A Publication of the UMass Extension Greenhouse Crops & Floriculture Program

Floral Notes Newsletter

Volume 29, No. 5 http://extension.umass.edu/floriculture March-April 2017

In This Issue

Management of Diseases on Edibles in the Greenhouse

Many nurseries and garden centers produce vegetable and herb plants for sale to home gardeners. Managing diseases on edibles in the greenhouse can be challenging, particularly since the list of products labeled for use on these crops is currently rather short. A balanced IPM program involving both cultural methods and disease control products is the best approach for producing robust herbs and vegetable transplants.

Cultural methods for disease management

- **Start with clean seed**. Several common diseases can be seed-borne, including anthracnose, downy mildews, bacterial leaf spot, and cucumber mosaic virus. Some seed companies advertise certified disease-free seed- ask for information on what diseases the seed has been tested for. Seeds pre-treated with fungicides are available for some crops. The UMass Vegetable Program also offers a hot water treatment service. See www.ag.umass.edu/services/hot-water-seed-treatment for details.
- **Proper production timing, light, temperature, and nutrition**. Give your seedlings what they need in order to grow up strong and healthy. Healthy plants are less likely to become diseased. Avoid overfertilization, which results in an abundance of succulent tissue and encourages diseases such as *Pythium*.
- **Reduce relative humidity (RH) and leaf wetness duration**. Fungal and oomycete pathogens thrive in high humidity. Most also require free moisture to be present on the plant surface for a certain period of time in order for spore germination and infection to occur. Decreasing RH and facilitating rapid drying of foliage are therefore two of the most critical management techniques for preventing disease development in the greenhouse. This is often achieved through short periods of ventilation: cooler air comes into the greenhouse, and as it warms, RH decreases. Fans will also help improve horizontal air flow. Use drip irrigation when possible. Avoid overwatering.
- **Sanitation**. Dead plant material can be a source of fungal spores, especially those of *Botrytis*. Remove dead and dying leaves from plants. Control weeds in the greenhouse, as these may also harbor diseases. Control insect plants such as thrips and aphids, which can spread viruses.
- **Grow disease tolerant/resistant cultivars**. Some crop cultivars are tolerant of or resistant to certain diseases. Education may be necessary in order to gain customer acceptance of these cultivars, as their names are often unfamiliar. Some may also believe that hybrids are in fact GMOs. A little education can go a long way to promote acceptance of new cultivars.

A number of commercial products, both conventional and organic, are labeled for use on edibles in the greenhouse in New England. Be sure to check the labels to make sure a product is approved for use in your state. Also be aware that not all products are labeled for all diseases on all crops. Be certain to rotate products from different fungicide groups to prevent resistance development.

Biofungicides, those based on the activity of organisms such as *Bacillus*, *Trichoderma*, etc., can be incorporated directly into seeding and potting media. This can be especially helpful in

preventing damping off and root rot. Most of the conventional products and all of the organic products are best used as protectants.

OMRI approved products for vegetables and herbs in greenhouses

Bacillus: Double Nickel, Triathlon, Sonata, Cease
Streptomyces: Actinovate, Mycostop
Gliocladium: Prestop
Trichoderma: RootShield, Bio-Tam
potassium bicarbonate: Milstop
copper soap: Camelot O
soaps (potassium salts): M-Pede
disinfectants: Oxidate
oils: Trilogy
biostimulants: Regalia

Conventional products for vegetables and herbs in greenhouses

azoxystrobin: Heritage
copper: Phyton 35
fludioxonil: Emblem
mineral oil: Ultra Pure
phosphorus acid: Alude, Fosphite, OxiPhos

Labeled for basil downy mildew control only

cyazofamid: Ranman
mandipropamid: Micora

Other products (labeled for vegetables but NOT herbs) in greenhouses

azoxystrobin + benzovindiflupyr: Mural
PCNB: Terraclor
copper: Champ, Cuprofix, Badge
propamocarb: Previcur
pyraclostrobin + boscalid: Pageant Intrinsic (tomatoes only)
pyrimethanil: Scala (tomatoes only)
cottonseed/ corn/ garlic oil: Mildew Cure (powdery mildew only)
fenhexamid: Decree (Botrytis only)
dichloran: Botran (Botrytis only)
sulfur: Micro-sulf (powdery mildew only)
streptomycin: Agri-mycin 17 (bacterial diseases only; pepper and tomato only)

For further information, please see the New England Vegetable Management Guide section on vegetable transplant production (http://nevegetable.org/). The University of Connecticut has also published a fact sheet on products labeled for use on herbs in the greenhouse (http://ipm.uconn.edu/pa_greenhouse/).

