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Floral Notes Newsletter

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In This Issue

Edema on Spring Crops

Edema (or oedema) has been observed on ivy geraniums. Injury from edema, mites and thrips can look similar and even the most experienced growers are sometimes stumped diagnosing the problem. Edema symptoms appear as bumps or blisters initially on the undersides of lower or older leaves on a plant. They may then turn brownish or tan and become corky. Severely affected leaves will often turn yellow and drop.

Edema is a physiological disorder occurring mainly on ivy geraniums but is also found on sweet potato vine (ipomoea), begonias, cacti, ferns, palms, pansy, cleome, cineraria and cole crop vegetables like broccoli, cabbage and cauliflower.

Edema blisters form on ivy geraniums when water and solutes build up underneath or possibly within cells, causing the epidermal cells to stretch and collapse. The corky spots sometimes resemble spider mite or thrips damage. To rule out pest damage, use a handlens and check carefully on the undersides of leaves along midveins for spider mites and in growing points for thrips. Stippling from mite feeding is not seen on ivy geraniums like other crops. Thrips feeding injury appears as white scarring and leaf distortion on ivy geraniums, especially on the youngest leaves.

Mildly affected plants often recover from edema, putting out symptomless new growth in late spring and early summer. Some plants however are severely affected, have dropped significant numbers of leaves and have badly distorted remaining leaves. These plants are probably not worth saving as they will not recover in time for sale. *Tina Smith and Leanne Pundt, Greenhouse Update.*

Biological Controls – Putting it all Together for Success

For Greenhouse Ornamentals and Greenhouse Vegetables
Tolland County Extension Center Vernon, CT
July 31, 2014
University of Connecticut Extension and University of Massachusetts Extension

8:00 – 9:00 Registration, Coffee available

9:00 - 10:00 Growing Greenhouse Plants with Water-soluble Organic Fertilizers

Douglas Cox, University of Massachusetts, Amherst, MA
Doug will talk about the use of organic liquid plant extract fertilizers, including the new Daniels Nature's Source fertilizer, for growing annuals and bedding plants. He will also suggest ways of using liquid fertilizers in combination with slow-release organic fertilizer for best results.

10:00- 11:00 Greenhouse Pest Control: A Systems Approach

Rose Buitenhuis, Vineland Research and Innovation Centre, Vineland Station, Ontario, Canada
We are all familiar with the saying: "You can't see the forest for the trees". Management strategies for one pest species have an effect on control of other pests, so we need to integrate approaches for all pests. In addition, production practices (such as lighting, use of plant growth regulators etc.) all influence pest biology and the success of biological control agents. This presentation will use a little bit of theory and lots of practical examples of recent research to illustrate the systems approach to pest control.

11:00 to 11:15 Break

11:15 to 12:15 Innovations in Greenhouse Pest Management

Rose Buitenhuis, Vineland Research and Innovation Centre, Vineland Station, Ontario, Canada
Rose will highlight research conducted on managing pests through the introduction of predatory mites (including *Amblyseius swirskii*), the use of banker plants and cutting dips to reduce the risk of importing pests on vegetative cuttings.

12:15 to 1:15 Lunch

1:15 to 2:15 A "Softer" Approach To Managing Diseases in the Greenhouse

Cheryl Smith, University of New Hampshire Cooperative Extension, Durham, NH
Cheryl will discuss options for managing diseases with biological and biorational products. She'll discuss the efficacy (where study data is available) and pros and cons of some of these products. You'll also have an opportunity to share your own personal experiences using these alternative disease control products.

2:15 to 2:30 Break

2:30 to 3:30 Biocontrol Programs in Greenhouse Vegetable Crops (Greenhouse tomatoes, Cucumbers and Edible Greens)

Ronald Valentin, Biobest USA Inc., Romulus, Michigan
Ron will discuss the importance of starting early with bio-control, the systems approach looking at all pest problems including such as thrips, whitefly, aphids and two-spotted spider mites that do occur in greenhouse vegetable crops. Ron will also briefly discuss implementing banker systems into the overall pest management program for greenhouse vegetable crops.

