UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

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In this issue:

A picturesque field of brassicas in Hatfield, MA. Photo S. B. Scheufele

Crop conditions

We have had some wild temperature swings the last few weeks, going from 90-degree weather two weeks ago to 40-degree nights over May 28-30, then back to the high 90s this week. The extreme fluctuations have left plants and people alike struggling to keep up – putting on and taking off row cover, turning on high tunnel heat one day and putting on shade cloth the next. We are now seeing both cold damage *and* heat stress in crops in the field – cucurbit plantings melting from cold damage and foliar symptoms of cold damage on cucurbits and tomatoes alongside transplant stems burned from hot black plastic. After patchy thunderstorms across the state over the last few days, we received one report of hail damage in greens crops – raggedy holes in chard and brassicas. Despite some whiplash from the temperatures, early summer crops are coming along: early field tomatoes are setting fruit, zucchini and summer squash harvest has begun, and garlic scapes are being picked to divert the plants' energy into the bulbs.

Pest alerts

Brassicas

Diamondback moth (DBM) caterpillars were found in brassicas in Hampshire Co. this week. DBM does not overwinter in the Northeast; it is blown northward from the southern US on storm fronts, usually arriving in the Northeast later in the summer. Imported cabbageworms are also present in brassica crops now. *Bt* products are effective and selective for caterpillar pests, protecting beneficial insects in the field. Conventional products include spinosads (e.g. Radiant), neonicotinoids (e.g. Brigade, Asana, Declare, Warrior, Mustang), pyrethroids (e.g. Assail) and diamides (e.g. Exirel, Verimark). Diamide products are more expensive but are systemic, have long residuals, and will also protect against flea beetles, cabbage root maggot, and cabbage aphid.

Diamondback moth with characteristic window-pane feeding damage that doesn't cut through the uppermost leaf layer.

Alternaria leaf spot in broccoli. Photo: G. Higgins

Alternaria leaf spot is present in brassica plantings now. Alternaria overwinters on infected crop residue and brassica weeds and infects new crops in the spring by splashing up from the soil. Infections usually begin on

Contact Us:

Contact the UMass Extension Vegetable Program with your farm-related questions, any time of the year. We always do our best to respond to all inquiries. **Office phone:** (413) 577-3976 *We are currently working remotely but checking these messages daily, so please leave us a message!* **Email:** umassveg@umass.edu

Home Gardeners: Please contact the UMass GreenInfo Help Line with home gardening and homesteading questions, at greeninfo@umext.umass.edu.

lower leaves, within the humid canopy. Reducing leaf wetness by using drip irrigation or overhead watering in the morning to allow leaves to dry quickly can help slow the spread of Alternaria. Crop rotation and field sanitation are also important. See Fungicide Recommendations for Alternaria Leaf Spot & Head Rot in Broccoli for recent recommendations from Cornell University.

Table 1. Sweetcorn pest trap captures for week ending June 10

Location	GDD (base 50°F)	ECB NY	ECB IA
Western MA			
Sheffield	431	-	-
Southwick	569	-	-
Whately	615	9	0
Central MA			
Bolton	593	3	0
Leominster	581	0	0
Spencer	585	-	-
Eastern MA			
Ipswich	535	-	-
Concord	573	-	-
Millis	-	0	0
North Easton	558	0	0
Sharon		0	1
Seekonk	655	0	1
Swansea		8	2

- no numbers reported for this trap
N/A this site does not trap for this pest

*GDDs are reported from the nearest weather station to the trapping site

Cucurbits

Last week we received reports from several farms across the state of cucumber and melon plants melting in the field, which we believe to have been caused by the sudden cold snap May 28-30. Stems were rotting at the soil line. Bare ground and plasticulture plantings were both affected. Cucumbers and melons are more susceptible to cold damage than squash and zucchini. Recently transplanted crops experiencing transplant shock may have been more severely affected, as well as unthrifty plants fighting Pythium root/crown infections.

Striped cucumber beetles (SCB) are continuing to feed in unprotected cucurbit crops. Plants are especially susceptible to heavy feeding damage before the 5-leaf stage. SCB vectors the pathogen that causes bacterial wilt; some cucurbit crops are more susceptible to bacterial wilt than others (cucumber, muskmelons, summer squash, and zucchini are more susceptible while butternut, watermelon, and most pumpkins are less susceptible) so SCB management is even more crucial in those crops. Treat for SCB when 1 beetle/2 plants is found in highly susceptible crops, or when 1-2 beetles/plant are found in less susceptible crops. Conventional insecticides for foliar control include carbamates, pyrethroids, and neonicotinoids. All are highly toxic to bees and should only be used before bloom. Some systemic products may also be applied through drip irrigation. The diamide products Exirel and Harvanta are also labeled for SCB – trials from the University of Delaware have found that they don't kill the beetles at the same rate as neonicotinoids but do stop SCB feeding. The most effective OMRI-listed material is pyrethrin (e.g. Pyganic). Small plants can also be protected using kaolin clay (e.g. Surround).

