UMASS EXTENSION

Vegetable Notes

For Vegetable Farmers in Massachusetts

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In this issue:

Crop conditions

While parts of Massachusetts received thunderstorms last night, though some areas remain dry. One farmer in Rehoboth reports that his soils are dry 2-3" deep, and while he welcomes the rain from the impending tropical storm, he hopes that it won't be 5" at once. Others are concerned that the tropical storm will bring up more pest problems from the south including corn earworm, cucurbit downy mildew, and late blight. Crops shot up in the last week with warm weather and residual moisture from the last rain. Earliest corn is almost ready to pick and potato fields are in full bloom. Cucumbers are producing heavily, spring cabbage is being harvested, and on at least one farm, the earliest, row covered field tomatoes are turning red. Within a week or two sweet corn planting will be over for the year, which is good since harvesting demands will keep going up from here on out.

The first of the field tomatoes are beginning to ripen, after a period of dry hot weather this past week.

Pest alerts

Sweet Corn: European Corn Borer: Captures for the week rose in some locations (eg Sunderland, Amherst, Leominster) and dropped in most others compared to last week--we are nearing the end of the first flight. Continue scouting for borers in pre-tassel and green tassel and spray if 15% of plants are infested. To use a quick decision tool see scouting sheets in the Record Keeping Booklet of the Sweet Corn IPM Field Guide and use the full guide for ID and scouting tips. Making decisions quickly based on sampling saves you time and avoids unnecessary sprays. Corn earworm is zero or below threshold at most sites. More traps are going up as corn reaches silk stage across the region; watch traps closely when storm fronts move through from the south. Consider using newer more selective products that have lower bee and beneficial impact, including spinosyns (Radiant, Entrust SC), diamides (Coragen, Belt), mixtures of diamides and pyrethroids (Besiege). Sap Beetle was observed this week in Franklin and Worcester County, MA, in low numbers – specifically dusky sap beetle, which is all black and about 1/3" long. Sap beetles including the four-spotted sap beetle and strawberry sap beetle are commonly found in ripe and rotting fruit. Dusky sap beetle is the most common to invade early sweet corn, and is a consistent pest on some farms. If ECB damage is present they will seek out damaged tissue, but fields without damage are also attractive during silk drying and ear fill. Eggs laid in silk result in tiny white larvae which feed on kernels. Now is the time to scout if this has been a problem on your farm.

Cucurbits: Squash Vine Borer moths have been captured above threshold in pheromone traps in Hampshire and Franklin Co., MA, Chittenden Co., VT, Hillsborough Co., NH and southern RI. One trap in VT captured 97 adults, so we know the population has emerged in the north. Eggs were found on giant pumpkin in one field with a trap capture of 12, so an insecticide treatment targeted at the base of the plant was recommended to kill hatching larvae. SVB populations are very site specific, so make treatments based on scouting or trap captures. Threshold is 5 adults per trap per week but based on 2013 Rutgers Extension Publication we suggest a threshold of 1 adult per trap per week

when using organic products. Spinosyns (EntrustSC or Radiant) have shown efficacy if coverage is good. Angular leaf spot (see Cucurbit Disease Scouting & Management Guide, p 36) has been diagnosed as a seedborne pathogen in "Paycheck" zucchini and there is a recall of the seed for this crop. ALS has also been found in other varieties of zucchini and summer squash this week. Copper sprays can help reduce the spread of this disease to other cultivars planted nearby though some cucurbits are sensitive to copper sprays. Harvest infected crops last to avoid spreading the disease through the field. Cucurbit downy mildew was confirmed on cucumbers in Maryland this week. All cucurbit growers should scout fields regularly, as this disease moves fast and can take plants down quickly. Cucumber growers should be especially diligent in light of the major storm which is heading up from the south. Monitor disease progress and get up-to-date forecasts at http://cdm.ipmpipe.org/.

Potato and Tomato: Late blight has been confirmed on potato and tomato in Lancaster County, PA and confirmed on potato in west-central PA (Cambria County); in potato on Long Island, NY (Suffolk County) and on potato in western NY (Erie County). To date the disease has not been reported in MA, check usablight.org to track outbreaks. The LB Decision Support System is recommending a 5-10 day spray interval for susceptible varieties, depending on location and last fungicide sprayed. To get spray recommendations tailored to your location and fungicide program check our DSS website here. In potato and eggplant, larvae of the first generation Colorado potato beetle (CPB) are large and feeding heavily where not controlled. They will pupate in the soil and emerge in 10-14 days. Potato Leafhopper numbers are increasing, but variable in different fields -- scout. Maintain adequate soil moisture during tuber initiation to reduce scab risk. See DSS for recommendations on late blight prevention in your area. Botrytis and Fulvia Leaf Mold are abundant in greenhouse and high tunnel tomatoes regionally. Keep humidity below 85% if possible and remove lower and infected tissue to increase airflow. Watch for early blight and Septoria leaf spot in the field (see article).

