A Publication of the UMass Extension Greenhouse Crops & Floriculture Program

Floral Notes Newsletter

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In This Issue

Construction Progress on New UMass Greenhouses

The steel framework of the new headhouse was erected November 23 as work continued on the foundations and floors of the new greenhouses. This view looks north toward Bowditch Hall and original greenhouse in the background.

2011 UConn Perennial Plant Conference

March 10, 2011

Lewis B. Rome Commons, University of Connecticut, Storrs, CT

www.hort.uconn.edu/2011ppc

Beneficial Nematodes: An Easy Way to Begin Using Biological Control

Leanne Pundt, University of Connecticut Extension with input from Tina Smith, UMass Extension

Growers that are interested in using biological control are encouraged to begin by using beneficial nematodes to manage fungus gnats. Beneficial nematodes are relatively easy to use and are applied similar to conventional pesticides with some special precautions listed in this article.

What are beneficial nematodes?

Nematodes are small, colorless, cylindrical round worms that occur naturally in soils throughout the world. Different species work best against different target pests. *S. feltiae* is primarily used against fungus gnat larvae and most recently, thrips pupae in the soil. Fungus gnat larvae may be parasitized in any larval stage. Nematodes have traditionally been used against soil dwelling pests because they are sensitive to ultra violet light and desiccation.

The nematodes enter the insect host through body openings. They multiply within the host and release a symbiotic bacterium whose toxin kills the fungus gnats. The larvae are killed in one to two days by blood poisoning. More than one generation of nematodes may develop in dead host insect in the media. The infective juveniles then exit the dead body and search for new hosts to infect.

How to use beneficial nematodes

The nematode *S. feltiae* is sold under the trade names of NemaShield, Nemasys, Scanmask and Entonem. All of these products are labeled as a soil drench treatment against fungus gnat larvae. Preventative applications to moist soils work best.

Apply nematodes with a sprayer (remove screens and filters), injector, hose end sprayer or even a watering can. If using an injector, set the dilution to 1:100. Remove all filters or screens (50 mesh or finer) in any spray lines so that the nematodes can pass through unimpeded and undamaged and spray pressure should be kept below 300 psi. Although nematodes are applied in water, they are not aquatic animals and therefore they need extra care while in stock and tank solutions, so adequate aeration of the nematode suspension during application is important. This can be done using a small battery powered submersible pump or even mechanically to keep the solution agitated. The small pump will also keep them from settling on the bottom, which they tend to do.

The suspension in the spray tank should be kept cool and applied as soon as possible after mixing. This is especially important during the warmer months. The longer they are kept before spraying and the warmer the tank water, the more quickly their energy reserves are used up. Weaker nematodes are less robust during and after application, and less able to search for and infect a susceptible host.

Unlike many traditional pesticides there is no REI (an added bonus in propagation houses), nor possibility that the target pest will develop resistance. No adverse effects have been shown against non-target organisms in many different field studies. But, beneficial nematodes are living organisms, so there are a number of precautions you need to follow for their successful use.

- Check their viability before application

  To do this, place a small amount of the product in a small clear container or petri dish. Add 1 or 2 drops of room temperature water; wait a few minutes and look for actively moving or swimming nematodes. They have slight “J”curvature at the end of their bodies. Use a dark black background and a hand lens or field microscope to see the small (0.6 mm or 0.02 inches in length) nematodes. Dead nematodes will straight and still.

- Apply in the evening or at dusk or on a cloudy, overcast day. (Nematodes are very sensitive to UV light and desiccation).
- Nematodes are compatible with a number of different pesticides. However, they are generally not compatible with organophosphates, carbamates, nematicides and hydrogen dioxide. Do not mix nematodes with your fertilizer solution!
- For more detailed information on pesticide compatibility: consult with your supplier or with the following resources on the Internet:

  - Pesticide Side Effects Database – www.koppert.com

  - Pesticide Side Effects Database - www.biobest.be/

  -Becker Underwood Compatibility Chart- http://www.beckerunderwood.com/library/Nematodes_Chemical_Compatibilty_05%2007%202020 08.pdf

Keeping nematodes

Apply immediately after receiving them, if possible. If you must store the nematodes, store them in a refrigerator (38-42°F). Avoid placing them in a small refrigerator where they may freeze and die!.

Check the expiration date on the package for the length of time they can be stored.

