UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

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In this issue:

Celeriac, amongst other fall crops like leeks, are beginning to take off in the field. Photo: G. Higgins

Crop conditions

As one farmer put it this week, summer on the farm means the three w's: weeds, worms and water! Many caterpillarshave now arrived and are chomping away on brassicas, tomatoes and sweet corn, hot sunny days are good for killing weeds, and irrigating or dodging storms is the order of the day. Sudden, heavy, erratic rainstorms continue to batter crops and soils across the region, between periods of heat and drought—this is our new summer normal. From the Cornell Climate Smart Farming Program: "The average annual temperature in the Northeast has increased by approximately 2.4°F, and annual precipitation has increased by 4.9 inches over the last 120 years. The frequency of extreme rainfall events (e.g., 2 inches of rain in a 24-hour period) has increased 71% between 1958-2012 (NOAA/NCDC). The length of the frost-free growing season has increased by 10 days, on average. These changes are projected to continue and increase in the future, and will pose threats to soil conditions, farm buildings, livestock health, as well as crop and animal productivity and quality. Despite these risks, farmers can make changes to their practices and systems which will reduce the severity of these climate impacts. Climate change may create opportunities for new enterprises as warmer temperatures lengthen the growing season, while the variability and unpredictability will remain a challenge."

One of the best and ways to mitigate effects of extreme rain and drought that you are probably already doing in some capacity is to focus on soil health: "healthy, well-structured soil that is protected by vegetation captures more water and is less susceptible to surface runoff, compaction, and erosion during heavy rain events." Strategies to improve soil structure include: reducing tillage frequency and intensity; increasing organic matter by planting cover crops both within and between seasons; incorporating manure, compost and other organic residues; using perennial crops in rotation to minimize tillage; reducing compaction by making fewer tractor passes; and avoiding fall tillage and bare winter fallow. Another important piece is managing water resources efficiently by: "improving irrigation efficiency by using the latest technologies, such as micro-, subsurface, or drip irrigation; utilizing reclaimed water if possible to conserve water during droughts; installing tile drainage in fields to remove excess water and control runoff; expanding or improving water supply systems to meet future demand; and increasing water storage capacity by constructing deeper wells and ponds." For more climate change mitigation strategies, see this fact sheet from the Cornell Climate Smart Farming Program. Two other excellent resources in these areas that are available online are the books Building Soils for Better Crops, and Managing Cover Crops Profitably.

How are you adapting to climate change on your farm? Share your adaptations or questions with us at umassveg@umass.edu!

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Pest alerts

Alliums

Bacterial bulb rot in onion. Bacteria that cause this rot can enter leaves through thrips feeding wounds. Photo: M. Hausbeck

Onion thrips damage is now high in leeks and onions throughout the region, especially where thrips have gone unmanaged. Populations tend to increase rapidly in hot, dry weather and are knocked back by rain. Thrips feeding damage allows soft-rot bacteria to enter onion bulbs, which can lead to rot in storage. This is less of an issue in leeks, because leeks are not typically stored for as long as onions, but cosmetic damage to wrapper leaves can reduce marketability. With bulk onion harvests starting soon, it's likely not worth beginning thrips management now, but take note of damage present now and bacterial diseases in storage and consider managing this pest next year if disease does occur.

Brassicas

Alternaria leaf spot on brassica. Photo: G. Higgins

Alternaria leaf spot was seen developing on lower leaves of older brassica plantings this week. This fungal disease is caused by 3 species of *Alternaria*, all of which are limited to brassicas. The pathogen overwinters in crop debris and spores are spread primarily by wind, rain, and splashing water, though it can also be seed-borne. Long periods of leaf wetness promote disease development, usually cool nights with overnight dew are enough to do it. Till under brassica crop residue promptly, and practice 3-year crop rotations. Labeled products include Endura (FRAC 7), Inspire Super (3 + 7), Procure (3), Omega (29), and Quadris and Cambrio (11), and it is recommended to spray on a 7-day schedule. Resistance to FRAC group 11 has been documented so materials in this group should be used with caution, especially on farms where they have been used a lot in the past. Endura was most effective in some university trials. For organic control, copper and/or Double Nickel (or other *Bacillus* based biofungicides) may provide some control.

Onion thrips damage was seen this week on brassicas planted last month. Some insecticides may control onion thrips, flea beetle, and caterpillars, all of which may be infesting fall brassicas. Broad-spectrum products include neonicotinoids (Admire Pro, Assail), diamides (Exirel, Harvanta) and numerous synthetic pyrethroids (including Warrior, Pounce, Baythroid, Brigade, and Mustang). Biorational or organic products include spinosad (Entrust, OMRI listed; has both contact and ingestion toxicity), spinetoram (Radiant SC), novaluron (Rimon 0.83EC, insect growth regulator for immature stages only), and pyrethrin (PyGanic EC5.0, OMRI listed; contact activity only). Repeat applications at 7 to 10-day intervals based on scouting. Use a shorter interval in hot, dry weather. Use a spreader-sticker for better coverage. Apply in early evening, using high pressure and 100 gal water/A for best results. Systemic insecticides applied as a side dress up to 4-6 weeks after transplanting may provide adequate control in long-season cabbage. Rotate between insecticide groups to help prevent or delay resistance development.

Carrots

Characteristic orange, mustard seed-like sclerotia of southern blight. Photo: G. Higgins

Southern blight, caused by the fungus *Sclerotium rolfsii*, was diagnosed on carrots this week. This fungus is somewhat rare in the Northeast in field-grown vegetables, but has a very wide host range, including many vegetable crops and ornamentals. It produces distinctive white fan-shaped mycelial growth and orange sclerotia (masses of fungal tissue) that allow it to survive in the soil for several years. Removing infected plants can help reduce the number of sclerotia in the soil. The sclerotia have high oxygen demands to survive, so plowing under infected debris deeply (>8") can help decrease sclerotia viability.

