UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

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In this issue:

Crop conditions

With relative humidity at 100% several days this week and temperatures well in the 90's, crops may be doing better than field crews who are wilting while harvesting in full force during this summer heat. Onions, potatoes, tomatoes, carrots, beets, peppers, and many other crops are coming in from fields in large numbers. Garlic is being harvest and cured - see our fact sheet on garlic curing and storage for optimum conditions.The humidity has, however, been conducive to disease development in several crops. Once in a blue moon (that's tonight by the way; we will have 2 full moons in the month of July), it is a good idea to check your sprayer calibration and coverage with water sensitive spray cards. Drop nozzles are recommended for many of the diseases showing up now so that materials can reach the undersides of leaves. A spreader sticker is recommended as well, especially in crops with waxy or slippery foliage such as alliums and some brassicas.

Under threat of thunderstorms, the UMass Vegetable Program hosted a Field Walk this week at Simple Gifts Farm in Amherst, MA where Angie Madeiras of the UMass diagnostic lab demonstrated diagnostic techniques. Under the microscope we identified *Phytophthora capsici* and *Peronospora belbahrii* (basil downy mildew) sporangia, and *Alternaria porri* (purple blotch) spores. Angie also demonstrated the best ways to collect and submit a sample to the diagnostic lab with tips such as: submit samples with living plant material as well as diseased plant material so that she can identify the causal agent of disease rather than secondary organisms which invade already dead tissue. Guidelines and forms for submitting vegetable disease samples may be found here.


Bringing the lab to the farm! Angie Madeiras, UMass Plant Diagnostician, describes how to identify different pathogens under a microscope and how to submit a good sample.

Accumulated Growing Degree Days (F): 1/1/15 - 7/29/15	
Location	**GDD Base 50 deg F**
Pittsfield, MA	1248.9
S. Deerfield, MA	1477.1
Northboro, MA	1441.2
Dracut, MA	1436.1
Boston, MA	1458.0
Sharon, MA	1451.2
Seekonk, MA	1478.8
Burlington, VT	1433.7
Middletown, RI	1306.8

Pest alerts

Vegetable scouting sheets can be found on the UMass Extension Vegetable Program website. When not given here, refer to the New England Vegetable Management Guide for scouting thresholds and treatment options.

Allium: **Onion thrips** were above threshold on onions on black plastic this week next to a field of onions in bare ground that were well below threshold. Earlier in the season, thrips pressure was reversed with greater pressure in the bare ground crop. The whole field has been treated the same all season with organic materials including Entrust applied at a threshold of 1 thrips per leaf. If your crop is above threshold, consider treating now even if onion tops are starting to die back since thrips can harbor and transfer bacterial and some fungal

diseases that will impact storage quality of onions. **Purple Blotch** was confirmed on onions at low levels in Hampshire and Bristol Cos., MA. Serenade has shown efficacy in reducing disease spread when used preventively. A spreader sticker is recommended, as many materials will not stick well to onion leaves. **Downy mildew** was confirmed on one yellow storage onion variety this week. Symptoms were yellowed or straw-colored leaves with light gray furry sporulation, typical of downy mildews. There also were some lens-shaped or oval lesions and leaves were girdled and collapsed in the region where the mildew developed (see photo). **Leek Moth** continues to cause damage in northern VT. This pest is moving around the state. It has 2 generations per year and the 2nd generation can cause bulb damage. Look for feeding on foliage with transparent window-paning and larvae inside the leaf.

Onion downy mildew. credit S. Scheufele

Location	FAW	ECB	CEW	Spray Interval for CEW
Western MA				
Hadley	.	3	.	*na*
South Deerfield	22	8	.	*na*
Whately	3	5	0	*no spray*
Central & Eastern MA				
Leominster	.	20	3	*6 days*
Millis	.	0	2	*6 days*
Sharon	.	2	1	*no spray*
NH				
Litchfield	10	3	0	*no spray*
Hollis	0	2	0	*no spray*
Mason	0	0	0	*no spray*
Burlington, VT	.	5	.	*na*
Scituate, RI	0	2	0	*no spray*

Location	Total Weekly SVB
Western, MA	
Amherst	10
Deerfield	2
Central & Eastern MA	
Barnstable	20
NH	
Litchfield	28
Hollis	24
Mason	3
Burlington, VT	n/a
Matunuck, RI	7

Basil Downy Mildew (BDM) was confirmed in Hampshire Co., MA this week in a U-Pick field. Elsewhere on the farm, the tolerant variety Eleanora is still BDM free. However, in RI, one crop of Eleanora and Thai Basil was confirmed to have BDM.