5.0 Pesticide Recertification Credits have been approved in categories PA, 3A for attendees from CT, RI, MA, ME, NH and VT

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"Ammonium Toxicity" as a Cause of Foliar Chlorosis on Geranium

Douglas Cox
Stockbridge School of Agriculture
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In earlier *Floral Notes* articles (Cox, 2013, 2014) I reported on trials with plant extract fertilizers and a granular organic fertilizer for seed geranium. Overall, plant growth and flowering with the liquid plant extract fertilizers Bombardier and Espartan and the organic granular fertilizer Sustane was similar to that with Plantex chemical water-soluble fertilizer.

However, the liquid organic fertilizers developed foliar symptoms probably due to nutrient disorder. Leaves taken from plants fertilized with liquid Espartan and Bombardier plant extract fertilizers plants displayed a marked interveinal chlorosis (Figure 1), similar to magnesium deficiency in most plants, but the symptoms were not similar to those described in Geraniums IV (White, ed., 1993). Symptoms occurred on upper leaves rather than the lower leaves described in the reference. Since then I have observed similar symptoms on 'Pink Carpet' petunia (Figure 2) fertilized with plant extract fertilizers.

Figure 1. Chlorosis occurring on geranium leaves fertilized with plant extract fertilizers.

Figure 2. Chlorosis occurring on petunia leaves fertilized with plant extract fertilizers.

What caused the interveinal chlorosis which afflicted the plants fertilized with liquid plant extract fertilizers? To answer this question I collected leaves for nutrient analysis to hopefully discover the cause of the problem (Cox, 2014).

The results of the nutrient analysis revealed that there were many statistically significant differences in the levels of 10 nutrient elements in the leaves of plants in the different fertilizer treatments. Statistical differences, however, do not imply deficiency or excess of nutrients. A low nutrient level, for example could still be in the normal range for geranium. Of most relevance were the magnesium (Mg) results since the symptoms were interveinal chlorosis. However, the magnesium (Mg) content of leaves from the plant extract fertilizer treatments, while slightly below Plantex and Sustane levels, were within the published normal range for geranium (White, ed., 1993). Mg deficiency, therefore, did not seem to be a likely cause of the interveinal chlorosis.

Since organic fertilizers are generally high in NH_4-N and low in NO_3-N and because I've found large amounts NH_4-N in the leachates collected from plants fertilized with plant extract fertilizers, I decided the chlorosis might be caused by too much NH_4-N or "ammonium toxicity". So I decided to grow another crop of geraniums, fertilize them in the same way except for adding the new Nature's Source fertilizer, and harvest their leaves for NH_4-N analysis. The results are discussed here.

How the plants were grown

'Ringo 2000'seed geranium plugs sown 13 January 2014 were potted on 4 February 2014 in 4½-inch

pots of Fafard 3B soilless mix. Plants were fertilized with 225 ppm N from Plantex (20-2-20) chemical fertilizer or Nature's Source (3-1-1), Bombardier (8-0-0), or Espartan 2.0-3.03-2.6 plant extract fertilizers. Potassium phosphate was added to the Bombardier solution to supply P and K. Sustane (8-4-4) granular fertilizer was incorporated with the growing mix prior to planting at a rate of 7 gm/pot (0.25 oz./pot). In other treatments some fertilizers were applied in combination: Nature's Source + Sustane, Bombardier + Sustane or Espartan + Sustane. Water-soluble fertilizer was applied at every other watering. The first application of water soluble fertilizer in the combinations treatments was made four weeks after potting, 3 March. The experiment ended 10 April when recently-mature leaves were sampled from key treatments for ammonium analysis. Ammonium was determined using an ammonia gas-sensing electrode to analyze a distilled water extract of dried and ground leaf tissue.

Results

Table 1. NH_4-N content of geranium leaves.