Alternaria leaf blight was diagnosed on carrots this week. This disease can be caused by 2 species of *Alternaria* (*A. dauci* and *A. radicina*), both of which only cause disease on umbelliferous plants, including celery, celeriac, dill, fennel, parsley, and parsnips. These pathogens can be seedborne; hot water seed treatment is an effective tool if you suspect that the disease is coming in

on seed. Control weeds to maximize air flow throughout plantings and reduce leaf wetness periods. Incorporate crop residue promptly to speed up decomposition of the crop debris that harbors the pathogen. Several conventional fungicides are labeled for this disease and can provide control if applied at the first sign of infection. See the carrot disease section of the New England Vegetable Management Guide for labeled products.

Alternaria leaf blight on carrot foliage. Photo: G. Higgins

Cucurbits

Alternaria leaf spot was diagnosed on cantaloupe on one farm in Hampshire Co., MA this week. This is a different *Alternaria* species than those on brassicas or umbelliferous crops and its host range is limited to cucurbits. Muskmelons/cantaloupes are most susceptible, but this disease may occur on watermelon, squash, and cucumber as well. Necrotic spots are often surrounded by a yellow halo. Older lesions may show concentric rings, the characteristic look of many *Alternaria* diseases. Defoliation exposes the fruit to sunscald, which reduces fruit quality.

Alternaria leaf spot on cantaloupe. Photo: G. Holmes, Bugwood.org

Several viruses were diagnosed on cucurbits throughout western New York this week, including cucumber mosaic virus, zucchini yellows mosaic virus, and watermelon mosaic virus. Symptoms include stunted leaves, leaf blistering, color breaking in leaves and fruit, and warts on fruit. These viruses are transmitted by aphids and are best controlled by choosing varieties with resistance and/or controlling aphid populations.

Squash vine borer numbers are dropping, while damage is high in untreated fields as larvae are now boring into plants. We expect trap numbers to continue falling slowly over the next few weeks. Eggs take 10-15 days to hatch, so it may not be too late to get some control from an insecticide application made now. Labeled products include acetamiprid, spinosad, and several synthetic pyrethroids. Make 2-3 applications, 1 week apart, targeting the base of the plant.

Table 1. Squash Vine Borer (SVB) trap captures July 17-23, 2020

Location	SVB
Deerfield	3
Westhampton	1
Whately	0
Leominster	11

Cucurbit downy mildew is continuing to spread from the Northwest and South, with new reports from western and central New York as well as Delaware and Maryland this week. Storms tracking from the south and/or west of us could bring the pathogen to our region, today's forecast shows moderate risk for most of New England. Cucumbers are most at risk, with no nearby reports in other cucurbit crops.

Ozone injury was reported on cucumber foliage in western MA this week. Ozone is considered the most damaging phytotoxic air pollutant in North America. Injury to sensitive crops (many including tomato, potato, beets, carrots, strawberry, beans, and cucurbits, especially squash, watermelon and cantaloupe) can occur during hot, humid weather with stagnant air masses. Symptoms consist of small, irregular shaped spots or flecks that range in color from dark brown to black or light tan to white, and can also include stipples (small darkly pigmented areas approximately 2-4 mm in diameter), bronzing, and reddening. These symptoms usually occur between the veins on the upper leaf surface of older and middle-aged leaves, but may also involve both leaf surfaces. The type and severity of injury depends on the duration and concentration of ozone exposure, weather conditions, and plant genetics. New growth should be unaffected and the plants will grow out of the damage.

Ozone injury on a cucurbit crop. Photo: Long Island Horticultural Research & Educ Center

Solanaceous

Verticillium wilt was observed this week in eggplant. This is a soil-borne, fungal disease that invades the water-conducting tissue of the plant and causes wilt. Wilt often begins in only one side of a leaf. This fungus can survive in the soil for several years; practice a 4- to 5-year rotation away from solanaceous crops to reduce soil inoculum levels. There is no effective chemical control for this disease, avoid planting into infested fields.

Table 2. Sweetcorn pest trap captures for July 17-23, 2020						
Location	**GDD (base 50°F)**	**ECB NY**	**ECB IA**	**FAW**	**CEW**	**CEW Spray Interval**
Western MA						
Sheffield	-	1	0	-	7	*4 days*
Southwick	1484	1	0	3	0	*no spray*
Whately	1499	6	0	-	0	*no spray*
Central MA						
Bolton	1392	1	2	-	1	*no spray*
Leominster	1369	0	1	-	4	*5 days*
Spencer	1327	1	0	3	0	*no spray*
Eastern MA						
Ipswich	1265	9	0	6	0	*no spray*
Concord	1351	4	0	1	0	*no spray*
Millis	1484	0	0	N/A	6	*5 days*
Sharon		2	0	N/A	0	*no spray*
Seekonk	1508	1	0	7	2	*6 days*
Swansea						
- 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						

Table 3. Spray intervals for corn earworm based on Heliothis net trap captures		
Moths/Night	Moths/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

Saprophytic Alternaria alternata growing on pepper tissue damaged by sun scald.
Photo: C. Radon

Blossom end rot is showing up now in field tomatoes, as fruit begins to ripen. This disorder is caused by calcium deficiency in the fruit tissue. Usually, this is due to dry soil conditions or irregular watering; plants can only take up calcium along with water. **Sunscald** is also developing on pepper fruit that isn't covered by leaves. Dead tissue caused by blossom end rot and sunscald is often colonized by a non-pathogenic fungus, *Alternaria alternata*, which produces fuzzy black sporulation. This fungus will not spread to healthy fruit. For more information about blossom end rot and other abiotic disorders of tomato, see the article in this issue.

Bacterial leaf spot of pepper was diagnosed this week. This disease can defoliate plants, exposing fruit to the sun, which often leads to sunscald. It survives on crop residue and trellising materials, and can be seed-borne. There are several strains of this pathogen and varieties are often resistant to a specific set of strains.

Sweet corn

We are entering the season where all 3 major caterpillar pests of sweet corn, **European corn borer**, **corn earworm**, and **fall armyworm**, may be present in the crop. The 2nd generation ECB adults are continuing to emerge across the region. CEW remains present, and FAW adults are beginning to be caught. To learn more about identification and management of each of these pests, see the article in this issue.

