UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

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In this issue:

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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.

Crop conditions

Spring field work has begun – folks are beginning to plow, seed the earliest corn, plant the earliest brassica and allium transplants, and seed cover crops into fields that won't be used this spring. It has been a dry April so far. We have seen above-average temperatures and below-average rainfall so far this spring, and groundwater levels are below normal in most of the region, giving most of MA an "Abormally Dry" rating from the US Drought Monitor and pushing the north-central part of the state into a moderate drought. Although the dry spring weather makes it easier to plow fields earlier than normal this year, we're hoping that forecast rain today and tomorrow falls gently and that these conditions don't continue for too long and give us a repeat of last year's drought.

Thankfully, the stress around farm crew COVID safety is beginning to lift due to the vaccine rollout. Last spring brought unending uncertainty about the effects of COVID safety protocols on sales, but even though the threat of COVID is beginning to recede, many growers are choosing to keep protocols like pre-ordering and pick-your-own reservations in place after finding that they improved things like sales and customer flow last year.

Pest alerts

Allium leafminer oviposition marks on onion.

Allium leafminer: The spring flight of allium leafminer began a few weeks ago just to our south in PA and NJ. This is a new pest of allium crops in our region that affects all allium crops, including overwintered onions and perennial chives that may be present now. Garlic may be affected but is less preferred by allium leafminer. The first sign of this pest are white oviposition marks on the leaves, in a neat row (see photo). If you see this in your allium crops, please let us know at umassveg@umass.edu so we can confirm and track the pest in New England.

Imported cabbageworm moths are flying now. If you have uncovered brassicas in the field, scout for pale-yellow eggs laid singly on the undersides of leaves. It may still be too early for caterpillars, but this is the first of several generations of ICW, and whenever the larvae start to show up, treat leafy brassicas when 15% of the crop has 1 or more caterpillars and heading crops before head formation when 35% of the crop has 1 or more caterpillars. Start with selective Bt materials (e.g. Dipel, XenTari, Javelin).

Imported cabbageworm egg (left) and caterpillar (right).

Seedcorn maggot flies are likely to be active in most of the state now, and the first flight of **cabbage root maggot (CRM)** is projected to begin this week in most of the state, and next week in far western MA. CRM flies lay eggs at the base of brassica crops and the resulting larvae (maggots) tunnel into the roots, making brassica root crops unmarketable and causing wilting, stunting, and plant death in non-root crops. See the article in this issue for information about managing spring maggot flies.

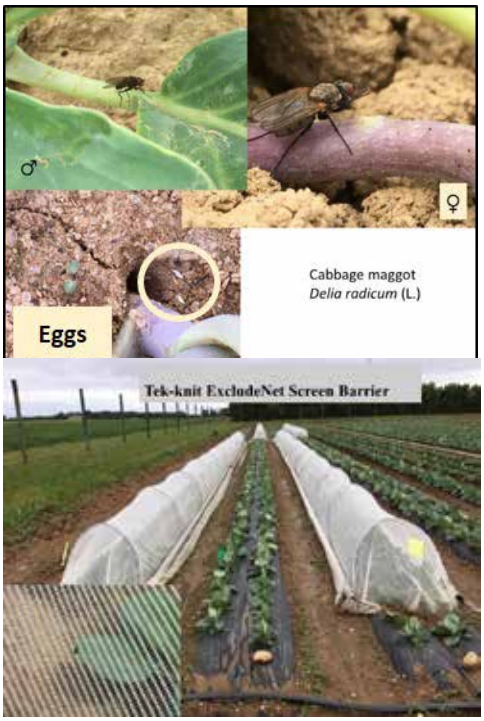
Aphids: We commonly get reports of aphid populations in high tunnels at this time of year. If you plan to implement a biocontrol strategy using parasitic wasps or predatory midges or lacewings, start early to stay on top of it. See the article in the August 27, 2020 issue of Veg Notes for more information on aphid biocontrol in high tunnels.

TIPS & TRICKS FOR MANAGING INSECT PESTS OF BRASSICAS

--Written by Dan Gilrein - Cornell Cooperative Extension, Ana Legrand - UConn Extension, Sue Scheufele - UMass Extension, Becky Sideman - UNH Extension, and Faruque Zaman - Cornell Cooperative Extension

Brassicas are among the first crops to be planted out in the field in the spring, and brassica insect pests are not far behind. Cabbage root maggot flight has started in most of MA as of this week, imported cabbageworm butterflies are flying, and flea beetles will soon be emerging from their overwintering sites. This fact sheet, created by the Brassica Pest Collaborative, a group of Extension educators from UMass, UConn, UNH, and Cornell Cooperative Extension of Suffolk County, is an overview of brassica insect pest management for both organic and conventional producers. The Brassica Pest Collaborate hosted a webinar covering the management of these same pests this week; the recorded webinar is available here.

Cabbage Root Maggot



Photos: F. Zaman, Cornell

- Rotate locations of spring and fall brassica plantings within and between seasons.
- Predict CRM emergence using indicator plants (flowering yellow rocket), NEWA model, or other monitoring tools.
- Check for signs of infestation: Look at the base of the plants for CRM eggs and check roots for damage.
- Control: Look for alternatives to chlorpyrifos. Verimark is a good choice, and other options are available including Entrust (OMRI-listed) for some crops (check labels, regional restrictions apply).
- Grow your own transplants and treat before setting out or during hardening off.
- Exclusion netting can be used for small-scale or organic producers. It will protect from cabbage maggot and other insects—cabbage and other waxy crops can be grown on black plastic mulch for weed control under exclusion netting.
- Mature plants can withstand some level of root damage.