Specific Tips for Use Against Fungus Gnat Larvae

- Treat as soon as possible (2 to 3 days) after sticking cuttings, planting plugs or starting seeds. Some growers apply the nematodes to the media directly before sticking cuttings to insure that the nematodes reach the media. Injectors are placed directly on the planting line.
- Apply as a media drench to target the fungus gnat larvae.
- Media temperatures should be above 50° F but avoid applying when soil temperatures are above 80°F. Optimum media temperatures are between 60-70°F. (Use a soil thermometer to monitor temperatures).
- Water the growing media before and after application. (Nematodes need moisture for movement). But, avoid over watering, so they aren't washed out of the container.
- Apply in the evening or at dusk or on a cloudy, overcast day. (Nematodes are very sensitive to UV light and desiccation).
- Repeated applications are often needed. Reapply in 2 to 4 weeks under moderate to heavy infestations. For longer term crops, apply at the beginning and at mid crop.

How to tell if they are working

The symbiotic bacteria breaks down the host insect's cuticle. The infected larvae rapidly disappears, so may be difficult to locate. Infected fungus gnat larvae are often opaque-white to light yellow in color. Use potato disks to monitor for fungus gnat larvae. Place disks on the surface of the growing medium two days before application in order to determine the population level prior to treatment, and again 3-5 days and 10-12 days after application. Leave the potato disks for two day in each case, before examining them for fungus gnat larval activity.

Use against thrips

In addition, the product Nemasys is also labeled for use against western flower thrips. In the late 1990s in the U.K., it was reported that cut chrysanthemum growers who applied nematodes weekly as a foliar spray, noted a reduction in their thrips populations. More recent work in Canada, the U.K. and Germany

showed that soil-dwelling stages of thrips (especially the pupal stages) were highly susceptible to several species of nematodes, and particularly to *Steinernema 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. Mobile life stages on the plant (adults and larvae) appear to be less susceptible to attack. Thrips control noted in commercial crops probably occurred as a result of overspray and run-off into the soil after spraying. 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.

Specific tips for use against western flower thrips (from the Nemasys label).

- Nematodes require moist conditions to enhance effectiveness.
- If plants are dry, provide light overhead irrigation prior to nematode application.
- Ensure good foliar coverage of spray mix to enhance contact with the target pest.
- Use of a wetting agent or surfactant will enhance wettability of the spray mix and encourage nematode movement.
- Following application, ensure that the crop remains wet for at least two hours. Note:
- Do not apply in direct sunlight.
- Note: the nematodes will dessicate after about one day, depending upon environmental conditions.. Grower feedback has been variable, with some observing excellent 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. Some growers apply the nematodes with additional water in the summer months to ensure that the foliage stays wet to contact the thrips stages on the foliage. Depending upon the temperature, relative humidity levels and other environmental conditions, up to 2x the amount of water may be needed to keep the foliage wet for two hours. Regular monitoring, sanitation, proper spacing and judicious use of fungicides and biological fungicides may be needed to discourage foliar diseases.

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. Growers who have had success with this application method, apply the nematodes on a weekly basis, and target the young growing point where thrips tend to hide. As with any biological control measure, they are most effectively used preventively in conjunction with good cultural practices for thrips control (sanitation, rigorous weed controls, etc).

For more information on *Steinermena feltiae* consult these references

2011-2012 New England Greenhouse Floriculture Guide: B.14. Ordering information: http://www.umass.edu/umext/floriculture/pest_management/ne_pest_manage_guide.html

NemaShield – BioWorks www.bioworksinc.com

Nemasys – BeckerUnderwood - www.beckerunderwood.com

Searchable Database On Insect Parasitic Nematodes: www.oardc.ohio-state.edu/nematodes

McGaughey, R. 2009. Growers Talk Production: A New Rainy Day Activity 6/15/2009 Grower Talks. http://www.ballpublishing.com/growertalks/

Murphy G. 2010. Greenhouse grower notes: March 2010, Nematodes in pest management. http://www.greenhousecanada.com/index.php?option=com_content&task=view&id=2060&Itemid=153

Spring 2010 UMass Plant Diagnostic Lab Results

Bess Dicklow
Plant Pathologist
UMass Plant Diagnostic Laboratory
Amherst

Greenhouse specimens submitted to the UMass Extension Plant Diagnostic Lab in Spring 2010 included annual bedding plants, vegetable transplants, and perennial flowering plants as well as greenhouse grown vegetables (tomatoes, cucumbers). Fungal diseases were predominate among diagnoses while bacterial diseases, virus diseases, and insect infestations also occurred. A large category of diagnoses were abiotic (not the result of a disease causing organism). Factors negatively impacting plant growth included scorch, freezing injury, chemical injury, mechanical injury, environmental stress, nutrient imbalances including high soluble salts, physiological diseases, and poor cultural practices.

