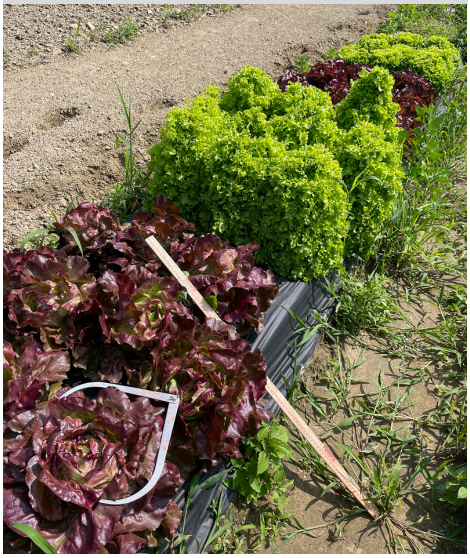
UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

Volume 35, Number 16 August 3, 2023

In this issue:



We harvested and collected data from a field trial yesterday, looking at the heat mitigation effects of shade cloth and different types of plastic mulch on lettuce quality. Clearly the green variety in the background didn't do well! Stay tuned for results!
Photo: S. B. Scheufele

Crop conditions

The weather continues to be surreal and unpredictable as we all woke up to 40 and 50°F weather this week. Thankfully not much more rain has fallen this week, but fields are still mucky and compacted, and crops are struggling to recover after long periods of waterlogged roots and now nutrient leaching and compacted soil. Growers missed seedings and plantings due to the rain and flooding and many are still unable to get into their lowest, wettest fields to plant now, leaving farms tight on space for fall crops. We're expecting to see a gap in sweet corn coming up soon, resulting from missed seedings during the rain.

Despite all of this, in those crops that have made it through it all, storage onion harvests are coming in, and the summer staples of melons, tomatoes, peppers, eggplants, summer squash, and zucchini are continuing to roll in.

Pest alerts

Basil

Basil downy mildew (BDM) was confirmed last week on 'Genovese' and 'Prospera' basil in Hampden and Barnstable Cos., respectively. BDM has also been reported in Suffolk Co. BDM development can be delayed by using resistant varieties for mid-/late summer production. Resistant varieties include Obsession, Devotion, Thunderstruck, Passion, Prospera, Amazel, and Pesto Besto. As shown by the report on Prospera last week, these varieties do not have immunity to BDM but will produce for longer before developing symptoms. Eleonora, Emma, and Everleaf are older resistant varieties that have shown limited to moderate resistance in recent years. Conventional growers can also control BDM with fungicides applied weekly on a preventative schedule. See the basil disease control section of the New England Vegetable Management Guide for labeled materials. Phosphite fungicides (e.g. K-Phite, Prophyt, Fungi-phite) are among the most effective, along with mandipropamid (e.g. Revus), cyazofamid (e.g. Ranman), and azoxystrobin (e.g. Quadris). No OMRI-listed materials have been shown to be effective at controlling BDM. Let us know if you have BDM in your basil crops so we can track this important disease!

Cross-striped cabbageworm.
Photo: T. Kuhar

Brassicas

Cross-striped cabbageworm (CSCW) is active now in brassica crops. Unlike other caterpillar pests of brassicas, CSCW eggs are laid in clusters, resulting in many caterpillars on one plant. They can skeletonize a plant and leave the neigh-

boring plants completely untouched. See the appropriate crop insect control section of the New England Vegetable Management Guide for labeled materials. Bt products (e.g. Dipel, Xentari) are the most effective OMRI-listed materials. Include a spreader-sticker unless the label instructs otherwise to help materials adhere to waxy brassica leaves.

Cucurbits

Plectosporium blight is widespread in some cucurbit plantings now, due to the wet weather. This fungal disease produces elongate, white lesions on cucurbit stems and fruit, and primarily affects pumpkins, summer squash, zucchini, and some gourds. It is hard to avoid this disease in wet years, but planting susceptible cucurbits into your sunniest, driest fields can help. Fungicides must be applied when symptoms first appear for effective control. The strobilurin (QoI) fungicides Flint (trifloxystrobin), Cabrio (pyraclostrobin), and Quadris (azoxystrobin) will control this disease but should not be rotated with each other or the pathogen will develop resistance. Apply a protectant fungicide such as chlorothalonil (Bravo) or mancozeb (Dithane) following a strobilurin.

