floral Notes Editor dcox@umass.edu
Geoffery Njue Extension Specialist gnjue@umext.umass.edu
Tina Smith Extension Specialist tsmith@umext.umass.edu

Six monthly issues of *Floral Notes By email* are published yearly.
Subscription (2 years) is $5. Contact Doug Cox for more information.