Fertilizer	**NH_4-N (ppm)**
Plantex 20-2-20	224b
Sustane 8-4-4	101c
Bombardier 8-0-0	947a
Nature's Source 3-1-1	243b

Foliar chlorosis like that in Figure 1 occurred to varying degrees on the upper leaves of plants fertilized with Bombardier and Espartan. No chlorosis showed up on plants fertilized with Plantex, Sustane, Nature's Source, and the combination treatments. The fact that leaves of plants fertilized with Nature's Source had no chlorosis is interesting since it is a plant extract fertilizer. Table 1 shows the NH_4-N content of leaves from several key treatments. The NH_4-N content of the leaves of plants fertilized with Bombardier, which were chlorotic, was substantially higher than the other treatments. NH_4-N content was lowest in the leaves from plants fertilized with Sustane, a granular slow-release fertilizer rather than a soluble liquid.

It's not common for routine leaf analysis tests to include NH_4-N so good standard values for excess are not available. In my experience NH_4-N levels of 300 or lower are common in healthy plants without symptoms of ammonium toxicity, but an NH_4-N level of 947 is abnormally high and confirms that the chlorosis is caused by excess NH_4-N fertilization.

Preventing ammonium toxicity caused by plant extract fertilizers is possible by following practices that prevent NH_4-N accumulation in the plants. The best way is not to depend on soluble organic fertilizers as the sole source of nutrition. I have had success with this approach in my work by combining the plant extract fertilizers with the slow-release Sustane organic fertilizer. No plants in the combination treatments have developed symptoms of ammonium toxicity. Other ways that might prevent NH_4-N accumulation in the plants would be to avoiding high fertilizer levels, less fertilizer during cloudy and cool weather when plants grow slowly, and adequate watering and leaching. Also, try Nature's Source plant extract fertilizer since it doesn't seem to cause foliar chlorosis and did not cause a harmful accumulation of NH_4-N in the leaves in this study.

References

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Cox, D.A. 2013. Response of 'Ringo 2000' seed geraniums to plant extract and granular organic fertilizers. *Floral Notes.* 25(6):3-6.

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Natural Ventilation in Hoophouses

John W. Bartok, Jr.,
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Natural Resources and the Environment
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Storrs

Roll-up sides and drop-down curtains are low-cost vent systems that can be installed in most hoophouses. These systems operate on the principle that heat is removed by a pressure difference created by wind gradients. A wind speed of 2-3 miles per hour is adequate to force cool air in the windward sidewall. The air traveling over the greenhouse creates a vacuum on the leeward side to pull the heated air out.

In both systems, a rail, either wood or metal extrusion, is attached to the greenhouse frame 3' to 5' above the base board. Rails are usually attached on both sides of the greenhouse to allow for cross ventilation. The plastic over the top of the greenhouse is attached to the rail to form a seal for air inflation. In roll-up systems, the remaining material becomes the vent. The bottom of the plastic is attached to a piece of steel tubing with clips or battens. A two-piece roll bar that clamps the plastic is available from Advancing Alternatives, Inc., Schuylkill Haven PA., www.advancingalternatives.com. To open the vent, the tubing is rolled up with a hand crank or vent motor. Opening the vent introduces cool air at the bottom which may or may not be desirable depending on the placement of the crop in the greenhouse.

In drop down systems, cool air is introduced at the top of the curtain allowing it to moderate before it reaches the plants. The bottom of the curtain wall material is attached to the baseboard with a batten or aluminum extrusion and the top is attached to the steel tubing. The curtain is lowered or raised by a system of cables and pulleys that are attached to either a manual or motorized winch. A separate sheet of plastic is frequently used for the curtain. This material can be a 4-year copolymer film or it can be a heavier material such as a reinforced polyethylene or polyvinyl.

Another drop down system utilizing inflated poly tubes (Poly-vent) is available from Poly-tex, Inc., Castle Rock MN – www.poly-tex.com. The poly tubes, held in place along the sidewall with retainers, are inflated in two stages by small blowers to provide two levels of ventilation. A back-up generator or 12 volt battery operated blowers are needed to handle power interruptions.