Table 1. European corn borer and corn earworm trap captures for week ending 7/3/14.

Location	Weekly ECB reported	Weekly CEW reported	Spray Interval for CEW
Western, MA			
Sheffield	1	0	
South Deerfield	1	0	
Sunderland	20	0	
Amherst	11	0	
Hadley	4	0	
Feeding Hills	5	0	
Central & Eastern MA			
Spencer	0	-	
Tyngsborough	0	1	*Below threshold*
Concord	1	-	
Millis	-	-	
Sharon	2	1	*Below threshold*
Leominster	7	-	
Lancaster	-	-	
Seekonk	0	3	*6 days*
Rehoboth	7	-	
NH			
Litchfield	2	2	*6 days*
Hollis	6	0	
Mason	2	.-	
Burlington, VT	2		

Scarab beetles: are out and can be a pest defoliating basil, pepper, collard, and other crops.

Brassicas: Imported cabbageworm and diamondback moth have been seen in Saunderstown, RI and higher numbers in Eastern MA with many eggs, and adults seen. Newly hatched larvae are difficult to see, so now is the time to scout!

Spotted Wing Drosophila and Brown Marmorated Stink Bug Monitoring in 2014: SWD and BMSB traps have gone out statewide in MA and email updates and text alerts will be available soon. To sign up for SWD and BMSB text alerts, go to: https://extension.umass.edu/fruitadvisor/alert-signup

Once you fill out the form and submit it, the system will send you a confirmation email to which you will need to reply to confirm that you do, in fact, want to sign up for this service. Cancellation information will also be included in the email. You can cancel at any time. The system will not collect or provide your email or cell phone number to any other entity.

You can sign up for either or both pests. Please indicate if you would like to receive weekly email updates, text alerts (only for urgent events) and provide your email address and/or cell phone number accordingly. Be aware that texting charges may apply, but texts will only go out for very urgent notifications. If you have any questions, please contact

either Sonia Schloemann (sgs@umext.umass.edu) or Arthur Tuttle (aft@umass.edu).

In addition and new this year, there will be a mapping feature to the SWD and BMSB pages which will show updated information on where these pests are being found and relative abundance. This does not replace the need to trap and/or monitor on your own farm, but will give you an idea of if and where things are happening near you. -- *Sonia Schloemann, UMass Extension*

MANAGING HEAT RELATED DISORDERS IN BRASSICAS

Many growers focus their brassica production on the cooler ends of the season. They have been harvesting early spring brassicas since May, are now cutting spring cabbage and broccoli, and are starting to to plant their fall brassica crops. Some growers are managing to produce summer brassicas successfully, but this can be challenging. As our first heat wave of the summer hit New England this past week, we thought now would be a good time to discuss management of heat related disorders in brassicas. Heat and moisture stress reduce the crops' ability to take up and translocate nutrients within the plant, ultimately leading to a majority of the disorders discussed below. For example, head rot, brown beading and tip burn are all caused by calcium (Ca) deficiencies in the plant, while hollow stem is caused by a boron (B) deficiency. Achieving 500-600 boxes per acre of broccoli through the hottest part of the summer is a tricky proposition, and while there isn't a silver bullet that will ensure a perfect crop, there are ways that you can mitigate your risk and ensure the best possible broccoli crop all summer long.

Head Rot and Brown Beading

Problems with Ca uptake combined with rapid growth can result in head rot or brown beading, even when soil Ca levels are high. Head rot results from bacteria breaking down the tissues under wet conditions, and brown beading results from individual flower buds aborting under dry conditions. Excess nitrogen and extended periods of wet or dry conditions during warm temperatures give rise to rapid plant growth while Ca uptake is diminished due to poor transpiration rates in the plants.

Uneven bead size & floret height, brown beads, and leaves forming in the head-- all symptoms of heat stress in broccoli.

