UMass Extension

Vegetable Notes

For Vegetable Farmers in Massachusetts since 1975

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In this issue:

Crop conditions

Warm, muggy days with frequent heavy rains and cool nights continue to be the norm across the region. Not surprisingly, we've seen a dramatic increase in plant diseases this week, in the field and in the lab. In the past few days late blight has sprung up across the Northeast, with new outbreaks in NY, VT, and NJ. In our region the outbreaks have mostly been in potato, except in NJ where tomato was affected. The dominant strain this year (US-23) is capable of affecting both tomato and potato and is sensitive to Ridomil (metalaxyl). Similarly, cucurbit downy mildew has spread across the Midwest just west of us, and is now approaching from the South with an outbreak on cucumber in PA. It is definitely time to get out and start spraying for these two diseases which can cause severe crop loss when conditions are favorable, if you have not begun to do so already. Growers should consider mixing in targeted, oomycete-specific materials with protectant, broad-spectrum chemistries at this time–see the pest alerts section for more information. Bacterial diseases thrive during the warm, humid days and another case of bacterial canker, and signs of pith necrosis were observed in tomato and leaf spot on peppers this week. Keep in mind that as rains continue, the residual effects of pesticides are lessened and shorter spray intervals or avoiding applications before rain are recommended. Nonetheless the harvests continue to come in with fennel, spring onions, cabbage and broccoli new on farmstand shelves, early sweet corn, the earliest of field tomatoes. Some heat and sun over the weekend should do those fruiting crops some good.

UMass Extension Fruit Specialist Arthur Tuttle gave IPM training to employees of Red Apple Farm who will be selling produce at the Boston Market

Pest alerts

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

Allium: White rot was diagnosed in garlic on one farm in Chittenden Co., VT. This fungal pathogen produces sclerotia that can survive up to 20 years in the soil without a host, making it very difficult to manage. The most effective way to avoid this disease is to plant seed from sources with no history of white rot into uninfested fields. Hot water treatment of garlic cloves at temperatures 115-118°F will greatly reduce the amount of pathogen present and is a good preventative measure, although it may not completely eradicate the fungus. Garlic germination will be inhibited above 120°F, so careful management of water temperatures is important. Leek moth larvae and damage continue to be reported in Chittenden Co., VT where this pest has become established over the last few years.

Basil: No new reports of basil downy mildew this week.

Brassica: Black rot has been diagnosed at the lab in VT and is a continuing problem in several crops. Hot water seed treatment of fall crops is recommended to avoid this disease. Cabbage Aphid was found above threshold of 15% infestation in cupping cabbage in Hampshire Co., MA--this early outbreak is likely due to overwintering in high tunnels and greenhouses with brassica crops. Diamondback moth and imported cabbageworm were found at threshold on Brussels

sprouts but not on collards in the same field and at the same growth stage in Washington Co., RI. Scout your brassicas separately as there may be host preferences for these crops. Untreated cabbage at the UMass research farm in Franklin Co., MA had sustained a lot of damage from ICW and large larvae were present.

Corn: **European corn borer** trap captures continue to be low or nonexistent in Western MA and NH but have climbed in Chittenden Co., VT this week, but are still below threshold. According to growing degree days, a second flight should occur soon: at 1400 GDD; first eggs 1450 GDD; and egg hatch 1550 GDD. After observing more than 15% tassel infestation last week, one organic grower in Franklin Co., MA targeted ears and tassels with Dipel and achieved successful control. To avoid impacting bees and other beneficials in pollen laden tassels, other growers may use Belt or Coragen. Scout fields with tasseling and silking corn now and treat at a threshold of 15% infestation. A simple sequential scouting guide is available at the UMass Vegetable program website here: Sweetcorn IPM Guide. **Corn earworm** is being captured in central and south eastern MA at 3-5 moths per week, and a 5-6 day spray interval is called for. Southwesterly storms this season have brought this pest into New England earlier than in the last several years. See article in the July 2nd issue of Vegetable Notes on corn earworm management options. **Fall armyworm** traps in MA, VT and RI remain empty--only one location in NY is reporting any FAW moths this week.