Table 1. Squash vine borer trap captures for week ending July 26	
Whately	0
Leominster	2
North Easton	-
Sharon	10
Westhampton	1

Plectosporium blight on zucchini stems. Photo: G. Higgins

Nightshades

Growers have had a hard time getting into wet fields to spray fungicides this year, so we're seeing more leaf spots in tomatoes, including **early blight**, **Septoria leaf spot**, **Stemphylium**, and **bacterial leaf spot** and **speck**, than other years. We've had several reports of **bacterial canker** as well, which thrives in wet weather. Fungicides and bactericides, even the conventional ones, are preventative not curative, so once diseases have become established in a crop, sprays will only protect new growth. See the article in this issue for more information on the fungal leaf spots of tomato.

Late blight on tomato

Late blight was confirmed on tomato in western NY, with symptoms first observed about a week ago. Late blight was also confirmed on potato in southwestern Ontario two weeks ago. Late blight has not been reported in NY since 2019, and hasn't been reported in MA since 2017. In 2019, late blight spread throughout western NY, starting in late August, but did not spread to MA. With this earlier report from western NY and storms coming from the west, we may see spread to potatoes and/or tomatoes this season. Late blight is monitored through an online reporting system, here. We will track it and put out alerts if it moves east. Preventative fungicide applications with a broad spectrum fungicide can be made according to recommendations from the late blight decision support system – see the Potato Disease model or the Tomato Disease model. See the tomato disease section of the New England Vegetable Management Guide for labeled materials.

Sweet Corn

Fall armyworm was caught at 3 out of 16 sites this week. We have had reports of significant

Fall armyworm larva (above) and damage (right).

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 **Email:** umassveg@umass.edu

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

Table 2. Corn earworm spray intervals based on Heliothis trap moth captures

Moths per night	Moths per week	Spray interval
0 - 0.2	0 - 1.4	no spray
0.2 - 0.5	1.4 - 3.5	6 days
0.5 - 1	3.5 - 7	5 days
1 - 13	7 - 91	4 days
Over 13	Over 91	3 days

damage from FAW in whorl corn despite low or no trap captures, so it's a good idea to get eyes on those blocks even if trap captures are low. Look for ragged feeding damage and lots of sawdust-like frass. The caterpillar is often deep within the whorl.

European corn borer (ECB) trap counts remain low in most of the state except at two sites that have had a significant second generation emerge. **Corn earworm** (CEW) numbers are also relatively low for this time of year, with most locations on 5- to 6-day spray schedules, and some needing no spray at all. If CEW trap captures do not warrant a pesticide application (below 1.4 moths/week), scout blocks for caterpillars and make an application if 15% of plants are infested with ECB or fall armyworm.

Table 3. Sweetcorn pest trap captures for week ending August 3

Location	GDD* (base 50°F)	ECB NY	ECB IA	FAW	CEW	CEW Spray Interval
Western MA						
Feeding Hills	1691	5	0	0	1	no spray
Southwick		0	0	1	5	5 days
Granby	1606	32	0	0	5	5 days
Whately	1690	2	0	0	-	-
Central MA						
Leominster	1726	12	0	0	7	4 days
Lancaster		0	0	0	3	6 days
North Grafton	1480	4	0	0	0	no spray
Spencer	1560	0	0	0	3	6 days
Eastern MA						
Bolton	1591	0	2	0	4	5 days
Concord	1569	10	0	0	5	5 days
Haverhill*	1628	0	0	0	5	5 days
Ipswich*	1525	1	0	3	0	no spray
Millis	-	4	1	n/a	5	5 days
North Easton	1656	-	-	-	-	-
Sharon		0	0	0	20	4 days
Sherborn	1657	1	0	0	0	no spray
Seekonk	1576	0	0	0	7	4 days
Swansea		0	0	1	6	5 days

- 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

Multiple Crops

Potato leafhopper is causing widespread **hopperburn** on untreated eggplant, potato, and beans now. PLH injects toxins into the leaves when they feed, causing the edges of the leaves to turn yellow and then brown, giving the plants a scorched look. See our article in the June 16, 2022 issue of Veg Notes for management recommendations.

Phytophthora blight continues to develop in cucurbits and peppers. If disease is just starting in a low spot of a field, tilling in the affected area and harrowing a border of healthy, unaffected plants may slow the spread. Get suspected infections definitively diagnosed at the UMass Plant Diagnostic Lab if you haven't confirmed *P. capsici* in that field in the past, so that you know what crops are safe to plant in that field going forward.

Fungal leaf diseases of tomato

All the recent rain has made for perfect conditions for the spread of plant diseases, and with wet fields, growers had few opportunities to get in and spray protectant fungicides. The lush canopies of tomato plantings make great environments for moisture-loving fungal pathogens. 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 is often perceived as the scariest tomato disease because of its ability to rapidly wipe out a crop; however, the other diseases outlined below, which we see every year without fail, routinely have significant effects on fruit quality and yield. The last time late blight was confirmed in Massachusetts was in 2017. We haven't had any reports yet in MA this year, though with cases recently confirmed in Ontario and Western NY, there is some chance this streak could be broken this season. Stay tuned to Veg Notes or check this outbreak map for updates. Unlike the other tomato pathogens discussed below, the late blight pathogen, *Phytophthora infestans*, does not overwinter on tomato residue in the Northeast but instead relies on storms to carry infectious spores to susceptible hosts during favorable conditions for the disease.