Flea Beetle

- Rotate crop locations, moving spring crops away from fall crops in order to leave FB behind.
- Use row covers or insect netting in spring and/or for direct-seeded crops.
- Grow larger transplants, which can tolerate more damage.
- Use Surround to protect waxy seedlings during establishment. Mix well, include an adjuvant, and re-apply at least weekly and after rain.
- Conventional: many effective options including diamides (e.g. Exirel, Harvanta), neonicotinoids (e.g. Admire, Platinum, Venom), Sevin XLR, Torac, and pyrethroids.
- Organic: spinsoad (Entrust) is the most effective organic treatment. Pyganic is not effective alone.
- Improve spray coverage: Use an adjuvant (wetting agent or sticker), hollow cone nozzles, and enough spray volume to cover plants.
- **Re-apply insecticides** as long as FB are present during the susceptible period for that crop (first 2-4 weeks for transplanted waxy crops, or for the life of non-waxy crops).

Flea beetle (top) and Surround on kale (bottom).

- Till under residues quickly after harvest, and eradicate weed hosts.
- Use mustard trap crops (or use highly attractive cash crops e.g. bok choy as traps) to reduce spraying. Keep the trap crop healthy and spray the trap crop regularly to be successful.

Caterpillars

Photos: A. Legrand, UConn

- Identify the caterpillar species present to determine proper threshold level and inform choice of insecticide.
- Grow your own transplants to avoid introducing resistant diamondback moths.
- For small-scale production or hardening off transplants, exclusion netting works great to keep out caterpillars and other pests.
- Include an adjuvant (wetting agent or sticker) to keep spray materials on foliage.
- Do as much as possible to improve spray coverage, especially to get material under foliage and in center growth.
- Start with Bt materials – inexpensive and generally sufficiently effective – rotating to others as needed for larger loopers and other pests like FB.
- Rotate Bt subspecies used (Bt kurstaki or Bt aizawai) for resistance management.
- Check pesticide side effects on beneficial insects like predators and parasitoids. Use selective pesticides.
- Scout weekly, if possible, to re-assess pest status and spray efficacy. Look for eggs (looper, ICW mainly) as well as larvae, to prevent feeding damage from large larvae.

Cabbage Aphid

- Rotate crop locations, moving spring crops away from fall crops in order to leave CA behind.
- Scout regularly for signs of the very first aphids, ESPECIALLY if there were high populations the previous year. Watch for patchy leaf yellowing!
- Rogue out any plants that are severely infested.
- Take action when aphids are first observed: **treat with insecticides when 10% or more of the plants have at least one aphid.** For organic growers, options include azadirachtin, pyrethrum, and insecticidal soaps, alone or in tank-mixes or rotations. There are many effective conventional insecticide options: https://nevegetable.org/crops/insect-control-3
- After treating, continue scouting on a weekly basis and treating whenever the threshold is exceeded.
- Do as much as possible to improve spray coverage, especially to get material under foliage and in center growth, and include an adjuvant (wetting agent or sticker).
- Incorporate crop residues thoroughly at the end of the season or in very early spring.

CA on Brussels sprouts (Photo: UMass) and leaf chlorosis caused by CA feeding on underside of leaf (Photo: R. Sideman, UNH)

Common Themes

- Rotate spring from fall plantings, and fall from spring plantings—leave your worries behind! (for CRM, FB, CA—not caterpillars)
- Scout early and often in order to catch problems early, get a proper ID, and keep up with continuous pests. (FB, caterpillars, CA)
- Improve spray coverage: Hollow cone nozzles are recommended for insecticide and fungicide applications. Consider adding drop nozzles for large crops like Brussels sprouts. Always use a spreader and/or sticker to keep spray materials on foliage. (FB, caterpillars, CA)

Kale crop residue (left; Photo: UMass Vegetable Program) and a hollow cone nozzle (Photo: TeeJet)

- Continue treating as long as thresholds are exceeded—one spray will not keep all the caterpillars, or aphids, or flea beetles away.
- Till under residues as soon as possible. Mow if you cannot till in order to start the breakdown process.

Ammi majus insectary planting in a brassica field. Photo: A. Legrand, UConn

Alternatives & Frequent Questions

- Use insectary flowers to attract predators and parasitoids: alyssum, cilantro, dill, and *Ammi majus* attract both types of biocontrol organisms in New England.
- Mulches may interfere with insect host finding and deter activity and egg-laying of root maggots, flea beetles, and cabbage aphids.
- Beneficial nematodes may kill flea beetle larvae, but will not have a direct impact on damage, as adult beetles will move in from other fields.

This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, through the Northeast Sustainable Agriculture Research and Education program under subaward number LNE18-365

CALCULATING FERTILIZER APPLICATIONS

It can feel overwhelming to calculate fertilizer needs for each of the many crops and fields on your farm. Every year we help growers, both new and seasoned, to make these calculations and, if you follow these steps, the process should get easier over time. Our recommendation is always to make these calculations to determine what you should add in an "ideal" setting (if fertilizer was free and easily available and you had all the time in the world), and then figure out what you can realistically add to your fields, based on what is available and economical. Keep records on what you apply so that you can make educated changes to your applications if you see nutrient deficiencies in your crops. Here are the steps to follow, with details below:

1. Work from a soil test.
2. Find nutrient recommendations for your crop.
3. Calculate nitrogen credits.
    - Contributions from previous applications of organic amendments, like compost and manure
    - Cover crop nitrogen contributions
    - Soil organic matter contributions
    - Contributions from sod plowdown

4. Choose your fertilizer.
5. Calculate fertilizer needed to meet N needs.
6. Calculate how much P and K that fertilizer will add.
7. Calculate how much additional fertilizer you need to reach your other nutrient needs.