Location	Weekly ECB reported	CEW Weekly Total	Spray Interval for CEW
Western, MA			
Hadley	0	.	
Sheffield	2	.	
South Deerfield	0	.	
Whately	1	0	
Central & Eastern MA			
Leominster	2	.	
Millis	0	4	*5 days*
Sharon	5	5	*5 days*
Swansea	3	3	*6 days*
NH			
Litchfield	2	.	
Hollis	0	.	
Mason	0	.	
Burlington, VT	7	.	
Kingstown, RI	.	.	

Cucurbit: **Cucurbit downy mildew** was reported this week on cucumber plants in Orleans and Allegany Cos., NY and in Berks Co., PA. Disease development is favored by just the sort of wet conditions and cool night-time temperatures we have seen quite a bit of so far this summer. Track the arrival and forecast risk of this migratory disease at: http://cdm.ipmpipe.org/. Current risk for CT, RI, Southern MA and Cape Cod is low and no risk in the rest of New England. When the forecasting program predicts a risk of CDM in your area consider switching to targeted, materials such as Ranman, Gavel, Curzate, Tanos, Forum or Zampro. **Powdery Mildew** was confirmed on Waltham butternut in Franklin Co., MA. Broad spectrum fungicides used to protect crops against cucurbit downy mildew are also effective at protecting crops for powdery mildew, however, once powdery mildew is present on 1 leaf out of 50 scouted in a field, targeted, mobile (to reach the underside of the leaf) fungicides are recommended. **Striped cucumber beetle** pressure was low in organically managed fields scouted in Hampshire Co., MA, Washington Co., RI,

Symptoms of CDM on upper and lower leaf surfaces.

Location	Weekly SVB reported
Western, MA	
Amherst	64
Deerfield	8
Central & Eastern MA	
Barnstable	23
NH	
Litchfield	18
Hollis	37
Mason	1
Burlington, VT	.
Kingstown, RI	.

and Chittenden Co., VT. **Squash vine borer** trap captures have dropped into the teens in 25 out of 27 traps in NH, remain steady in MA and are climbing in RI. Due to rain this week fields have not yet been scouted for eggs or larvae, and damage has not yet been reported by growers. In years with mild temperatures such as we are having this summer, SVB adults tend to remain active throughout the summer rather than dropping off in summer then returning again to infest fruit in late-August and September. Fields of bush type cucurbits with trap captures of 5 or greater and fields of vining crops with trap captures of 12 or greater should receive evening sprays targeted at base of the plant. **Squash Bug** adults but no eggs found in Chittenden Co., VT, and few adults and egg clusters found in fields scouted in NY, Hampshire Co., MA and Franklin Co., MA.

Late blight on potato.

Solanaceous: Late Blight *(Phytophthera infestans)* was newly confirmed in Chittenden Co., VT, Wyoming Co., NY and Morris Co., NJ this week on potato. These recent samples have not yet been genotyped but US-23 was confirmed on potato in Livingston Co., NY last week. This strain affects both potato and tomato, so both crops should be considered at risk, and is sensitive to metalaxyl. **Begin spraying for LB now,** if you have not already started, and consider mixing in a targeted material such as Ridomil, Ranman, Revus, Presidio, or Previcur Flex among others. Several forecasting and decision support systems are available for growers, read about them in the June 25th, 2015 Vegetable Notes article on Forecasting Tools for Late Blight Management. According to the Massachusetts Late Blight Decision Support System, a 5-7 day spray interval on potato and tomato is recommended in most locations across the state. **Early Blight** was diagnosed on 'Dusky' eggplant in Chittenden Co., VT. This is the second diagnosis of this disease on this variety this year so the disease may have been seed borne. Use hot water seed treatment to prevent this disease on your crop next year. **Bacterial leaf spot** was confirmed on pepper in Chittenden Co., VT. This disease spreads quickly with rain splash and in humid weather. If seed-borne, it may start in one cultivar and spread to others. Make copper applications to prevent the spread of this disease. **Three lined potato beetle** larvae and adults were seen causing damage on tomatillo in Chittenden Co., VT. Eliminate nearby weeds in the solanaceous family, especially *Physalis*, also called husk tomato or groundcherry.