Carrot seed moths are being captured in ECB traps in high numbers right now—these are generally not pests on vegetable farms, but look similar to ECB and can be confusing in sweet corn pest monitoring. Carrot seed moths have a single spot in the center of each wing, while ECB moths have 2 serrated lines across the back of each wing.

Multiple Crops

Both spider mites and **western flower thrips** are causing significant damage in peppers, tomatoes, eggplant, and cucumbers, in both field and high tunnel crops. In some cases, both pests have been seen infesting the same crop. For control of mites see article this issue. Controlling Western flower thrips in tunnel vegetables is a bit tricky—resistance issues are common, and the pest is not always listed for indoor use on vegetable crops, since it is most commonly considered an ornamental pest—check labels to ensure a product is listed for the crop and pest and can be used indoors. Pyrethroids are generally not effective, spinosad e.g. Radiant/Entrust have provided some control though there is some resistance in WFT populations. Another option is Assail.

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.

The UMass Plant Diagnostic Lab and the UMass Soil & Tissue Testing Lab are both now open: See the News section of this issue for more info.

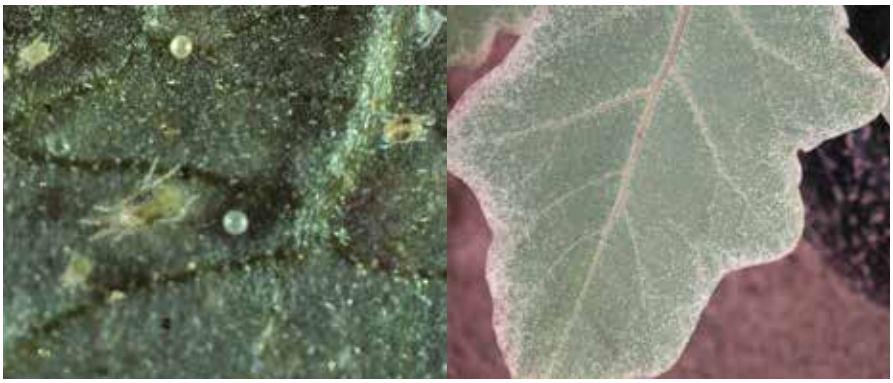
Mites in Solanaceous Crops

We are beginning to get reports of mite infestations in solanaceous crops across the region, especially in high tunnel crops including tomatoes, eggplants, peppers and also cucumbers. Both broad mites and two-spotted spider mites (TSSM) affect solanaceous crops—broad mites are the most heavy hitting on pepper, and TSSM are particularly devastating on eggplant and tomato, though they can both affect a variety of crops, including tomato, eggplant, potato, beans, and vine crops such as melons and cucumbers.

Two-Spotted Spider Mite

TSSM are favored by hot, dry, and dusty conditions, which also aggravate mite injury by stressing the plant. Damage is often underestimated since both the mites and the wounds they cause are difficult to see without inspecting plants closely, or until the problem becomes widespread.

Description. Adult females are tiny—about a ½ mm long—slightly orange to pale green in color, with two dark spots on their body. They are visible with the naked eye, but a 10x hand lens is helpful to see them. Initially, mites will feed on the undersides of leaves but in heavy infestations, they will move to the tops of leaves and onto fruit. Large populations will produce visible webbing that can completely cover the leaves. Mites hide under the webbing, making them difficult to reach with sprays.



Two-spotted spider mite and damage on eggplant. Photos: J. Boucher

Life cycle. All mobile life stages—adults, larvae, and nymphs—can feed on plant tissue. Eggs are laid singly, up to 100 per female, during her 3- to 4-week life span. Eggs hatch into larvae in as few as 3 days. Following a brief larval stage, several nymphal stages occur before adults appear. The egg-to-adult cycle can be completed in just 7 to 14 days, depending on temperature, leading to explosions in mite population and damage.

Damage. Adult TSSM feed by sucking chlorophyll out of the leaves, creating blotchy pale to reddish-brown spots. Feeding injury often gives the top leaf surfaces a mottled or speckled, dull appearance. Leaves eventually turn yellow and drop. Other symptoms include distorted leaves, overall loss of plant vigor, whitening or spotting of leaves, or abnormalities on stems and fruits. On tomato, mites can damage fruit, causing small whitish spots that render fruit unmarketable.

Broad Mite

Broad mites also have a very wide host range, including many weeds and ornamentals, but cause the most damage within the solanaceous family and are especially damaging on pepper. The source of broad mite infestations in veg-

etable crops is often ornamentals from greenhouses, or high tunnels where vegetable transplants were grown. Adult broad mites are even tinier than TSSM—only 0.02 mm. They're notoriously tricky to find, even on severely symptomatic plants. Similarly to TSSM, broad mites reproduce very quickly; their life cycle takes only 7 to 8 days at 85°F.

Broad mite damage on pepper fruit and plant. Photos: S. Ghimire, UConn Extension

Broad mites differ significantly from TSSM in their feeding habits and damage. Broad mites feed in the growing tip, and inject a toxin as they feed that causes the growing tip to become distorted or die. Plants become severely stunted and twisted and fruit develops an unmarketable gray scar tissue. While plants infested with TSSM can recover from feeding damage after the pest has been controlled with pesticides, plants will not grow out of broad mite damage. Early in an infestation, if only a few plants are heavily infested, pull and bag those plants and treat the remaining plants.

Cultural control. Outbreaks may be worsened by excess nitrogen fertilization, or by the use of broad-spectrum insecticides that kill naturally occurring mite predators. Overhead irrigation or prolonged periods of rain can help reduce populations. Keep weeds under control. Control broad mites in ornamentals if you grow ornamentals and vegetable transplants in the same structure.

Biological control. Preventative releases of the predatory mite, *Phytoseiulus persimilis*, may suppress TSSM populations in vegetable fields, as they do in strawberry fields. *Amblyseius fallicis* is a predatory mite that is widely used in greenhouses. See the New England Vegetable Guide for Table 18: Scouting and Biological Control Guidelines for Vegetable Transplants.