Basil downy mildew on Thai basil. credit A. Radin

Brassica: **Cabbage aphid** is beginning to appear in more fall brassica fields this week (in Franklin, Worcester and Hampshire Cos., MA and in Washington Co., RI). Spraying with insecticidal soap can be effective if started early–drop nozzles can help with better targeting the undersides of leaves or buds. **Black rot** was confirmed on kale several weeks ago in Chittenden CO., VT and on Napa Cabbage in NH this week. Weather conditions are becoming favorable for this disease. Promptly incorporate crop residues after harvest to speed decomposition. Practice a three year rotation and control cruciferous weeds.

Sweet Corn: During silking stage, combined trap captures of 12 or more European corn borers is the threshold for initiating weekly sprays, and these should be made until 5 days before harvest. Only one location in our trapping network, South Deerfield, MA is over threshold. However, in fields where trap captures are lower, scouts have seen damage and infestation over 15%. Therefore it is important this time of year to scout your crop in addition to checking trap captures. Lures for ECB NY and IA were tested in a wind tunnel at Cornell last week with live moths and results show they are still highly effective. There should be no concern that lures are not working. One outlier trap in NY captured a total of 159 ECB in one trap this week! Many ECB traps are now capturing gypsy moths; do not be alarmed as they are not a corn pest. Corn earworm moths are being captured where traps are up, but mostly at low numbers, so CEW is not driving sprays. Fall armyworm traps were set out yesterday in Chittenden CO., VT. In NH and MA, FAW moths were trapped with a high of 22 moths in one trap in South Deerfield, MA. The main pest alert message for corn this week is to SCOUT YOUR CROP; use the scouting forms found here. In whorl stage, treat if 15% are infested with FAW. In emerging tassels to silk stage, combine counts for ECB and FAW. For example, if 10% of plants have FAW and 12% have ECB, the combined infestation is 22%, above the 15% threshold. **Sap beetle** presence and damage have been reported in Worcester and Hampshire Cos., MA and in Chittenden Co., VT. Usually a secondary pest in corn, sap beetles are being found in otherwise uninfested ears, and can be a problem in some fields. Adults lay eggs in the silk and larvae feed on kernels, making

the ears unmarketable or a surprise for customers. Varieties with exposed tips or in super sweet or Bt varieties (which may not be sprayed for other insect pests) are hardest hit.

Cucurbit: **Phytophthora blight** was confirmed on summer squash in Hampshire Co., MA this week in a field that had standing water for almost 2 weeks after heavy rains earlier this month. Symptoms first appeared 2 weeks ago. Stop harvesting from areas of the farm with Phytophthora and turn the residue under deeply to reduce potential for spread of inoculum. Work in these fields last, and be sure to clean boots and equipment before traveling to other fields. **Squash vine borer** trap catches are dropping in many locations, but a second generation is expected. We are at a high risk for spread of **cucurbit downy mildew** because of the storm coming this afternoon. All cucurbits should be protected but cucumber, watermelon, cantaloupe, butternut, and giant pumpkins are of greatest priority. **Powdery mildew** is worsening on older successions of summer squash, zucchini and cucumber in organically and conventionally managed fields. Treat when 1 leaf out of 50 scouted has powdery mildew with conventional materials, and perhaps at a lower threshold with a material such as Milstop or Impede in organically managed fields. Protect earlier successions now. **Squash bug** egg masses and nymphs are being found in large numbers in Chittenden Co., VT and Hampshire Co., MA.

Bacterial leaf spot on pepper. credit A. Radin

Solanaceous: **Late blight** still has not been confirmed in Massachusetts! Track the disease here: http://www.usablight.org and continue following a preventive control strategy based on the Late Blight Decision Support System for MA here: http://blight.eas.cornell.edu/blight/ma. **Septoria leaf spot** has 'blossomed' in NH, Washington Co., RI and Bristol Co., MA. **Gray mold** was observed in field tomatoes in Bristol Co., MA, causing dark gray leaf spots reminiscent of late blight. See article in this issue for pictures and scouting tips so you don't get fooled! **Green peach** and **potato aphids** found but also high numbers of predatory lacewing larvae in a field in Chittenden Co., VT. **Tomato russet mites** are not common in New England, but have been found in damaging numbers in a research high tunnel in Washington Co., RI. **Bacterial leaf spot** was diagnosed on pepper in Hampshire Co, MA and Washington Co., RI. Copper is an effective material to keep this disease from spreading throughout the field in this humid weather. **Verticillium wilt**, **hopper burn**, **flea beetle**, and **early blight** were all confirmed on one sad eggplant crop in Washington Co., RI (see photo at right).