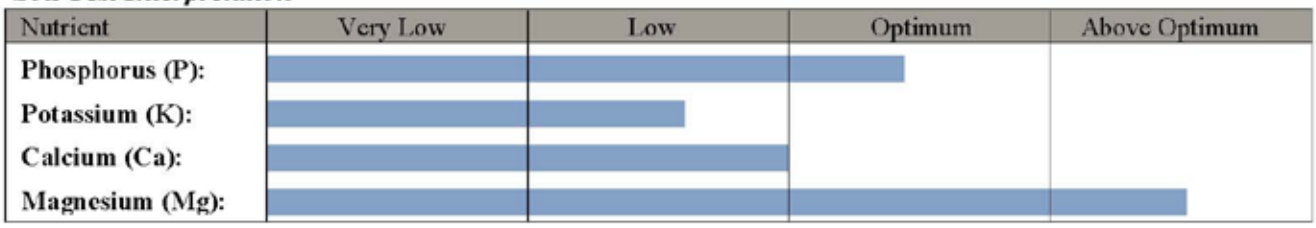
1. **Work from a soil test.** A typical soil test will report macro- and micronutrient levels and soil pH. Some labs will automatically report soil organic matter (SOM) levels, and at other labs (including the UMass Soil Lab) you need to specifically request for SOM to be tested for. On UMass Soil Lab test results, in addition to reporting the soil nutrient level and optimum range of each nutrient in parts per million, macronutrient (phosphorous, potassium, calcium, and magnesium) levels are reported as *very low, low, optimum, or above optimum*. Because nitrogen is so mobile and ephemeral in soils, nitrogen is not routinely tested for in soil tests, and instead, nitrogen applications are made solely based on crop need. To test plant available nitrate during the growing season, you can take a pre-sidedress nitrate test. PSNTs are not currently available from the UMass Soil Lab but are available from the UMaine (available nitrogen test) and Penn State soil labs. We recommend having your soil tested at one of the

Results

Analysis	*Value Found*	*Optimum Range*	*Analysis*	*Value Found*	*Optimum Range*
Soil pH (1:1, H2O)	5.7		**Cation Exch. Capacity, meq/100g**	10.6	
Modified Morgan extractable, ppm			**Exch. Acidity, meq/100g**	4.0	
Macronutrients			**Base Saturation, %**		
Phosphorus (P)	8.5	4-14	Calcium Base Saturation	47	50-80
Potassium (K)	80	100-160	Magnesium Base Saturation	13	10-30
Calcium (Ca)	1002	1000-1500	Potassium Base Saturation	2	2.0-7.0
Magnesium (Mg)	163	50-120	**Scoop Density, g/cc**	1.03	
Sulfur (S)	14.8	>10	**Optional tests**		
Micronutrients *			Soil Organic Matter (LOI), %	4.4	
Boron (B)	0.0	0.1-0.5			
Manganese (Mn)	2.5	1.1-6.3			
Zinc (Zn)	2.0	1.0-7.6			
Copper (Cu)	1.0	0.3-0.6			
Iron (Fe)	3.0	2.7-9.4			
Aluminum (Al)	59	<75			
Lead (Pb)	0.9	<22			

* *Micronutrient deficiencies rarely occur in New England soils; therefore, an Optimum Range has never been defined. Values provided represent the normal range found in soils and are for reference only.*

Soil Test Interpretation



New England state soil labs, as the tests run at these labs are specific to New England soils.

2. **Find nutrient recommendations for your crop.** If you indicated a crop on your soil test submission, you will receive nutrient application recommendations based on the crop need and the soil test results. For commercial vegetable growers, those recommendations will be in lbs/acre; for home gardeners, they will be lbs/100 sq. ft. If you indicate what crop you're growing on your soil test form, you'll receive nutrient recommendations for

that crop on your results. If you don't indicate a crop, you can easily look it up in the crop sections of the New England Vegetable Management Guide. In this example, we'll make a fertilizer plan for broccoli, so the nutrient

PLANT NUTRIENT RECOMMENDATION ACCORDING TO SOIL TEST RESULTS FOR CABBAGE, BROCCOLI, CAULIFLOWER, AND OTHER BRASSICA CROPS

CABBAGE, BROCCOLI, CAULIFLOWER AND OTHER BRASSICA CROPS	NITROGEN (N)* LBS PER ACRE (N)	PHOSPHORUS (P) LBS P_2O_5 PER ACRE (P)				POTASSIUM (K) LBS K_2O PER ACRE (K)			
SOIL TEST RESULTS		VERY LOW	LOW	OPTIMUM	ABOVE OPTIMUM	VERY LOW	LOW	OPTIMUM	ABOVE OPTIMUM
Broadcast and Incorporate	100	150	100	50	0	175	125	50	0
Sidedress 4 weeks after transplant	60*	0	0	0	0	0	0	0	0
TOTAL RECOMMENDED	**160**	**150**	**100**	**50**	**0**	**175**	**125**	**50**	**0**

*CAULIFLOWER APPLY 30 LBS/A

recommendations will be from the Cabbage, Broccoli, Cauliflower, and other Brassica Crops section.