Chemical control. Early or preventative control is essential for controlling both broad mites and TSSM, as populations can explode quickly. Use selective products whenever possible. Selective products which have worked well in the field include:

- **Agri-Mek** (Group 6, 7d PHI): abamectin, derived from a soil bacterium. TSSM & BM. Must be mixed with non-ionic activator type wetting, spreading,and/or penetrating adjuvant.
- **Acramite** (Group 25, 3d PHI): bifenazate, a contact nerve poison with a long residual. TSSM only.
- **Movento** (Group 23, 1d PHI): spirotetramat. Active primarily by ingestion. Systemic. Labeled for control of BM and suppression of TSSM in solanaceous crops. Mainly affects immature stages.
- **Oberon 2SC** (Group 23, 1d PHI for solanaceous, 7d PHI for cucurbits): spiromesifen. Mainly affects immature stages.

Two other selective products are:

- **Kanemite** (Group 20B, 1d PHI): acequincyl. TSSM only. Knockdown and residual control.
- **Portal XLO** (Group 21A, 1d PHI): fenpyromixate. TSSM & BM. Stops feeding immediately after application. Mites die in 3 to 7 days.

OMRI-listed products include insecticidal soap (M-Pede) and horticultural oils (e.g. Trilogy, Suffoil X, and Golden Pest Spray Oil). These can be effective, especially if utilized early and regularly and with good leaf coverage. The bioinsecticides Met52, Grandevo, and Venerate (all 0 PHI) are also labeled.

See the New England Vegetable Management Guide for more details, including resistance groups.

With most miticides (but not bifenazate, which has a long residual), use 2 applications approximately 5 to 7 days apart to help control immature mites that were in the egg stage and protected during the first application. Because mites reproduce

so quickly, populations can easily develop resistance to products; alternate between products after 2 applications to help prevent or delay resistance. Check product labels for specific use restrictions.

Sources:

Watch for Spider Mites in Eggplant, Tomato, and Vine Crops, Ruth Hazzard, UMass Extension

Two Spotted Spider Mites on High Tunnel Vegetables, Gale Hermenau, Delaware Weekly Crop Update, June 21, 2019

Significant Crop Losses on Pepper Due to Broad Mites, Judson Reid, Cornell VegEdge, August 7, 2019

Broad Mites in Fruiting Vegetables, Steve Bogash, Penn State Extension

--Written by Genevieve Higgins, UMass Extension

IDENTIFYING CATERPILLARS IN SWEET CORN

We are entering the point in the season when all of the major caterpillar pests of corn are present in corn fields—European corn borer (ECB), corn earworm (CEW), and fall armyworm (FAW). The second ECB flight is beginning in some locations and we're still seeing damage from caterpillars resulting from the first flight. CEW showed up in pheromone traps early this year, in late-June, implying that it is overwintering in some locations in New England instead of blowing up on storms from the South. FAW has just begun being caught in pheromone traps and we expect numbers to increase slowly over the next few weeks. In the hot weather, eggs can hatch quickly, so arrival of these pests means imminent damage.

If you are noticing unacceptable amounts of caterpillar damage in your sweet corn now, take the time to identify which corn pests are present. The most effective management strategy involves attracting and trapping moths using pheromones and using trap counts for each moth to inform spraying and/or scouting schedules. Earlier in the season, when ECB is the only caterpillar pest out and about, ECB trap captures tell us when the moth flight is beginning and therefore when to scout for caterpillars in the emerging tassels and early silks. Scouting results tell growers' if they are under or over a predetermined spray threshold. Once CEW arrives, the CEW trap captures determine the spray schedule: more moths caught per week mean fewer days between sprays. For more information on managing all 3 corn caterpillar pests, see the following articles in past *Vegetable Notes* issues:

Corn Earworm Management

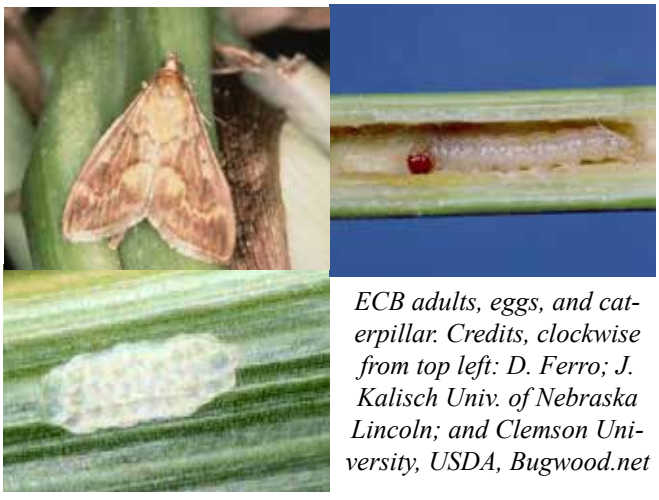
Manage Sweet Corn Pests Through Scouting & Pheromone Trapping

European corn borer is the first corn caterpillar pest to show up in sweet corn, as they overwinter in the Northeast. ECB moths begin emerging in May (at 375 GDD base 50°F), mate, and lay eggs, which will hatch in 4-9 days, depending on the temperature. The newly hatched larvae will move to the closest protected feeding spot—whorl, tassel, ear—and will feed for 5-7 days before boring into the corn stem or ear. First generation larvae will pupate and emerge as adults at 1400 GDD (usually mid- to late-July) to mate and lay eggs. The second generation will overwinter as pupae, protected inside corn stems in the field. There are 2 strains of ECB, the New York strain and the Iowa strain. ECB-NY usually arrives in New England before ECB-IA, and in greater numbers. This year, a hybrid NY-IA strain that is not captured by either individual pheromone trap, has been captured in NY and may be present in New England as well.

Adults are ¾ inch long moths, white to tan, with 2 dark, serrated lines running across the lower part of the forewings.

Eggs are laid in clusters on undersides of leaves—they are flat and overlap each other like fish scales. Eggs are white when freshly laid, becoming cream-colored then orange-tan as they mature. Before hatching, the black head capsules of the enclosed larvae are visible.

Caterpillars vary in color from light-gray to pink but always have small, dark spots on each body segment. They have brown head capsules, and light red-brown stripes running the length of their bodies. Mature larvae are ¾ to 1 inch long.