Early blight on 'dusky' eggplant.

Multiple: Potato leafhopper was reported causing hopper burn in beans and strawberries in Washington Co., RI, on potato in Plymouth Co., MA, and on young apple trees in NH. Nymphs and adults have been seen in all locations. Plant later successions of beans away from the first successions, as this pest will continue to cause damage on younger successions next to infested crops.

Weeds: Breakdown in weed control has been seen throughout New England with the high rainfall we have been receiving. Weeds such as crab grass can be very aggressive, especially in crops under 1 ft. tall. Reapply herbicide or cultivate if needed at this stage.

GARLIC HARVEST, CURING AND STORAGE

Many farmers are beginning to think about harvesting garlic, a big task that usually occurs around mid-late July. Timing the harvest can be tricky—heads should be left in the ground as long as possible to attain maximum bulb size (which doubles in the last stage of growth), but not so long that the cloves begin to separate, as overripe bulbs sell and store poorly. Harvest when leaves begin to turn yellow, but when about 60% are still green. Check bulbs by cutting through the head sideways to see how well developed the cloves are. Cloves should fill the wrappers - if they seem a little loose, the garlic has a little ways to grow. A little of the very outer wrapper may have started to discolor at this point. Harvest before the bulbs pop, which can happen relatively quickly, especially in a wet year. Remember that it is better to harvest too early than too late.

Use hand tools to loosen soil under the bulbs or a mechanical harvester to undercut the bed. Pulling bulbs out when they are tight in the ground can open wounds at the stem-bulb junction and allow for fungal infections. Fresh bulbs bruise easily and these wounds can also encourage infection. Don't knock off dirt by banging bulbs against boots, shovels, or

buckets – shake or rub gently, and leave the rest to dry out during curing.

Curing is important for successful bulb storage and finding the ideal conditions for curing can also be a challenge. Curing in the field runs the risk of sunscald, while poorly ventilated barns can result in loss from disease. Avoid high temperatures (over 90°F) and bright sunlight. Rapid curing can be achieved by placing bulbs roots up on 1" wire mesh in a hoophouse covered with a shade cloth, and with the sides and ends open. A well-ventilated barn will also work, but be sure that bulbs are hung with adequate air circulation or on open racks up off the floor. Curing takes 10-14 days. Stems may be cut before or after curing. Curing is complete when the outer skins are dry and crispy, the neck is constricted, and the center of the cut stem is hard.

Storing Bulbs. After curing, garlic can be kept in good condition for 1 to 2 months at ambient temperatures of 68 to 86 °F under low relative humidity (< 75%). However, under these conditions, bulbs will eventually become soft, spongy and shriveled due to water loss. For long-term storage, garlic is best maintained at temperatures of 30 to 32°F with low RH (60 to 70%). Good airflow throughout storage containers is necessary to prevent any moisture accumulation. Under these conditions, well-cured garlic can be stored for 6-7 months. Storage at higher temperatures (60 °F) may be adequate for the short term, but it is important to select a place with low relative humidity and good air flow. As with onions, relative humidity needs to be lower than for most vegetables because high humidity causes root and mold growth; on the other hand, if it is too dry the bulbs will dry out.

Storing Seed. Garlic bulbs that are to be used as seed for fall planting of next years' crop should be stored at 50 °F and at relative humidity of 65-70%. Garlic cloves break dormancy most rapidly between 40 to 50 °F, hence prolonged storage at this temperature range should be avoided. Storage of planting stock at temperatures below 40°F results in rough bulbs, side-shoot sprouting (witche's-brooms) and early maturity, while storage above 65°F results in delayed sprouting and late maturity.

Garlic cloves used for seed should be of the highest quality, with no disease infections, as these can be spread to new fields and to next years' crop. Be on the lookout for garlic blight nematode which may have been distributed around New England on infested seed garlic. This nematode, which is also known as a bulb and stem nematode, causes bloated, twisted, swollen leaves, and distorted and cracked bulbs with dark rings. Infestation with this nematode can weaken plants, causing them to be susceptible to secondary infections. The UMass Plant Disease Diagnostic Lab can make a positive identification; call 413-545-3209 to submit a sample.