These are some other key characteristics of **late blight** that can help you distinguish them from symptoms of the other diseases included in this article:

- 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

The common fungal foliar diseases of tomato 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. It's common to see multiple of these diseases on a single plant. 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. It's especially important to identify what diseases you have if you plan to control them using resistant varieties. For help with tomato disease identification, you can send us photos at umassveg@umass.edu, or submit samples to the UMass Plant Diagnostic Lab.

Botrytis gray mold & ghost spot (*Botrytis cinerea*): This pathogen 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

Botrytis in tomato. From left: Characteristic concentric rings of leaf spots (Photo: S. B. Scheufele). Fuzzy gray sporulation (Photo: G. Higgins). Ghost spot on fruit (Photo: G. Higgins).

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 horizontally, you will see fine mycelia sticking up with little tuftlets on the ends that resemble grape clusters. *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 dieback. 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 tunnels. (Note: this is a different pathogen than the one that causes powdery mildew on cucurbits.) Infections begin as small, white, powdery, circular lesions on the upper and lower leaf surfaces that can expand and coalesce until they cover entire leaves. 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 and avoid excessive nitrogen fertilization. High tunnel tomato fertility recommendations were recently updated in the New England Vegetable Management Guide, based on New England state Extension research—see the Greenhouse and High Tunnel Tomato section of the 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.

- **Chemical control:** Start chemical control before or as soon as symptoms first develop. See the Greenhouse and High Tunnel Tomato disease control 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. Symptoms consist of small, circular, tan-to-grey lesions with dark brown margins that appear on lower leaves first, after the first fruit set. Lesions usually have yellow halos and as the lesions coalesce, significant leaf yellowing can occur. *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.

Septoria leaf spot. Photo: B. Watt

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. The fungus overwinters on infected crop debris in the soil and can survive there for several years.


Early blight lesions, showing characteristic yellow haloes and concentric rings. Photo: M. T. McGrath

Stemphylium or gray leaf spot can be caused by several different species of the genus *Stemphylium*. This is a new disease of tomato in the Northeast—we first saw it in MA in 2020—but is common in southern states. Over the last few years, it's been reported in both field and high tunnel tomatoes throughout the region. Stemphylium leaf spots are tan to gray and irregularly shaped, with *no* yellow halo. Sparse gray sporulation is sometimes visible at the center of the spots with a 10X hand lens. Lesions occur on upper and lower leaves simultaneously, distinguishing this disease from early blight and Septoria that often start on lower leaves and move upwards as the diseases progress. Similar to early blight and Septoria, Stemphylium spores are dispersed by wind and splashing water, and the fungus can survive on crop residue in the soil as well as on seeds.


Stemphylium leaf spot. Photo: S. Menasha

Septoria, Early Blight, and Stemphylium Management:

- **Plant resistant varieties.** Some tomato and potato varieties with early blight resistance or tolerance are available. Stemphylium-resistant tomato varieties are also available. However, most tomato cultivars are susceptible to Septoria leaf spot.

You can find a list of resistant tomato varieties here.

- **Provide adequate nutrients.** Adequate nitrogen fertility throughout the season can help delay onset of early blight; lower leaves become more susceptible 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.
- **Apply protectant fungicides**, starting before symptoms begin to develop and apply at regular intervals (depending on weather conditions and disease pressure). 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.
- **Practice a 2-year crop rotation out of tomatoes.**
- **Control solanaceous weeds.**
- **Incorporate crop debris promptly** after harvest to encourage decomposition.
- **Use drip irrigation, widen plant spacing, and stake tomatoes** to reduce the length of time that tomato foliage is wet Keep workers and equipment out of wet fields where possible.
- Stemphylium leaf spot is not currently included in the New England Vegetable Management Guide, and fewer fungicides are labeled specifically for this disease than for early blight and Septoria. In MA, fungicides can legally be used if the target crop and use pattern (e.g. foliar sprays) are both on the label—fungicides that are effective against early blight and Septoria should also be effective against Stemphylium. Chlorothalonil, mancozeb, Aprovia Top, Inspire Super, Luna Tranquility, ManKocide, Gavel, Revus Top, Mettle, Flint are labeled specifically for Stemphylium/gray leaf spot.