For most crops, these tables are split between up-front application (broadcast and incorporate) and sidedressing a certain number of weeks after seeding or transplanting. All of the P and K that a crop needs can be put down up front, before planting, as P and K will stay in the soil and remain available for when the crop needs them. Depending on the N source, N applications can be split between pre-plant and sidedressing. Inorganic forms of N (e.g. urea) will leach quickly from soil, so any N you put down pre-plant that your crop doesn't take up relatively quickly will leach out, along with the money you spent on it! Organic forms of N are released slowly by microbial activity throughout the season, so if you are using an organic form of N, you can apply all N up front, along with P and K.

Broccoli N recommendations are 100 lbs/A pre-plant and 60 lbs/A four weeks after transplant (circled in yellow). We'll do our calculations using Kreher's 5-4-3 chicken manure, which is an organic amendment that will release N slowly, so we will apply the full 160 lbs/A up front.

P and K recommendations are based on your soil test recommendations. In our example soil test, our P levels are optimum, so the recommendation is to add 50 lbs P/A (circled in red). New England state soil tests are based on a "build and maintain" model, which recommends you add nutrients even when the level in the soil is optimum, so that soil reserves are not depleted. In our example, K levels are low, so we should add 125 lbs K/A (circled in blue).

Table 1. Nutrient credit calculations.

Recommendation	N 160 lbs/A	P 50 lbs/A	K 125 lbs/A
Credits			
Manure	-	-	-
Compost	-	-	-
Cover crop	10	-	-
Soil organic matter	45	-	-
Sod	-	-	-
Total credits	55		
Nutrients needed	105	55	125

Table developed by Becky Maden, UVM Extension

3. **Calculate nitrogen credits.** Manure, compost, some cover crops, soil organic matter, and sod all contain N that can be credited towards your total N needs for the season. The recommendation entered at the top of Table 1 is the preplant nutrient recommendation from step 2, and the following paragraphs will explain how the credits are calculated:

Manure and compost: Like soil, manures and composts can be analyzed by a soil testing lab to determine the nutrient content, pH, C:N ratio, and other important characteristics. Compost and manure analysis is available through the Penn State and UMaine soil testing labs. If testing your organic amendment is not possible, approximations can be found in Table 2 at the end of this article.

Cover crops: When a cover crop is tilled in, N stored in the leaves and roots is released and much of it will be available for your summer and fall crops. The maximum amount of N is released 4-6 weeks after incorporation. In the spring, the soil doesn't warm up fast enough for the microbes to release the N before the main crop needs

it, so don't include N credits for early spring crops. Sod also contributes some N when it's plowed under to start production in a new field. Below is a table with some estimations of N contributions from certain cover crops. These numbers can vary widely, based on the quality of the cover crop stand and time of incorporation. If you're interested in learning more, the SARE publication Managing Cover Crops Profitably is a great resource.

Soil organic matter: Soil organic matter (SOM) contains N that becomes available for plant uptake slowly throughout the season as it is released through microbial activity. The general rule of thumb in MA is: **credit yourself 10-20 lbs/A of plant-available N per 1% SOM, capped at 4% or 40 lbs/A.** The amount of N released from SOM increases with soil temperature, so numbers may vary between New England states.

Example credits, entered into Table 1 on previous page:

- Buckwheat cover crop: 10 lbs N/A (see Table 3, below)
- Soil organic matter: Our example field has 4.4% SOM, but the SOM credit is maxed out at 4%. Also, knowing that this field is relatively slow to warm up in the spring, we won't credit ourselves at the full 20 lb/A rate.

$$4\%\ SOM \times \frac{15\ lbs/A\ \ nitrogen}{1\%\ SOM} = 45\ lbs/A\ nitrogen$$

Table 2. Nitrogen Credits from Manure Applied Before Planting

Type of manure	Dry Matter	Total N	NH_4-N	Organic N	P_2O_5	K_2O
		---------- lbs/1,000 gallons ----------				
Dairy, liquid	<5%	12-16	4.9	7.3	4.8	15.1
Dairy, slurry	5%-10%	22.3	7.6	14.7	8.9	22.0
		---------- lbs/ton ----------				
Dairy, semi-solid	10%-20%	8.5	1.8	6.7	4.1	6.1
Dairy, solid	>20%	5-12	1.4	10.9	8.1	10.0
Beef (paved lot)	29%	14	5	9	9	13
Swine (hoop barn)	40%	26	6	20	15	18
Sheep	25%	23	n/a	n/a	8	20
Poultry, layer	41%	16-37	18	19	55	32
Poultry, broiler	69%	75	15	60	27	33
Horse	20%	12	n/a	n/a	5	9
Source: New England Vegetable Management Guide						

Table 3. Nitrogen contributions from select cover crops.

Cover Crop	Lbs N per acre
Rye*	25
Oat, Leonard*	10
Hairy vetch, spring incorp.	40-70
Hairy vetch, mid-summer incorp.	90-200
Red clover, spring incorp.	40-70
Red clover, mid-summer incorp.	70-150
Alsike clover	90
Sweetclover	90-170
Sudangrass	25
Field Peas	90-150
Buckwheat	10
Berseem clover	75-220
Sod	20-40
*young rye/oats only. As rye matures, C:N ratio increases and the N release rate becomes neutral. Mature rye/oats can tie up N.	
Compiled by Becky Maden, UVM Extension	

After subtracting our nitrogen credits from our total nitrogen needs, we now need to apply only 105 lbs N/A.