Research done by Thomas Bjorkman at Cornell University, using the cultivar Galaxy, showed that the critical period for heat sensitivity in broccoli only lasts for roughly ten days. This 'window' of sensitivity corresponds to the time when the growing tip shifts from vegetative growth to flower bud initiation. This period of about 10 days begins prior to when a tiny crown is visible in the center of the plant. Temperatures above 35°C (95°F) for more than four days during that period causes uneven bud development, resulting in heads that were uneven and poorly shaped leading to head rot and brown beading. Other references suggest that temperatures above 85°F can cause heat injury.

Management: Uneven or inadequate soil moisture also exacerbates heat stress. Trickle irrigation is helpful for supplying water on a steady basis without increasing the risk of water sitting on the head. When individual buds or areas of the head are killed by heat stress, this allows entry of pathogens. Uneven heads also allow water to remain longer on the surface of the head, which increases the likelihood of disease development. Mixing varieties based on rate of maturity offers growers another practical defense against either head rot or brown beading, because it distributes the critical period for heat sensitivity across a range of weather conditions. Select a later-maturing cultivar to be harvested along with your regular cultivar for that part of the growing season when problems have typically occurred. Check with your seed supplier regarding heat tolerant varieties. Emerald Crown (Seedway), Green Magic (Johnny's Selected Seeds, Harris), and Belstar (JSS, High Mowing Seeds) are varieties reported to have good heat stress tolerance in New England.

Tip Burn

Tipburn has been generally recognized as a calcium (Ca) disorder, though it usually results from high temperatures and uneven rainfall/irrigation preventing the plant from taking up adequate Ca, rather than from a deficiency in the soil. Tipburn and internal browning affect many brassicas and both head and leaf lettuce. Calcium (Ca) deficiencies show up on young, growing tissues. In cabbage, margins of inner leaves turn brown, beginning at the hydathodes (structures in the leaf tip or margin that excrete excess water), and later desiccate to become thin and papery at the margin or over large portions

of the leaf. The affected tissue may turn dark brown to black, occasionally being invaded by secondary bacteria that cause a watery soft rot. In cauliflower, internal leaves turn brown and fold over the developing curds. When secondary microorganisms attack these leaves, they become a mushy smear over the curd and make the head unmarketable. In lettuce, the symptoms appear on the inner leaves of the head which are more visible during head formation, so it is usually noticed before harvest. Cavity spot on the roots of carrots and parsnips is also due to Ca deficiency, as roots are the young growing tissue in these plants.

On a daily basis, Ca moves with the transpiration stream to the outside leafy parts of the plant, which are actively transpiring on sunny days. At night, especially when dew forms, transpiration is reduced and water movement generated by the roots is direct to the inner part of the head. However, on warm, dry nights the outer leaves continue to transpire, and Ca is diverted away from the head. Once Ca is fixed by the outer leaves, it cannot be translocated to the interior of the head.

Environmental conditions that favor rapid plant growth favor tipburn. Abundant soil moisture promotes rapid growth, while excess moisture reduces soil oxygen levels, which in turn reduces Ca uptake and movement. A warm dry spell after a period of abundant moisture may aggravate the disorder. Drought or root damage such as early season cabbage maggot feeding also stress the root system and can impair the plant's ability to take up Ca and translocate it. Excess nitrogen (N) encourages rapid growth, and also results in large outer leaves that accumulate Ca at the expense of young inner leaves. Wide spacing also encourages large outer leaves and rapid growth.

Use of urea, ammonium nitrate, or Ca ammonium nitrate fertilizer can aggravate Ca problems, because ammonium cations out-compete uptake of Ca in the plant. Ca nitrate is more expensive, but the N is all in the nitrate anion form which will give brassicas the needed N fertility but will not compete with Ca for uptake. Note that when applying Ca nitrate through a drip system it is important to use greenhouse grade material rather than field grade to avoid clogging the system. Excess potassium cations also inhibit uptake of Ca, while excess phosphorus binds with Ca in the soil and reduce uptake of both nutrients. Some of our soils have excessively high phosphorus relative to potassium.

Management: Factors that promote rapid plant growth should be avoided, because rapid growth puts a high demand for Ca on the tissues. Maintenance of optimum but not excessive fertility (including N) is important. Maintaining a phosphorous to potassium ratio of 1:1 should help to minimize the incidence of tipburn. Irrigation may be necessary to maintain steady and optimum levels of soil moisture. Addition of high levels of Ca to the soil and foliar applications do not seem to alleviate the problem. Close plant spacing and prompt harvesting of crops when mature are beneficial practices. Internal symptoms grow worse as heads become larger and more mature. Avoid aggressive cultivation which can damage roots.