-R Hazzard. Resources: New England Vegetable Mgt Guide, Oregon State, ATTRA, Wishingstone Farm, Astarte Farm, USDA Handbook 66.

MANAGEMENT OF PHYTOPHTHORA BLIGHT

This disease, caused by the soil-dwelling oomycete Phytophthora capsici, has a wide host range including all cucurbits, tomato, eggplant, pepper, beans, and some weeds (purslane, American black nightshade, Carolina geranium). Warm wet conditions with frequent rainstorms, like the recent weather, favor disease development. Symptoms vary by crop and may be easily confused with other diseases or issues such as water-logging. Be on the lookout and submit suspect plants or fruit to the diagnostic lab in order to get a proper ID.

Sporulating lesion on zucchini fruit.

Symptoms. Many of you are probably all too familiar with the symptoms of Phytophthora blight on cucurbit fruit but many other vegetable crops are also susceptible, though they may exhibit different symptoms. Symptoms of *P. capsici* on squash fruit are firm, round, water-soaked lesions that develop white mycelial growth that resembles powdered sugar under warm, moist conditions. Cucurbit plants, especially non-vining varieties, can also develop symptoms of crown rot where whole plants or vines wilt suddenly and eventually the whole plant collapses. Symptoms on pepper are distinctly different, as plants become infected with *P. capsici* via their roots and develop a crown rot that causes

darkening of roots and stems and permanent wilt of foliage, while stems remain rigid. Pepper fruit remains attached to the upright stems but may eventually develop dark, water-soaked lesions which can spread to the whole fruit giving it a soft, wrinkled appearance. On tomato, *P. capsici* causes 'buckeye rot' on fruit where it comes in contact with the ground. Small brown spots on fruit grow in to large, round or oblong lesions with alternating rings of light and dark-brown discoloration. The lesions are firm, with smooth margins but eventually become soft. In recent years, Phytophthora blight has been confirmed on lima and snap beans, crops which had previously been considered non-hosts, in the field and on soybean under lab conditions. Bean pods develop water-soaked lesions followed by diffuse, white sporulation. Bean stems and crowns can also be affected and collapse of low-lying areas of fields is common.

Phytophthora blight causing stem lesions, wilt, defoliation, and fruit rot, though fruit remain attached to stems.

Life Cycle. *P. capsici* persists in soil for many years as thick-walled resting spores called oospores. The oospores germinate to produce asexual, short-lived sporangia, which are produced on sporulating fruit lesions. These sporangia germinate directly or release 20-40 zoospores. One infected spaghetti squash is estimated to contain 44 million sporangia with the potential to release 840 million zoospores (Hausbeck and Lamour, 2004). This accounts for the rapid, above-ground spread of disease within a field or a season via surface water, rain, or splash. Outbreaks often start in low-lying or poorly drained areas of fields where zoospores are released in saturated soils and swim to find their hosts. Growers often assume that stunting or death of plants in these areas of the field is caused by waterlogging, but infection with *P. capsici* may be the real cause. Importantly, water run-off from an infested field may contaminate surface water sources used for irrigation. This has been well documented in irrigation ponds and rivers in NY and MI, and researchers at UMass have trapped *Phytophthora* species in several locations along the Connecticut, Deerfield and Mill Rivers in MA in an attempt to determine when *P. capsici* starts to build up in our irrigation sources. Look for results of this study in future Vegetable Notes issues.

Outbreak of Phytophthora blight starting in low lying area of field.

During the busy harvest period, plan on harvesting from uninfested fields before you go into infested fields with tractors, trucks, workers, and bins. Take time to wash equipment when moving between fields to remove soil or crop residues that may contain sporangia or oospores. Do not leave fruit in fields or in cull piles, as a single fruit infected with both mating types of *P. capsici* can contain thousands of oospores that could establish populations in new fields or contribute to increasing the population size and diversity within a previously infected field. If the infested area is large and plant material cannot be removed from the field, make sure to till it under deeply. Remember that there is a 2-6 day lag period between infection and symptom expression so if you suspect *P. capsici* is present, hold fruit for a few days before sending large wholesale shipments out to avoid their being returned due to rot.