Verticillium, flea beetle damage and early blight on eggplant. credit A. Radin

Multiple: Potato leafhopper burn is severe in many New England locations. Mow tops on older plantings where harvests have begun or are about to and treat foliage of storage varieties to keep them photosynthesizing and allowing the tubers to size up.

ABOUT PHOSPHORUS ACID (PA) FUNGICIDES

What are they? Phosphorous acid (PA) fungicides, also referred to as phosphite or phosphonate fungicides, are effective in controlling plant diseases caused by oomycetes such as downy mildews, and species of *Pythium* and *Phytophthora*. They have targeted activity against oomycetes since these organisms contain phosphonate in their cells (fungi and bacteria do not), and have a unique mode of action which directly inhibits growth and development of oomycetes. They may also trigger plant immune response. Because of their broad activity against oomycetes the potential for rapid resistance development is not as strong as with some other oomycete-specific, systemic fungicides, and therefore are great tools to use in rotations with other materials. Furthermore, PA fungicides are systemic within the plant, and unlike most other systemic fungicides, they can be transported by both the xylem and phloem, and therefore can move up and down in the plant. Because of this they are very useful in controlling soil-borne diseases e.g. damping off caused by *Pythium* spp. And Phytophthora blight caused by *P. capsici.* Another benefit is that because of their low toxicity, PA fungicides are considered biorational, though they are not approved for use in organic systems.

How do they work? PA fungicides interfere with phosphorous metabolism in oomycetes by diverting ATP (chemical energy) from other metabolic pathways, resulting in decreased growth, and by inhibiting function of certain enzymes involved in growth and development. The active ingredient in PA fungicides may seem confusing, often going by different names, but basically when phosphonic acid is neutralized with an alkali salt such as potassium hydroxide (KOH), salts of phosphorous acid are produced (trade names include Fosphite, Prophyt, and K-Phite). Alternatively, phosphonic acid can be neutralized with ethanol and aluminu to form fosetyl-Al (trade name Aliette). This is how you get different

active ingredients within the same PA fungicides group, FRAC Group 33. (FRAC = Fungicide Resistance Action Committee). All of these materials release phosphite when mixed with water, and it is this phosphite ($HPO3^{2}$-) that does the work. Phosphite ions interfere with phosphate metabolism in the oomycete, diverting chemical energy from other metabolic pathways and reducing growth. Phosphite ions have also been found to inhibit several key enzymes needed for growth and development in *Phytophthora* spp.

PA products should not be confused with phosphate or phosphonate fertilizers. Despite the similarities, these compounds behave very differently in plant tissues. Phosphate (PO^{4}-) is the main source of phosphorus nutrition for plants. Phosphate is not a natural breakdown product of phosphorus acid, nor is phosphorus acid or phosphite transformed into phosphate within plants. Some soil microbes can transform phosphite into phosphate, but this process is very slow and its effects are negligible on crop nutrition. PA products, therefore, do not provide plants with phosphorus in a form that can be utilized as a nutrient.

Using PA Fungicides.

Always read product labels thoroughly and follow label directions, as the label is the law.

PA fungicides are extremely useful tools in managing development of resistance to targeted, oomycete-specific, systemic fungicides for which resistance development can be rapid. Because of the broad activity, the risk of resistance development is low for PA fungicides; however, resistance has been reported in some *Phytophthora* species (not *P. capsici* or *P. infestans*) so you do still need to rotate chemistries to prevent development of resistant populations.

Phosphite ions are readily taken up and translocated throughout plants. They are very stable and persistent in plant tissues; for this reason, PA products need to be applied less frequently than many other fungicides.

PA has an average pH of 6-7, so it is only slightly acidic, but it is wise to avoid mixing PA products with copper fungicides, as the acidity increases the potential for copper phytotoxicity to occur. Phytotoxicity may also be a concern when PA products are mixed with sulfur, fertilizers, surfactants, or other pesticides. Test tank mixes on a few plants before spraying an entire crop.

Various studies have shown phosphorus acid fungicides to be effective protectants, but like most fungicides, they are not curative.

For information on fungicides for specific crops, consult the New England Vegetable Management Guide.

Examples of Effective Use

Phytophthora blight. Some populations of *P. capsici* have become resistant to Ridomil, which was often used to drench plants in the early season, but may not be effective in fields with a long history of treating the disease this way. PA fungicides offer an alternative. Since they work on *Phytophthora* species and can move easily up and down within the plant, they can be used as soil drenches at planting or in the early season, or as foliar sprays once plants vine out or once fruit is present on the ground. Furthermore, they can be used in drip irrigation systems for row crops like peppers which are also very susceptible to Phytophthora blight.