Internal tip burn of cabbage.

Cultivars that grow less vigorously are less prone to this disorder. Resistant cultivars are available for some crops, check your seed suppliers for their recommendations. Growers reported that the cabbage cultivars Green Cup and Bronco had worse symptoms than other cultivars when the problem occurred in 2004 and 2005.

Hollow Stem

Heat and rapid growing conditions exacerbate the effects of boron deficiency leading to hollow stem in heading crops which is often not noticeable until harvest. Chlorotic younger leaves or rosette die-back can be a sign of B deficiency and hollow stem. Hollow stem is worsened by pH greater than 7. Excess moisture leaches B out of the soil and low moisture inhibits soluble B uptake and poor root development. Excess Ca, K, or Zn have also been shown to outcompete B in plant uptake. Other causes include excess nitrogen fertilizer, imbalance of nitrogen and boron, or rapid growth after head initiation. High P levels in soil have been shown to increase B uptake. There are cultivar differences in boron sensitivity.

Management: Avoid sidedressing brassicas with nitrogen after head development begins. Broccoli, cabbage, cauliflower, turnip and rutabaga are very sensitive to boron deficiency. The best method to apply a small amount of boron is as an additive to the fertilizer or diluted in a water spray applied to soil before final field preparation. For example, if the level of boron in the soil is low, apply 3 lb of boron (15 lb Solubor, or 30 lb Borax)/A before planting broccoli and cauliflower, and 2 lb/A for cabbage. Conventional fertilizers can be purchased with added boron.

--Katie Campbell-Nelson and Ruth Hazzard, UMass Extension

CATERPILLARS IN BRASSICA CROPS

Imported cabbageworm and diamondback moth eggs and larvae have been observed in leafy and heading brassica crops this week. Feeding damage can reduce yield and marketability of both leafy and heading crops, but more damage is caused when early cabbage and broccoli crops are beginning to form heads. In the early season, caterpillar numbers tend to be lower than late season, but keeping the first heads clean is key. The major caterpillars on Brassicas include four species that differ in size and feeding habits, as well as how susceptible they are to certain insecticides. The first to arrive and the most common are imported cabbageworm and diamondback moth. Getting acquainted with the pests helps you to know what kind of damage to expect and what to look for.

Imported cabbageworm (*Pieris rapae*) is a very familiar white butterfly which can be seen in the daytime fluttering around brassica fields. Each forewing has a dark border and one or two round black spots. Eggs are laid singly on the underside of leaves, about 1/8 inch in length, light green and slightly elongated, standing upright. The larva is gray-green, slightly fuzzy, and sluggish but can be very well camouflaged. Feeding and resting occur on the underside of leaves, and larvae feed more heavily in the head of cabbage or broccoli as they develop. The overwintering stage is the crysalis (pupa), which is green or brown, smooth with three pointed ridges on its back. There are 3-4 generations per year.

Imported cabbageworm larvae have rounded ends, are furry, and move slowly.

Diamondback moth (*Plutella xylostella*) caterpillars are smaller, light green, appear more segmented with a forked end and more pointed in shape. When disturbed they wiggle vigorously and may drop off the plant on a string of silk. Feeding causes small, round holes and tends to be spread across the foliage and not necessarily concentrated in the head. The adult moths are tiny (<1/2 inch), light brown, and rest with their wings folded together like a tent. They overwinter in crop residue, but may also enter the region by migrating from southern states.

Field Scouting and Management. It is especially important to check cabbage or broccoli plantings as they begin forming heads. Greens such as collards and kale should be scouted earlier, since all leaves are marketed. Check at least 25, randomly-selected plants throughout the field, looking for caterpillars or fresh feeding damage on the top or underside of leaves. Feeding damage can be found on the underside of leaves or in the center of the plant where heads are forming. Look for black or green frass and tiny feeding holes, clustered together. Often it is easier to spot the frass and feeding damage first, then find the caterpillar. Classify plants as infested (one or more caterpillar present) or non-infested, and calculate the percent of plants infested. In the Northeast, there is generally no need to treat young plants unless weather conditions delay plant development and at least 35% of them are infested with any of these pests. Treat heading crops between the start of heading and harvest if 15-20% or more of the plants are infested. The most critical time to scout and apply controls is just prior to head formation. For leafy crops like kale and collards where all leaves are marketed a 10-15% threshold should be used.