Natural ventilation is better

Roll-up and drop down systems have several advantages over fan systems.

> Eliminating the fans reduces the electric bill, a nice bonus in a time of increasing rates. Fan cooling for a typical hoophouse operated spring, summer and fall is 8¢ -10¢ per square foot based on 12¢ per kilowatt hour.
>
> During warm weather, the temperature inside the greenhouse can be maintained within a degree or two of outside. Unlike fan ventilation where the temperature at the fan end is 8ºF to 12ºF warmer than the intake end, natural ventilation will provide uniform temperature throughout the

greenhouse. The best cooling is achieved where the greenhouse is not obstructed by other buildings and is orientated to receive the summer breeze.

Opening the sidewall allows easy accessibility for moving plants into or out of the greenhouse.

There is a reduction in noise if fans are not used.

A tight seal is important

Air leaks can be a problem, especially on windy days. There are systems that reduce infiltration including (a) installing plastic over the first frame on each end to form a seal, (b) attaching Velcro to the outside frames and an adhesive backed, felt strip to the plastic, (c) inflating a polytube attached to the end frames and (d) installing a curtain pocket.

To seal the bottom of a roll-up system, the bottom of the curtain can be lowered onto a shelf made of wood or metal that seals along the entire length. A continuous extrusion manufactured by Advancing Alternatives, Inc. can be installed to fully seal the bottom of the curtain. On drop-down systems the curtain is drawn up into a pocket or hood that sheds rain and snow and forms a tight seal.

To keep the curtains from billowing out in the wind, a retainer is needed along the side of the greenhouse. It needs to be firmly attached at the rail and baseboard as there is considerable pressure built up on the curtain in a heavy wind. Several methods are used.

Retainer clips attached at the rail and baseboard allow nylon or polypropylene cord to be laced into zig-zag pattern.

Curtain brackets made from 1" conduit or tubing placed at 4' to 5' intervals makes a permanent installation and allows easy access through the wall for materials handling.

Polypropylene strapping, 2" to 4" wide, attached vertically every 4' to 6' gives good support and reduces wear on the curtain.

Some growers have installed a double layer of poly curtain and inflated it to reduce heat loss. This also reduces the rippling effect of a single layer material and the associated wear.

Methods for raising and lowering the curtain

The simplest method for opening a roll-up curtain is a hand crank. Adding a universal joint allows the crank to be operated in any position.

To reduce the job of raising long, heavy curtains, a gearbox assembly that rides on tubing or a rail can be used. Usually the gearbox has a ratio of 10 to 1 or 15 to 1. Operation of the gearbox can be either manually with a crank or powered with a battery-operated drill.

Motorized gearboxes and tube motors are available that can be controlled by thermostats, humidistats, timers or a controller. Cost is around $1000. Limit switches that provide stops at the top and bottom are needed.

Drop down curtains are frequently operated with a winch. A series of vertical support cables are attached to the tubing in the top edge of the curtain. Usual spacing is at least one foot more than the height of the curtain. The other end of each cable is drawn through a pulley and then clamped to a main

control cable. The main cable is supported by pulleys at each end. One end of the main cable is attached to the winch. A counterweight is attached to the far end to maintain tension and to lower the curtain evenly. The cables, clamps and pulleys should be stainless steel to have trouble free operation. The size of the winch is determined by the length of the curtain. One with two-way operation is desirable. Electric winches allow automatic ventilation. They are available in 120 volt and 12 volt models. Limit switches and a thermostat are needed.

Several manufacturers offer a ridge vent for their hoophouses. Vents operate based on wind pressure differences, air temperature buoyancy and the vacuum created by air passing over the ridge. The vent can be operated manually, motorized or fitted with the inflated tube system. Ridge vents make covering the hoophouse with film plastic more difficult as attachments are required on both sides of the vent.

Growers with hoophouses have found that roll-up and drop down curtain systems and ridge vents work well for warm season ventilation. A location with good summer breezes and plenty of space between houses will allow the temperature to remain within a degree or two of outside. The vent areas need to have a tight seal if the hoophouse will be heated during the winter.

