UMASS EXTENSION

Vegetable Notes

For Vegetable Farmers in Massachusetts

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Keeping bins stocked in road side stands can be a challenge when vegetables like these hot peppers fly off the shelves.

Crop conditions

Road side stands, farmers markets, and farm stores are at their peaks this time of year and harvest is in full tilt. Meanwhile, the Market Basket standoff is impacting many growers wholesale accounts. Cool nights herald the coming of fall and bright sun has helped with ripening and curing; drying fields out after last week's deluge. More and more onions are curing in the field or in greenhouses or barns. Sweetcorn successions are reaching their final harvests in some parts of the state while in south-eastern MA some corn is still just reaching fresh silk stage. Melons are winding down, tomatoes are pumping out fruit. Beet, radish and carrot harvests are steady. Large trucks of wholesale potatoes are leaving fields for distribution. The drier weather this past week has allowed growers to get into fields and cultivate their fall carrots, beets, and brassicas before weeds establish. Growers are working to get fields ready for fall cover crops, to take advantage of the dwindling weeks of strong growing conditions that remain. Those with an eye to winter growing are working their way through their carefully planned plantings of fall spinach, lettuces, kales, and salad mix, overwintering onions (seed now!), salad turnips, and pak choy. Pumpkins and winter squash are at a critical point where the fruit is nearing full size and maturity, and growers are eyeing the weather and trying to address the disease risks that can mean the difference between terrific yields and terrible crop losses. Reports from RI and VT confirm that most crops have been about a week late this year due to a late spring start and cooler summer weather. A few locations around New England are >100 GDD below the 30 year average, but the vast majority are still above it by 25-200 GDD (base 50), so the perceived coolness of this summer shows how much we have adapted our own expectations as patterns change.

Pest alerts

Cucurbits: Cucurbit downy mildew was confirmed on pumpkin in Franklin Co. MA this week (see image). It has been reported on cucumber, cantaloupe, acorn and summer squash in other states, but all cucurbits should be considered at risk. Growers in MA should spray cucurbits on a 7 day rotation with oomycete specific materials. Fungicides registered for Downy Mildew include Tanos, Zampro, ProPhyt, Curzate, Forum, Gavel, Presidio, Ranman, Previcur Flex, Pristine, and Reason. Apply these chemicals in a tank mix with contact fungicides such as chlorothalonil, copper, or mancozeb and rotate among chemical classes to prevent fungicide resistance development in the pathogen population. No organic-approved fungicides have been shown to have efficacy in controlling cucurbit downy mildew. Some growers are testing CDM resistant cucumbers in their late crop. Track the progress of this disease at CDM-IPM-PIPE. Powdery mildew

Cucurbit downy mildew (dark spores) and Powdery mildew (light spores) on a pumpkin leaf.

is now being controlled in combination with downy mildew in cucurbits across the north east. See the article "Fungicide Resistance Management for Cucurbit Diseases" in the May 15th issue of VegNotes for tips on managing both of these diseases. Anthracnose was diagnosed on kabocha squash and cucumber this week in Franklin and Worcester Co. MA. This fruit rot can be seed borne and persists in soil for up to 2 years. See article this issue for more information. Squash Vine Borer pheromone trap captures continue to be low or zero across the north east, however, two fields in Hampshire Co. MA were found with larvae. One summer squash field was found to be heavily infested with larvae (2 or more per plant) and arvae were also found in bush type acorn squash causing whole plants to wilt. Inspect early succession squash plantings now for larval infestation (easily spotted by brown frass coming out near the bottom of the plant, often where leaves attach) and till under plants to kill the larvae.


Anthracnose on cucumber leaf

Table 1. European corn borer (ECB), fall army worm (FAW), and corn earworm (CEW) trap captures for the week ending 8/21/14.

Location	ECB	FAW	CEW
Western, MA			
Amherst	9	-	-
South Deerfield	1	-	0
Sunderland	6	-	0
Hadley	3	0	0
Feeding Hills	1	0	0
Central & Eastern MA			
Spencer	0	0	0
Tyngsborough	4	0	1
Leominster		0	2
Concord	5	0	3
Millis	2	-	6
Lancaster	0	0	0
Seekonk	6	0	0
Rehoboth	4	0	5
NH			
Litchfield	1	4	7
Hollis	0	4	2
Mason	3	0	0
Burlington, VT	15	-	-
Kingstown, RI	5	5	0

Solanaceous crops: Late blight is widespread in organic fields across MA and several tomato fields have been plowed under. Growers are harvesting some infected potato fields now after mowing and letting skins harden for 2 weeks. In conventional fields of potato and tomato, targeted fungicides have generally prevented the disease from developing. LB was identified in greenhouse tomato in Windham Co., Vermont. Weather conditions continue to be favorable for spread of this disease. For a map of late blight reports and photos of symptoms, see usablight.org. Continue to apply protectant and targeted LB fungicides. Get spray recommendations tailored to your local weather conditions and fungicide program using the MA DSS website here. Spider mites were reported in a greenhouse in Chittenden Co. VT. Tomato leaf blights including Septoria (on 80% of crop), early blight and powdery mildew (on 65% of crop) were found infecting field tomatoes in Washington Co. RI.