Diamondback moth larvae have tapered ends and wriggle when distrurbed.

Insecticide applications. Use at least 50 gal spray material/A; higher volumes provide better coverage. Better coverage of lower leaf surfaces can also be achieved by using drop nozzles. Use a spreader-sticker. Use selective insecticides to protect beneficial insects that keep aphids under control, eat insect eggs and small caterpillars, and parasitize either ICW or DBM. Selective products often are most effective when consumed with foliage so coverage is important. Effective, selective insecticides include:

diamides (Bee toxicity: L, Group 28) including chlorantraniliprole (Coragen, 3 dh, REI 4h,) and the newly registered cyantraniliprole (Exirel ;

spinosyns (Bee toxicity: M, Group 5) and spinetoram (Radiant, 1 dh, REI 4h) and spinosad (EntrustOG,1 dh, REI 4h)

Bacillus thuringiensis (Bee toxicity: L, Group 11)products including Bt aizawi (XenTariOG , 0 dh, REI 4h) and Bt kurstaki (such as Dipel DFOG and many other products, 0 dh, REI 4h).

These newer materials and the aizawai strain of Bt will usually provide better control of resistant DBM than older prod-

ucts. See the cabbage/insect control section of the New England Vegetable Management Guide for additional synthetic and naturally derived products and more details.

-- Written by Ruth Hazzard and Susan B. Scheufele, UMass Extension

SCARAB BEETLES: JAPANESE, ORIENTAL AND ASIATIC GARDEN BEETLES ARE ACTIVE

Japanese beetles have been flying for the past week or two. Oriental beetles and Asiatic garden beetles are also actively flying now and, though less damaging, may appear in vegetable fields as well. All species are feeding and starting to lay eggs. There are four species of scarab beetles that are common in New England turf, fruit and vegetable crops, though none are native to the US. Japanese beetles are the most common and widely distributed but oriental and Asiatic garden beetles are expanding their range and activity.

Japanese beetle (*Popillia japonica***)** adults are about half an inch long, with a metallic green head. The wings are shiny copper or bronze color, and there are a few tufts of white "fur" along the side of each wing when it is folded back over the body. The adults are active in daylight and feed on many different kinds of trees, fruit and flower crops. Fruit and ornamental plants are preferred, but beetles can congregate in vegetables also. In vegetables, adults can cause silk clipping in corn, and leaf damage in sweet basil, collards, other greens, green beans, eggplant, asparagus, rhubarb, and peppers. Though numbers may be high, there is no need to treat unless actual feeding damage is significant. In corn, if there are more than two Japanese beetles per ear and corn is less than 50% pollinated, a pesticide application may be warranted to reduce clipping and ensure adequate pollination.

Larvae and adult Japanese beetles.

Asiatic garden beetles (*Maladera castanea***)** are about half as long as a Japanese beetle adult, and somewhat more "plump" or domed in appearance. They are reddish-brown or copper-colored. They often are found near roots of plants when one is weeding. Adults feed at night, so one may find damage without seeing the beetles. During the day they hide in the loose soil or mulch around the base of the plants. Scout with a flashlight at dusk or during the night, or sift through soil to find them. Larvae feed on beet, carrot, corn, lettuce, onion, Swiss chard, and strawberry. Adults feed on carrot, beet, parsnip, pepper, cabbage and turnip.

Asiatic garden beetle.

Oriental beetles (*Anomala orientalis***)** fly at night but are very active during the day as well. The beetles are smaller than Japanese beetles, and usually are a rather mottled gray with black splotches. The pattern and color varies. The antennae are branched and are quite striking if you take a close look. Oriental beetles have a long flight period – through early August – and are very mobile. Adults tend not to feed heavily in vegetable crop foliage but show up in many crops. Grubs damage may be worse in drought years and in weedy fields, but is not commonly a problem in vegetable fields and crops, though this is not well studied.

Oriental beetle.

European chafers (*Rhizotrogus majalis***)**, a fourth species which may also be found, are slightly larger than Japanese beetles and are a fairly dull brown or tan in color. They are night fliers but can be seen in large numbers just at sunset, when they congregate in favorite trees (such as locust or willow). Adults are not foliage feeders and grubs are mostly a turf problem.