--Written by Bess Dicklow, retired UMass Extension Plant Diagnostician, and Susan B. Scheufele, UMass Extension Vegetable Program

Preventing Bird Damage to Sweet Corn

Bird damage in sweet corn is always a problem. Although it tends to be worse in a dry year, we are certainly seeing a lot of damage this year, despite the wet season. To be successful controlling birds, it is best to take action in advance of the problem, because once birds get in the habit of feeding on your corn, it will be harder to stop them. Redwing blackbirds and other flocking birds can cause serious crop losses in some fields. Unfortunately, there is no easy answer and no guarantee that a particular tactic will work.

Bird damage in sweet corn

Redwing blackbirds nest in hayfields, marshes, and ditches and congregate at large nighttime roosts near their nesting sites. Large flocks feed in fields and bottomlands, and the worst damage to sweet corn is reported by growers near rivers and marshes. Insects are the dominant food in the nesting season (May through July), then the diet shifts to grain and weed seeds in late summer. This, along with the expanding acreage of ripening sweet corn in mid-July, may explain the 'sudden' appearance of flocks in sweet corn at this time. Grains that are affected by redwing blackbirds include sweet corn, ripening grain corn, sunflower, sorghum, and oats.

General Tips on Repelling Birds

- **Time any control techniques so they are in place BEFORE harvest** and remain in place until harvest is complete. Birds invade sweet corn fields about three days before picking.
- **Use multiple tactics that reach more than one sensory mode.** For example, combine scare-eye balloons with auditory repellents like shellcrackers or distress calls. This is likely to be more effective than using one tactic alone.

- **Move devices frequently.** Birds can learn and become habituated to any device that is used for a long time in one place.
- **Leave old corn for birds to eat.** After harvest, scare devices can be removed from one block and concentrated in the next block. Try to keep the birds foraging in the old block while delaying their move to the one that's ready for harvest. Some growers allow birds to scavenge in the old block before disking it in. A method that some growers say works is to rotary mow or disc the interior blocks of the previously harvested fields. Birds like to feed on the ground because it is easier than clinging to an ear, but they prefer perches nearby for protection and rest. It also helps if you plant succession blocks at opposite sides of the field, not right next door.
- **Control insect pests** to reduce the corn's attractiveness to birds. Birds that are attracted to ears by the presence of caterpillars will cause damage to non-infested ears in the block as well. They cause a lot more damage than most insects do.

Tools for Repelling Birds

- **Visual Scare Devices**. Eye-spot balloons and reflective mylar ribbons can be effective and fairly economical for small to medium sized fields, especially if combined with other tactics like auditory deterrents.. Growers report that the following methods make balloons more effective: use at least 8 balloons per acre, place them in the field several days before harvest, and leave the previous block standing, without balloons, to allow birds to feed in the older corn.
- **Chemical Deterrents.** Bird deterrent sprays contain methyl anthranilate (e.g. Avex, Avian Control or Migrate, Avipel), a chemical allowed for use on fruits and vegetables. Methyl anthranilate is also a food additive that imparts a fruity odor to products. Methyl anthranilate works by irritating nerves in birds' bills. There is not strong evidence that methyl anthranilate deters birds in field settings, so if you use this material, follow the label as closely as possible to increase the likelihood of effectiveness. For example, efficacy may be improved if the material is applied with foggers, which produce smaller droplets, than typical sprayers. Sprays also need to be reapplied after rain. Repellents are also likely to be most effective if combined with other tactics.

Auditory Scare Devices:

- **Exploders** are gas-fired cannons placed in the field that fire automated, timed discharges. These can be quite effective. Cannons are available from some agriculture supply sources. Notify your farm neighbors and the local police to let them know what you are going to do. Cannons are very loud. Neighbors may complain.
- **Shellcrackers** are 12-gauge shotgun shells in which the lead shot has been replaced with a bulldog firecracker. When fired from a shotgun, this firecracker travels 75 to 150 yards and explodes in the air with a loud report. Use a single shot, inexpensive 12-gauge shotgun as the loads are very corrosive. Firing a few rounds early and late in the day will unsettle birds. Federal permits are not required. Again, notify local police and neighbors to let them know what you are doing. Check on local town ordinances. This method can be satisfying on a short-term basis. The disadvantage is that it requires a person to take time in the field to discharge the shellcrackers. For a more detailed fact sheet on shellcrackers and other prevention devices, contact USDA Wildlife Services (413-253-2403).
- **Distress calls and raptor calls.** Recordings of distress calls or the calls of predatory birds, which repeat at regular or random intervals and operate on battery or solar power, can be quite effective. Because flocking birds are very responsive to the signals from others in their flock, a distress call from one bird is a sign to all the others that an area is unsafe. These tools have become quite sophisticated, with programmable or random call intervals that help to overcome birds' ability to acclimate to regular sound intervals. Make sure you are using a distress call that matches the bird species you need to scare away. These can be purchased through many farm and orchard suppliers.