Brassicas: Imported cabbageworm and diamondback moth caterpillars were found above threshold of 15% infestation in brassica fields in Cittenden Co. VT, and Worcester Co. MA this week. Scout now for these pests. Dipel and Xentari are selective materials (OMRI listed) with good efficacy for these pests and very low impact on beneficials. Look for cross striped cabbageworm in central and southern New England because they can cause late season damage. Alternaria leaf spot is a risk in fall brassica fields especially in densely foliated Brussels sprouts. Removing lower foliage in Brussels sprouts can reduce conditions favorable for disease spread.

Sweet Corn: Some growers are now harvesting their last plantings, while others have corn plantings just going into fresh silk now, partly as a result of cool temperatures overall. **Corn earworm** captures remain unusually low for late August, **European Corn Borer** flight continues to drop, and **fall armyworm.** Silk sprays should not be needed at this level of flight except in northern VT where 2nd flight continues. Check pre-silk blocks that remain.

Other Crops:

Another case of Anthracnose leaf curl of celery was diagnosed in the cultivar 'Tango' in Hampshire Co. MA.

Deer and mammal damage has been seen in many pumpkin and squash fields across MA. Protect your ripening crops now with electrical fencing if feeding damage has been spotted.

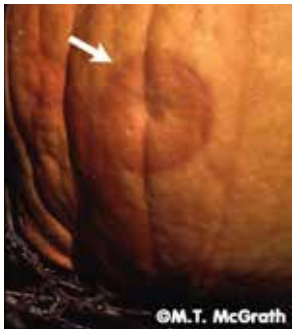

feeding damage on pumpkin

Spotted Wing Drosophila: Track trap captures across MA here.

FUNGAL FRUIT ROTS OF FALL CUCURBITS

Many pathogens (fungi, bacteria, and viruses) cause fruit rot, fruit spotting, and other fruit abnormalities in pumpkins that render them unmarketable. The vast majority of fruit rots are caused by the fungal organisms discussed in this article, although several bacteria (*Xanthomonas campestris pv. cucurbitae* and *Pseudomonas syringae pv. lachrymans*) can also cause fruit lesions and rots. In addition to the pathogens discussed below, other fungi that can cause fruit rots include Alternaria Rot (*Alternaria alternata*), Blue Mold (*Penicillium species*), Crater Rot (*Myrothecium roridum*), Pythium Cottony Leak (*Pythium species*), and Rhizopus Soft Rot (*Rhizopus stolonifera*). Successful management of pumpkin fruit rots depends on accurate identification of the causal organism so that the appropriate control measures can be employed. Refer to the New England Vegetable Management Guide for chemical control options and the Cucurbit Disease Scouting & Management Guide for more photos. Many of these diseases show up in storage, and it is important to know which disease is present and dispose of the infected fruit properly. Dumping rotting fruit in your fields or compost pile may result in higher initial inoculum and more disease the following year. In the case of *Phytophthora capsici*, disease could be devastating for years to come.

Phytophthora Fruit Rot (*Phytophthora capsici*) Perhaps the most serious fruit rot in wet years, Phytophthora infection begins as a water-soaked or depressed spot, most often on fruit undersides which are in contact with the soil. The pathogen produces a white, yeast-like growth that contains many fruiting bodies (sporangia) and affected fruit may be completely covered. The disease can develop and spread rapidly with excessive moisture and temperatures between 80-90F.Entire fields may be destroyed. Phytophthora persists in the soil for many years; no effective crop rotation interval has been determined. **Management:** Manage soil moisture by sub-soiling, avoiding over irrigating, selecting well-drained fields, and avoiding areas of fields that do not drain well. Destroying diseased areas at the start of disease development can be effective. Planting pumpkins into cover crop mulch or following the biofumigant cover crop 'Caliente' mustard has shown promise in research trials. Pumpkins with hard, gourd- like rinds or shells are less susceptible to Phytophthora fruit blight. Lil' Ironsides, Apprentice, IronMan, Rockafellow, Cannon Ball have been reported as moderately resistant. IronMan, CannonBall, and Rockafellow also possess powdery mildew resistance.