Life Cycle. The life cycle of the Japanese beetle fits most of the species of grubs we encounter in New England, with minor variations. They have a one-year life cycle, with adults emerging from the soil in early July in most of Massachusetts (later farther north) to feed and mate. The females burrow into the soil (often in or near wide expanses of grass or sod) to lay eggs which hatch into tiny grubs (cream-colored larvae, C-shaped, with brown heads) that feed on roots of grasses and other plants (especially corn). Grubs molt twice by the middle of September, and continue feeding until the soils begin to cool down. In late fall the grubs migrate downward through the soil profile, staying below the frost line throughout the winter. In the spring as the soils warm up, the grubs move back into the root zone and resume feeding for about six weeks. By the middle of June, most grubs have completed their feeding requirements and pupate (still in the soil) for about a

week before emerging as new young adults.

Management. On turf, insecticide controls normally target young grubs just as they begin to emerge from eggs. In vegetables, managing the grub stage may not be feasible (or necessary) since the grubs are most likely feeding elsewhere. Vegetable growers could run into problems with grub damage if turf or sod is plowed under in fall or spring and followed by a spring vegetable crop. A fallow or very weedy field may generate a hefty population of Oriental or Asiatic Garden beetles the following year.

Insecticides may be needed to control adult beetles if numbers are high and damage is significant. The 2014-2015 New England Vegetable Management Guide lists products for Japanese and/or oriental beetles in basil and sweet corn. For controls in a crop where these beetles are rarely a pest and therefore not mentioned in the Guide, check the label of commonly used broad spectrum synthetic pyrethroids, carbamates, and neonicotinoids (as foliar spray). Organic options include neem/azadiractin products and pyrethrin.

- Ruth Hazzard, adapted from Turf Management Update, Pat Vittum, Turf Entomologist, UMass, Beth Bishop, Michigan State University, Michael Seagraves, Cornell Cooperative Extension, and Ann Hazelrig, University of Vermont.

UVM STUDY ON LEAFY GREENS WASHING – AFFORDABLE PRACTICES FOR REDUCING CONTAMINATION RISKS

The busy (and hot!) summer months when the harvests are big and the days are long, are also the times when bacteria tend to multiply most quickly[1]. There's no such thing as a farm that is completely free of the microorganisms that can cause disease in humans. What do exist are some simple techniques for managing those areas where there is the greatest risk for passing these pathogens on to consumers. Produce that is likely to be consumed raw, such as salad greens, is also the most likely to be contaminated when it's eaten, as it isn't exposed to the microbe-killing heat of cooking. Taking some simple measures when washing leafy greens for market can go a long way toward reducing contamination risks.

During the 2012-13 growing season, researchers Lynn Zanardi Blevins and Vern Grubinger at The University of Vermont Extension studied the effects of double and triple rinses of greens, compared to just a single rinse, on the levels of generic *E. coli* in the wash water. They also looked at the levels of *E.coli* in wash water before and after addition of the OMRI-approved sanitizer Sanidate 5.0, with both single and multiple rinses. The results of their study indicate that both double and triple rinsing will greatly reduce bacterial loads in wash water, and that adding a full dose of sanitizer at the labeled rate is effective in significantly reducing *E. coli* even in single rinses.

Please read the full fact sheet on the study, which is also posted on the UVM Vermont Veg and Berry website, here:

1Effectiveness of Multiple Washings and/or Organic Sanitizer Treatment in Reducing E. coli Levels in Leafy Greens Wash Water

And watch this brief but very informative video demonstrating the results of the study: https://www.youtube.com/watch?v=9WaYu8jYkho.

--Written by Lisa McKeag

THE 'OTHER BLIGHTS' OF TOMATO: SEPTORIA LEAF SPOT, EARLY BLIGHT AND LEAF MOLD

While late blight has become the dominant force in tomato disease management, it is certainly not the only foliar leaf blight in the picture. The warm, humid weather with frequent rain and long periods of leaf wetness we are experiencing in provides prime growing conditions for fungal diseases of tomato.

Septoria leaf spot caused by the fungus *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.

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.

Septoria leaf spot on tomato foliage. Note the tan centers of lesions where tiny, black pycnidia form. Photo by MGabrowski, UMN.

Fruit infection is rare, but lesions occur on foliage, stems, petioles, and calyces. 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 but the disease is not known to be truly seedborne. Asexual spores form in spring and germinate on susceptible tissue, but free moisture on the leaf surface is required for infection of leaf tissue, which occurs through stomates. Once established, Septoria is spread by splashing water, insects, workers, and equipment. High humidity, long periods of leaf wetness, and temperatures between 60 and 80°F are conducive to disease development.