Squash bug adults were present in one Hampshire Co. field this week. Adults and nymphs inject a toxin into leaves as they feed with their piercing, sucking mouthparts, and feeding damage can cause plants to wilt. Squash bugs can also vector a bacterium that causes yellow vine decline. See the article in this issue for more information and cultural and chemical control recommendations.

Solanaceous

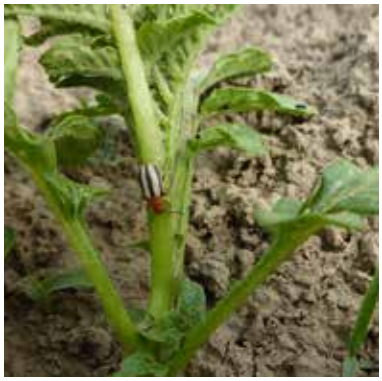
Early blight, **botrytis**, and **leaf mold** were all reported on high tunnel or greenhouse tomatoes this week in MA. All 3 are common fungal foliar diseases of tomatoes that survive on crop residue and in the soil and thrive in humid, hot

environments. See the article in this issue for more information.

Potato leafhopper adults are being found in eggplant, bean, and potato fields now. PLH suck plant sap out of host tissue and inject a toxin, causing marginal leaf burn – a condition called "hopperburn". See the article in this issue for recommended chemical control.

Newly hatched Colorado potato beetle larvae. Photo: K. Campbell-Nelson

Newly hatched Colorado potato beetle larvae were seen in Hampshire Co. this week. The best control of CPB is achieved if sprays are targeted at small larvae (smaller than half-grown). The spray threshold for small larvae is 4 per plant; the threshold for large larvae is 1.5 per plant (or per stalk in midseason). CPB readily develop resistance to insecticides. Do not use the same chemical class on successive generations of CPB in the same year. Labeled conventional products include pyrethroids, neonicotinoids, novaluron (e.g. Rimon), cyromazine (e.g. Trigard), and diamides (e.g. Verimark, Exirel). OMRI-listed materials include spinosad (Entrust), azadirachtin, pyrethrin (Pyganic), and *Beauvaria bassiana* (Mycotrol O, Botanigard), which can be tank-mixed and/or rotated. For more information, see the article in the June 4, 2020 issue of Veg Notes.



Three-lined potato beetle

Three-lined potato beetle adults are active and laying eggs now in crops. This pest is most common on tomatillo and ground cherries and is more rarely seen on potato and tomato. Eggs are oval, yellow-orange, and laid on-end in clusters on undersides of leaves, commonly near leaf veins. Adults and larvae feed on foliage. Tomatillo and ground cherry production is not widespread in MA and most growers do not actively control for this pest. In small-scale production, hand-picking into soapy water is effective. Row cover applied before adults emerge in the spring will exclude the beetles. Control solanaceous weeds.

Sweet corn

European corn borer trap captures (Table 1) are continuing to slowly increase at some sites but remain at 0 at most locations. Small larvae and feeding damage were found in tassels in one field in Franklin Co. this week. Scout the tassels of 50 to 100 plants, in groups of 5 to 20 plants throughout the field. Treat if more than 15% of the plants have one or more larvae present. Timing sprays for tassel emergence reaches larvae in the whorl and the young tassel. A sprayer configuration with one nozzle directed into the tassel and a single drop nozzle to the upper parts of the plant gives the best control. At high levels of infestation, 2 applications may be needed to provide control.