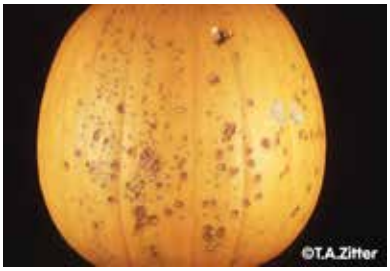
Fusarium Fruit Rot (*Fusarium solani f.sp. cucurbitae*) Pumpkin fruits are attacked by Fusarium at the soil line and the severity of infection varies with soil moisture and the age of the rind when infection occurs. Surfaces of fruit that are in contact with the soil develop tan to brown, firm, dry and sunken lesions which may occur in concentric rings and remain firm unless invaded by secondary organisms. It does not survive for more than 1-2 years in seed and does not affect the germination or viability of the seed. Fusarium produces abundant resting spores (chlamydospores) in the soil, but only persists there for 2-3 years. Wounding is not necessary for infection to occur. Cultivars vary in their resistance with larger pumpkins being generally more susceptible. The pathogen can be seed-borne-both internally and externally. **Management:** Because this pathogen exists in several races, knowledge of the prevailing races is needed so that resistant varieties may be selected. A four year rotation out of pumpkins will eliminate soil propagules and fungicide treated seed will reduce initial inoculum. Culling of unmarketable fruit can reduce the risk of spread during the post-harvest period.

Black Rot (*Didymella bryoniae*) Also called Gummy stem blight when it occurs on other plant parts, this disease produces a distinctive black decay. Initially, a brown to pink, water-soaked area develops in which numerous, black fruiting bodies are embedded. Black rot on butternut may appear as a superficial hardened tan to white area which can develop concentric rings. Large Halloween pumpkins are more susceptible to black rot than smaller pie types. The pathogen is soil and seed borne and can overwinter in infected crop debris as dormant mycelium or chlamydospores. Wounding is not required

for disease initiation, but wounding by striped cucumber beetles, aphid feeding, and powdery mildew infection enhance susceptibility. **Management:** Start with certified, disease-free seed. A two year rotation out of cucurbits can reduce field inoculum. Crop debris should be plowed under promptly after harvest. Control of powdery mildew can significantly reduce black rot infection of pumpkins. Avoid chilling injury to winter squash and pumpkins in storage as this activates dormant black rot lesions and increases losses in storage. Store fruit at 50-55°F and ~60% relative humidity.

photo: K. Campbell-Nelson

Anthracnose (*Colletotrichum orbiculare*) is common on the fruit and foliage of watermelons, squash, melons, and cucumbers in humid regions. Young fruit may turn black and die if their pedicels are infected, while older fruit develop circular, noticeably sunken, dark-green to black lesions which may exhibit a salmon colored exudate in moist weather. The pathogen is both seed and soil borne and can cause serious losses. Infected fruit may have a bitter or off-taste, in addition to lesions, and deteriorate quickly due to the invasion of secondary rot organisms. *C. orbiculare* survives between crops in infected crop debris, in volunteer plants, or weeds of the cucurbit family. The fungus does not require a wound to initiate infection and is spread by splashing water, workers, and tools in warm, humid weather. **Management:** Start with certified, disease-free seed and/or grow resistant cultivars. Rotate out of cucurbits for 2 years and control volunteer cucurbit plants and weeds. Collect and burn or plow down deeply infected crop debris after harvest. Avoid wounding fruit during harvest and immerse fruit in a solution of 120 ppm chlorine after harvest.



Scab (*Cladosporium cucumerinum*) This pathogen attacks all parts of the plants, but is most serious because of the disfiguring scab lesions that develop on fruit. The disease is favored by heavy fog, heavy dews, light rains, and temperatures at or below 70˚ F. The spores (conidia) are borne in long chains, are easily dislodged, and spread long distances on wind. On foliage, the first sign of the disease is pale-green, water-soaked lesions which turn gray and become angular. On fruit, spots first appear as small sunken areas which can be mistaken for insect injury. The spots may ooze a sticky liquid and become crater-like as they darken with age. Dark green, velvety layers of spores may appear in the cavities and secondary soft-rotting bacteria can invade. Severity of symptoms varies with the age of fruit when it becomes infected. *C. cucumerinum* overwinters in infected squash and pumpkins vines, soil, and may also be seedborne. Spores produced in the spring can infect in as little as 9 hours, produce spots by 3 days, and produces a new crop of spores by 4 days. Management: Start with disease-free seed or use fungicide treated seed. Do not save your own seed if the disease is present. Select well-drained fields with good air circulation to promote rapid drying of foliage and fruit. Rotate out of cucurbits for 2 or more years as the pathogen over seasons very well. During cool, wet weather fungicide sprays may not be entirely effective because of the rapid disease cycle.

Plectosporium Blight (*Plectosporium tabacinum*) Like Scab, Plectosporium Blight is most damaging when it appears on the fruit. Pumpkins, yellow squash, and zucchini are the most susceptible. Lens to diamond shaped, white to tan, lesions occur on stems, leaf veins, petioles, peduncles, and fruit. Severe stem and petiole infections can result in death of leaves and defoliation. Infected stems are dry and brittle. On fruit, the pathogen causes white, tan, to silvery russeting; individual lesions can coalesce to form a continuous scabby layer. In wet years, which favor disease development and spread, crop losses in no-spray and low-spray fields can range from 50 to 100%. No resistant cultivar of pumpkins has been reported and it has not been reported to be seed borne. Management: Plectosporium tabacinum survives in crop debris, so plow deeply immediately after harvest. Rotation with non-cucurbit crops for 2 years can reduce disease. Choose sunny, well drained sites for cucurbit production.

