



UMASS  
EXTENSION



# Vegetable Notes

For Vegetable Farmers in Massachusetts

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## **BRASSICA BIOFUMIGATION FOR MANAGING *PHYTOPHTHORA CAPSICI***

*Phytophthora capsici* can be an enormous problem in cucurbit crops and peppers. The disease is persistent in the soil, there is no chemical treatment program that has proven to provide reliable cost-effective control, and losses can be devastating. Employing strategies to mitigate the impact of this disease is critical for growers who have infested fields.

One such strategy that shows promise is bio-fumigation with certain species of Brassicas. Mustard and other plants with biofumigant activity have been found effective for Phytophthora blight through research conducted at Long Island Horticultural Research & Extension Center in 2008 and 2009. Caliente 199 mustard (available from Siegers Seed) was grown during spring prior to a cucurbit crop.

Fertilizer (100 lb/A N) was applied to obtain adequate growth. This

variety was selected because it has a high concentration of glucosinolates, which breakdown as the plant decomposes into allyl isothiocyanate, which is similar to methyl isothiocyanate, the active ingredient in the chemical fumigant Metam Sodium. It is important to note that the concentration of these chemicals can be variable, so choosing a Brassica variety that is bred for consistently high concentrations (such as Caliente 199) is important.

In the Long Island trial, Caliente 199 mustard was allowed to grow for several weeks after the start of flowering, when plants were about 5-ft tall, then was flail chopped and immediately incorporated by rototilling, then the soil surface was sealed by rolling with a cultipacker, followed by irrigation. When done early in the morning and quickly, loss of biofumigant through volatilization is minimized. Zucchini was direct seeded on 23 Jul into the strip where the mustard was incorporated and an adjacent strip that had been fallow during the spring. Crop plants and weeds that grew where the mustard was incorporated were stunted relative to the fallow strip, indicating that planting was done too soon after mustard incorporation; however, the soil surface was not disturbed, such as by scratching before seeding, which would have helped release remaining biofumigant. On 15 Aug symptoms of Phytophthora blight were observed on almost all plants in the non-fumigated strip whereas only end plants were affected in the biofumigated strip. The effectiveness of this technique may be dependent on soil type and characteristics, and more research is underway to determine the best use scenarios. Zucchini plants were not stunted in a second seeding done 4 weeks after biofumigation.

Brassica biofumigants need to be seeded as early as the soil can be worked in the spring, to give time for growth before incorporation and planting. Suggested seeding rate for Caliente is 10 lb per acre. In addition to the Caliente 199 product from Siegers, seed blends of mustards for biofumigation can be purchased from High Performance Seeds (Dale Geis, 509-750-4850).

If you're interested in experimenting with this system on your own farm with support from UMass Extension, please contact Andy Cavanagh at 413-658-4925 or [acavanagh@psis.umass.edu](mailto:acavanagh@psis.umass.edu). We have a limited amount of seed to offer to growers who are willing to work with us in experimenting with this system on their farms.

## **TRANSPLANT HEIGHT & HARDENING OFF**

At this time of year growers are anticipating planting vegetable transplants in the field. Greenhouse and outside weather factors can contribute to transplant growth and quality, and when plants can get out into the field. Transplants may be at the perfect growth stage to plant into the field, but if reoccurring rains prevent field preparation or the ability to get into a prepared field to plant then transplants need to be held. Holding back plants and preventing them from getting too tall can be a challenge. In some crops plant growth regulators can be used. However, in vegetable crops there are few growth regulators labeled or that work well, and in some cases these products may continue to restrict growth in the field.

Perhaps a safer way to control height is using the DIF method (the difference between day and night temperatures in the greenhouse). In most greenhouse heating programs the greenhouse will be much hotter in the day than in the night. The greater this difference the more the plants will stretch and grow tall. By reducing this temperature difference or even by reversing it to have higher night temperatures you can greatly reduce stem elongation. The critical time period is the first 2-3 hours after sunrise. By lowering temperatures to ~55 degrees Fahrenheit for the first 2-3 hours of daylight, starting just before dawn and then going back to 60-70 degrees Fahrenheit for the rest of the day can keep plants shorter and stockier. This method does not work well for all transplants and is mainly for controlling height in tomato transplants.