Interfering with birds' perception of their environments. Recently developed devices in bird management impair birds' abilities to perceive their environment and may have applicability in fruit production systems. "Sonic nets", for example, are not physical nets; they are systems that broadcast noise at the same frequencies at which birds communicate, potentially interfering with birds' ability to warn each other about danger. One test showed that the nets deterred birds from an airfield. By reducing birds' abilities to communicate and perceive predators, these techniques may be less susceptible to habituation than scare techniques. One producer of such devices is at http://sonicnets.com/.

Using falcons. Even better than recorded raptor calls is the real thing! There are falconer clubs in many areas. Hire a falconer to fly their bird over your field. Nothing will clear out a flock of blackbirds faster than a falcon swooping over the field! American kestrels can also be attracted to some fields with nest boxes. Information about building and maintaining nest boxes can be found here. Kestrels nest in May, June and sometimes July, and they are most likely to be helpful as

a bird deterrent if your crop is ripening during those months—these also work well in sweet cherry orchards. The nest boxes can also be attractive to European starlings. If a starling occupies a box, it will add grass and other materials to the box and lay 5-7 pale blue eggs. A starling nest should be removed from the box, and new wood shavings added to the box if needed. Starlings are not native to North American and are not protected by the Migratory Bird Treaty Act so no permits are needed to remove their nests. An important consideration is that kestrels eat voles and mice, so rodenticides should not be used in fields when kestrels are present.

Laser scarecrows and drones show promise in reducing bird activity in sweet corn. Laser scarecrows sweep a laser beam over a field. Studies show significant reductions of bird damage but the damage may still be too high for some (about 15% damage, down from 20-50%). For more information on building a laser scarecrow, visit the URI laser scarecrow project website at https://sites.google.com/view/urilaserscarecrow/home. In recent preliminary work with drones in sweet cherry orchards, results were inconsistent but suggest drones may deter birds in some contexts. On some days, in some orchards, fruit-eating bird numbers were lower when drones were flying over a block. Larger-scale trials to investigate this strategy are warranted.

Netting is often used in berry or cherry production and is sometimes used by enterprising sweet corn growers too. This was considered the most effective bird deterrent in a survey of 1500 fruit growers (Anderson et al. 2013). Netting requires considerable effort and materials. If one employs netting, it is important that the netting enclose the vulnerable crop completely. That means with sweet corn you will need to cover the block entirely and bury the edges in the ground. Folks who have been successful using this method in corn recommend setting the nets after sidedressing and leaving extra netting for the crop to push up as it grows. You will need a sturdier netting than that used in fruit settings. On one farm it takes 6 workers 25 minutes per acre to set the nets up but once in place it will protect the crop from birds as well as corn earworm (though not European corn borer or fall armyworm) and so can reduce the number of insecticide sprays needed.

Sweet corn topping (de-tasseling). A technique that has been studied in NY and CT is to 'top' the corn. Topping is the removal of the top of the corn plant from just above the silk or top of the ear, after pollen shed and pollination. The advantages may include 1) harvesting 2 to 3 days earlier than un-topped, 2) improved picking ease 3) reduced bird damage, 4) easier to monitor bird activity in the block 5) improved spray coverage and 6) reduced lodging due to wind. One significant risk is that cut stems are sharp and pointed and can cause eye injury to pickers; it's a good idea for pickers to wear goggles in topped fields. It is important to use equipment that is designed for this purpose to ensure safety; one source for a topper unit is Hagie. As with other methods, topping should be done early, several days before harvest, so the birds are not already feeding in the block.

Shooting birds. A federal permit is not required to shoot or otherwise control blackbirds, cowbirds, grackles, crows, or magpies when they are found committing or are about to commit damage to or "depredation upon" agricultural crops. In Massachusetts, state permits are not needed for controlling starlings. State regulations allow hunting of crows any time of year except during the nesting season. For more details contact your MA Division of Fish and Wildlife District Office (western district (413) 684-1646; CT Valley (413) 323-7632; central district (508) 835-3607; northeast (978) 772-2145; southeast (508) 759-3406). From now through the rest of the corn harvest season, no permit should be required to hunt crows. While hunting can reduce numbers over the long term, it may not be effective against flocks of invading birds. It is not illegal to display dead birds in the field, but it is not clear that this is an effective deterrent. For regulations on geese, consult the US Fish and Wildlife service at 413-253-8200.