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Updated by Katie Campbell-Nelson, 2014

COVER CROPS FOR WILD BEES IN PENNSYLVANIA CUCURBITS

Honey bees are important pollinators. They are also considered "managed" pollinators, because people manage honey bee colonies. However, unmanaged bees, comprised of various species that exist as wild populations, also play key roles in providing pollination of cucurbit crops. The degree to which different species of bees provide pollination services varies among cucurbit crops. It also changes as the season changes, and can even vary at different times of the day.

Among the cucurbits, pollination services to crops in the Cucumis genus –cucumbers and melons – appear to be more sensitive to the need to achieve pollination by honey bees. Studies show a mix of both honey and wild bees in these crops, and in several studies honey bees were the most frequent visitor to flowers. But even in these crops, Smith et al (2013) show more than 28 species of wild bees visiting cucumber flowers in addition to honey bees in central Indiana, and we have seen similar variation in PA (Sidhu 2013).

In eastern PA and parts of NJ, Winfree et al. (2007a, 2007b) observed 44 species visiting watermelon flowers planted in small, diversified farms. She and her team developed individual-based models to simulate pollination services from data on visitation rates, along with number of pollen grains deposited per visit. Results showed that wild bees provided full pollination in ~90% of these farms, even though honey bees were also present. Honey bees alone provided pollination in ~70 to 80% of the farms. The presence of both honey bees and wild bees helped ensure resiliency in pollination services.

In the *Cucurbita* genus – the squash and pumpkin crops – wild bees may well be the dominant floral visitor, regardless of whether the field is stocked with honey bees. This has been seen in NY (Artz and Nault 2011, Artz et al 2011, Petersen et al 2013), MA (Alder and Hazzard 2009), VA (Shuler et al 2005, Julier and Roulston 2009), and in diversified farming operations in PA (Sidhu 2013). In larger 'Gladiator' pumpkin fields in 2013 in Columbia and Lancaster Counties destined for wholesale markets, measures of 4,853 bee visits showed that 67% came from bumble bees, and 25% from squash bees. Thus, wild bees provided 92% of the visits to flowers (honey bees added an additional 6%) in that year.

Among the several bumble bee species in PA (Winfree et al. 2007 document 5 species visiting watermelon), the Common Eastern Bumble Bee, *Bombus impatiens*, played the key role in PA. Overwintered solitary queens are establishing nests in late March, April, and May. During this very sensitive time in their life cycle, queens are finding and building nests, laying eggs, keeping the brood warm with her body heat, provisioning brood with pollen sometimes mixed with nectar, and rearing the first generation of brood. She needs plentiful, diverse, and high quality floral resources in close proximity to her nest. We are experimenting with a cover cropping system, planted in September of the previous year, to provide floral resources during this time. Along with providing the spring floral resources, this mix is designed to stop flowering (or be killed) by the time that the pumpkin crop needs to be pollinated (~mid July through mid August). You may have other ideas that would achieve this same purpose.

Trial Seed Mix, with a mid September Planting Date, to provide floral resources for the overwintered queen of the Common Eastern Bumble Bee (*Bombus impatiens)* during the time she establishes a nest and provisions the first brood in spring of the following year.

Crop Species	Seeding rate (lbs/ac)
Oats	30lbs (nurse crop)
Canola	5
Crimson Clover	20
Vetch	30
Austrian Winter Pea	60-70

Bombus impatiens, the Common Eastern Bumble Bee, was the most frequent visitor to 'Gladiator' pumpkin fields in 2013

During the mid-summer, do you want to provide additional floral resources? Some would argue this would help support

bumble bee, honey bee, and other "generalist" bee species (species that visit flowers from multiple plants). Others argue that these flowers would compete with the pumpkin flowers for visitation by bees. In our current experiments, we are not adding a floral resource during the July-late August time frame, and we see good numbers of bumble bees working pumpkin fields. This is also the time frame when Bombus impatiens colonies should be at their strongest, because they should have multiple broods of workers helping support the colony.

As summer comes to a close, Bombus impatiens enters a second sensitive time. Instead of developing as workers, female offspring become reproductive, and males are produced. These new females will mate, and attempt to overwinter – they are called 'gynes'. Gynes need to acquire substantial resources if they are to successfully overwinter. Thus, we are trialing seed mixes designed to flower during the time that gynes are acquiring resources for overwintering. Again, you may have additional ideas.