Save Fuel and Electricity with an Energy/Shade Screen

John W. Bartok, Jr.
Agricultural Engineer Emeritus
Univ. of Connecticut

Energy/shade screen systems are one of the most common conservation measures funded by federal and state grant programs. With a payback of two to three years, these systems provide a good return on the money invested. The USDA Rural Development's Section 9007 grant program has been paying 25% of the cost of the total installation. Some state programs add up to 50% more to the grant. Low interest loans are available for some of the remaining cost.

A good website to visit is www.desireuse.org that lists information and contacts for most of the energy conservation assistance programs in the United States. Just punch in on your state and the programs will come up.

Screens provide insulation and reduce heat loss area

Energy/shade screen systems can provide 30 to 50% savings in heating costs. Often referred to as energy blankets, they save energy by reducing the heat loss surface area, provide an extra insulation barrier and trap a layer of dead air on both sides of the screen material. If the material contains some aluminum, the infrared part of the heat within the greenhouse will be reflected back toward the plants reducing heat loss another few percent. The aluminum strips can also save energy in the summer by reflecting the incoming heat back out of the greenhouse reducing fan operation.

The typical cost of a screen system is $2.00 to $3.00/sq. ft. depending on the size of the installation, screen material used, number of obstructions that have to be worked around and ease of maneuvering man-lifts in the greenhouse. Although energy screens can be installed in hoophouses, they are easiest to install in A-frame and gutter-connected greenhouses.

The standard system uses nylon monofilament or stainless steel cables to support the screen material. The material can either rest on top of the network of cables or be suspended by hooks from the cables. A gearmotor powers a drum or rack and pinion that moves the leading edge of the screen material. Control is either with a manual switch or controller that activates the gearmotor.

Choose the best system

Gutter to gutter systems require less material but form a larger bundle in the storage position. They are easier to install as work is done a lower height. With this system, equipment and plants cannot be supported from the lower truss cord.

Truss to truss systems are more common. They can be configured flat at the lower cord of the truss or formed into a slope-slope or slope-flat-slope shape to follow the roof of the greenhouse. The latter two may allow heating, lighting and watering equipment to remain in place without having to move it. Flat systems reduce the volume of greenhouse that has to be heated.

Some growers in northern climates are installing a two screen system. The lower screen has a high energy rating and the upper one is mainly for shade but provides additional energy savings when used at night. This may provide an additional 10-15% greater energy savings. Another variation is to install a clear screen material as the energy saver and keep it extended on cloudy days when there is very little sunlight.

Select the right screen material

The most common materials for energy screens are composite fabrics of alternating strips of clear and aluminized polyester or acrylic held together by a finely woven mesh of threads. Other materials include knitted and woven bonded polyester, metalized high density polyethylene and polypropylene. Things to look for include the warranty life (usually 5 to 10 years), strength and flexibility.

Many screen materials are designed to also provide shading during the summer. For comparison, manufacturers list both the shade factor and the energy savings. Shade levels from 5 to 90% are available.

Screens can also have an open weave or closed weave. The closed weave has a higher energy savings and is used in greenhouses with fan ventilation systems. For natural ventilation, an open weave allows the heat to rise through the screen when it is extended. Some growers install a closed weave to get the high energy savings and then crack the screen open to allow the summer heat to escape up through the vents.

Most screen materials are plastic. In a fire these can support combustion and increase the intensity of the fire. Materials selected should either have a fire break installed or be fire-retardant. The fire break is a section of fire-retardant material on both edges of a screen panel. It reduces the flame travel. Some building inspectors require the screen be fire-retardant material when used in garden centers and greenhouses open to the public. Along with this the support cables should be stainless steel cable instead of the more common monofilament.