ECB adults, eggs, and caterpillar. Credits, clockwise from top left: D. Ferro; J. Kalisch Univ. of Nebraska Lincoln; and Clemson University, USDA, Bugwood.net

Where might you see ECB? Before there is silk, caterpillars bore into the tassel or stalk. The weakened stalk will often flop over and you will see flagging tops in the field. Once there is silk in the field, ECB will enter the ears through the silk channel, or bore directly into the side of the ear. You may often see them in ripening corn boring into the side of the ear next to the corn stalk.

Corn earworm historically did not overwinter in New England and was instead blown in on storms coming from the south or from western New York, where they overwinter, arriving in mid-July. In recent years, CEW is showing up earlier in the season, implying that there are pockets of overwintering populations of CEW in our region. Eggs are laid in silks and hatch in 2.5 to 6 days. Newly hatched larvae enter the ear through the silk channel and feed for 3-4 weeks before pupating. Although each female lays several eggs on each ear, you will only find one caterpillar per ear, as the small caterpillars are cannibalistic. Moths are blown in throughout the growing season, so infestations are sometimes linked to storms. Additionally, a 2nd generation of moths can emerge to mate and lay eggs.

CEW adult, eggs, and caterpillars, showing variation in color. Credits, top to bottom: E. Burkness, UMN, Bugwood.org; B. Huchison, Univ. of Minnesota; R. Clark II.

Adults are yellow-brown moths, with a dark spot in the middle of each wing and a dark band across the bottom of each wing. Live or newly dead moths have light green eyes.

Eggs are tiny, white, and round. In the silk, they look like dew drops and are very hard to see.

Caterpillars vary in color, similarly to ECB, from green to pink to brown to nearly black. Alternating light and dark stripes run the length of their bodies, and they have sparse hairs covering their bodies. Each body segment has a group of 3 small dots on the side. The head capsules are always plain golden brown (compared to the head capsules of FAW, which have a Y pattern—see below).

Where would you be seeing CEW now? CEW are in ear tips—look for messy frass and/or chewed up silks.

Fall armyworm does not overwinter in the Northeast but is blown northward on storm fronts, usually starting in mid-July. CEW is also blown in on storms, though they don't always move together. Females prefer laying their eggs in whorl-stage corn. Eggs are laid on leaves and hatch in ~5 days. The larvae feed in the whorl and newly forming tassel, creating large, ragged holes in the leaves and drop big clumps of frass. Larvae feed for 15-20 days.

FAW adult, eggs, and caterpillar. Credits, top to bottom:C. Barrentine, BugGuide.net; F. Peairs, Colorado State Univ., Bugwood.org; J. Castner, Univ. of Florida;

Adults are ¾ inch long and mottled dark gray moths, with some light spots on their wings and an obvious white area at the extreme tips of their wings.

Eggs are laid in masses on leaves and are surrounded by fuzzy hairs from the female moth.

Caterpillars are light-tan to dark black, with some longitudinal striping along their bodies. Their bodies are smooth, unlike the hairy CEW caterpillars. When viewed head on, FAW head capsules are divided by an inverted "Y", compared to the solid CEW head capsule.

CEW (left) and FAW (right) head capsules. FAW head has an upside down y-shape. Photo: A. Eaton

Where would you be seeing FAW now? Check whorl-stage corn for large, ragged holes in the foliage, and big clumps of frass in the whorl. Often, the FAW caterpillar will be within the developing tassel. FAW will also bore into the sides of ears, similarly to

ECB, and can also infest ear tips.

References:

Fall Armyworm, Corn Earworm, and European Corn Borer Factsheets, New York State IPM Program

Using IPM in the Field: Sweet Corn Insect Management Field Scouting Guide, UMass Extension

--Written by Genevieve Higgins, UMass Extension

ABIOTIC DISORDERS OF TOMATO

Field tomatoes are beginning to ripen, and high tunnel tomatoes have been going strong for the last month or so. With recent hot and humid weather and intermittent rain, we're beginning to get reports of blossom end rot and leaf curl. These are both abiotic disorders of tomato, not caused by a living pathogen, but instead caused by environmental factors. In addition to these two, there are several other abiotic disorders of tomato, described below, along with how to mitigate their effects.

Blossom end rot is characterized by dark brown or black sunken areas at the blossom end of the fruit. The lesions are a direct result of a localized calcium deficiency at the blossom end. Although calcium deficiencies in the soil are sometimes responsible for blossom end rot, much of the time, blossom end rot is the result of plant water stress. Calcium is taken up by the plant primarily through the water-conducting tissues of the plant, so when the soil is dry or the plant's roots are compromised and the plant isn't taking up water, calcium deficiencies develop. Problems can be prevented by regular watering to avoid extreme fluctuations in soil moisture. Good soil drainage, mulching, and preventing root damage also help. High soluble salts, low calcium, and high cation (potassium, magnesium or ammonium) levels in the soil may also contribute to blossom end rot; other cations may out-compete calcium on soil exchange sites, making it unavailable to the plant. The saprophytic fungus *Alternaria alternata* commonly grows on the dead tissue caused by blossom end rot, producing fuzzy black sporulation. This fungus will not spread to healthy fruit.
Management: Maintain sufficient, even soil moisture. Use soil nutrient testing to monitor soil soluble salts and cation ratios, and maintain adequate calcium in the soil.

Blossom end rot.
Photo: K. Campbell-Nelson

Leaf roll is usually a reaction by the plant to conserve water by reducing the surface area from which water can evaporate. This disorder is often seen just after plants are heavily pruned under dry soil conditions, but oddly enough, leaf roll disorder also has been found to be caused by excess soil moisture coupled with extended high temperatures. If the tomato plant's top growth is more vigorous than root growth and we are hit with a hot, dry period, the foliage may transpire water faster than the root system can absorb it from the soil, and the plant's reaction is to roll it's leaves up to reduce transpiration. Leaf rolling can also result from growing high-yielding cultivars under high nitrogen fertility programs. Cultivars selected for high yield or early ripening tend to be the most susceptible and indeterminate varieties are more sensitive than determinant. The good news is that leaf roll rarely affects plant growth, fruit yield, or fruit quality. Some viruses can look similar to tomato leaf roll, but if the symptoms appear suddenly, involve many of the plants in a field, and largely affects lower leaves, it is probably just physiological leaf roll.
Management: Reduce symptoms by maintaining consistent, adequate soil moisture (~1 inch per week during the growing season, which will also help with calcium up-take, reducing blossom end rot problems). Do not prune heavily during hot, dry conditions or over-fertilize with nitrogen.