Basil downy mildew. PA fungicides are some of the more effective materials available to control basil downy mildew. Again, because the material can move within the plant, the lower leaf surfaces where sporulation occurs will be well protected. PA fungicides have very low toxicity and are considered biorational, and have no pre-harvest interval.

-Written by Angie Madeiras and Susan B. Scheufele

PEPPERS: WATCH FOR PEPPER MAGGOT FLY & EUROPEAN CORN BORER

Pepper maggot fly (*Zonosemata electa*) adults emerge in mid to late July and are active for several weeks, so this is the time to watch for their activity. The fly is confined to solanaceous plants, including ground cherry, horse nettle, tomato, pepper and eggplant. Pepper is the preferred host and green bell peppers and cherry peppers are especially susceptible to pepper maggot fly damage.

Pepper maggot adult fly. credit J. Boucher.

The pepper maggot fly is found throughout eastern North America and in New England, the range of pepper maggot has been creeping northward and now extends into southern NH and throughout Massachusetts. Populations are spotty and rather unpredictable – that is, pest status is often a farm-by-farm or field-by-field phenomenon without any clear reason for high or low populations that occur in a particular place. The best way to detect activity is to look for stings on the fruit, and these are easiest to spot on cherry peppers.

Pepper maggot oviposition scars. credit B. Grube

Pepper maggot flies are smaller than a house fly, bright yellow with three yellow stripes on the thorax, green eyes, and clear wings with a distinct banding pattern. Flies aggregate in forested field edges and enter the field during the day to lay their eggs. Females insert eggs directly into immature pepper fruit and leave a small dimple – an ovipositor sting or scar. Eggs hatch after about 10 days and the legless white maggots then feed and tunnel inside the fruit, especially in the placenta, causing soft spots on the wall of fruit and brown mines within. Maggots reach about ½ inch in length over a period of about two weeks, and do not have a distinct head capsule. When they are ready to pupate, they exit at the blossom end, leaving tiny round exit holes, usually in the end of August or in early September. These holes allow for the entry of soft rot bacteria into the fruit. Sometimes the oval brown pupae can be found inside the fruit. Often damage is detected only because of premature ripening or decay of the fruit.

Pepper maggot larva and damage in cherry pepper. credit NCSU.

Pepper maggot monitoring: Maggots prefer to lay eggs in the small (1-3 cm in diameter) round fruit of cherry peppers. When these are planted in the border rows they work very well as indicator plants. The egg-laying stings appear as depressions or scars and are easy to find on these small, round fruit. By timing insecticide applications with the first occurrence of the stings on the indicator plants' fruit, damage to the main crop can be avoided with a minimum of spraying. If cherry peppers are not part of your crop mix, look for stings on bell peppers.

If this pest is a concern for your farm, consider using perimeter trap cropping which is very effective. Two or three rows of hot cherry peppers can be planted around the perimeter of the pepper crop, encircling it like castle walls. These peppers are more attractive to the maggot flies than the sweet bells, so the flies will build up in the perimeter, allowing for a perimeter spray that will reduce pest populations and protect the main crop. Perimeter trap crop systems can be as effective as whole field sprays while dramatically reducing pesticide costs and protecting beneficial insects within the main crop.

Pepper maggot threshold: If stings are observed on fruit, make two insecticide applications, 10-14 days apart, with a material labeled for pepper maggot. Pepper maggot fly activity can be very localized, and varies by farm, by region, and by year. Many farms never have a problem with this pest. Some may have it and not realize it, because it is possible to confuse maggot damage with damage caused by European corn borer. Check nearby fruit carefully for proper identification if fly has been captured. If a given farm has a history of pepper maggot activity, then it is recommended that an insecticide be applied on that farm. Farms that have never had a problem with this pest generally do not need to be concerned; however, the range of this pest seems to be expanding.

When the activity of European corn borer and pepper maggot fly overlap, use of Orthene at 8-10 day intervals for control of ECB will also provide control of pepper maggots. However other, selective insecticides for ECB will not control pepper maggot. Insecticides labeled for pepper maggot fly include Dimethoate, Malathion, Mustang (zeta-cypermethrin), and GF-120 Naturalyte (spinosad). GF-120 Naturalyte is allowed for organic production. When using Naturalyte, a large spray droplet size of 4-6 mm is recommended to optimize the duration of this bait's attractiveness to the flies. See Vegetable Management Guide for more details on using these products.

ECB larva and damage in pepper fruit. credit J. Boucher.