If you do have P. capsici present on your farm a minimum **crop rotation** of 3-4 years is recommended, although fields that have been out of susceptible crops for >5 years have had outbreaks in recent years. Keep in mind that every year you rotate an infested field to a non-host crop the number of spores that survive to the following year will be reduced, so any rotation you can do will help. The host range of *P. capsici* is broad but the list of non-hosts includes brassicas, carrots, onions, and small grains. Tolerant pepper varieties are available and should be planted when the disease may be present and a susceptible crop must be planted before the end of the minimum rotation period. Similarly, pumpkin varieties with hard shells, such as Lil Ironsides or Apprentice have been shown to be significantly less susceptible to disease than similar varieties with conventional, soft rinds. **Cover crops** can be used to help mitigate the effects of *P. capsici*, as the addition of soil organic matter stimulates beneficial microbes. A healthy soil microbial community can reduce plant pathogen

activity by outcompeting them for space and nutrients, by direct parasitism of plant pathogens, by producing antibiotic compounds that slow pathogen growth, and by stimulating the plants' natural defense systems. Furthermore, research suggests that *brassicaceous* cover crops (especially mustards and canola) release several compounds and gases as they break down that are toxic to microorganisms, and *P. capsici* specifically. This "biofumigation" process kills plant pathogens and beneficial microorganisms repopulate the soil quickly. Successful reduction in pathogen population size through **biofumigation** requires large volumes of brassica residues which must be incorporated shortly before planting and need to be chopped, rototilled, cultipacked, and irrigated. Allelopathy is also a concern for some sensitive crops when using this system.

Fungicides can be used effectively and economically to reduce the impact of disease on yield, though none will provide sufficient protection to be used as the sole management strategy–they must be part of an integrated program including cultural controls. For many row crops, applying fungicides through trickle irrigation (if allowed per product label) can help control crown rot, but in vining crops, foliar applications will be needed later to protect developing fruit which may be resting on infested soil. Foliar applications can be difficult because of dense canopy–air-assisted nozzles may help improve coverage. *P. capsici* has the ability to develop resistance to targeted fungicides, so resistance management strategies like mixing targeted fungicides with protectant fungicides and rotating modes of action with every application, are extremely important. Some populations of *P. capsici* have become resistant to Ridomil, which was often used to drench plants in the early season, but may not be effective in fields with a long history of treating the disease. Instead you can treat transplants or seedlings with a drench treatment of a new phosphorous acid fungicide such as ProPhyt, K-phite or Fosphite, which have been shown to be effective as soil or foliar applications. New effective, targeted materials include Ranman, Forum, Tanos, and Gavel. Ranman can be used at 2.75 fl oz/A beginning before symptoms occur for a maximum of 6 applications. Forum can be used on all cucurbit crops at 6 oz/A every 5 to 10 days, depending on disease pressure, beginning when plants are 4-6 inches high for a maximum of 30 oz or 5 applications. Tanos is labeled at 8 oz/A for a maximum of 4 applications. Tanos must be tank-mixed with a copper fungicide and a fungicide containing maneb or mancozeb. Follow a strict alternation with no consecutive applications of Tanos. Gavel can be used on cucumber, melon, summer squash, and watermelon but not on pumpkin because it contains mancozeb. It is labeled for use at 1.5–2.0 lb/A every 7 to 10 days or when conditions are favorable for disease for a maximum of 8 applications.

Dr. Meg McGrath of Cornell University calculated the cost/A of applying these new materials, listed in the accompanying table. Meg suggests the following program for effective control:

> Begin with a drench treatment of ProPhyt to transplants, then alternate among the following applied to foliage (5 to 10 day spray interval; can be extended under dry conditions):

1. Forum + copper fungicide when plants are 4-6 inches high or at 2-leaf stage.
2. Ranman + copper fungicide.
3. ProPhyt, Phostrol or Fosphite
4. Tanos + copper fungicide + maneb or mancozeb
5. Gavel for cucurbit crops other than pumpkin.