Potato leafhopper active in potato, eggplant, beans

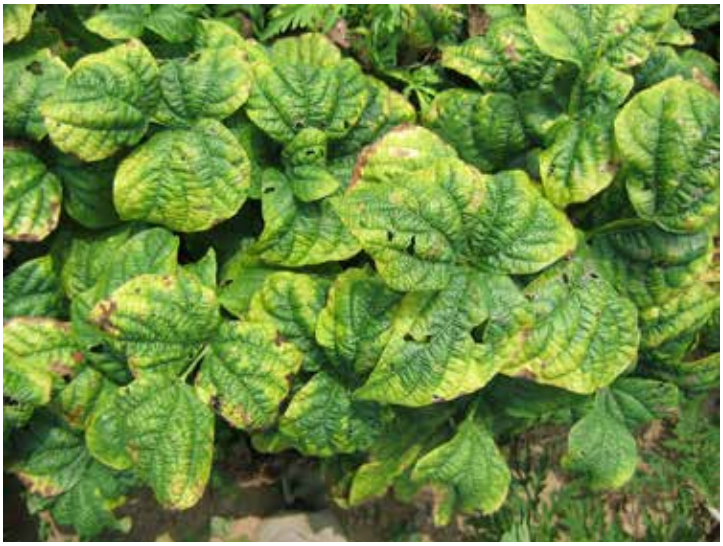
Potato leafhopper (PLH) adults have arrived and are now being observed across MA on potatoes, eggplants, and beans. Damage is high now in shell-beans, since they often do not get insecticide seed-treatments as other beans do. In about 7-10 days we should begin seeing the immature "nymph" stage crawling side-to-side on the undersides of leaves. Because low numbers of adults or nymphs cause injury and reduce yield, it is important to protect plants before adult numbers are high and before nymphs build up. Left uncontrolled, PLH populations will continue to grow rapidly. Plant injury and yield loss can be significant. In potato, yield loss occurs even before the development of obvious symptoms. Green beans are very susceptible, especially when they are infested prior to flowering.

Potato leafhopper adult on ptoato. Photo: D. Ferro

Identification. Adults are about 1/4 inch long, light yellow-green, and fly up from foliage when it is disturbed or shaken—they look like tiny green sparks flying away from the plants. PLH overwinters in the southern US and the adults move north annually. Once adults arrive they begin to lay eggs, inserted into the veins and petioles of leaves, and nymphs hatch after about 10 days. Nymphs hang out on the underside of leaves; they are tiny, light green, wedge-shaped and very fast-moving. They tend to move sidewise, crab-like, on the bottom of the leaf.

Presence of nymphs indicates an established population.

Damage. Adults and nymphs feed by inserting a needle-like beak into the plant and sucking out sap. They also inject a toxin into the plant, blocking conductive tissues and causing yellowing, browning, and curling of leaves. In potato, leaf margins turn brown and brittle first, followed by death of entire leaves, a condition known as 'hopperburn.' In eggplant, leaf margins and tips turn yellow and curl up. Feeding can reduce yield before damage is visible. Damage can be severe on early-season and red varieties of potato, as well as in green beans, eggplant and raspberries. Long-season cultivars tend to be more tolerant (see Table 1 on the next page for resistant and more tolerant potato varieties). Beans are more susceptible when they are young than at later stages. Field crops such as alfalfa, clover, soybean, sunflower and tobacco are also hosts.



Hopperburn on bean

Scouting and thresholds. It is difficult to count adults since they fly quickly when foliage is shaken or disturbed. Sweep nets can be used to detect adults—treat if more than 1 adult is found per sweep. If you see one adult per plant when you shake the foliage, you are in that range. Once nymphs develop, they can be monitored by visually inspecting lower leaf surfaces on lower-canopy leaves. Treat if more than 15 nymphs are found per 50 leaves. Use a threshold of 1.5 leafhoppers per leaf in eggplant.

Conventional products. In potato and eggplant, some materials registered for Colorado potato beetle (CPB) adults will also control leafhopper, including neonicotinoid foliar sprays such as Admire Pro or Assail. These and several other carbamate, synthetic pyrethroid and organophosphate products are also registered for leafhopper in potato, eggplant and snap beans. Refer to the New England Vegetable Management Guide for registered products. While the classes of insecticides listed above generally have high toxicity to bees, there are variations within classes; for example, Assail (acetamiprid) has a lower toxicity to bees (rated as 'medium') while most neonics are rated as highly toxic to bees. Sivanto (flupyradifurone) is a new product in a novel class of chemistries, the butenolides, that works against sucking pests, including PLH. It is also labeled for CPB control. This new active ingredient is being touted as an alternative to neonicotinoids, and has been given a bee toxicity rating of Low.

Organic products. PyGanic EC5.0 (Pyrethrin) has been shown to be the most effective product for reducing leafhopper numbers and damage. Good coverage is important, especially of the leaf underside where nymphs are found. Pyganic breaks down quickly in sunlight, so the residual period is short. Spraying late in the day or in the evening may provide better control than spraying early in the morning. Products containing azadiractin have also demonstrated efficacy against leafhoppers (especially in fruit systems) and could be used in tank-mixes or in rotation with Pyganic EC5.0. Don't wait for numbers to build up. Row cover can be used to delay PLH infestation in snap beans until flowering, when plants are less susceptible to damage. Using row cover is recommended on young eggplant, as it protects from flea beetles, CPB and PLH.