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. Infected fruit often drop prematurely, resulting in losses of 30-50% of immature fruit.

Early blight symptoms on tomato foliage. Photo by G.Holmes.

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 produced continually throughout the season, as long as the conditions remain favorable. Spores are dispersed mainly by wind but also by splashing water, overhead irrigation.

Management of Septoria and Early Blights. 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 the disease; 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 of fungal diseases. Both pathogens survive between crops on infected plant debris, soil, other solanaceous host weeds and can be carried on tomato seed. Early blight can be spread via infected potato tubers. 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, wider plant spacing, and staking. Keep workers and equipment out of wet fields where possible.

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.

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.

Leaf mold symptoms on upper and lower tomato leaf.

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 and 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.

Management of Leaf Mold. Start with certified disease free seed. Improve air circulation by increasing plant spacing and removing lower leaves. Avoid the formation of water droplets on leaves by using drip irrigation and watering in the morning. Reduce relative humidity by a combination of heating and venting, especially at night. Avoid excessive nitrogen fertilization. Remove diseased leaves—place in plastic bag, and destroy. Remove all plant residue and destroy and disinfest the entire greenhouse after harvest. There are a few products labeled for use on indoor tomato to control leaf mold, please see the New England Vegetable Management Guide for recommendations.

-Bess Dicklow and Susan B. Scheufele, UMass Extension

UPCOMING EVENTS

IPM Field Walks

July 9th, 2014, 4-6 pm
Casey Farm, 2325 Boston Neck Rd, Saunderstown, RI, 02874

August 14th, 2014 3:30-6:00 pm
High Meadows Farm, 742 Westminster West Rd., Putney, VT

August 22nd, 2014, 3-5 pm
The Farm School, 488 Moore Hill Road, Athol, MA 01331

UMass Agricultural Field Day

When: Tuesday, July 29, 2014, 10:00am to 4:00pm

Where: UMass Animal and Crop Research Center, 89-91 North River Road, South Deerfield, MA 01373

Come tour the research farm and learn about all of the exciting projects currently underway on a broad range of agricultural topics. Vegetable topics that will be covered include:

- Organic Management of Basil Downy Mildew: Susan Scheufele, Katie Campbell-Nelson, Lisa McKeag, Ruth Hazzard
- Evaluation of Conventional and OMRI-Approved Fungicides to Control Fall Diseases of Brassicas: Susan Scheufele, Katie Campbell-Nelson, Lisa McKeag, Ruth Hazzard

- Evaluation of Conventional and OMRI-Approved Insecticides to Reduce Cabbage Root Maggot Damage: Susan Scheufele, Katie Campbell-Nelson, Lisa McKeag, Ruth Hazzard
- Organic Fertility in High Tunnel Vegetable Production: Frank Mangan, Zoraia Barros, Aline Marchese and Viviane Barros
- Growing Fava Beans in Massachusetts: Fatemeh Etemadi, Masoud Hashemi, Francis Mangan
- On-Farm GAP Certification: Zoraia Barros, Frank Mangan, Aline Marchese and Viviane Barros
- Integrating Livestock Production into Vegetable Systems : Frank Mangan, Zoraia Barros, Aline Marchese and Viviane Barros
- Jilò (scarlet eggplant) Variety Trial: Aline Marches
- Cover Crop and Nitrogen Management for Sustainable Potato Production: Emad Jahanzad, Allen V. Barker, Masoud Hashemi
- Amending Soil with Biochar and Rock Dust to Improve Sweet Corn Yield: Emily Cole, Kate Gervais, Stephen Herbert, Masoud Hashemi
- Integrating Forage Radish for Sustainable Early Sweet Corn Production: Julie Fine, Masoud Hashemi, Amanda Chuong
- Native Pollinator Installations: Sonia Schloemann

Contact Madeline Madin, cdle@umext.umass.edu, 413-545-5221 for more information on this event.

Vegetable Notes. Ruth Hazzard, Katie Campbell-Nelson, Lisa McKeag, Susan Scheufele, co-editors. Vegetable Notes is published weekly from May to September and monthly during the off-season, and includes contributions from the faculty and staff of the UMass Extension Vegetable Program, other universities and USDA agencies, growers, and private IPM consultants. Authors of articles are noted.