Product	Cost/Acre/Application
Ranman	$16.75
Forum	$8.90
Tanos	$10.30
Gavel	$7.75-$10.30

Meg also says that Presidio and Revus are other materials that would make good choices for managing Phytophthora blight in cucurbit crops now while downy mildew is not yet present. The pathogens causing these two diseases are oomycetes, thus they are sensitive to similar targeted fungicides. However, Presidio and Revus are no longer recommended for downy mildew because that pathogen has developed resistance, but they do still work for Pytophthora blight and are also labeled for pepper and eggplant.

For organic growers, there are several soil-applied materials labeled for use in controlling *Phytophthora* species including *P. capsici*, and while they may not work as well as targeted synthetic fungicides, they can reduce disease severity and improve yield. Dr. Mary Hausbeck at Michigan State University is a Pytophthora blight expert who has done field trials looking at efficacy of various fungicides. In 2013 she evaluated some OMRI-approved biofungicides and the results were published in the MSU Extension News for Agriculture newsletter and can be found online here. She found BioTam, Serenade Soil, and Actinovate Ag all significantly reduced plant death and increased yield relative to the untreated control, when applied as soil drenches at the base of yellow squash plants grown on black plastic. When she used these biofungicides in rotation with a synthetic fungicide, Presidio, she got even better control, indicating these materials could be used

as rotational tools in conventional spray programs.

Management of Phytophthora begins with prevention. Be aware, informed, and proactive. If infections occur, a program that includes multiple control strategies can reduce the pathogen population size over time.

-Written by Susan B. Scheufele, UMass Vegetable Extension. Information and figure from Hausbeck, MK & KH Lamour. 2004. Phytophthora capsici on vegetable crops: Research progress and management challenges. Plant Disease. 88(12): 1292-1303, and Hausbeck, M.K., and Krasnow, C. 2014. "Watch for Phytophthora on vine crops." Jun 18, and from Magaret T. McGrath, "New Developments in Managing Phytophthora Blight in Cucurbit Crops" Vegetable MD Online, Cornell University.

Caterpillars in Brassica Crops

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

Imported cabbageworm.

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

Diamondback moth larva.

Diamondback moth *(Plutella xylostella)* adults are tiny (<1/2 inch), light brown, and rest with their wings folded together like a tent. They overwinter in crop residue, but may also enter the region by migrating from southern states. Eggs are laid singly or in small clusters. Caterpillars go through four instars and are small (<1/2 inch when fully grown), light green, and appear segmented, with a forked end and pointed shape. When disturbed they wiggle vigorously and may drop off the plant on a string of silk. Feeding causes small, round holes and tends to be spread across the foliage and not necessarily concentrated in the head.

Cabbage looper.

Cabbage looper *(Trichoplusia ni)* usually does not survive the winter in New England and arrives in migratory flights from farther south. Generally populations of cabbage loopers are not high until late-July or August, though some years they are not found at all or earlier flights occur. Adult moths are mottled gray-brown, about 3/4 inch long, with a distinct round silver-white mark on each fore-wing. Since they fly at night, they are rarely seen unless monitored with pheromone traps. If you want to know when moths arrive, use a wing trap baited with *Trichoplusia ni* lure, placed near the canopy. Eggs are round, light green or yellow, and are laid singly underneath the foliage. The cabbage looper caterpillar is light green, smooth, with wavy white or light yellow lines down the back and sides, and prolegs at the tip of the abdo-

men. Full-grown larvae reach 1 ½ to 2 inches. Cabbage loopers of any size will raise the middle of their body in a characteristic "loop" shape, as an inch worm would. Feeding tends to create ragged, large holes in foliage, on both frame leaves and heads. Cabbage looper also feeds in many non-brassicas including lettuce, celery, spinach, and chard so when they do arrive, scout those crops as well as brassicas.

Cross-striped cabbageworm.