Pollinators and other beneficials. Although bees do not forage extensively in beans or potatoes, they may be active in the field when these crops or the weeds within the crop fields are flowering. During that time, selection of products with lower toxicity to bees is advised. Look for toxicity information on the label, and also in the New England Vegetable Management

Table 1. Resistance of potato varieties to potato leafhopper

Resistant	Tolerant	Susceptible
Elba: Very late, white	Green Mountain: Late, white	Superior
King Harry: Early, white	Snowden: Very late, white	Red Norland
	Ontario: Very late, white	
	Katahdin: Late, white	
	Marcy: Late, white	
	Keuka Gold: Medium-late, yellow	
	Red Maria: Late, red	

Guide Table 26, and in the products listed for each crop & pest.

For conservation of both native pollinators and honeybees, control weeds in the crop and avoid drift onto flowering borders or crops. However, encouraging some flowering areas in the margins is good for supporting pollinators before and after crops bloom. These can also be a nursery and refuge for beneficial predators and parasites of insect pests.

—UMass Extension Vegetable Program

FUNGAL LEAF DISEASES OF TOMATO

Early blight, leaf mold, and botrytis were all reported in high tunnel or greenhouse tomatoes this week—tomato disease season is upon us! The recent hot, humid weather in combination with tomato plants rapidly growing into dense plantings creates the perfect environment for the fungal pathogens that attack tomato foliage every year. Most of the diseases caused by these pathogens can occur in both field and high tunnel tomatoes, but Botrytis, leaf mold, and powdery mildew are most commonly seen in high tunnels and Septoria and early blight are most commonly seen in the field. Late blight, which occurs sporadically, is often perceived as the scariest tomato disease because of its ability to rapidly wipe out a crop; however, the diseases outlined below, which we can expect to see every year, routinely have significant effects on fruit quality and yield. Late blight has not been observed yet this year in the southern US were the pathogen overwinters, so we don't expect to see it anytime soon, but in order to distinguish them from symptoms of the other diseases included in this article we will list some **key characteristics of late blight below**,

- Leaf lesions are dark-green to gray, and appear water-soaked or greasy
- No leaf yellowing occurs
- Stem lesions are brown and can occur anywhere on stems or petioles
- White sporulation may be seen within or on the edges of lesions on leaves or stems
- Lesions can occur anywhere on the leaf and anywhere on the plant, meaning that they don't necessarily start at leaf margins or at the base of the plant but are distributed throughout the canopy

Late blight lesion on tomato

These diseases are similar in that they all thrive in hot, humid weather and once established, are spread by wind, splashing water, insects, workers, and equipment. Most also survive in infested crop residue or in the soil. Management practices are similar for all of these diseases, but it is still helpful to know what diseases you are seeing in your crop so you know where it is coming from and how to stop its spread. For help with tomato disease identification, you can send us photos at umassveg@umass.edu, or submit samples via mail to the UMass Plant Diagnostic Lab.

Botrytis gray mold & ghost spot (*Botrytis cinerea*): *Botrytis cinerea* causes leaf spots, stem cankers, fruit rot, and ghost spot on fruit. The pathogen thrives in humid greenhouse conditions, but it has been observed in field tomatoes when humidity is very high. Leaf lesions are dark gray and have no yellow halo, and therefore are often mistaken for late blight lesions. Under conditions of alternating heat and humidity, like in a high tunnel, the pathogen grows in such a way as to form concentric rings, and for this reason can also be confused with early blight. The way to distinguish Botrytis from early blight is by its characteristic fuzzy, brownish-gray sporulation. If you hold the leaf up and look across the lesion you will see fine mycelia sticking up with little tuftlets on the ends that resemble grape clusters.

Botrytis gray mold: Development of conentric rings (left) can make this disease look like early blight, but the presence of fuzzy gray sporulation (right) is characteristic of botrytis.
Photos: S.B. Scheufele (left), G. Higgins (right)

B. cinerea primarily feeds on dead tissue and is only weakly pathogenic, therefore, you will likely see this sporulation on senescing tissue including flowers, pruning scars, or leaf tips and margins where nutritional disorders have caused tip burn. Spores that land on fruit cause ghost spot, which appears as pale white haloes or ring spots on the green fruit. On ripe fruit, the ringspots may be yellow. Ghost spot develops when the fungus initiates infection, but disease progress is stopped by dry environmental conditions. This spotting may adversely affect market quality. Under more humid conditions, ghost spot may lead to fruit rot. *B. cinerea* has a wide host range and can survive on dead plant tissue for long periods of time. It overwinters as mycelium in crop residues and sometimes as sclerotia in the soil.