Fungal diseases

Two pathogens dominated the diagnoses-*Pythium* species and Botrytis species. *Pythium* was detected causing damping-off, root rot, and crown/stem cankers. *Pythium* root rot is often associated with high soluble salts as excess fertilization increases the plant's susceptibility to *Pythium* diseases. *Botrytis cinera* was detected causing damping-off, stem canker, and leaf spot and blight. *B. cinera* is ubiquitous in the environment, has an extremely wide host range, and attacks injured or senescent plant parts.
Tulip Fire caused by *B. tulipae* observed on newly emerging, forced tulip bulbs and can be carried in infected bulbs. *Rhizoctonia solani* was responsible for damping-off as well as stem cankers. Other stem canker diagnoses were caused by *Alternaria alternata*, *Phoma* species, and *Colletotrichum* species (anthracnose). Leaf spot/leaf blight symptoms were confirmed as Powdery Mildew, Downy Mildew, *Stemphyllium* and *Myrothecium* as well as bacteria.

Bacterial diseases

Four genera of bacteria were responsible for symptoms such as leaf spot, stem cankers, and soft rot. Pathovars (strains specialized to host) of *Xanthomonas campestris* were detected causing leaf spot and blight on begonia, pepper, tomato, cabbage and kale seedlings. *X.campestris* can be carried in seed and even a small percent of infected seed can result in an epidemic in greenhouse seedlings. *Pseudomonas syringae* was responsible for leaf spots and blight on ornamentals. Bacterial canker caused by *Clavibacter michiganiensis* was detected in greenhouse tomato as was Pith necrosis caused by *Pseudomonas corrugata.* Soft rot caused by species of *Erwinia* was detected on annual and perennial ornamental crops. Bactericides are only marginally effective in controlling bacterial diseases; sanitation and environmental controls are important disease management principles.

Virus diseases

Virus diseases diagnosed by the lab this year include HVX (Hosta Virus X), DMV (Dahlia Mosaic Virus), and TSWV (Tomato Spotted Wilt Virus). There are no effective chemical controls for viruses; plants must be discarded and insect vectors, if any, controlled.

Insect pests

Insects observed in the lab included thrips, mites, and psyllids. Many growers are controlling these insects using predators and parasites, a practice known as biological control. See http://www.umass.edu/umext/floriculture/ fact sheets for more information.

Disease prevention for 2011

Sanitation and environmental control are two strong tools to prevent plant diseases in greenhouses in spring 2011. Start with a clean greenhouse by removing all plant debris, infested soil, used pots and flats, and "pet" plants. Start with clean pots and flats and use pasteurized soil or soilless growing media. Clean benches and potting areas with approved greenhouse disinfectants. Keep growth media covered and hose ends off the floor. *Pythium* and *Rhizoctonia* species are natural inhabitants of the soil and can persist there indefinitely as well as in plant debris and greenhouse floors. Other pathogens such as *Botrytis, Alternaria*, Powdery and Downy Mildews can persist in infected plant debris. Start with certified, disease free seed and culture-indexed plants (geraniums, chrysanthemums). Buy resistant varieties, if available. Inspect all incoming plant shipments for signs of disease and/or insect infestations. Reject these shipments or isolate them for treatment. For control of the Topsoviruses (INSV and TSWV), it is recommended that ornamentals and vegetable transplants not be grown in the same greenhouse.

Two environmental conditions that favor foliar disease development are high relative humidity and prolonged periods of leaf wetness. Leaf wetness duration can be lessened by reducing the density of the plant canopy by spacing, watering in the morning or sub-irrigating, and improving air circulation by the use of fans. Relative humidity can be reduced by a combination of heating and venting, especially when warm days are followed by cool nights. Excess water in the growth medium can also encourage root rot diseases and damping-off. Providing plants with optimum growing conditions (temperatures, light) can also reduce disease development by improving plant vigor.

Integrated Pest Management

Integrated Pest Management (IPM) principles should be applied in a disease management program. IPM involves using all tools available to a grower including genetic, cultural, physical, biological controls, and environmental manipulation. IPM does not preclude fungicide use; the principles aim to reduce the need for chemical intervention. Basic steps of an IPM program include:

Correct identification of pathogen. Familiarity with the biology and life cycles of pathogens allows intervention when the pathogen is most vulnerable to control measures.