Cross-striped cabbageworm (*Evergestis rimosalis*) has not historically been found in New England but has gradually extended its range northward. We first listed it in the New England Vegetable Management Guide around 2005, because it had become common in Connecticut. By 2012 it was found in Hampshire, Worcester and Norfolk Counties in MA. Its damage is similar to that of other caterpillars but it can be even more damaging if populations are high. One of the major differences between this insect and the other brassica caterpillars is that the eggs are laid in a group (see photo), and caterpillars feed in a group on one plant so that it's covered with big holes like buckshot.

Cross-striped cabbageworm eggs are laid in clumps while the other pests lay their eggs singly.

Cross-striped cabbageworm (CSC) is closely related to European corn borer, and the adults are similar in shape and coloring – straw-colored with a little purple, and crossed by wavy lines. Since it flies at night, you will likely only notice the caterpillars and their damage. The clusters of 3 to 25 eggs are yellow, flattened, and attached to the lower leaf surfaces. The caterpillars are light bluish-grey on top and green underneath, with numerous black transverse bands across their backs and a yellow line down each side. Larvae grow to 3/4"-long in 2 to 3 weeks. There are 2-3 generations per year, but generally it's only in late summer that numbers reach damaging levels. Larvae can produce small holes in leaves until only veins remain, feed in terminal buds and sprouts, or burrow into heads. Plants with larvae are often completely skeletonized. Adjacent plants may be left undamaged.

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

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

- *diamides* (Group 28) including chlorantraniliprole **(Coragen**, 3 dh, REI 4h, Bee toxicity: L) and the more recently registered cyantraniliprole (**Exirel**, 1 dh, REI 12h, Bee toxicity: H).
- *spinosyns* (Group 5) including spinetoram (**Radiant**, 1 dh, REI 4h, Bee toxicity: M) and spinosad (**Entrust**^{OG},1 dh, REI 4h, Bee toxicity: M).
- *Bacillus thuringiensis* (Group 11) products including *Bt aizawi* (**XenTari**^{OG}, 0 dh, REI 4h, Bee toxicity: L) and *Bt kurstaki* (such as **Dipel DF**^{OG} and many other products, 0 dh, REI 4h, Bee toxicity: L).

These materials and the *aizawai* strain of *Bt* will usually provide better control of resistant DBM than older products. See the cabbage/insect control section of the New England Vegetable Management Guide for additional synthetic and naturally derived products and more details.

Cotesia rubecula larva in imported cab-

Cultural and Biological controls. Incorporate crop residues shortly after harvest to reduce movement to successive plantings and reduce overwintering populations. Populations are suppressed by a wide range of natural enemies. There are several species of wasps that are important parasitoids of brassica caterpillars. Diamondback moth eggs are parasitized by the ichneumonid wasp, *Diadegma insulare*, which occurs naturally in Eastern North America. *D. insulare* females require sources of nectar to be effective DBM parasitoids, so maintain wildflower stands near brassica fields. The braconid wasp, *Cotesia rubecula*, was introduced to New England from China in 1988, and is now established in Massachusetts. This wasp parasitizes imported cabbageworm eggs. You may see their small white cocoons on brassica leaves. The chalcid wasp, *Trichogramma brassicae*, will lay its eggs in many species of caterpillar, including all of the brassica pests above (as well as non-target caterpillars, so be cautious if you *are* maintaining wildflowers that might attract endangered moths or butterflies). These wasps are not found in New England, but can be purchased from several biological control companies for release in brassica fields. The wasps arrive as pre-parasitized caterpillar eggs that are glued to cards that can be distributed throughout the crop. Each card costs around $16-$20, and contains about 100,000 wasps, which is enough for up to one acre. According to one source of *T. brassicae* wasps, IPM Labs Inc., some growers will release one card per acre per week for about 4 weeks, while others will release every week for the life of the crop, and will release the wasps in lieu of using any kind of pesticide. These biological controls are compatible with many selective and lower impact sprays (Bt, oils, soaps) used for control of caterpillars, particularly since the wasps are protected from sprays for longer than they are vulnerable, as much of their life cycle is spent inside of their host eggs. Another source, Evergreen Growers Supply, notes *Trichogramma* wasps are more effective against moth species that lay their eggs in clusters, so those species may be good options if cross-striped cabbage worm has been a particular problem.