Leaf mold (*Passalora fulva*, previously *Fulvia fulva*): This disease is quite common in tunnels and greenhouses, in both soilless and hydroponic systems. 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-brown fuzzy sporulation on the underside of the leaf. 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. The fungus can survive and reproduce between 50-95°F, with optimal infection and growth between 71-75°F.

Leaf mold: Yellow spots appear on the tops of leaves (left) and produce fuzzy olive green sporulation on undersides of leaves (right). Photos: Cornell Coop. Extension

Powdery mildew (*Oidium neolycopersici*) of tomato is primarily a concern in high tunnel crops. (Note: this is a different pathogen than the one that causes powdery mildew on cucurbits.) Look for white, powdery, circular lesions on the upper and lower leaf surfaces. Unlike other powdery mildews, affected leaves may rapidly 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. Unlike the other pathogens in this article, *O. neolycopersici* does not require leaf wetness 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 poor fruit flavor if untreated.

Powdery mildew. Photo: S.B. Scheufele

Botrytis, Leaf Mold, and Powdery Mildew Management:

Reduce humidity within the canopy, improve air circulation, and reduce leaf wetness by controlling weeds, using wider plant spacing, removing suckers, pruning lower leaves, and watering early in the day or using drip irrigation. In high tunnels, improve horizontal airflow with fans, and reduce humidity by a combination of heating and venting in the evening, particularly when warm days are followed by cool nights.

Provide sufficient nutrients to avoid tip burn from nutrient deficiencies. Avoid excessive nitrogen fertilization. Researchers at the Universities of Vermont and Maine have been working on establishing updated high tunnel fertility recommendations over the last several years. New recommendations vary by the expected yield of a high tunnel system—indeterminate, hybrid, disease resistant varieties in heated tunnels would be expected to produce relatively higher yields whereas heirloom varieties in an unheated tunnel would produce relatively lower yields. For updated high tunnel tomato fertility recommendations, see the high tunnel tomato section of the New England Vegetable Management Guide.

Remove and destroy all diseased plant residue; disinfest the entire greenhouse after pruning and harvest. See our Cleaning & Disinfecting the Greenhouse article for more information.

Choose resistant varieties. This is especially effective for leaf mold management. You can find a list of resistant tomato

varieties here: https://www.vegetables.cornell.edu/pest-management/disease-factsheets/disease-resistant-vegetable-varieties/

See the high tunnel tomato section of the New England Vegetable Management Guide for current chemical control recommendations. Always alternate fungicide applications between materials with different modes of action to prevent resistance development. Check labels to ensure using indoors (in tunnels and greenhouses) is not prohibited. If a label does not explicitly prohibit indoor use, a product may be applied in tunnels and greenhouses. Michigan State University has a spreadsheet that compiles indoor use allowances of pesticides, available here; but you should always check the label yourself as well!

Septoria leaf spot (*Septoria lycopersici*) usually occurs in the field and 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 canopy.

Septoria leaf spot. Photo: B. Watt

Symptoms consist of small, circular, tan-to-grey lesions with dark brown margins 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 that produce asexual spores) 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. The pathogen can also be seed-borne.

Early blight (*Alternaria solani*) occurs on the foliage, stem, and fruit of tomato, as well as on potato foliage and tubers. 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 turn 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 for several years.

Early blight: Note concentric rings in lesions. Photo: Clemson University, USDA Cooperative Extension

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. You can find a list of resistant tomato varieties here: https://www.vegetables.cornell.edu/pest-management/disease-factsheets/disease-resistant-vegetable-varieties/

Adequate nitrogen fertility throughout the season can help delay onset of early blight; lower leaves become more sus-

ceptible as the nitrogen demand increases with fruit production and nitrogen is pulled from older leaves. See the field tomato and high tunnel tomato sections of the New England Vegetable Management Guide for nutrient recommendations.

Protectant fungicide sprays at regular intervals (depending on weather conditions and disease pressure) will delay the onset of disease.

Reduce overwintering inoculum by rotating out of tomato crops for at least two years, controlling solanaceous weeds, and incorporating crop debris after harvest.