What are Genetically Modified Organisms (GMOs)?

Geoffrey Njue and Rich Bonanno
UMass Extension

Crop varieties which have been developed using genetic engineering techniques are commonly known as GMOs (genetically modified organisms). Genetic engineering allows the transfer of one specific gene or a set of genes within a plant family or across genetic lines. The overall goal of genetic engineering is to add a gene that will express a desirable trait in the plant such as resistance to a herbicide or resistance to pests. Genetic engineering techniques involve extracting and isolating a specific DNA segment that makes up a gene and inserting it into plant cells. Whole plants are grown from the successfully transformed cells using tissue culture, and then using traditional plant breeding the new gene is transferred into the crop population.

Currently there are nine (9) crops that have GMO varieties available. These include: Corn (field and sweet corn), soybeans, canola, papaya, cotton, alfalfa, sugar beets, squash and rice. Soybean, canola, sugar beet, alfalfa, and corn GMO varieties have been modified for resistance to Roundup (Roundup Ready) and in some cases, Rely (Liberty Link); field corn, sweet corn and cotton varieties have been modified to contain and express one or more B.t (*Bacillus thuringiensis*) genes to make them resistant to some insect pests; papaya and squash have been modified to be resistant to insect vectored viruses (ring spot virus in papaya and squash mosaic virus). Scientists have also developed a genetically modified rice variety (Golden Rice) that is high in vitamin A.

Crops that are genetically modified are food and feed crops. The only crops that are likely to be in a greenhouse would be squash or sweet corn transplants being grown for setting out in a field. Those plants cannot be sold to homeowners. Farmers must sign a technology agreement with the seed producer much like an agreement when buying software. Only those growers signing the agreement can grow the crops, so sale to other growers or homeowners is not allowed. There are currently no flowers or ornamental GMO crops on the market. Some greenhouse growers are posting signs on their operations to assure customers that there no GMOs in their product line.

In addition, seeds packaged for home garden use are not and cannot be genetically modified. In saying this, there is a bit of confusion in that one home garden seed supplier has told customers that all seeds are genetically modified (GMO) but not all seeds are modified using genetic engineering. Although this is true, the term GMO is commonly used to refer to seeds that have been modified using genetic engineering. Also, all commercial (farmer) seed packages are clearly marked if they contain genetically modified seeds.

Attitudes about GMOs vary widely both in the US and around the world. Many commodity crop farmers in the US have adopted GMOs as a way to grow better crops with fewer pesticides. Many consumers are concerned about GMOs due to the fear about potential health risks and fear of potential environmental risks. Many scientists support GMOs because of many years of studies showing little or no health and ecological risks, and the potential for developing higher yielding crops to feed the rapidly increasing world population.

In the United States GMOs are regulated by the US Department of Agriculture (USDA), The Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA). The USDA ensures the health and safety of the GMOs to plant and animal health. Developers of GMO Crops must apply for a permit that requires them to address the potential risks of the GMO to plant and animal health and the possibility of the organism spreading into the environment. The EPA regulates only the genetic material incorporated into the plant not the plant itself. It regulates any GMO that contains a pesticide (e.g. Bt) as part of the genetic makeup and requires developers to address the short term and long term consequences of the pesticide on humans, livestock and the environment

The FDA regulates the safety of the GMOs consumed by people or animals. The FDA requires that the GMOs be substantially equivalent to non GMOs and therefore classifies them as safe. Under the FDA policy GMOs do not require approval from FDA before they are marketed. However the GMO developers are given voluntary option to consult with the FDA to discuss nutritional or safety issues.

The FDA does not require the labelling of GMOs unless a food contains an allergen, a known toxicant that exceeds tolerable limits, or has nutritional properties that have been significantly altered. Currently the only food label that ensures absence of GMO is the USDA Certified Organic label. GMOs are prohibited in organic production and in organic products. In addition, organizations such as "The Non-GMO Project" www.nongmoproject.org lists foods that do not contain GMO's on their web site.

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