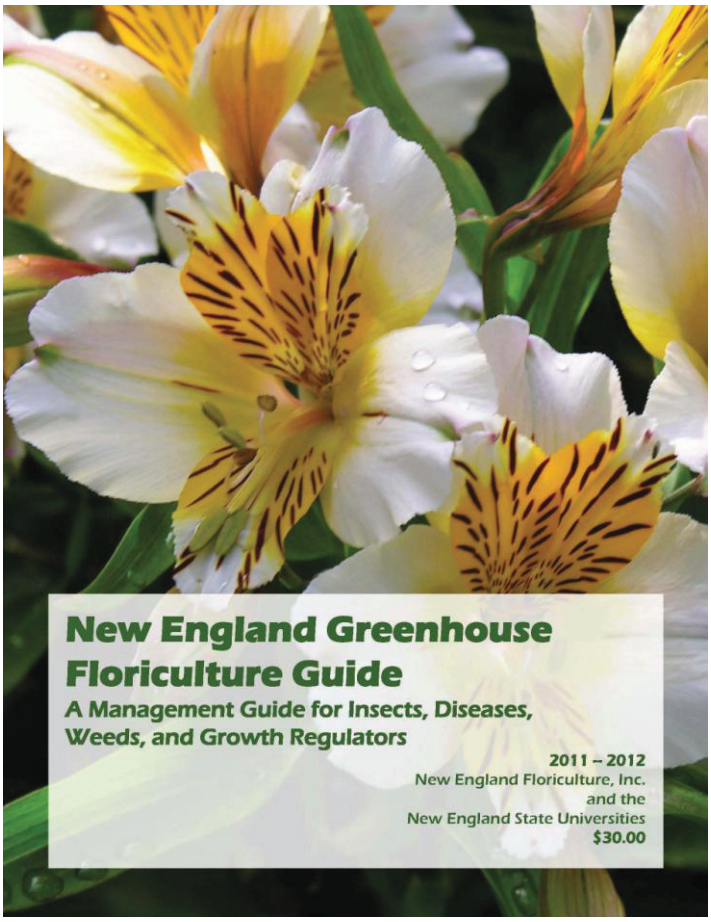
Scouting and Monitoring. Crops should be inspected for disease in a systematic manner on a regular basis. Scouting crops allows for early detection, more effective control, and reduction in crop damage.

Establish action thresholds which indicate the level of disease that require chemical intervention to prevent economic loss. The use of Action Thresholds improves fungicide timing, effectiveness, minimizes the number of applications and associated costs, and helps reduce crop damage.

Keep accurate records of pathogen occurrences, environment, and management actions. Record the success or failure of management tactics.

Identify alternative or preventive controls such as indicator plants or biological controls. There are numerous biological controls available (Actinovate, Kodiak, Mycostop, Plant Shield) and these materials are most effective in container media to prevent the growth of root pathogens such as *Pythium, Phytophthora, Rhizoctonia*, and *Alternaria* species. Fungicides are an important tool for managing plant diseases. It is critical to have a correct diagnosis of the pathogen to use fungicides effectively. Different pathogens are controlled by different active ingredients. Remember that the label is the law and fungicides must be applied according to label directions and on crops that are listed on the label. It is advisable to test a fungicide on a small portion of the crop before applying to the entire crop unless you are certain of the fungicide/crop compatibility. For specific fungicide recommendations, see the 2011-2012 New England Greenhouse Floriculture Guide.

Rotate fungicide applications among active ingredient classes (FRAC cod listed on label), to prevent fungicide resistance development in pathogen populations. Many greenhouse isolates of *Pythium* are resistant to Subdue due to repeated applications.



2011-2012 New England Greenhouse Floriculture Guide

250+ pages of up-to-date recommendations for nonchemical and chemical management of greenhouse problems, specific to New England, in a durable plastic comb binding

Practical guidance for using natural enemies to manage insects and mites

Expanded coverage of how to manage beetles on greenhouse crops

Details about how to use pesticides safely and effectively, and how to mitigate development of pesticide resistance

New plant growth regulator recommendations, including information about new generic PGRs and newly labeled PGR uses on vegetable crops and herbaceous perennials

General pest management information, lists of references, and New England resources

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Your city/state/zip: _____

Funding for High Tunnels Available

Just a reminder that the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) has a pilot project under the 'Know Your Farmer, Know Your Food' initiative for farmers to establish high tunnels - also known as hoop houses - to increase the availability of locally grown produce in a conservation-friendly way.

A seasonal high tunnel is an unheated hoop house, at least six feet in height, which create more favorable growing conditions for vegetable and other specialty crops grown in the natural soil beneath it. This pilot will test the potential conservation benefits of growing crops under these structures. Participating farms can receive funding for one high tunnel. High tunnels in the study can cover as much as five percent of one acre or approximately a 30 by 72 foot structure. The high tunnels or hoop houses cannot have power, all snow loads must be managed for the length of the project and the grower needs to keep records.

NRCS will provide financial assistance for the project through the Environmental Quality Incentives Program (EQIP).Massachusetts farmers who would like to sign-up for the high tunnel pilot should call or visit their local NRCS office.

NRCS has seven Massachusetts field offices – in Greenfield, Hadley, Holden, Hyannis, Pittsfield, Westford, and West Wareham – that work with local conservation districts and other partners to serve farmers and owners throughout the Commonwealth.

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