Tomato leafroll/curl.
Photo: C. Steinberg

Catfacing: Tomatoes are considered "catfaced" if the blossom scar is enlarged or perforated. This can happen to both field and greenhouse tomatoes, and is more common in heirloom varieties. Often times, the fruit becomes extremely misshapen, but fruit distortion is not necessary to classify it as "catfaced". This disorder has not been extensively researched and is still not fully understood. Cold temperatures during flowering have been shown to increase incidence of catfacing,

as have extreme fluctuations in night versus day temperatures. Damage from thrips to the side of the pistil of tomato flowers can also cause this disorder, and under some conditions, pruning and high nitrogen levels can increase catfacing incidence. Catfacing can increase chances of fruit becoming infected via the rough blossom scar by black mold rot, a disease caused by several different fungi. **Management:** Avoid excessive pruning and nitrogen fertilization. Avoid low greenhouse temperatures for both greenhouse tomatoes and transplants. Use cultivars that are less prone to catfacing.

Catfacing in heirloom tomatoes. Photo: K. Campbell-Nelson

Stitching/Zippering is the term for when a thin, brown, necrotic scar extends from the stem to the blossom end on fruit. The longitudinal scar has small transverse scars along it, making it resemble a zipper or seam. Fruit can have one or several scars. This disorder is purely cosmetic and does not affect the edibility of the fruit, but may render fruit unmarketable. Zippering is caused by anthers (the pollen-producing flower part) fused to the ovary wall of newly forming fruit. This disorder occurs more frequently in cool weather. **Management:** Plant varieties that are less susceptible to stitching/zippering. Avoid low greenhouse temperatures.

Stiching/zippering. Photo: J. Howell, UMass

Yellow shoulder is commonly caused by potassium deficiency in tomato. Recent surveying by several New England state Extensions has shown that tomatoes, especially high tunnel tomatoes, have very high potassium requirements and crops tend to be deficient. Nutrient recommendations for high tunnel tomatoes have been overhauled in the current edition of the New England Vegetable Management Guide. Current recommendations advise to fertilize based on the potential yield of your crop (with indeterminate, disease-resistant, varieties planted early into heated tunnels expected to yield more than heirloom or determinate varieties planted later). Click here to go to the high tunnel tomato section of the Guide. One recommendation for K fertility in high tunnel tomatoes is to apply ¼ lb of K/1000 sq. ft. through the drip every week for 10 weeks, using potassium sulfate fines. In both the field and high tunnels, the following factors can also lead to K deficiency in tomatoes: waterlogged and/or compacted soils, below-optimal potassium application rates, above-optimal nitrogen application rates, excessive application of potassium competitors, and excessively large or dense canopies. Some varieties are also more prone to developing yellow shoulder than others; varieties with the "green shoulder" gene are more likely to develop yellow shoulders. High temperatures and sun can also cause this disorder, both by directly damaging fruit tissue and by inducing water stress that can limit the uptake of K.

Yellow shoulder. Photo: K. Campbell-Nelson

Blotchy ripening, gray wall, and internal whitening: Tomatoes with blotchy ripening ripen unevenly with yellow or orange discolored areas on their surface or shoulders. Tomatoes with gray wall have grayish-brown discolorations on the fruit wall and may also exhibit internal browning. Gray wall typically appears on green fruit before ripening. 'Gray wall' is the term used when the outer fruit walls turn brown or gray and collapse, compared to 'internal whitening', which refers to when the outer and inner fruit walls become white and corky. Factors that increase the severity of these disorders include cloudy weather, wet and cool conditions, high nitrogen, low potassium, and compacted soils. Good irrigation management and organic soil and nutrient management will reduce the risk of these disorders.

Internal whitening. Photo: G. Brust

Ripening disorders, including yellow shoulder, blotchy ripening, gray wall, and internal whitening, are most prevalent when air temperatures during mid-late stages of fruit ripening are extreme (e.g., below 60°F and/or above 90°F) or highly variable, when humidity levels remain high, and/or when these conditions prevail and light levels are low. Unfortunately, these are not uncommon conditions in New England and are largely out of our control. Tomato mosaic virus can cause similar symptoms

of uneven fruit ripening and should be ruled out as the underlying cause.

Jerry Brust, IPM Vegetable Specialist at the University of Maryland, researches the management of abiotic disorders in tomato; he recommends using white plastic mulch laid early in the season to keep the crop cooler and using shade cloth on your most marketable varieties. In over 5 years of trials, Brust's research has shown that a 30% filtering shade cloth increases marketable yields by 20-50%, depending on the year. A 4 ft-wide shade cloth covering even a quarter of the crop canopy is sufficient to achieve this increase in yield, and the cloths may be used for many years.

When ripened fruit are showing these deficiencies, it's too late this season to correct any of these disorders. Identify them now to avoid making unnecessary fungicide and fertilizer applications in the future which might, in the end, lead to phytotoxicity. Instead, take note of when and where you are seeing these disorders and plan changes for next year.

Sources:

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- Maynard, Liz, Assistant Professor of Horticulture, emaynard@purdue.edu, 219-531-4200. "Yellow Shoulder and internal white tissue in tomatoes" Veg Crop Hotline, Purdue Extension. August 7, 2014.
- Scott, J.W. 2014. "Zippering" and "Catfacing". Compendium of Tomato Diseases and Pests, 2nd ed., eds, J.B. Jones, T.A. Zitter, T.M. Momol, and S.A. Miller.