Trial Seed Mix, with a July 7 Planting Date, to provide floral resources for the new queens of the Common Eastern Bumble Bee (*Bombus impatiens*) during the time they are foraging prior to overwintering.

	Time to flower	Initial flower	Seeding rate (lbs/ac)
Buckwheat	6 weeks	Aug 19	20
Phacaelia	6 weeks	Aug 19	7
'Caliente' Mustard	6-8 weeks	Aug 26-Sep 1	5
Cowpeas	8 week	Sep 1	15
Sunn Hemp	10 week	Sep 14	8
Sunflower	12 week	Sep 25	??

You might consider trialing seed mixes to see what works on your farm. What seeding rates work? What plant species mixes result in flowering at what time, and are you seeing bumble bee visitations to those flowers? When can you fit this into your cropping system?

Using cover-crop types of plant species is one option that could fit well within farming systems based around annual crops. You might also consider installing some perennial species, which have different advantages and logistical issues to consider. There are a wide range of perennial species that are visited by bumble bees, and food for thought in another article.

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-- by Shelby Fleischer, Professor of Entomology, PennState July 2014

PREVENTING DEER DAMAGE

The population of deer in Massachusetts continues to grow, and damage on vegetable and fruit crops can be serious. Deer can be especially damaging in vine crops and now that fall pumpkins and winter squash are maturing, it is critical to take action to prevent damage if you are in a high-pressure deer area. There are several options available for managing deer damage on your farm. Factors such as the amount of crop land that you're trying to protect and the time and resources available will determine which options you choose.

Electric fencing is the most cost-effective measure to prevent deer damage. For small fields of a few acres or less, portable fences of electric wire, woven rope, or tape will provide relief from deer. Solar or battery-powered chargers make it possible to set up a fence even in remote locations. Woven ropes and tapes enhance protection by being very visible to deer, even at night, while providing an electric shock on contact. They are also more visible to people. As few as two strands of electric wire can be used to protect crops; three strands are better. In a two-wire fence, the first wire should be at a height of 10-12 inches and the second at 30-36 inches. A three-wire fence can have strands at 12, 24, and 40 inches. Double fences - that is, two fences in parallel, spaced about 3-5 feet apart - can be very effective if deer are jumping over a single fence. The outer fence can be a single strand at approximately 36 inches.

Deer are well-insulated over most of their body with fur, dampening the shock of an electric fence. Baiting the fence, with store-bought lures or a metal tab or piece of aluminum foil smeared with peanut butter, will entice the deer to contact the fence with its more sensitive nose and tongue, and help to educate a deer to respect the fence. Space the bait about 30 feet apart around the perimeter and keep the fence baited for at least a few weeks after the fence is installed. Be sure to regularly check the strands to ensure that they have adequate charge – about 2.5 kilovolts for a baited fence. Portable voltage readers can be purchased for as little as about $10. Make sure fence lines are well maintained as weeds or grass touching the wires will reduce the charge. Electric fence supplies can be found easily on the internet, at farm supply centers or through fencing specialty companies.

Permanent fencing is the most effective long-term solution to deer damage. In this case it is the fence itself, not an electric shock, that provides the deterrent. A non-electric fence should be at least 8 feet high and either have a lower bottom wire than a movable electric fence – about 6 inches off the ground - or be of mesh construction.

Fence maintenance is critical in both applications. If a tree falls on the fence or a hole is cut in the fence, it should be repaired immediately. Once deer have gotten inside and discovered the crop, it will be harder to keep them out, even with an electric fence. No gaps should exist in the fence; access must be provided through gates that are closed at all times. Fences should have a clear outer perimeter, at least 5 or 6 feet on the outside of the fence, so deer have to cross an opening before encountering the barrier. This also enhances visibility of the fence to the deer. Deer will blunder into a fence placed tight to a wooded edge and can actually damage or take down sections of a fence simply because they do not see it very well, especially with smooth wire designs. Having a clear border will increase the effectiveness of the fence and aid in maintenance. Permanent tall wire fences while more expensive may be a worthwhile investment on the home farm, or where you will always be planting vulnerable crops. Moveable electric fences make sense in fields that are rented, far from the home farm, or are planted to different crops each year.

Scare devices can be effective when deer populations and pressure are fairly low. There are devices that make noises, squirt water, give off bright light, or are made to look like predators. Some are motion sensitive. Placing these tools at field edges where deer are entering can help to scare them off, and can be used in addition to fencing. Deer get accus-

tomed to these devices pretty quickly, though, so they must be moved frequently.

Repellents reduce deer damage by making the target crop taste or smell unpalatable to deer. All repellents are billed to reduce, not eliminate, deer damage and don't provide reliable protection when deer densities are high. To achieve this reduction, they must be consistently applied and reapplied as directed. Once a feeding pattern has been established, repellents are usually less effective. Repellents fall into three categories: taste, odor, and combination taste and odor. Different formulations allow the user to change the repellent and keep the deer on guard by providing a change in the range of odors and tastes.