4. **Choose your fertilizer.** This choice can be made based on many different factors, including:
   - What fertilizer you already have on hand
   - Price
   - Application equipment (some materials are easier to spread with certain types of spreaders)
   - Availability of materials from local distributers
   - What materials meet your nutrient needs most closely

   We'll use Kreher's 5-4-3 chicken mnaure for this example.

5. **Calculate how much fertilizer you need to apply to meet your pre-plant N needs.**

   We need to apply 105 lbs/A N (from Table 1) and our fertilizer is 5% N: $\frac{105\ lbs/A\ nitrogen}{0.05} = 2,100\ lbs/A$ **5-4-3**

6. **Calculate how much P and K that amount of fertilizer will add.**

   Kreher's 5-4-3 is 4% P and 3% K.

   2,100 lbs/A of 5-4-3 $\times 0.04 = 84$ lbs P/A
   $\times 0.03 = 63\ lbs\ K/A$

   Total P needed (from Table 1) = 50 lbs/A. Our application of 5-4-3 will apply 84 lbs/A of P, so we don't need to apply additional P.

   Total K needed (from table 1b) = 125 lbs/A.

   125 lbs/A – 63 lbs/A = **62 lbs/A K**

   Our application of 5-4-3 will apply 63 lbs/A of K, so we need to put down an additional 62 lbs/A to reach our total K need.

7. **Calculate how much additional fertilizer you need to reach your other nutrient needs.**

   We'll use potash (0-0-50) to meet our remaining K needs.

   $$\frac{62\ lbs/A\ K}{0.5} = \mathbf{124\ lbs/A\ potash}$$

Now we have application rates for both of our fertilizers:

- 2,100 lbs/A Krehers 5-4-3
- 125 lbs/A potash

And you're ready to brew a big pot of coffee and do the same math for your remaining fields and crops!

--Written by G. Higgins, UMass Vegetable Program, with many thanks to Becky Maden, UVM Extension

BE ON THE LOOKOUT FOR SPRING MAGGOT PESTS

There are three maggot fly pests that are active on Massachusetts vegetable farms in early spring: seed corn maggot, cabbage root maggot, and onion maggot. The emergence of adult flies from pupae that overwintered in the soil can be predicted using growing degree days (GDDs)[1] with a base temperature of 40°F. The base temperature for monitoring the emergence of maggot flies is lower than the base temperature for many other vegetable pests because they are active at fairly cool temperatures early in the spring. These three maggot fly pests emerge and reach peak flight at different times throughout the spring (Table 1) and infest different crops. Seed corn maggot reaches peak flight earliest in the spring and has a host range of over 30 crops (including alliums and brassicas). This maggot is a common reason for poor germination of peas or small plantings of sweet corn. Cabbage and onion maggots are host-specific, attacking brassicas and alliums, respectively.

Seed corn, cabbage, and onion maggots share many characteristics. There are three to four generations of each of these pests per year. They prefer cooler temperatures, so damage from the spring and fall generations is typically worse than the mid-summer generation(s). All three maggot flies emerge from pupae that overwintered in fields where a host crop was located the previous fall. Adults emerge from the soil, mate, and then search for a host plant. Eggs are laid at the bases of host plants or on emerging seedlings. The resulting larvae will feed on host roots, causing the plants to collapse, or, in the case of seed corn maggot, kill seedlings before they emerge. All three flies are attracted to decomposing organic matter, and infestations can be worse in manured, cover-cropped, or composted fields where organic matter is still breaking down. Several consecutive days of soil temperatures above 95°F can kill the larvae. All three maggot fly adults are similar in ap-

[1]Growing degrees days (GDD) are the number of degrees that the average daily temperature exceeds a base temperature at which a particular organism is dormant. GDD = $((T_{max} + T_{min})/2) - T_{base}$
If the average temperature for a day is lower than the base temperature, then no GDD accumulate.
GDD accumulate daily, starting on a specific date, by adding each day's total GDD to the previous tally.

pearance (small, gray, humpbacked, housefly-like) and size (5-7mm long).

Preventive measures are generally most effective for managing these pests as chemical treatment options are limited. These may include using floating row covers or insect netting to protect plants from egg-laying adults, delaying planting susceptible crops until the first emergence has largely passed, or waiting to plant until soil temperatures are high enough to kill larvae. Most labeled pesticides for maggots are labeled only for use pre-plant, at the time of planting or seeding, or immediately after setting transplants. Use pre- or at-plant treatments where damaging populations are expected, such as in