--Written by R. Hazzard, updated for 2021 by S. B. Scheufele

CELERY ANTHRACNOSE: THE LEAF CURL DISEASE

--Written by Elizabeth Buck, Cornell Vegetable Program

Since 2010, celery anthracnose (aka leaf curl) has become a major challenge in large celery production regions in Michigan and Ontario and sporadically occurs in the Northeast. It does not appear to affect celeriac or other closely related crops. Symptoms, listed from the first noticeable to the most severe, include:

- Small, slightly sunken, light brown elliptical lesions or cracks on the stalks
- Curling leaves (usually downward cupping) and twisting petioles
- Pale green (not yellowed) color +/- stunting
- Sunken dark brown or black lesions along stalk edges, particularly on young heart tissue
- Ruptured, greenish to light brown outer stalk lesions, frequently with gall tissue or adventitious roots on the inside
- Slimy, brown to black rot of the heart tissue that leaves intact outer leaves standing

Celery plant with anthracnose (foreground) and without (background).

Celery leaf curl, which describes the most recognizable early symptom, is the descriptive name used when this disease first showed up—before the causal pathogen was identified. We also call it celery anthracnose because we now know that an anthracnose fungus causes the issue.

Disease biology. Celery anthracnose is caused by a tightly related cluster of *Colletotrichum* (pronounced cauli-TOT-rick-um) species, formerly referred to as *Colletotrichum acutatum*. **Researchers have genetically determined that at least two species cause celery leaf curl. *C. fioriniae* and *C. nymphaeae* are the major species causing celery crop losses in Ontario, Canada.** *C. nymphaeae* has also been implicated in Japanese outbreaks of celery anthracnose. These are different from the main anthracnose species that attack tomato, pepper, and vine crops. *C. fioriniae* is also responsible for garlic anthracnose (aka orange fuzzy scape disease), bitter rot of apples and bitter rot of pears while *C. nymphaeae* causes strawberry anthracnose.

Ruptured stalk lesion with gall tissue and adventitious roots (L) and dark stem lesion (R)

How celery anthracnose arrives on farms is unclear. Some work suggests that seeds may carry the disease, which helps explain why symptoms often start in greenhouse transplant production. The pathogen is easily spread in the field by water and splashing soil. The life span of the pathogen in the soil isn't well understood at this point. Once on the farm, celery anthracnose fungi can infect several weeds. Common lambsquarters, redroot pigweed, yellow nutsedge, oakleaf goosefoot, and common groundsel can all harbor celery anthracnose without clearly expressing symptoms. **An important feature of celery anthracnose is its ability to infect a plant then lay quietly in an undetectable, asymptomatic state (a latent or quiescent infection) until environmental conditions become favorable.**

Celery anthracnose thrives under warm, wet conditions. Rapid growth occurs when temperatures are 77 to 86°F, with substantially more disease development at 86°F than 77°F. Temperatures as cool as 60°F will support fungal growth and spread, but field progression will be slow. Wet leaves also facilitate leaf curl development. Long wetting periods of 48 to 96 hours best promote outbreaks, though as little as 12 hours is sufficient to cause disease. It takes 3-5 days after infection for the small, sunken stalk lesions to appear. The curling starts just days after the initial lesions. **Celery leaf curl frequently develops when it has been very hot with heavy thunderstorms followed by high humidity.** Overhead irrigation and poor airflow due to weedy fields also increase leaf wetness periods and exacerbate disease.

Full disease outbreaks in celery can cause heavy losses. When environmental conditions favor disease, infection can range from 17 to 100% and cause marketable yield loss of up to 80%. In cooler, drier weather, infections can be as low as 1 to

10% with very little to no loss in marketability. If an infection is mild and the heart tissue is unaffected, some plants with celery leaf curl can be marketed after an aggressive trimming.

Management - Preplant.

- For starters, **become familiar with the symptoms.**
- Keep the greenhouse free of weeds.
- **Scout your plug trays** before transplanting into the field.
- **Remove suspicious seedlings and treat the remaining ones,** or consider starting over using new plug trays.
- Consider your rotations and don't plant into fields with a recent history of celery or garlic anthracnose.

Rotational considerations are under-studied at the moment and are currently based on general precaution and common sense. For each of the following scenarios, assess your farm's risk profile (history, severity of disease) and your comfort level for rotating between or planting near other susceptible crop hosts. Currently, there isn't a clear understanding of whether *C. nymphaeae* will move from strawberries to celery and vice versa. To be cautious, don't move from an infected celery or strawberry planting into the other crop when doing field work. Avoid rotating with garlic following an outbreak of orange fuzzy scape or celery anthracnose. Avoid planting near apple and pear trees that have a recent history of bitter rot.