Another method is mechanical movement of plants by brushing them over the tops two times a day with a pipe or wand made of a soft or smooth material. Be careful to gently do this so not to damage softer plants like squash, cucumber and pepper. Reducing watering and fertilizer is also a method in controlling plant growth. However, be sure not to reduce water or fertilizer so much that it causes plant injury. Besides reducing growth, limiting watering and fertilizer just before planting is part of the hardening off process.

When hardening off vine crops, tomatoes, peppers, or eggplants, do not lower the temperatures for hardening more than 5 degrees Fahrenheit below the recommended minimum growing temperature. Tomato, pepper, broccoli, cabbage and cauliflower are best hardened off at temperatures around 60 degrees Fahrenheit. Cucumber, squash, melon, and eggplant are best hardened off at around 65 degrees Fahrenheit. Cold tolerating transplants like lettuce can be hardened off at temperatures as low as 40 degrees Fahrenheit. Even though cole crops like broccoli and cauliflower survive cold temperatures, they should not be hardened right away to cold temperatures after leaving the greenhouse to prevent bolting and buttoning of the crop later during head formation.

*- Michelle Infante-Casella. Reprinted from Plant & Pest Advisory, a Rutgers Cooperative Extension Publication*

## **GROWER FRIENDLY WEATHER AND PEST RESOURCE FOR MASSACHUSETTS**

UMass Extension Vegetable and Fruit programs have recently joined the Network for Environment and Weather Applications (NEWA), a web-based weather and pest reporting and forecasting system. The NEWA website was developed by the New York State Integrated Pest Management program and relies on a network of on-the-ground weather monitoring stations. NEWA publishes forecasts and alerts for insect and disease pests of both fruits and vegetables.

Massachusetts has joined the NEWA network and has over twenty locations reporting to this network. Many of these are located at airports and report hourly temperatures, daily max and min temperatures, rainfall, relative humidity and hours > 90% RH, and windspeed. Others have been set up on vegetable and fruit farms around the state, reporting directly from the field to an onsite computer, then through the Internet to the NEWA website. These also report leaf wetness. So, from your own computer you can access the kind of weather data and pest forecasts that you need to help make management decisions on your farm.

From each weather station, hourly data are run through models that describe or predict key pest events – such as when an insect pest will become active or when a disease might develop. For example, the models for cabbage maggot tells us when flight can be expected, and the model for late blight of tomato and potato tells when the first outbreak might occur. NEWA also reports out the growing degree day (GDD) accumulation by day, month and season at various base temperatures; along with GDD models for pest flights.

This is a terrific resource for farmers, easy to navigate and updated daily. It's great to just pick a weather station and get degree days, a whole weather report for the previous month, or a forecast for a specific pest. There are a number of dif-

ferent ways to get to the information you're looking for on the NEWA website. We've described what we think are the simplest methods for common use cases:

To find the growing degree days accumulated at the weather station nearest your farm, go to <http://newa.cornell.edu/>, hover your cursor over 'Weather Data' on the menu along the top, and choose 'Degree Days' from the drop down menu. That will bring you to a page where you can select your nearest weather station (NOTE: Mass stations are grouped at the bottom of the list), your base temperature, the month and the year, and click 'Get Report'. Voila!

To find the forecasts for a specific pest or disease, go to <http://newa.cornell.edu/>, hover your cursor over 'Pest Forecasts' on the menu along the top, and choose whichever pest model you're interested in from the drop down menu. That will bring you to a page where you can select your nearest weather station (NOTE: Mass stations are grouped at the bottom of the list). Click 'Get Report' and it will bring you to the most current model report for your selected pest. For pests not listed on NEWA, a good resource for degree day information on vegetable and fruit insects can be found at University of Wisconsin Extension, <http://hort.uwex.edu/articles/degree-days-common-fruit-vegetable-insect-pests>. In Vegetable Notes this season we'll be putting out articles with specific information about how to use these models to inform your pest management programs as the season progresses.