European Corn Borer (ECB) is a resident pest that has 2 generations per year in southern and central New England and 1 generation in northern New England. Pepper is one of over 200 crop and weed host plants of this pest. The severity of ECB in peppers varies in MA and around New England. Some farms – typically in areas where farming is less dense and ECB populations have not built up – do

not see much damage from this pest. In the Connecticut Valley and in Southeastern MA, an unsprayed pepper field is likely to have anywhere from 10 to 100% of the fruit infested. In some cases, it seems that sweet corn – which ECB prefer over peppers – helps to draw ECB away; in other cases, presence of sweet corn near peppers provides no benefit at all. Use flight counts and historical experience to help you decide which applies to you. Getting good ECB control is especially critical when you want to sell ripe, colored peppers.

Larvae overwinter in stalks of corn and other host plants and pupate in the spring. Adult moths emerge in late May or early June and mate in weedy or grassy areas. The moths are about 3/4" long, light brown in color with lighter bands on the wings. Three to 7 days after emergence (depending on temperature), females begin to lay flat, white egg masses on the underside of leaves. Eggs hatch in about 5 to 7 days (100 degree days, with a base temperature of 50°F).

ECB larvae are light colored, with a pattern of small dark spots on each segment. The head capsule is flattened and black or dark brown. Newly hatched larvae are 1/8" long and full-grown larvae are 3/4" to 1" long.

In southern and central New England, ECB generally does not become a pest in peppers until the appearance of the second generation in late July or early August. Apply insecticides when second generation moths become active. Check state sweet corn IPM reports for flight activity, or use pheromone traps for monitoring adult flight activity. Make first application 1 week after moth count equals or exceeds 7 moths per week and fruit are present on the plants. Discontinue sprays 1 week after moth counts drop below 21 moths per week. The spray interval depends on the residual period of the insecticide used as well as weather conditions and pest pressure. Use shorter spray intervals during peak flights and while pheromone trap catches exceed 150 moths per trap weekly. Choose selective/microbial products such as Bacillus thuringiensis aizawai or kurstaki strains whenever possible to preserve beneficials and reduce the chance of aphid outbreaks. Pyrethroids may cause aphid outbreaks by eliminating their natural enemies.

Using Trichogramma wasps for biological control of ECB in pepper. Sweet corn is not the only crop where ECB can be controlled with the parasitic wasp, Trichogramma ostriniae. Most of what you have read about using Trichogramma in corn applies to peppers, with a few important differences. Peppers are susceptible to the second generation of ECB, because that is when the plants are fruiting. ECB will invade fruits that are > ½ inch across. Trichogramma attacks only the egg stage, so timing is critical. We recommend that you begin releases the week that flight begins and continue weekly releases for a total of 4 weeks. Release 90,000 to 120,000 wasps per acre and spread the cards out throughout your pepper block. Higher rates are needed in peppers compared to sweet corn because the tolerance for damage is virtually zero and ECB larvae attack the fruit directly. Four releases are needed because the egg laying period for the second generation is longer than for the first generation of ECB. Fortunately, peppers are also a higher value crop and worth the extra cost. After four releases, Trichogramma will have reproduced in the field and biocontrol should continue.

Trichogramma cards hanging in pepper plants. credit R. Hazzard.

Wasps can be ordered from IPM Laboratories, at www.ipmlabs.com or by phone, 315-497-2063. Wasps can also be used in combination with insecticide; if so, choose a selective material (see above) that will not kill wasps.

-R. Hazzard, University of Massachusetts with source material from J. Boucher, University of Connecticut Extension

THE 'OTHER BLIGHTS' OF TOMATO

While late blight has become the dominant force in tomato disease management, it is certainly not the only foliar leaf blight around. The warm, humid weather with frequent rain and long periods of leaf wetness we have been experiencing in recent weeks has been providing prime growing conditions for fungal diseases of tomato, but not necessarily for the late blight causal organism (*Phytophthora infestans*) which prefers cooler conditions.

Septoria Leaf Spot

Septoria leaf spot (*Septoria lycopersici*) is one of the most destructive diseases of tomato foliage, resulting in considerable leaf drop that can cause sunscald, failure of fruit to mature properly, and reduced yields. Once infections begin, the

disease can spread rapidly from lower leaves to the upper tomato canopy.

Septoria on tomato. credit S. Scheufele.

Symptoms consist of circular, tan to grey lesions with a dark brown margin that appear on lower leaves first, after the first fruit set. If conditions are favorable, lesions can enlarge rapidly, turning infected leaves yellow, then brown. *S. lycopersici* forms pycnidia (structures where asexual spores are formed) in the center of expanding lesions which can be seen with a 10X hand lens as tiny black dots. The presence of pycnidia, plus the generally smaller size of the lesions and the absence of target-like circular bands within the lesion, distinguish this disease from early blight.