Management – In Season

- **Use drip irrigation** if there is celery leaf curl in the transplants.
- Minimize overhead irrigation and splashing. Mulch can also reduce weed pressure.
- **Remove infected plants** to minimize field spread of celery anthracnose.
- Control weeds in infected fields to improve airflow and reduce the risk of carryover on weedy hosts.
- Harvest fields with infections as soon as the plants are of marketable size to reduce the chances of developing heart lesions.
- Disc infected crop residue as soon as possible to promote break-down and reduce inoculum.
- Rotate away from celery for 3 to 4 years.
- **Scout fields and treat at first symptoms using effective materials or preventatively during periods of highly favorable (hot, wet) weather.**

Scouting. Scout your celery planting during a long hot period or a few days after a short one. Hold off on scouting until the foliage dries. Pay particular attention if you've had heavy rain, high humidity, or overhead irrigation. Look for curling leaves and then examine the stalks and hearts of plants more closely. Foliar symptoms are usually absent. Remember that aster yellows requires the presence of leaf hoppers for transmission, produces pronounced yellowing, and does not cause dark stem lesions.

Resistant varieties. Some varieties show some tolerance to celery anthracnose, though no variety is resistant and all varieties screened to date will show some disease. Variety screenings were undertaken by the University of Guelph so cultivars identified as somewhat tolerant should be well adapted locally. I've also included susceptible varieties used by Michigan State for leaf curl experiments (Table 1).

Table 1. Variety selection for celery anthracnose mitigation

Least susceptible	Moderately susceptible	Highly susceptible	
Merengo	Sabroso	Plato	Nero
Hadrian	TZ 6010	TZ 9779	Green Bay
Geronimo		Stetham	Dutchess
Balada		Kelvin	Tango

Chemical control. Fungicides can help slow celery anthracnose progression and retain marketable yield. Applications should be directed at the most susceptible young tissue in the heart of the plant. Trials examining fungicide efficacy most often make 1 application before the disease starts, so keep in mind that field results may not be as good if sprays begin after disease is found. Stobilurin fungicides (Group 11) best reduce celery leaf curl progression in the field and best help maintain yield. Cabrio consistently performs well. Stobilurin fungicides really should be applied with a protectant and be

rotated with non-group 11 fungicides because of resistance concerns. Treat any infected seedlings with a group 11 when they are set in the field. Cuprous oxide forms of copper can help in low pressure weather conditions, but do little in when environmental conditions are highly favorable. See Table 2 for which fungicides are available to treat celery anthracnose, and early and late blights of celery.

Table 2. Fungicide options available in NY for common celery foliar diseases. Always check the product label for the most thorough and current application information.

Fungicide	Active Ingredient	FRAC Group	Diseases Listed	Rate & Notes	PHI (days)
Cabrio	Pyraclostrobin	11	Anthracnose, Early & Late Blight	12-16 oz /A, 64 oz/yr max ≤ 2 sequential apps	0
Pristine	Pyraclostrobin/ boscalid	11 + 7	Anthracnose, Early & Late Blight	10 -15 oz /A, 2 apps/yr	0
Merivon	Pyraclostrobin/ fluxapyroxad	11 + 7	Anthracnose, Early & Late Blight	4-11 fl oz, 3 apps/yr	1
Quilt	Azoxystrobin/ propiconazole	11 + 3	Early & Late Blight	14 fl oz /A, max of 1.5 lb azoxystrobin products/yr	14
Bravo WeatherStik	Chlorothalonil	M5	Early & Late Blight	2-3 pt/A, protectant	7
Quadris	Azoxystrobin	11	Early & Late Blight	9.0-15.5 fl oz /A, 1 spray then rotate groups	0
Flint	Trifloxystrobin	11	Early & Late Blight	2-3 oz /A	7
Tilt	Propiconazole	3	Early & Late Blight	4 fl oz /A	14
Various	Cuprous oxide	M1	Check the label of your preferred formulation		
Switch	Cyprodinil/ fludioxonil	9 + 12	Late Blight	11-14 oz/A	0

Forecasting models. Work at the University of Guelph has shown good disease control success by using the TOMCAST forecasting model with a threshold of 15 disease severity units to help time fungicide applications. Using TOMCAST instead of calendar schedule spraying will reduce the number of applications and make rotating fungicide groups much more achievable. Remember that protectant fungicides applied for celery early and late blight are generally effective against a broad range of diseases and may have a secondary benefit of allowing you to postpone treatment for anthracnose.

With good cultural practices and fungicide use, sporadic outbreaks can often be controlled enough to harvest a portion of an infected planting. While celery may not be a major crop in the Northeast, celery anthracnose tends to cause major losses when it shows up. There is ongoing research into celery leaf curl in Ontario and Pennsylvania which will hopefully lead to improved future control.