For protecting vegetable and fruit crops, make sure that a product is approved for use on edible crops. Certain taste-based repellents can be used on edible plants such as vegetable crops, fruits, berries, nuts and herbs, but they must be washed off prior to eating. The following repellents are among those approved for use on edible plants: Hinder (ammonium soaps of higher fatty acids; for apple, pear, carrots), Millers' Hot Sauce (capsaicin), Deer Stopper (putrescent egg solids, rosemary and mint oils), Deer Off (putrescent egg solids, capsaicin, garlic oil). Some growers report that foliar applications of fish emulsion, which is sold and applied as a nutrient supplement, have an additional benefit of repelling deer. There are also numerous home-made products that may work as repellents.

Repellents should be applied before damage is likely to occur, when precipitation is not expected for 24 hours, and temperatures will remain between 40° to 80°F for that period. Hand-spray applications may be cost effective on small acreages, while machine sprays will reduce costs for larger areas. If the materials are compatible, spray costs may be reduced by adding repellents to pesticide sprays.

Maintaining optimal densities of deer populations through habitat management and hunting can help to keep deer pressure in vegetable crops low. The Massachusetts Division of Fisheries and Wildlife sets management goals and regulates hunting during three designated seasons. For more information on white-tailed deer and this control strategy, see the official Massachusetts website on Deer Management at http://www.mass.gov/eea/agencies/dfg/dfw/fish-wildlife-plants/mammals/deer-management.html

Resources: John E. McDonald, Jr., formerly US Fish & Wildlife; Craig Hollingsworth, University of Massachusetts; Richard Ashley and Norman L. Gauthier; University of Connecticut; Maryland Dept of Agriculture (http://www.dnr.state.md.us/wildlife/ddmtrepell.asp); Massachusetts Division of Fisheries and Wildlife; http://www.electric-deer-fence.com; growers who build deer fences.

-by R. Hazzard. Updated and adapted by L. McKeag, 2014

INTRODUCED PARASITOID SUPPRESSES IMPORTED CABBAGEWORM

History of project. Cole crop growers in the Northeast US traditionally have had to control imported cabbageworm (Pieris rapae) in their broccoli, Brussels sprouts, cabbage and other brassicas. In 1988, UMass entomologist Roy Van Driesche imported and released a potentially more effective and safer parasitoid of this pest from China. This braconid wasp (Cotesia rubecula) established and spread and in spring of 2007, he measured its presence in organic, conventional and home garden cole crops in MA and found that C. rubecula was present at all 20 sites in the survey, with high levels of parasitism (75%, averaged over all 20 sites). Because this parasitoid kills caterpillars when they are less than 1/3 grown (4th instar larvae), over 70% of the damage that might be done by a healthy caterpillar is prevented. In the 2007 survey, only 10% of the larvae encountered had reached the highly damaging mature stage (5th instars) that does most of the feeding. Additionally in the 2007 survey, he found that the once common parasitoid, Cotesia glomerata had been largely replaced in the spring by the newer, more effective species, C. rubecula. Over 99% of all P. rapae parasitoids recovered in the spring 2007 survey were C. rubecula.

2009 late-summer survey. The 2007 surveys were all done in May and June, during the first generation of P. rapae caterpillars. The question remained whether the high level of parasitism seen in spring would hold up over the summer. Also, it was also possible that the originally introduced parasitoid, C. glomerata, would become more common later in the year. To answer these questions, in 2009 Van Driesche repeated the survey done in 2007, visiting 19 sites in MA, one in Burlington, VT and one in Charleston, RI. Based on the collection of 719 P. rapae larvae (or pupae or parasitoid cocoons), he found that parasitism of P. rapae in late summer (September-October) of 2009 again 75%, the same as in the spring of

2007. Also, he found that while *C. glomerata* increased somewhat in relation to *C. rubecula* (being 12% of all parasitoids collected), *C. rubecula* remained the dominant parasitoid, accounting for 88% of all parasitism. It was also present at all 21 of the sites surveyed.

2011 survey. Samples of P. rapae and Cotesia parasitoids were collected from May to late Sep 2011 in 14 states and 2 Canadian provinces, from New England to North Dakota, southward to North Carolina and northward to New Brunswick and Quebec. In total, 32 samples of P. rapae larvae or pupae and parasitoid cocoons were examined, comprising 1571 individuals. Cotesia rubecula was present at 22 of the 32 sample sites and where it was present, the average parasitism rate was 47%. Cotesia glomerata remains the dominant parasitoid in the mid-Atlantic states, from Virginia to North Carolina and westward to southern Illinois, above latitude N 38° 48', where it has displaced the previously common parasitoid *Cotesia glomerata*. This pattern suggests that the released populations of *C. rubecula* presently have a lower latitudinal limit south of which they are not adapted (see Figure 1.)