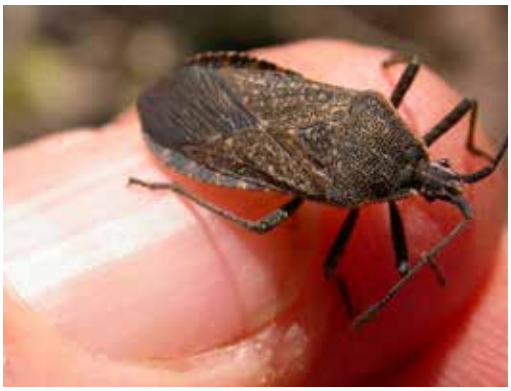
Reduce the length of time that tomato foliage is wet by using drip irrigation, using wider plant spacing, and staking. Keep workers and equipment out of wet fields where possible.

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.

--Written by Bess Dicklow and Susan B. Scheufele, UMass Extension

SQUASH BUGS OUT NOW

Squash bug (*Anasis tristis*) adults are just starting to move into summer squash and zucchini plantings to mate and lay eggs. These are their favorite host plants, especially when these plants are large and provide ample shelter, food and egg-laying sites. Sheltered and protected areas such as crop residue, field borders, woods edges, brush or wood piles provided a home for unmated adults last fall through the winter, and now they are busy locating mates and host plants.



Squash bug adult

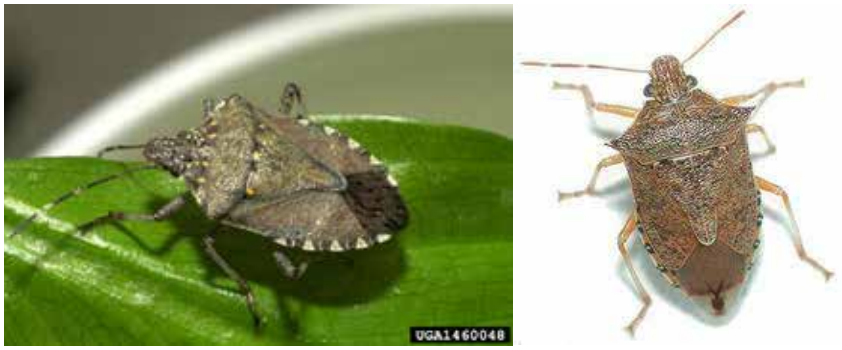
Squash bug eggs and nymphs

Life stages and identification. Squash bugs are a type of true bug, a group that also includes other pests like the native brown stink bug and brown marmorated stink bug, as well as beneficial insects like the spined soldier bug. Adults are 0.5-0.75 inches long, flattened and grayish-brown. The edge of the abdomen is marked with alternate gold and brown patches. Adults frequently shelter beneath debris in the field at night, and it's common to see many bugs congregated beneath a squash fruit in the field. Adults are long-lived and lay eggs over several weeks. A single female can lay up to 250 eggs. Yellow to bronze colored eggs are usually laid on the underside of leaves, often in the junction of leaf veins, in an orderly cluster, and hatch in 7-10 days in summer conditions. Wingless nymphs are light green when small, with a brown head and dark legs, and are usually found in groups. Nymphs become darker gray and more solitary as they grow and molt through 5 nymphal stages. There is one generation per year in the Northeast, and the complete life cycle requires 6-8 weeks.

Host crops and damage. The most susceptible and attractive crops are yellow summer squash, zucchini, and pumpkin (*Cucurbita pepo*) as well as Hubbard squash (*Cucurbita maxima*) and other *C. maxima* crops. Watermelon, cucumber, muskmelon, and butternut resist damage, and provide poor food quality for adults and nymphs. Resistant varieties also include sweet cheese pumpkins (*C. moshata*) and royal acorn squash (*C. pepo*). Both adults and nymphs feed by inserting their beak and sucking sap from plant tissue. Adult feeding on seedlings can cause wilting of the whole plant. Places on the leaves where the bugs feed develop small, yellow specks that eventually turn brown due to a toxin released by the bug while it feeds. High densities and intensive feeding cause foliage to wilt, turn black and die in a condition known as "Anasa wilt". Squash bugs also feed on the fruit, causing scarring that can make the fruit unmarketable.

Squash bugs also vector the bacterium, *Serratia marcescens*, which causes the disease yellow vine decline. Yellow vine decline was first observed in the US in 1988 in Texas and Oklahoma and has since spread throughout the southern US and has been reported intermittently in New England. It is not thought to be widespread in the Northeast, but it was found in

MA in 2003 and was again confirmed from one site in CT in 2020. The bacterium is introduced into a cucurbit plant by the piercing-sucking mouthparts of the squash bug and enters the phloem of the plant. Symptoms of yellow vine decline include a general yellowing of the entire vine within a two- to three-day period. Infected plants usually collapse completely approximately 10 to 14 days before the fruit matures. Plants infested with squash vine borer can display similar symptoms—leaf yellowing, wilt, lack of vigor—but will have an entry hole in the stem where the borer entered, usually accompanied by lots of sawdust-like frass. If you are seeing symptoms that you suspect could be yellow vine decline in your cucurbit crops, let us know! umassveg@umass.edu or (413) 577-3976.