Table 1. Maggot Comparative Table

	Seed Corn Maggot	Cabbage Root Maggot	Onion Maggot
Host	40 different plants, large germinating seeds, seedlings (including allium and brassica)	Brassicas	Alliums
First emergence	< 360 GDD base 40°F	~ 288 GDD base 40°F	~ 390 GDD base 40°F
First peak flight (50% emergence)	360 GDD base 40°F	452 GDD base 40°F	735 GDD base 40°F
Adult	Small: ~ 3mm, 3 stripes on the thorax	Medium: ~5mm, 2 stripes on the thorax.	Large: ~6mm.
Eggs	Hatch in 2-4 days	Hatch in 7-10 days	Hatch in 2-5 days
Larvae (maggot)	Active for 3 weeks	Active for 2-4 weeks	Active for 2-3 weeks
Pupae	In soil for 1-2 weeks before next gen adults emerge (last gen pupae overwinter)	In soil for 2-3 weeks before next gen adults emerge (last gen pupae overwinter)	In soil for 3-4 weeks before next gen adults emerge (last gen pupae overwinter)
Notes	Short, 21-day lifecycle. 3 gen per year. Usually only spring gen is damaging.	Long, 60-day lifecycle. 4 gen per year. Spring and Fall gen most damaging.	Medium, 30-day lifecycle. 3 gen per year. Usually only spring gen is damaging.

fields with high organic matter or a history of infestations. Scouting for adults and eggs can help you understand infestation levels and inform management decisions in future plantings.

Below is more information about each maggot pest, including additional scouting and management recommendations.

Seed corn maggot (*Delia platura*): Seed corn maggot adults have likely begun emerging in many fields in Massachusetts where they will lay eggs on the soil surface. Hatching larvae will burrow into the soil in search of food and penetrate seeds as the seed coat splits open. Where possible, delay planting for several weeks in the spring after a cover crop is incorporated to allow for organic matter to break down. Warmer soils with more decomposed organic matter will mean fewer problems with seed corn maggot. Floating row cover is not as effective in managing seed corn maggot because this pest has many hosts and could have overwintered in virtually any field on your farm. If you cover plants in an infested field, the adults will emerge under the row cover. Organic fertilizers containing seed meals can attract this pest. Other pests and diseases, including wireworms and damping off, can also prevent seedlings from emerging, so check for maggots and feeding tunnels inside seeds or stems to confirm what pest you're dealing with. Plant shallowly to promote rapid seed emergence. Among bean varieties, those with a dark seed coat sustain less injury than white varieties. Preventive chemical treatments include commercially applied systemic seed treatments and in-furrow applications of insecticides. Rescue treatments are not effective. If there is enough damage to warrant replanting, wait at least 5 days if maggots are a quarter inch long; if they are smaller than that, wait at least 10 days to make sure they have pupated and will not damage the new seeds.

Cabbage maggot (*Delia radicum*): Cabbage maggot flies are either nearing or just past first emergence across the state depending on the accumulated GDDs in your area. If using row cover, now is the time to make sure it's in place to pro-

tect vulnerable brassica crops from egg-laying adults. Row covers can be very effective in the spring against this pest as long as crops are rotated into fields without a history of recent infestation since, as with seed corn maggot, if there are pupae in the soil from the previous season the adults will emerge under the row covers.

Yellow rocket blooming coincides with the first CRM peak flight. Photo: UMass Veg Program

A good indicator of the first cabbage maggot peak flight is blooming of the common roadside weed yellow rocket or wintercress (*Barbarea vulgaris*). There can be up to 4 generations of cabbage maggot per year. There is a model for tracking the emergence of cabbage maggot on the Network for Environmental and Weather Applications (NEWA) website: NEWA Cabbage Maggot Model. On the left-hand side of the page, choose a weather station that is close to you. After egg-hatch in an infested crop, upon inspection of the root area you may find the legless, white maggots feeding; the small brown, oblong pupae; or tunnels from maggot feeding. In brassica root crops such as turnips, radishes, and rutabaga, maggot feeding tunnels make the crop unmarketable. When GDDs indicate peak flight, or when adult flies are found on sticky cards placed in the field, begin scouting every 3-5 days. A pencil point or knife helps stir the soil to look for eggs. Field scout by checking 25 plants, in groups of 2-5 plants, scattered around the field. Eggs may be more abundant in wetter areas of the field. There are no chemical treatment options at this stage, but again, scouting will help you determine the extent of infestations and whether an at-plant treatment should be applied in subsequent plantings.

Cabbage root maggot adult (left) and eggs at the base of a brassica plant (right). Eggs are white, ⅛ inch-long, and look like tiny grains of rice. Photos: UMass Vegetable Program

There are more pesticide options for control of cabbage maggot than the other maggot pests. Available products can be found in the New England Vegetable Management Guide. Apply a soil drench 2 to 3 days after finding an average of one egg per plant. Coragen (chlorantraniliprole) or Verimark (cyantraniliprole) may be applied at planting, and Radiant (spinetoram) or Entrust (spinosad) may be applied at planting and in up to two additional applications. Other management tips include:

Tunneling in hakurei turnip and stunting and discoloration in cabbage, both caused by cabbage root maggot damage. Photos: UMass Vegetable Program

- Delay planting until after first flight is done (usually mid-May, depending on GDDs) or when soil temperatures are high enough to kill eggs (95°F). Planting in late-May into June is generally safer than in the first half of May.
- Cultivate vigorous brassica crops so that soil is brought up around the stem to encourage adventitious root formation. This can help compensate for root loss even if maggots are present.
- Natural enemies: soil-dwelling beetles, including carabid ground beetles and staphylinid beetles, feed on cabbage maggot eggs, larvae, and pupae and can cause high levels of mortality. One staphylinid species, *Aleochara bilineata*, also parasitizes maggot larvae and has been shown to respond to chemicals given off by plants that suffer maggot damage. Because these soil-inhabiting beetles are susceptible to insecticides, broadcast soil insecticide treatments should be avoided. Other natural enemies include parasitic wasps and predatory mites.