News

USDA Disaster Designation for July Rain and Flooding

Eleven counties in Massachusetts will be covered under a Disaster Designation for the July Rain and Flooding from July 9 - July 16. This designation allows the USDA Farm Service Agency (FSA) to extend much-needed emergency credit to producers recovering from natural disasters through emergency loans. Emergency loans can be used to meet various recovery needs including the replacement of essential items such as equipment or livestock, reorganization of a farming operation, or to refinance certain debts. FSA will review the loans based on the extent of losses, security available, and repayment ability. Also, please be advised of the Disaster Designation for the May 17-18 freeze as well.

Contact the MA FSA State Office at 413-253-4500 with any questions.

Events

Twilight Meeting at Parlee Farms

When: Tuesday, August 15

Where: Parlee Farms, 95 Farwell Rd, Tyngsborough, MA 01879

Join UMass Extension to hear about pumpkin varieties grown at Parlee Farms, as well as sweet corn IPM and automated irrigation systems. 1 pesticide credit available. A light supper (and dessert!) will be provided.

South Deerfield Research Farm Field Day and Vegetable Twlight Meeting

When: Wednesday, August 16, 2:30-6 pm

Where: UMass Amherst Crop and Animal Research and Education Farm, 91 River Rd., South Deerfield, MA

Registration: Free! Please register in advance. Click here to register.

Join UMass Extension for a research tour and grower twilight meeting! In the afternoon, we'll tour the UMass Research Farm and hear about the graduate student and Extension research underway on the farm. Students and faculty are encouraged to come to learn about applied research and the research farm. In the evening, we'll have talks targeted more to commercial vegetable growers. A representative from Toro will discuss the automated irrigation system set up at the research farm, and the Extension Vegetable Program will discuss their applied research trials in more detail. Join us for both parts or just one! Up to 2 pesticide credits available. A light supper will follow the twilight meeting.

Click here for a full agenda.

The 38th Massachusetts Tomato Contest to be Held on August 22

When: Tuesday, August 22, 2023

Where: Boston Public Market, 100 Hanover St, Boston, MA 02108

Registration: Click here to register.

The 38th Massachusetts Tomato Contest will be held at the Boston Public Market on Tuesday, August 22nd. 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.

Open to commercial farmers in Massachusetts, growers can bring tomatoes to the market between 8:45 am and 10:45 am on August 22nd or drop their entries off with a registration form to one of the regional drop-off locations on Monday, August 21st. Drop off locations include sites in South Deerfield, Southboro, Dighton and West Newbury. These tomatoes will be brought to Boston on Tuesday.

For complete details, including drop off locations, contest criteria, and a registration form, click here. Be sure to include the registration form with all entries.

The 38th 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. *Please consider participating to showcase one of the season's most anticipated crops!*

Questions? Please contact David Webber, David.Webber@mass.gov.

Twilight Meeting at Heart Beets Farm: Sweet potato production and fall pest management

When: Thursday, September 21, 4-6pm

Where: Heart Beets Farm, 181 Bayview Ave, Berkley, MA 02779

Join UMass Extension to hear about sweet potato production at Heart Beets Farm, and to learn timely info about fall pest management. 1.5 pesticide credits.

Eastern MA CRAFT Meeting: Geothermal Water Use and Good Agricultural Practices at Farmer Dave's

When: Saturday, October 21, 4-6pm

Where: Farmer Dave's, Dracut, MA

We will take a tour of their solar and geothermal systems and the reuse of the geothermal water for hoop house irrigation. Lisa McKeag from UMass Extension will share about a project the farm is involved in to assess pre- and post-harvest agricultural water quality for food safety. She'll talk about the results of water samples taken at the farm in 2022-23 and give an update on current food safety regulations related to agricultural water.

THANK YOU TO OUR 2023 SPONSORS!

CERTIS Biologicals

NEW ENGLAND VEGETABLE & BERRY GROWER'S ASSOC.

RIMOL Greenhouse Systems

Johnny's Selected Seeds
An employee-owned company

FARM CREDIT EAST

HARRIS SEEDS EST 1879

4TownFarm

Vermont Compost Company
Feed the Soil

Supplying Growers, Gardeners
OESCO INC.
and Groundskeeping Professionals. Since 1954.

ipmlabs

SEVEN SPRINGS FARM SUPPLY

VALENT®

WILSON FARM
"Growing Since 1884"

CT GREENHOUSE
Structures & Supplies
WWW.CTGREENHOUSE.COM

Become a sponsor!

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

Where trade names or commercial products are used, no company or product endorsement is implied or intended. Always read the label before using any pesticide. The label is the legal document for product use. Disregard any information in this newsletter if it is in conflict with the label.

The University of Massachusetts Extension is an equal opportunity provider and employer, United States Department of Agriculture cooperating. Contact your local Extension office for information on disability accommodations. Contact the State Center Directors Office if you have concerns related to discrimination, 413-545-4800.