Installation and maintenance are keys to energy savings

A screen system is easiest to install if the greenhouse is empty of plants. Man-lifts are frequently used to elevate workers to the truss level and require space to maneuver. Heat supply pipes that are above the screen have to be insulated or moved lower. Vent arms, water pipes, light fixtures and electrical wiring may also be in the way. The screen system requires a clear area at least 12" high

Closed weave energy screens need to be installed to provide a tight seal all the way around the edges. The most common method is to install a narrow ledge along the sidewall made from polycarbonate sheets or fire resistant screen material. The side edges of the screen slide along the top of this ledge. The back edge is attached to the truss and the leading edge is attached to rigid tubing that seals the screen against the truss.

Typical temperatures that would be observed in a heated greenhouse on a cold night might be 60°F under the screen and 35-40°F above. I have been in greenhouses where it was warmer above the screen than below showing that heat was escaping through holes, or gaps around the edges.

Regular maintenance is needed to keep proper tension in the cable system. Pulleys and gear motors should be lubricated once or twice a year. Screen materials tend to wear at the rub points or where they are supported by hooks. Repairs may have to be made at these points.

Take advantage of grant funding to improve your greenhouse and reduce energy consumption. The payback is usually very short.

Transplant Disorders

Editor's note: Originally published by Gordon Johnson in University of Delaware Cooperative Extension's Weekly Crop Update, April 29, 2011.

This is the time of the year when county agents are called to look at disorders in transplants being grown in greenhouses and when samples routinely come into our offices for diagnosis. There are many diseases of vegetable transplants that can start in the greenhouse: fungal, bacterial, and viral. Diseases should be considered first when looking at transplants. Insects such as thrips, aphids, and whiteflies also can be a problem in greenhouses and should also be considered as causes of injury. They can cause direct damage and can be vectors of virus diseases. However, many vegetable transplant disorders are not cause by pests. Some of the most common are:

Excessive Stretch and Leggy Plants: This is most commonly due to too high of temperature differential in growing houses (wide differences between day and night temperatures), excessive fertilization (especially with ammonium N fertilizers), and excessive watering.

High soluble salts from excessive fertilization can cause stunting and yellowing in addition to dessication. Photo by T. Smith, UMass.

Irregular Growth: This can have many causes including differences in seeding depth, differences in tray filling, differences in watering, differences in location in the greenhouse, irregular heating in the greenhouse (hot and cold spots), and differences in media to name a few.

Salt Injury: Plant desiccation and injury due to high salts occurs commonly when fertilizer rates are too high or when dumping occurs from slow release fertilizers at high temperatures.

Leaf scorch. Wisconsin Extension

Leaf Scorching: This can be due to salt injury also, but can occur when plants that are overcrowded are then spaced and exposed to full light or when very tender plants are put out to harden off in windy conditions.

Nutrient Deficiencies: Iron deficiencies are common if media pH rises above 6.3. Calcium and magnesium deficiencies are common if media pH drops below 5.2. Nitrogen deficiencies from under-fertilization are also common and also where initial nutrient charge in the media runs out.

Stunting: Poor plant growth or stunting most commonly is due to lack of nutrients in media (media is missing initial nutrient charge). It also can be due to excessively cold greenhouse temperatures.

Ethylene Injury: Crops grown in greenhouses with propane or gas-fired unit heaters that are malfunctioning can be susceptible to ethylene injury. Ethylene (C_2H_4) is an odorless, colorless gas

that acts as a plant hormone. Symptoms range from misshapen leaves and flowers, thickened stems, stunted growth, flower or leaf abortion to stem curling and wilting.

Transplant Height and Hardening-off

At this time of year growers are anticipating planting vegetable transplants in the field. Greenhouse and outside weather factors can contribute to transplant growth and quality, and when plants can get out into the field. Transplants may be at the perfect growth stage to plant into the field, but if reoccurring rains prevent field preparation or the ability to get into a prepared field to plant then transplants need to be held. Holding back plants and preventing them from getting too tall can be a challenge. In some crops plant growth regulators can be used. However, in vegetable crops there are few growth regulators labeled or that work well.