Common lookalikes for squash bug: Brown marmorated stink bug (left) is another vegetable crop pest and has a pattern of white triangles around its abdomen and black-and-white striped antennae. Spined soldier bug is a beneficial insect and has pointed "shoulders".
Photos: D.R.Lance, USDA APHIS PPQ, Bugwood.org and M. Price

Cultural strategies. If possible, rotate cucurbit crops between fields as far apart as possible. Placing row covers over the young crop prevents adult access until blooming, when covers must be removed. Natural enemies of the squash bug include the tachinid fly (*Trichopoda pennipes*) which is a parasitoid that attacks nymphs and adults, and several wasps that parasitize eggs (Hymenoptera: *Encyrtidae* and *Scelionidae*). Squash bugs like sheltered hiding places, so keep headlands and field borders mowed and free of debris to reduce overwintering sites. Plastic and straw mulch and reduced tillage systems encourage higher populations, probably by providing good hiding places. In small plantings, boards can be used to attract adults seeking a protected hiding place; check in evening or morning and spray with insecticide or capture and remove. A study conducted by Oklahoma State University found that squash bugs prefer to lay eggs on yellow straightneck and crookneck squash (Bonjour *et al*. 1990) and these cucurbits can be used effectively as a trap crop planted earlier in the season along field edges. The trap crop must receive an insecticide application or be mechanically destroyed before eggs hatch. Remove crop residues and/or till field immediately after harvest to kill adults before they move to field edges seeking shelter.

Scouting and Chemical Control. Scout plants from seedling to vining/flowering stage to detect adults as well as eggs and nymphs. After flowering, thresholds are based on egg masses and young nymphs, but also note adults and large nymphs while scouting.

There are two key windows for control:

Target adults on young plants (before flowering or vining). An insecticide application made when adults are colonizing plants in June will prevent subsequent egg and larval populations. Coverage is easier at this time, and broad-spectrum pyrethroids (e.g. bifenthrin, lambda-cyhalothrin, permethrin) or carbaryl, which are reported to be effective on adults at this stage, can be used without risk to bees on the crop. OMRI-approved pyrethrin products are available (e.g. PyGanic). The threshold for targeting adults has been determined for watermelon crops at an average of 1 adult per plant (Dogramaci et al. 2006), but in more susceptible crops such as summer squash and zucchini, it might be appropriate to use a lower threshold (e.g. 1 adult per 2 or more plants). Aim for coverage of underside of leaves and stems where bugs hide. Systemic furrow, drip, or seed treatments and sprays for cucumber beetle at the seedling stage may also control colonizing squash bug adults.

Target smaller nymphs on flowering plants. Scout for egg masses and note first emergence of nymphs. The threshold is reached at an average of 1 egg mass per plant and when the first nymphs are seen. Good coverage of undersides of leaves is needed. For newly laid eggs and nymphs, consider a foliar application of acetamiprid (Assail 30 SG) which has moderate toxicity to bees (lower than other neonicotinoids). Adults and larger nymphs are more difficult to control, partly because they hide in the lower canopy and near the soil. An organic option for nymphs is a mixture of pyrethrin (a contact toxin) and azadiractin (an insect growth regulator, derived from neem). This can be achieved by mixing separate products or with a pre-mixed product called Azera, which has both. This would be gentler on bees than a high rate of pyrethrin alone, and would include two modes of action. Insect growth regulators work to disrupt

the molting process so are useful only on immature stages. Treat late in the day when the flowers are closed to reduce risk to bees.

Take note of re-entry and pre-harvest intervals of materials used on summer squash and zucchini that are being harvested frequently.

For more information on rates and products for squash bug control, see the Cucumber, Muskmelon, and Watermelon insect section and the Pumpkin, Squash, and Gourds insect section of the New England Vegetable Management Guide.

--UMass Vegetable Program

References:

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Dogramaci, M., K. Giles, J. W. Shrefler and J. V. Edelson. Spatial Pattern and Sequential Sampling of Squash Bug (Heteroptera: Coreidae) Adults in Watermelon. *J. Econ. Entomol* (2006). 99:559-567.

MDAR PRODUCE SAFETY PROGRAM UPDATE

The 2021 growing season is here, which means MDAR's Produce Safety Program is back in action! The COVID19 pandemic resulted in an unorthodox year last year, in which MDAR decided not to conduct inspections under the Food Safety Modernization Act's (FSMA) Produce Safety Rule (PSR). However, with restrictions lifting, MDAR fully intends on resuming a normal audit and inspection cycle.