--Compiled by Genevieve Higgins and Katie Campbell-Nelson, UMass Extension

MA PESTICIDE LICENSE INFO: LICENSES, STUDY MANUALS, & EXAMS

Pesticide License Exams - The MA Dept. of Agricultural Resources (MDAR) has begun opening dates to hold exams for new exam applicants. Individuals will be able to begin signing up for new exams beginning July 9, 2020. The exams will be held at the Colonial Inn in Gardener under a covered tent. Safety precautions will be sent to the examinees ahead of time so that they can be prepared when coming to the exam site. Please be aware that space is still limited, but MDAR is continuing to work on an online exam process, and will be adding some additional dates for the beginning of August. Safety of examinees and MDAR employees has been their priority when organizing this. To register, go to https://www.mass.gov/pesticide-examination-and-licensing.

The following announcement has also been released from MDAR: "The Department is pleased to announce that we are moving forward with online examinations. We are in the very early stages of setting up the exam online with the vendor. The priority is to put the Commercial Applicators Exam online first. As we are in the early stages of development it is unclear how long this will take and the exact details of how this will all work, but generally speaking an examinee will be able to go online and take the exam in a secure manner anywhere they have computer access. We are also trying to set it up so that an examinee can take the exam at any time of day and any day of the week, but that is a point we need to continue to work on. I would like to note that there will be an additional fee associated with taking the exam online. As we are in the very early stages of this development I cannot tell you what the exact fee is, but I can tell that that it is minimal given the flexibility this new system allows. As we move forward I will continue to provide updates and if you have any follow up questions, please let me know."

Pesticide Exam Preparation Workshops - The UMass Extension Pesticide Education Program is offering these workshops to help applicants prepare to take the Massachusetts Pesticide Applicator's License exam. Topics covered: Pest Identification, Pesticide Types and Formulations, Pesticides and Human Health, Pesticide Label, Pesticides and the Environment, Integrated Pest Management, Pesticide Laws and Regulations, and Practice Exam. For more information, go to https://www.umass.edu/pested/training_workshops/registration_form13.htm.

Pesticide Manuals - To order a copy to study prior to taking the exam, go to https://www.umass.edu/pested/study_materials/index.htm.

Recertification Credits - UMass Extension's Pesticide Education Program will resume offering online workshops in the fall that offer recertification credits. For info on how to register for these, go to https://www.umass.edu/pested/recertification/current_workshops.htm

For holders of Massachusetts pesticide licenses whose current three-year retraining or recertification cycle ends on July 1, 2020, the MDAR Pesticide Program has extended the time permitted to earn credits to December 31, 2020 as well as the number of computer-based or online credits that are acceptable for these specific individuals. This means that individuals with a three-year retraining cycle ending on July 1, 2020 may obtain any portion or all of the needed training credits from online sources and have until December 31, 2020 to do it. For more information, go to https://www.mass.gov/doc/pesticide-license-recertification-processes-and-related-impacts-from-covid-19/download

Temporary Licenses - If your pesticide license has expired and you are unable to re-take the pesticide exam in 2020, the Mass. Dept. of Agricultural Resources will issue temporary pesticide licenses, without an exam, if certain criteria are met. For an individual with an expired license who wants to obtain a temporary Massachusetts Pesticide Applicator License, the license must have an expiration date of December 31, 2017 or after; the license was in good-standing when it expired; and the applicator has not had a pesticide violation within the past three (3) years; among other criteria. This significantly impacts pest control services; especially, seasonal businesses such as lawn care and mosquito and tick services. For more info on this update, go to https://www.mass.gov/guides/covid-19-resources-for-agriculture under Addressing COVID-19 Impacts, Bulletins and Guidance. You can find the specific bulletin at https://www.mass.gov/doc/mdar-bulletin-17-temporary-pesticide-license/download. These temporary licenses will expire on December 31, 2020. If you will want to be licensed in 2021, you will be required to take the pesticide exam.

News

Northeast BIPOC Farmer Relief Fund Now Accepting Applications

The Northeast BIPOC Farmer Relief Fund is now accepting applications from BIPOC (Black, Indigenous and People of Color) folks living in the Northeast who work in agriculture and have been economically impacted by the COVID crisis. Applications will be accepted through August 10th.

This Relief Fund is providing support to BIPOC folks because they have received COVID relief funds at disproportionately lower rates than white individuals, while the COVID crisis has impacted BIPOC communities at disproportionately higher rates than white communities. Both of these disparities are the result of structural racism. The amount recipients will get from this initiative is not by any means meant to rectify the racism in how previous (and current funds) have been distributed, but it is one small step to acknowledge and address these disparities.

For more info and application link, click here.

The grant funds are being provided by Farm Aid, and Rural Vermont is excited to be among the farm and food systems organizations in the Northeast that are collaborating on this initiative.

Northeast Climate Adaptation Fellows Vegetable & Fruit Program for Commercial Farmers & Ag Advisors Now Accepting Applications

The Northeast Climate Adaptation Fellowship is open to commercial farmers in the Northeast U.S. who grow vegetables and/or small fruit and to agricultural advisors who work with vegetable/small fruit farms in this region. **Application Deadline: October 1, 2020**

Climate change is bringing challenges for vegetable and small fruit growers. For farmers to reduce their risk, they need to adapt. To address this increasing need, the Climate Adaptation Fellowship was created. The program provides a peer-to-peer curriculum for farmers and advisors. Its framework is designed to integrate climate science with a land manager's knowledge.

Participants in the vegetable and fruit program will enhance their knowledge of climate impacts to vegetable and fruit farms in the Northeast. Accepted fellows will complete the program in pairs (farmers and advisors) to develop personalized farm adaptation plans and outreach materials to share with peers.

Learn more: See flyer, Visit CAF website

National Tomato Brown Rugose Fruit Virus (ToBRFV) Greenhouse Survey

As a follow up to the initial find of ToBRFV in Florida in December 2020, the USDA is now requiring an emergency survey for ToBRFV in all states. As a result, the Massachusetts Department of Agricultural resources (MDAR) is seeking to determine the location of commercially grown tomato, pepper, or eggplant, at high yields, under a structure (not field grown) in MA. Plants can be either fruiting or not yet fruiting hosts (not just for seedlings as before), and includes plants intended for local distribution as well as non-local. These sites will need to be surveyed by MDAR staff as soon as possible.