The pathogen overwinters on infected tomato debris or infected solanaceous weed hosts (jimsonweed, horsenettle, groundcherry and black nightshade), and can also survive on stakes and other equipment. Tomato seed may be coated in spores. Once established, Septoria is spread by splashing water, insects, workers, and equipment. High humidity, long periods of leaf wetness, and temperatures 60 - 80°F are conducive to disease development.

Early Blight

Early blight on tomato credit S. Scheufele.

Early blight (*Alternaria solani*) occurs on the foliage, stem, and fruit of tomato as well as potato. In tomato, the disease first appears as small brown to black lesions with yellow haloes on older foliage. Under conducive conditions, numerous lesions may occur on each leaf causing entire leaves to become chlorotic (yellow). As the lesions enlarge, they often develop concentric rings giving them a 'bull's eye' or 'target-spot' appearance. As the disease progresses, plants can become defoliated, reducing both fruit quantity and quality. Fruit can become infected either in the green or ripe stage. Infections usually occur through the stem attachment. Fruit lesions appear leathery and may have the same characteristic concentric rings as the foliage. Fruit lesions can become quite large, encompassing the whole fruit.

On potato, foliar symptoms are quite similar, though complete defoliation rarely results. Tuber lesions are dark, sunken, and circular often bordered by a purple to gray raised tissue. The underlying flesh is dry, leathery, and brown. Lesions can increase in size during storage and tubers become shriveled.

The fungus overwinters on infected crop debris in the soil and can survive there several years. High humidity and warm temperatures (75-85°F) favor infection and disease development. Production of spores requires long periods of leaf wetness but can occur during alternating periods of wet and dry. Spores are dispersed mainly by wind but also by splashing water, overhead irrigation.

Septoria and Early Blight Management:

Some tomato and potato varieties with early blight resistance or tolerance are available, however, most tomato cultivars are susceptible to Septoria leaf spot. Adequate nitrogen fertility throughout the season can help delay early blight; lower leaves become more susceptible as the nitrogen demand increases with fruit load and older leaves decline in nitrogen. Protectant fungicide sprays at regular intervals (depending on weather conditions and disease pressure) will delay onset. Rotate out of tomato crops for at least two years, control susceptible weeds, and incorporate debris after harvest. Reduce the length of time that tomato foliage is wet by using trickle irrigation, use wider plant spacing, and staking. Keep workers and equipment out of wet fields where possible.

Botrytis on field tomato. credit K. O'Dwyer.

Many fungicides are registered and effective against both early blight and Septoria, please see the New England Vegetable Guide for recommendations. Use the TOMCAST forecasting model to help with the timing of fungicide applications for early blight and Septoria.

Botrytis Grey Mold, Ghost Spot

Botrytis (*Botrytis cinerea)* leaf spot, stem canker, blight, fruit rot, and ghost spot is seen most often in the greenhouse where humidity can be high, but it was

observed on field tomatoes this season due to the hot humid weather we've been having. Leaf lesions are dark gray with no yellow halo, and therefore are often mistaken for late blight. Under conditions of alternating heat and humidity, the pathogen grows in such a way as to form concentric rings, and for this reason is often confused with early blight. The way to tell it apart is by it's characteristic fuzzy brownish-gray sporulation. This is the same fungus that grows on strawberries. If you hold the leaf up and look across the lesion you will see fine mycelia sticking up with little tuftlets on the end. This is diagnostic of *Botrytis cinerea*–the name means cluster of grapes, describing those tufts of spores that resemble grape clusters. *B. cinerea* primarily feeds on dead tissue and is only weakly pathogenic, therefore, you will likely see this sporulation on senescent tissue including flowers, and the lesions often start from the leaf tip or margins when nutritional disorders cause them to start dying back. Spores that land on fruit cause ghost spot, which appears as pale white halos or ring spots on the green tomato fruit. On ripe fruit, the ringspots may be yellow. Ghost spots develop when the fungus initiates infection, but disease progress is stopped by dry environmental conditions. This spotting may adversely affect market quality. Under favorable conditions ghost spot may lead to fruit rot.

Botrytis on tomato.
credit S. Scheufele.

Leaf Mold

Leaf mold (*Fulvia fulva*) can occur in the field, but is most common in greenhouses, in both soil and hydroponic systems. Symptoms can be confused for those of late blight, but late blight is rarely found in greenhouses because of the high temperatures. Leaf mold infections begin on older leaves and cause pale-green to yellow spots visible on the upper leaf surface, with olive-green to grayish-purple fuzzy growth on the underside of the leaf where the fungus is producing spores. Heavily infected leaves turn yellow, then brown and may wither and drop. Occasionally petioles, stems, and fruit may be affected. Infected flowers wither without setting fruit and infected fruit has leathery, black, irregularly shaped lesions.