Farms that grow, harvest, pack, or hold produce in Massachusetts may fall under the **Produce Safety Rule** and may be subject to an inspection this year. If you already know that you fall under full compliance, you can expect one of our inspectors to reach out to schedule an initial visit. If you are unsure whether or not you fall under compliance, we ask that you register your operation with us here! All information collected is confidential. Farms that are classified as "Large, Small, or Very Small Covered Farms" are now eligible for inspections. Learn more about PSR inspections here.

The Produce Safety Program is also offering third-party audits this year through the **Commonwealth Quality Program (CQP)**. For farms that are already participants of the program, your auditor will be reaching out shortly to coordinate scheduling for renewing your certificate. For new farms that are interested in CQP, or have a buyer asking for a food safety certificate, we are happy to answer any questions you may have or explain the process of becoming certified.

Almost all major Massachusetts buyers accept CQP, and we are happy to speak with yours on your behalf. For farms that sell leafy greens to Whole Foods, you will be subject to some additional requirements, contact us for more information. Learn more about the Commonwealth Quality Program and request an audit here.

The CQP audit process includes questions about certain environmental practices, such as protecting pollinators and following the principles of Integrated Pest Management (IPM). UMass Extension is our educational partner in providing support to growers on both food safety and these environmental issues. Participating farms may receive a call or email from UMass Extension offering support on these topics. Growers can also reach out to UMass directly through their website to ask a question or request a visit.

As always, The Produce Safety Team is available to answer any questions regarding compliance under the Produce Safety Rule, information on audits and inspections, upcoming trainings, educational opportunities, as well as scheduling voluntary farm visits to discuss best practices for your operation. While restrictions are loosening up, we understand that there is still some apprehension in regards to COVID19. Please find comfort in knowing that we are happy to comply with whatever on-farm COVID19 policies you have in place.

To learn more, please reach out to Steven Pilis by email at Steven.Pilis@mass.gov or by phone at (774) 419-1804.

Events

No-Till Transplanter Demonstration

When: Friday, June 11, 2021 at 1 pm

Where: UMass Crop and Animal Research and Education Center, 89 River Rd., South Deerfield, MA 01373

American Farmland Trust and UMass Extension will offer the first of several demonstrations of the Cecchi and Magli 2-row no-till trium-10 transplanter! This no-till transplanter will be available as soon as this fall for lending to area farmers who are interested, as part of the MA Coordinated Soil Health Program. The demonstration and comments will last approximately 30 minutes, and there will be time for Q&A after.

Space is limited so please **RSVP by 8am Friday June 11** to ecole@farmland.org.

Bonus: If you would like a free Cornell Soil Health Test, feel free to bring a sample and completed submission form. Instructions in the link below. The Standard Package requires 4 cups of soil.

Cornell Soil Health Test Sample Instructions

Submission Form

UMass Worker Protection Standard (WPS) Train-the-Trainer

When: Wednesday, June 30, 4-7:30 pm

Where: Online

All farmworkers must receive annual training under the EPA Worker Protection Standard (WPS) if the farm where they work uses any pesticides in their crop production, **including those approved for organic production and other general use pesticides**. The agricultural worker employer is responsible for complying with all components of WPS including the training of farmworkers. This training can only be provided by an individual who has a pesticide certification license or has attended **an approved EPA WPS Train-the-Trainer workshop**, such as this one.

This training is appropriate for farmers and supervisors who want to be able to train farm employees on WPS without having to have a pesticide license. For farmers who do already have a license, 3 pesticide contact hours are available for this training.

***3** pesticide recertification credits are available for this program*

Cost: $60

Register here: https://forms.gle/ZoTAdTiB7N4Wc3Lt7

UNH North Country Lunch and Learn

UNH Extension is offering this online series, open to all but focused on growing vegetables commercially. So, grab your lunch and let's learn!

This event is free, but registration is required. Register once for all days.

- **July 7, 12-1pm:** Onions: Over Wintering and Direct Seeded
- **August 4, 12-1pm:** Brussels Sprouts: Growing and Storage

Registration: Click here to register for these workshops.

Questions? Contact nicholas.rowley@unh.edu or heather.bryant@unh.edu or call 603-788-4961 ext. 207

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Vegetable Notes. Genevieve Higgins, Lisa McKeag, Susan Scheufele, co-editors. All photos in this publication are credited to the UMass Extension Vegetable Program unless otherwise noted.

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