Growers should contact Joanne Klein directly at joanne.klein@mass.gov or call/text at 857-324-3404.

For more information on Tomato Brown Rugose Fruit Virus, refer to: http://ag.umass.edu/greenhouse-floriculture/fact-sheets/tomato-brown-rugose-fruit-virus-tobrfv

UMass Extension Lab Services

The UMass Soil & Plant Nutrient Testing Lab is now accepting new mail-in samples for ROUTINE SOIL ANALYSIS and PARTICLE SIZE ANALYSIS orders ONLY. Please do not send orders for other types of analyses at this time. Processing time will be longer than usual since we are operating with reduced staff and staggered shifts. Thank you for your patience and understanding. For more information, please visit their website at www.ag.umass.edu/services/soil-plant-nutrient-testing-laboratory.

The UMass Plant Diagnostic Lab is also now receiving mail-in samples. For more information, please visit their website at www.ag.umass.edu/services/plant-diagnostics-laboratory.

Paycheck Protection Program (PPP) Updates

The Paycheck Protection Program (PPP) has reopened the application period until August 8, 2020. The PPP original application period closed on June 30, 2020.

As a recap, PPP is a program administered by the U.S. Small Business Administration (SBA) with applications being processed through an SBA-approved lending institution. While PPP is a loan, an important point to note is that the loan will be fully forgiven if the funds are used for payroll costs, interest on mortgages, rent, and utilities (at least 60% of the forgiven amount must have been used for payroll). Forgiveness is based on the employer maintaining or quickly rehiring employees and maintaining salary levels. Forgiveness will be reduced if full-time headcount declines, or if salaries and wages decrease. The period used to cover eligible costs and expenses has also increased from 8 weeks to 24 weeks from loan disbursement, making it easier for PPP recipients to meet the 60% payroll requirement. Special consideration under PPP is provided for seasonal businesses such as farming operations.

More detailed information, including a list of SBA-approved lending institutions that process PPP applications can be found at: https://www.sba.gov/funding-programs/loans/coronavirus-relief-options/paycheck-protection-program

PPP is a program you should definitely look into if you employ agricultural workers on your farming operation!

Open Application Period for Food Security Infrastructure Grant Program

The Executive Office of Energy & Environmental Affairs (EOEEA) is accepting online applications for The Food Security Infrastructure Grant Program (FSIG) on a rolling basis now through September 15th, 2020.

The goal of the Food Security Infrastructure Grant Program is to ensure that individuals and families throughout the Commonwealth have access to food, with a special focus on food that is produced locally, and equitable access to food. The Program also seeks to ensure that farmers, fisherman, and other local food producers are better connected to a strong, resilient food system to help mitigate future food supply and distribution disruption. Participants selected to participate in the Program will be provided with reimbursement grants broken into three funding categories: $0 to $10,000; $10,000 to $75,000; or $75,000 to $500,000.

Eligible projects include: (i) information technology needs; (ii) facility adaptation to new safety guidelines; (iii) storage, processing, and delivery equipment, and (iv) other strategies that connect local food production with food insecure

communities and residents. Project categories are broken into three funding sections.

Examples of eligible projects for agricultural operations include:

- Signage & Handwashing Stations
- Equipment for Remote Ordering & Payment
- Food Storage, Processing, and Delivery Equipment
- Food Safety Equipment (i.e. coolers and thermometers)
- Food Processing, Washing & Packing, and/or Cleaning & Sanitation Equipment
- Season Extension (i.e. greenhouses, cold storage)
- Food Processing Facilities
- Distribution Vehicles
- Infrastructure

For more information, or to submit an online application go to: www.mass.gov/service-details/food-security-infrastructure-grant-program. Please refer to the Request for Response (RFR) available on this website for full Program details. To apply online please review the RFR and then click on the 'Food Security Application Questions' to submit your application.

2020 Tomato Contest – See You Next Year!

You're probably not surprised to hear that due to the uncertainty with COVID-19 and recommendations around social distancing, the 2020 Tomato Contest will not be held this year.

In the meantime, MDAR's Markets team is committed to promoting tomatoes! Please connect with us on social media. You can find us on Facebook, Twitter and Instagram. During the month of August, we'll be highlighting tomatoes, as well as National Mass. Farmers Week, August 2-9. We encourage growers to see and share our posts, as well as share your favorite tomato varieties, photos and tomato recipes.

We look forward to seeing you again in 2021!

Events

Today! UMass Extension Fruit Team and Massachusetts Fruit Growers Association 2020 Annual Summer Meeting

Where: Online

When: Thursday, July 23, 5:30 pm Eastern Time

Dr. Tracy Leskey, *Director of the USDA Innovative Fruit Production, Improvement and Protection Entomology Lab* in Kearneysville, WV will share details of her latest research on Spotted Lantern Fly and Brown Marmorated Stink Bug.

Dr. Jaime Piñero, *UMass Extension*, will share information on his latest research into the pests that "bug" you the most.

Also, take a **virtual orchard tour** of current research at the UMass Orchard YouTube channel: 2020 UMass Extension Fruit Team Virtual Summer Tour playlist

Plus, **include your address when registering** for the annual meeting to receive 2 laminated IPM posters for your farmstand.

Registration: Please register in advance for this meeting here: https://umass-amherst.zoom.us/meeting/register/tJckfu6orzIoE9Rh5avES0Fj2JXOs2ZW1hBZ

Upcoming Webinars from UNH Extension:

- **Wednesday, July 29, 5-7pm. Managing Humidity & Condensation in Coolers.** Please join UNH Extension for a virtual twilight meeting on how to manage humidity and condensation in coolers to increase shelf life and prevent

food-borne illness. Our speakers will include Chris Callahan and Andy Chamberlain from UVM's Ag Engineering program, Mary Chaote from UNH Extension's Food Safety Team, and Paul Franklin from Riverview Farm in Plainfield, NH.

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Vegetable Notes. Genevieve Higgins, Lisa McKeag, Susan Scheufele, co-editors.

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