The fungus overwinters in soil on crop residue and as sclerotia (hard, black, long-lived resting structures) and may be introduced on infested seed. Disease development is favored by warm, moist conditions with relative humidity over 85%. The fungus can survive and reproduce between 50- 95°F, with optimal infection and growth between 71-75°F. The disease can spread rapidly as spores disperse throughout a greenhouse on air currents, water, rainsplash, insects, and workers.

Fulvia on top and bottom of
tomato leaf.
credit UMass.

Powdery Mildew

Powdery mildew (*Oidium neolycopersici*) of tomato is emerging as an important disease of greenhouse and high-tunnel tomatoes, and is occasionally seen in field tomatoes. Look for light-green to bright yellow lesions on the upper leaf surface. The spots enlarge and become necrotic. Lesions may exhibit concentric rings similar to early blight. A light, powdery coating may be seen on leaf undersides, or a dense, white layer of growth may develop on both leaf surfaces if conditions are right. Entire leaves wither and die, but remain attached to the stem. There are no symptoms on fruit or stems, but loss of foliage may result in sunscald. The pathogen does not require free water to germinate and cause disease but it does thrive under humid conditions and a range of temperatures (50-86°F). This pathogen can be very aggressive and lead to reduced yield and flavor if untreated.

Powdery mildew on tomato.
credit S. Scheufele.

Botrytis, Leaf Mold and Powdery Mildew Management:

Control weeds and remove plant debris. Space plants and sucker them or remove lower leaves to allow good air circulation, reduce humidity within the canopy, and minimize leaf wetness by watering with drip irrigation or early in the day. In the greenhouse, improve horizontal air flow with fans, and reduce humidity by a combination of heating and venting in the evening, particularly when warm days are followed by cool nights. Avoid excessive nitrogen fertilization. Remove all diseased plant residue and destroy them; disinfest the entire greenhouse after harvest. Practice hot water seed treatment

for tomatoes as a general rule. For Fulvia in particular, start with certified disease free seed as there are there are a few products labeled for use on indoor tomato to control this disease.

Please see the New England Vegetable Management Guide (www.nevegetable.org) for current management recommendations. Always alternate fungicide applications between materials with different modes of action to prevent resistance development.

-Bess Dicklow and Susan B. Scheufele, UMass Extension

CABBAGE ROOT MAGGOT: ENTRUST LABEL EXPANSION SURVEY

Last year the UMass Extension Vegetable Program conducted field trials evaluating insecticides to control cabbage root maggot (CRM). The goal of this research is to get new tools and materials into the hands of growers who have been struggling to control this pest with inadequate options and limited success. We repeated and expanded our CRM studies in 2015 to include more OMRI-approved insecticides and to evaluate application methods for using Verimark in direct-seeded brassica crops. Again we saw that Verimark provided excellent protection from CRM damage, as well as feeding damage from flea beetle and imported cabbageworm, when seedlings were treated in trays in the greenhouse. We were also excited to see that our results from last year stood the test of time and variations in seasons, and that Entrust was still able to protect plants from CRM damage and performed as well as the industry standard, Lorsban. Currently Entrust is not labeled to control CRM outside of California, and using it as a drench application is an off-label use pattern. We are collecting information that will help us understand growers' interest and need for new, effective, OMRI-approved insecticides to help us pursue a label expansion for this product, but we need your help. Please take a few short minutes to fill out this survey on brassica acreage and the impacts of CRM on your farm. You can find the survey here: https://www.surveymonkey.com/r/3X5F7WS.

SEEKING FARMS FOR POST-HARVEST HANDLING VIDEOS!

As part of our continued efforts to help farmers adopt safe and efficient produce handling practices, especially in the packing house, we are working with collaborators at UCONN and UVM to develop a series of at least 4 videos focusing on standard operating procedures including greens washing, and cleaning and sanitizing of harvest and packing facility tools and equipment.

We are looking for growers to help with this process by allowing us to film techniques on their farms. This will likely entail one day of "B" shooting of video with no script, but pictures of farms and facilities related to the video in operation; and one day (perhaps a half day) of "A" shooting of video with the folks reading the script and perhaps showing some of the techniques we are teaching. These are very short videos—2 to 4 minutes at the most, being developed by the UMass Media Relations department.

We would like to involve at least one farm from Massachusetts to help illustrate some of these important best practices.