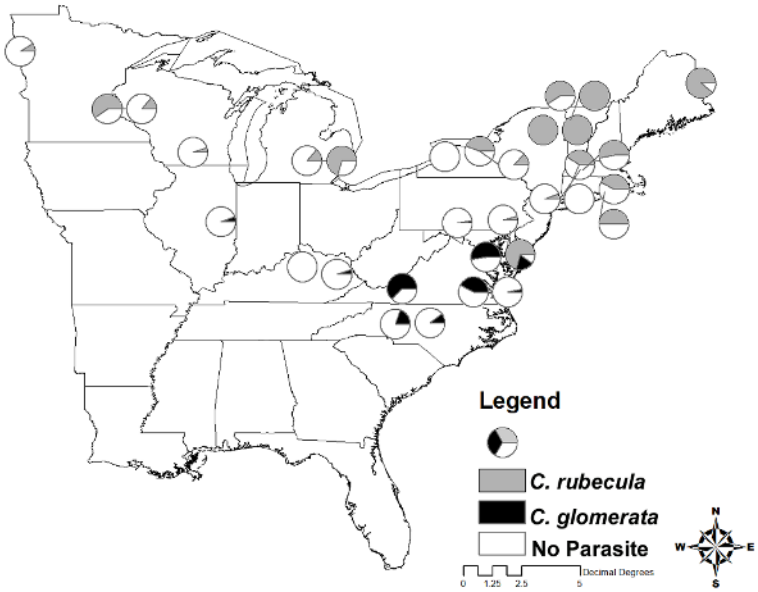

Figure 1. Map of C rubecula distribution

Discussion. This information shows that the classical biological control project against imported cabbageworm started back in 1988 at UMASS has been successful over a wide geographic area, and that the new parasitoid is now providing a high and consistent level of mortality in New England and beyond. Although the familiar white cabbage butterfly, Pieris rapae, is still present and active in New England Brassica crops, its damage to crops has been significantly reduced. Based on survey data, it is highly likely that *Cotesia rubecula* is present wherever *P. rapae* is found, and is laying eggs in young imported cabbageworm caterpillars and killing them before they cause most of their damage. For farmers and gardeners who scout their crops, the developing larvae of *C. rubecula* may be visible inside imported cabbageworm caterpillars as a translucent band, which is revealed when the caterpillar is opened (see photo 1). The small white *C. rubecula* cocoons are usually found singly on the underside of leaves (see photo 2).

1. Cotesia rubecula larva in

2. C. rubecula cocoon

-- by Roy Van Driesche, Department of Environmental Conservation, UMass

FALL CABBAGE MAGGOT IS ACTIVE

Cabbage root maggot (CRM) has four successive generations over the season at this latitude, and has a flight periods that typically peak in mid-August and again in mid September. Larval feeding can cause root injury in fall Brassicas, especially in the marketed roots o radishes, turnips, daikon and rutabagas. Scarring of the surface and tunneling through the root both reduce marketability. The timing of controls is more difficult than in spring crops, because the timing of the flight is more difficult to pinpoint than in the spring, and there are two flights during the growth period. Root crops are often planted before the fly is active and roots are subject to larval feeding damage later in crop growth. The organophosphate insecticides (diazion, chlorpyrifos) that are labeled for use against maggot flies need to be applied before, during or shortly after planting, as a preplant incorporated products, t-band, transplant or furrow drench, or immediate postplant directed spray; fortunately these products have a long residual period in the soil, but there is no option for rescue treatments.

New chemistry is available for maggot control with the newly labeled, reduced-risk diamide product Verimark (cyantraniliprole) which can be applied as a transplant drench, furrow drench, or through drip. It is systemic and works best when taken up by the roots. It showed very good control in a UMass trial for spring cabbage maggot in cabbage but has not yet been evaluated for fall root crops in New England.

Maggot fly models incorporated in the NEWA forecast system suggest that the third brood of flies has been active for >2 weeks which means that larval populations may be active. The fourth flight is likely to begin by early September, when many root crops will be partly grown. Another tool that was developed in western NY based on research done in the 1980's correlates flowering of wild plants with CRM flights. This showed that onset of flowering of in Canada Thistle and Goldenrod correlates with the third brood, and New England Aster with the fourth brood. You may also look for eggs at the base of the stem to determine activity.

While row covers are a valuable tool in spring, the added heat and reduced light has been shown to reduce root quality and yield in turnips and rutabagas. If row covers are used, select a non-heating type and apply before emergence of seeds or immediately after transplanting, to ensure that aphids are not trapped under the cover. Protected from all the natural enemies in the field, aphid numbers can explode under the cover.

Rotation is an important tool: adults flies do not migrate long distances, but will move into nearby fields (<400m) which see a spike in adult flight after a nearby field has been harvested and in spring fields that are planted near fall Brassica crops. Longer distance rotations will reduce populations.