- Nematodes for biological control: s. Soil application of the entomopathogenic nematode *Steinernema feltiae* has shown efficacy against cabbage maggot in trials even at low soil temperatures (50°F/10°C). Apply by suspending juvenile nematodes in water and treating transplants prior to setting in the field (as a spray or soaking drench), or in transplant water used in a water wheel transplanter, or a combination of pre-plant and post-plant applications. Post-plant treatments are likely necessary if maggot flight begins >1 week after transplanting. Rates of 100,000 to 125,000 infective juveniles per transplant have been shown to be needed to achieve reduction in damage. Nematodes need a moist soil environment to survive.

Onion Maggot (*Delia antiqua*): This pest begins its flight when cabbage maggots are at peak flight; yellow rocket bloom is an indicator of the beginning of onion maggot flight. NEWA also has a pest forecast model for onion maggot emergence: NEW Onion Maggot Model. Delaying planting is not a practical method of avoiding this pest because onions are typically planted very early in the spring and are in the ground about a month before the onion maggot becomes a problem. In onions, newly hatched larvae crawl behind the leaf sheath, enter the bulb, and feed on the roots, stem, and developing bulb. Feeding damage also allows for entry of soft rot pathogens. Some tips specific to managing onion maggot include:

- Minimize mechanical and chemical damage to onions throughout the season. Onion root systems are not as hardy as brassicas, so hilling them will not encourage more root production or recovery from root feeding. Hilling leeks can be a recommended practice for developing longer stalks though.
- Gather culled bulbs into deep piles as opposed to deep plowing or harrowing after harvest. This will limit fly reproduction to the surface layers of the cull pile.
- Naturally-occurring fungal diseases occasionally will reduce onion maggot numbers, particularly when flies are abundant and relative humidity is high. During a fungal epidemic, dead flies can be seen clinging to the highest parts of plants along field edges.
- As with cabbage maggot, predaceous ground beetles and entomopathogenic nematodes may help reduce maggot numbers. Avoid broadcast insecticide treatments to protect beneficial insects and follow nematode applications recommendations above.
- See the New England Vegetable Management Guide for pesticide options.

--UMass Vegetable Program

News

Northeast SARE Seeks Graduate Student Grant Proposals

The Graduate Student Research Grant program program funds graduate student research focused on sustainable agriculture using either or both natural and social science approaches. Proposals are capped at $15,000 and should address issues of current or potential importance to Northeast farmers and the agricultural community. Proposals are **due online by 5 p.m. ET on April 27**. Learn more about Northeast SARE's Graduate Student Research Grant program here.

This webinar, recorded on March 2, 2021, reviews the Northeast SARE Partnership Grant Program.

State Restricted Use status for some neonicotinoid products

Beginning July 1, 2022 certain outdoor uses of neonicotinoids in Massachusetts will be classified as State Restricted Use (in addition to those that already were, such as dinotefuran), per a recent decision by the Massachusetts Pesticide Board subcommittee. This will impact primarily the turf and ornamental uses of these materials, but leave agriculture-only use products available as general use. A Massachusetts pesticide license would be required to use the affected products. However, farmers would not need a license to purchase or use products UNLESS the product they were using had dual-use language. For example, If a product had agricultural uses and ornamental uses, the product would be State Restricted Use and a farmer would need a license. For more information, see the slides prepared by UMass Extension Entomologist, Tawny Simisky or contact Taryn LaScola-Miner, Director of MDAR's Crop and Pest Services Division (taryn.lascola@state.ma.us).

Open Application Period for MDAR Grants

MDAR is now accepting applications from agricultural operations who wish to participate in the Department's grant programs. Grants are available to help agricultural operations make farm improvements that enhance their economic viability, help prevent negative impacts to environmental resource, adapt and mitigate climate change, improve energy efficiency, adopt renewable energy, and improve on-farm composting. Interested farm operators are encouraged to review the information and applications on each program's webpage. If interested in applying, applications must be submitted with any supporting documentation by the program's deadline. Applications are being accepted for the following programs, click on each link for application and contact information:

- Climate Smart Agriculture Program (CSAP) – Application due: 4:00PM on Friday, June 11, 2021
- APR Improvement Program (AIP) – Application due: 4:00PM on Thursday, April 29, 2021
- Farm Viability Enhancement Program (FVEP) – Application due: 4:00PM on Thursday, April 29, 2021
- Matching Enterprise Grants Program (MEGA) – Application due: 4:00PM on Thursday, April 29, 2021
- Ag Composting Improvement Program (ACIP) – Application due: 4:00PM on Tuesday, June 1, 2021.

Federal Assistance Extended for Vegetable & Fruit Producers

Two Federal programs, the Coronavirus Food Assistance Program 2 (CFAP 2) and the Paycheck Protection Program (PPP), which can provide financial assistance to vegetable and fruit producers, recently announced the reopening/extension of signup periods. This is an excellent opportunity for producers who did not sign up initially for either or both programs!

Coronavirus Food Assistance Program 2 (CFAP 2)

Signup reopened on April 5 and will continue for at least an additional 60 days (actual signup deadline is yet to be determined) for the second round of Coronavirus Food Assistance Program payments (CFAP 2) at the USDA Farm Service Agency (FSA). The purpose of CFAP 2 is to provide financial assistance to producers who faced market disruptions and incurred increased costs because of COVID-19.