We are in the early stages of planning, but are looking for possible sites for filming to take place sometime between mid-August through the end of September. We would like to conduct the filming at farms that may be engaged in some of the best practices we hope to address in the videos. This could mean produce washing; development and implementation of standard operating procedures; cleaning and/or sanitizing of harvest tools and bins or packing house equipment including conveyors, bins, tables or wash tubs.

Is this something you would be interested in doing? If so, please contact Amanda Kinchla by email: amanda.kinchla@foodsci.umass.edu or by phone at: 413.545.1017. Thank you for your consideration.

MASSACHUSETTS TOMATO CONTEST TO BE HELD AUGUST 20TH

The 31st Annual Massachusetts Tomato Contest will be held in the KITCHEN at the Boston Public Market on Thursday, August 20th. Tomatoes will be judged by a panel of experts on flavor, firmness/slicing quality, exterior color and shape. Always a lively and fun event, the day is designed to increase awareness of locally grown produce.

Farmers who want to submit entries can bring tomatoes to the market between 9:00 am and 10:45 am on August 20th or

drop their entries off with the corresponding registration form to one of several locations around the state on August 19th. These tomatoes will be brought in to Boston on Thursday. For the complete details, including contest criteria and a registration form, go here or www.mass.gov/eea/agencies/agr/markets/farmers-markets/tomato-contest.html.

The 31st Annual Tomato Contest is sponsored by the Massachusetts Department of Agricultural Resources, New England Vegetable and Berry Growers Association and Mass Farmers Markets in cooperation with the Boston Public Market.

Events

IPM Field Walks

There is one field walk still upcoming in this series, where growers can learn to identify and scout fruit and vegetable pests and select integrated pest management strategies. Applicable to all, whether you are a beginner or an experienced farmer, organically certified or not! We will walk farm fields with Extension Educators and farmers in Massachusetts, Rhode Island, and Vermont to learn how each farm is practicing IPM. Bring a hand lens if you have one. This series is funded in part by a Northeast IPM Center grant. **.**

- **August 25th, 3:30-6pm**
  Hurricane Flats, 975 S. Windsor St. South Royalton, VT
  Join us to learn how to scout for disease and insect pests in the field and discuss effective organic control strategies with farmer Geo Honigford, Ann Hazelrigg and Gabriella Maia (UVM Disease Diagnostic Laboratory) and Katie Campbell-Nelson (UMass Extension Vegetable Program). Sponsored by Vermont Vegetable and Berry Growers Association and NOFA-VT.

Professional Development Soil Health Workshop Series

The University of Massachusetts Extension has been funded by the Sustainable Agriculture Research and Education Professional Development Grant (2014-2017) to provide educational opportunities to Agricultural Service Providers and Farmers in Soil Health topics.

- **August 17th, 3-5pm**
  Soil Tests for New England and interpreting them for Phosphorous Management, 89-91 River Rd. S. Deerfield, MA
  Tom Morris, University of Connecticut Professor, Plant Science will present methods of different soil extractions and tests, with a focus on those appropriate for New England soils. With his experience in field research on nitrogen and phosphorous, Tom will present Agricultural service providers with a basic understanding of the chemistry of Phosphorous in the soil, how it behaves, how best to assess P status of soil in different growing systems, how to assess potential loading from soil applications of fertilizer, compost or manure, and how to mitigate soil with excess Phosphorous aside from not adding more (e.g., cover crops or other ways to use up or sequester phosphorous to prevent off site movement or contamination.
  Tom Akin, Natural Resource Conservation Service Agronomist will present work on evaluating a new soil extraction method for New England with data from Massachusetts farms. The new Haney Soil Health Test is being tested in Massachusetts to evaluate it's ability to better predict active carbon and other indicators of soil health.

2015 NOFA Summer Conference

When: Friday, August 14 to Sunday, August 16, 2015
Where: UMass Amherst Campus

This year's main conference features 144 individual sessions with 27 different topic areas. Workshops address organic farming, gardening, land care, draft animals, homesteading, sustainability, nutrition, food politics, activism, and more. The theme for this year's Conference is "Healing the Climate, Healing Ourselves: Regeneration through Microbiology".

This year's conference will include sessions with UMass personnel:

- Amanda Brown, Director of the UMass Student Farm; Tour of the UMass Ag Learning Center
- Lisa McKeag, Extension Vegetable Program; Pest Scouting in the Field at Simple Gifts Farm
- Susan Scheufele, Extension Vegetable Program; Integrated Pest Management in Brassicas

THANK YOU TO OUR SPONSORS

Vegetable Notes. Katie Campbell-Nelson, Lisa McKeag, Susan Scheufele, co-editors.