Another way to control plant height that is less risky is using the DIF method (the difference between day and night temperatures in the greenhouse). In most greenhouse heating programs the greenhouse will be much hotter in the day than in the night. The greater this difference the more the plants will stretch and grow tall. By reducing this temperature difference or even by reversing it to have higher night temperatures you can greatly reduce stem elongation. The critical time period is the first 2-3 hours after sunrise. Lowering temperatures to 50-55°F for 2-3 hours starting just before dawn, and then going back to 60-70°F during the day can keep plants shorter and stockier. This method does not work well for all transplants and is mainly for controlling height in tomato transplants.

Another method is mechanical movement of plants by brushing them over the tops two times a day with a pipe or wand made of a soft or smooth material. Be careful to gently do this so as not to damage softer plants like squash, cucumber and pepper. Reducing watering and fertilizer is also a method in controlling plant growth. However, be sure not to reduce water or fertilizer so much that it causes plant injury. Besides reducing growth, limiting watering and fertilizer just before planting is part of the hardening off process. It is good to expose plants to lower daytime temperatures and wind to strengthen stems. Just be sure to not put them out in high wind situations and temperatures that are too cold—this can cause damage. Placing them in an overhang area or shed may be a good idea if weather is too harsh. If the greenhouse has roll up sides or ends that can be removed to expose plants to wind and outside temperatures, hardening can take place in the greenhouse. To begin hardening transplants, reduce the amount of water used, lower temperatures and stop fertilizing plants. Starter fertilizer can be used a day or two before planting or if using a waterwheel transplanter. It is best to add a soluble starter fertilizer to the tank water.

When hardening off vine crops, tomatoes, peppers, or eggplants, do not lower the temperatures for hardening more than 5°F below the recommended minimum growing temperature. Tomato, pepper, broccoli, cabbage and cauliflower are best hardened off at temperatures around 60°F. Cucumber, squash, melon, and eggplant are best hardened off at around 65°F. Cold-tolerating transplants like lettuce can be hardened off at temperatures as low as 40°F. Even though cole

crops like broccoli and cauliflower survive cold temperatures, they should not be hardened right away to cold temperatures after leaving the greenhouse to prevent bolting and buttoning of the crop later during head formation.

Pinching and Cutting Back Plants for Height Control

Tina Smith
Outreach Educator
UMass Extension
Amherst

Pinching. Plants that are slightly overgrown or need some shaping may benefit from being manually pinched. Pinching is often used to increase branching, shape plants and reduce plant height. Pinching removes the apical dominance of the shoot which prevents branching. Apical dominance results from the production of auxin, a natural plant hormone by the terminal growing point and young leaves. Removing the terminal growing point and young leaves (pinching), removes the source of auxin and allows dormant buds below the pinch to growth.

Pinching plants too soon after planting can delay plant establishment, and pinching too late can result in poor branching from hardened, woody stems.

A soft pinch is the process of removing the terminal growing point and one or two uppermost leaves just above a node or pair of buds using your thumb and forefinger, a knife, scissors or clippers. A soft pinch results in branching and fuller plants. Growers often make one or more soft pinches to hanging basket plants to control their overall size and shape, to increase flower number and to create full, thick growth. Pinching is often used to shape plants in mixed planters containing plants with different growth rates. Always work in blocks when pinching plants and clean tools and hands between blocks of plants to prevent transmitting diseases such as Tobacco mosaic virus.

Growers may use a hard pinch when plants are overgrown, beyond using a soft pinch. A hard pinch is done by removing the terminal growing point and two to four leaves. A hard pinch delays flowering more than a soft pinch and may also result in undesirable branching from the plant if not enough nodes are left on the stems. A hard pinch will delay flowering or re-flowering usually by two or more weeks, depending on the plant.

Some growers will make subsequent pinches at three- to four-week intervals as needed, depending on the plant species and growing conditions. Additional pinches result in fuller growth and add to the quality, but also add significantly to total production time. Plants can be pruned and shaped at any time to reduce stretch and to improve aesthetics.

Cutting back: There are times when plants may need to be cut back (removing one-half or more of a plant) to reduce its size. Some species respond well to being cut back by producing abundant new growth, but others may respond with poor branching from hardened woody stems.

If the response to cutting back a particular species is unknown, test it on a few plants to determine their ability to recover. Cutting back should be reserved as a last measure.