CFAP 2 uses 2019 calendar year sales of eligible vegetable and fruit crops as the basis for payments. Crops purchased for resale are ineligible for CFAP 2. Value-added or processed crops (such as apple cider) are eligible but applicants will have to determine the value of the commodity prior to processing and use that figure rather than the sales of the value added or processed commodity. Eligible crops sold through CSA's may be eligible provided they meet the FSA requirements for eligible CSA's.

More detailed information can be found at: https://www.farmers.gov/cfap

Producers are encouraged to contact the FSA Office that serves their farming operation with questions they have along with procedures to file an application and related paperwork.

Producers should call their FSA Office before visiting the FSA Office since FSA may have restrictions in place for in-person office visits. Sales records are not be required at the time of signup but producers will have to provide evidence of total sales if the application is selected for a later spot-check.

Bottom Line: If you grew and marketed an eligible crop, you likely are eligible for a CFAP 2 payment!

Paycheck Protection Program (PPP)

The U.S. Small Business Administration (SBA) announced on March 30, 2021, that signup for PPP has been extended to **May 31, 2021**. We strongly encourage producers who have not taken advantage of the PPP to take a close look at the PPP, which can provide financial assistance to vegetable and fruit operations. We have found that many agricultural operations don't believe they are eligible for PPP benefits since the PPP is not administered by USDA, however agricultural operations are eligible!

PPP provides loans to help businesses (including agricultural operations) keep their workforce employed during the Coronavirus (COVID-19) crisis. PPP is offered by the U. S. Small Business Administration (SBA) with applications processed by approved local lenders. A key component of the PPP is that the entire loan (or a portion of the loan) may be forgiven provided certain criteria are met! We believe that the PPP has been an under-publicized/under-utilized program in the agricultural community and encourage all types of agricultural operations to take a

closer look at the PPP.

Further details can be found at the SBA website: https://www.sba.gov/funding-programs/loans/covid-19-relief-options/paycheck-protection-program.

Our program at UMass Extension conducted a Zoom meeting on the PPP back on February 23 to go over the general provisions of the PPP. To view the presentation (which begins at the 2:30 mark), click here.

USDA Announces Funding to Assist Socially Disadvantaged Farmers And Ranchers

The U.S. Department of Agriculture (USDA) Farm Service Agency (FSA) announced the availability of $2 million to establish partnerships with organizations to provide outreach and technical assistance to socially disadvantaged farmers and ranchers. The funding was made possible by USDA's new Pandemic Assistance for Producers initiative, an effort to distribute resources more broadly and to put greater emphasis on outreach to small and socially disadvantaged producers impacted by the pandemic.

Events

Need pesticide recertification credits? All of the New England states have reciprocity in regards to recertification credits and NY credits are also accepted by most New England states, including MA. Check with your state pesticide board wth questions about NY credits in your state. This means that credits offered at virtual events hosted by these other states will be recognized by MDAR and will count towards your total recertification requirement. We will continue to send out relevant events, UMass Vegetable Program events can also be found on our Upcoming Events page, and links to event listings from other New England state Extension can be found in the November 2020 issue of Veg Notes.

Soil Moisture Monitoring and Using Sensors for Irrigating; Mr. Jeremy Delisle, UNH Extension

When: Monday, April 26 from 6 to 7:30 pm

This is the third and final installment of the New Hampshire Giant Pumpkin Growers' Association (NHGPGA) and UNH Cooperative Extension's joint "Zoom Webinar Series." Jeremy Delisle, UNH CE Field Specialist has been working with commercial farmers on using water sensors devices in determining when to irrigate fruit and vegetable crops. Jeremy will be discussing how these devices work and how to use them in the giant pumpkin patch.

Free, register here: https://unh.az1.qualtrics.com/jfe/form/SV_3WzAvgpabUyzjZI

Benchmarking for Farm Business Success!

When: Wednesday, May 5 from 11 am to noon

UConn Extension is hosting Chris Laughton, Director of Knowledge Exchange at Farm Credit East to discuss business benchmarking and its potential value for your agricultural enterprise. Chris will cover a number of topics related to benchmarking, including:

- What is benchmarking anyway?
- Why should I use benchmarks in my farm management?
- How can they help me improve my profitability?
- Where can I find benchmark data? And how can I use it?
- What should I consider next?

To register, email Mackenzie White for the WebEx link: Mackenzie.white@uconn.edu

New England Vegetable and Fruit Conference Postponed to December 2022

We have made the difficult decision not to hold an in-person New England Vegetable and Fruit Conference this coming December, due to the ongoing COVID-19 pandemic. Instead, we will hold an in-person meeting when we feel more confident that we can do so safely and cost-effectively, and have reserved dates for December 13-15th, 2022 to gather again in Manchester for a full Conference and Trade Show. While we would all prefer to be in person this year, we

feel it is unwise to take on the financial risk of attempting an in-person meeting that may not be well-attended due to COVID-19 safety limitations and travel restrictions.

In the meantime, we will plan a simple online conference for this coming December 13-17th, 2021, in order to provide education, professional development, and pesticide credits to growers and service providers across New England and New York. We are hopeful that this coordinated regional effort will be a fun, effective, and safe way to keep up to date with the latest and greatest vegetable and fruit news! Stay tuned for details as we develop our plan for the December 2021 meeting by checking our conference website or by following us on Facebook, and Twitter.

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