--R. Hazzard, S.B. Scheufele and L. McKeag

Events

IPM Field Walks

In this series, learn to identify and scout fruit and vegetable pests and select integrated pest management strategies that work for you whether you are a beginner, experienced, organically certified or not! We will walk farm fields with Extension Educators and farmers in Massachusetts, Rhode Island, and Vermont to learn how each farm is practicing IPM. Bring a hand lens if you have one. This series is funded in part by a Northeast IPM Center grant.

- **July 22nd, 4-6 pm**
  Waltham Fields Community Farm, 240 Beaver Street, Waltham, MA
  Learn to calibrate a backpack sprayer, select effective OMRI approved materials and calculate the economic threshold of vegetable crops after being trained to scout in the field with farmers Erin Roberts and Zannah Porter and UMass Extension staff Lisa Mckeag, Susan Scheufele and Rich Bonanno. **2 pesticide license contact hours available in the vegetable category.**
- **July 27th, 4-6 pm**
  Simple Gifts Farm, 1089 North Pleasant Street, Amherst, MA
  Come to this field walk to learn how to use pheromone traps to monitor Squash Vine Borer, use a microscope to identify plant pathogens, and learn to scout multiple vegetable crops with farmer Jeremy Barker Plotkin, UMass Extension staff Katie Campbell-Nelson, Lisa McKeag and Plant Diagnostician Angie Madieras. Leave after a discussion of control strategies for these pests on organic farms. **2 pesticide license contact hours available in the vegetable category.**
- **August 25th, 3:30-6pm**
  Hurricane Flats, 975 S. Windsor St. South Royalton, VT
  Join us to learn how to scout for disease and insect pests in the field and discuss effective organic control strategies with farmer Geo Honigford, Ann Hazelrigg and Gabriella Maia (UVM Disease Diagnostic Laboratory) and Katie Campbell-Nelson (UMass Extension Vegetable Program). Sponsored by Vermont Vegetable and Berry Growers Association and NOFA-VT.

Professional Development Soil Health Workshop Series

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

- **July 16th, 3-5 pm**
  Diagnosing Streams: Flood Protection Remedies for Farm and Forested Lands, 89-91 River Rd. South Deerfield, MA
  Christine Hatch, UMass Extension Assistant Professor, Geosciences, and Benjamin Warner, UMass PostDoc, Geosciences will present the latest science on "diagnosing streams" and provide best practices for farm and forest land managers to protect their land from the effects of stream flooding. Their goal is to help agriculture, forestry, and rural communities develop greater resiliency during extreme weather events. Christine and Benjamin are members of a New England "Fluvial Geomorphology" research group. The group has studied successes among restoration responses to Hurricane Irene in Massachusetts and Vermont and will be sharing findings from this work with Agricultural Service Providers in Massachusetts.

- **August 25th, 3:30-6pm**
  Soil Tests for New England and interpreting them for Phosphorous Management, 89-91 River Rd. S. Deerfield, MA
  Tom Morris, University of Connecticut Professor, Plant Science will present methods of different soil extractions and tests, with a focus on those appropriate for New England soils. With his experience in field research on nitrogen and phosphorous, Tom will present Agricultural service providers with a basic understanding of the chemistry of Phosphorous in the soil, how it behaves, how best to assess P status of soil in different growing systems, how to assess potential loading from soil applications of fertilizer, compost or manure, and how to mitigate soil with excess Phosphorous aside from not adding more (e.g., cover crops or other ways to use up or sequester phosphorous to prevent off site movement or contamination.
  Tom Akin, Natural Resource Conservation Service Agronomist will present work on evaluating a new soil extraction method for New England with data from Massachusetts farms. The new Haney Soil Health Test is being tested in Massachusetts to evaluate it's ability to better predict active carbon and other indicators of soil health.

2015 NOFA Summer Conference

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

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

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

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

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

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