Resources:

Jyoti 2003, Evaluation of Degree-Day and Julian-Day Logistic Models in Predicting Cabbage Maggot Emergence and Flight in Upstate New York.
NEWA Cabbage Maggot Model

-R Hazzard & K Campbell-Nelson

UPCOMING EVENTS

UMass Extension IPM Field Walk

When: August 22nd, 2014, 3-5 pm

Where: The Farm School, 488 Moore Hill Road, Athol, MA 01331

The Farm School has a day camp program for elementary students, a middle school, and an adult apprenticeship program. The apprentices grow food for a 175 member CSA, Farmers' Market, and manage 150 acres of forest land. The adult program's teacher/growers, Tyson Neukirch and Carlen Rigrod partnered with UMass Extension to train their students in IPM and scouting techniques. This field walk will feature IPM scouting and management practices in apples, raspberries, and multiple vegetable crops with UMass Extension staff: Sue Scheufele (vegetable), Katie Campbell-Nelson (vegetable), Sonia Schloemann (small fruit), and Arthur Tuttle (tree fruit).

UMass Extension Vegetable Twilight Meeting: Building Farms and Food Networks for Hunger Relief Sponsored by: UMass Extension Vegetable Program

Where: Community Harvest Project, Brigham Hill Community Farm, 37 Wheeler Rd, North Grafton, MA 01536.
When: Wednesday, August 27, 4-7 pm
Hosts: UMass Extension faculty and staff, and Ken Dion, Operations Director of Community Harvest Project

Massachusetts is seeing a rise in the number of farms managed by non-profit organizations with a strong social or educational mission. Community Harvest Project, Inc. is a 501(c)3 non-profit organization whose mission is "To build an engaged and healthier community by bringing volunteers together to grow fresh fruits and vegetables for hunger relief. " At Community Harvest Project, thousands of volunteers come every year to help plant, tend and harvest fresh fruits and vegetables for their neighbors in need. Produce is distributed through partner agencies including Worcester County Food Bank's network of hunger relief organizations which serve over 100,000 people. In 2013, Community Harvest Project donated over 324,000 lbs. – or 1.1 million servings – of fresh fruits and vegetables. Come and learn about how this farm and organization is succeeding and making a difference in the food systems of the Worcester region!

The tour will include the following:

- An automated irrigation system
- The construction of a new greenhouse
- The use of a hay-blower for mulching
- Ethnic crop trials, including ají ducle, cassava leaves and ethnic hard squashes – Frank Mangan
- A presentation on how CHP operates, how food gets distributed, how the volunteer farming program works, and how nutrition education is integrated with food distribution.

Refreshments will be served including Sancocho, a traditional hearty soup popular in the Caribbean. Pesticide applicator recertification credits (up to 2 contact hours) will be offered. For more information and directions see: http://www.community-harvest.org/. Contact Frank Mangan, 508 254-3331,fmangan@umass.edu or Ken Dion, phone: 508-951-3466 or kdionfly@verizon.net

UMass Extension Vegetable and Fruit Twilight Meeting: Food Safety, IPM and the Commonwealth Quality Program

When: September 3, 2014 4-7 pm

Where: Foppema's Farm, Northbridge, MA, 1605 Hill St, Northbridge, MA 01534

Join UMass Extension faculty and staff and the Foppema family to learn about how the farm is using food safety and IPM strategies in their vegetable, tree fruit and berry crops.

Foppema's Farm is a 75 acre fruit and vegetable farm located in Northbridge, Massachusetts. The farm is family owned and operated by the Ken Foppema family. Ken and Lisa and their four sons (along with a wonderful staff of employees) grow and sell produce from the farm out of a beautiful post and beam farmstand built in 1998. They sell wholesale and at farmers markets, and through pick-your-own, especially at nearby Keown Orchards which is now part of their farm.

The farm participates in the **Commonwealth Quality Certification Program** and they are taking steps to increase their implementation of the **food safety standards** as well as the **sustainability and IPM standards** that are part of this program. We will tour their wash room and packing area, and discuss specific steps that help to ensure food safety when **field packing greens**. Mike Botelho from the Mass Dept. of Ag Resources will talk about the Commonwealth Quality Program (CQP), its food safety standards, and the market access that can be gained through CQP. You'll see some of the CQP promotional materials, that can be customized to highlight aspects of your farm.

On the IPM side:

- Rich Bonanno, UMass Extension weed specialist, will discuss **weeds**: types of weeds, how they grow, how to identify them, and how to manage them on a very diverse farm like Foppema's.
- UMass Extension Fruit Program will tour the apple orchard and discuss **apple IPM** strategies.
- Ruth Hazzard, UMass Extension Vegetable specialist with Lisa McKeag, Extension Assistant and Ken Foppema will discuss how the Foppema's are using **IPM in onions** to solve a key disease problem.

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