## **CABBAGE AND ONION MAGGOT FLIES**

Onion maggot (*Delia antiqua*) and cabbage maggot (*Delia radicum*) flies look nearly identical but are likely to be found only on or near their host crop. Cabbage root maggot attacks on all types of Brassica crops, while onion maggots are highly specific for the *Alium* family including onions, garlic, leeks, chives, and shallots. A good indicator of the start of cabbage root maggot flight is blooming of the common roadside weed, yellow rocket. This weed typically blossoms in late April or the first week of May in western Massachusetts. First generation eggs are reported to be laid when the common lilac is in full bloom (source: Univ of WI). Onion maggot emerges slight later, while seedcorn maggot is active earlier (see table below).

**Life cycle.** Onion and cabbage maggot flies spend the winter as small brown pupae in the soil. Adults emerge in spring and adults can travel up to a mile in search of host plants. Cabbage root maggot flies are rather delicate, hump-backed gray-brown flies, about 5-7 mm long. Onion maggot flies are very similar. Female flies seek out their host crop to lay eggs at the base of the stem. Cool, moist soil conditions favor survival of the eggs, and soil temperatures over 95 F kill them. When the soil temperatures in the upper ½ to 1 inch are high (>100 degrees F) that soil temperature itself then reduces maggot damage by killing eggs.

When eggs hatch, larvae feed on roots and can cause complete destruction of the root system. In crops such as broccoli or cauliflower the first sign of a problem is wilting of the plant on sunny days and yellowing or purpling of outer leaves. Later, plants collapse, wilt down, and die. If you pull one up you will see that the reason it is wilting is the roots are gone. You may find the legless white maggots feeding, or the small brown, oblong pupae. In Brassica root crops such as turnips, radishes and daikon, feeding tunnels made by maggots make the root unmarketable. In onions, newly hatched larvae crawl behind the leaf sheath and enter the bulb, and feed on the roots, stem, and developing bulb. Feeding damage also encourages entry of soft rot pathogens.

**Avoiding damage by later planting.** The first flight and egg-laying period is generally most intense in the first half of May, depending on accumulated growing degree days – thus, it will vary with the season and location. After the first flight is over, and as soils heat up, fewer eggs are laid and those that are laid are less likely to survive. In the Connecticut Valley, we have observed in some years that Brassica transplants set out after May 15 did not suffer damaging infestations of cabbage maggots. In cooler areas of the state, scouting has sometimes found damaging levels into June. Each season will be



*Blooming yellow rocket is a good indicator of maggot fly flight*

different. It is impossible to name a consistent and reliable date after which it is safe to plant onions or cole crops, but late May into June will likely be safer than the first half of May.

**Monitoring.** Flies are attracted to bright yellow colors. Yellow sticky cards (3X5 inches) are inexpensive and easy to use; you can purchase small wire stakes made for this purpose, or clip to a wooden stake. Place near the soil. Check and change traps twice weekly to record changes in fly activity. Leaving them for a whole week usually results in a card and flies covered with blown soil, and is a less accurate measure of flight activity. (Trap sources: Great Lakes IPM, Gemplers). Yellow pan traps filled with water and a drop of soap also work.

**Using Growing Degree Days.** The beginning and peak of each fly generation can be identified using degree day accumulations. Most plants and insects have a base temperature of 50 F, but maggot flies are adapted to cooler temperatures, and are active at a lower base temperature of 40 F. Research by J. L. Jyoiti and A. M. Shelton has resulted in a model that describes what proportion of the overwintering fly population, on average, has emerged at certain cumulative GDD. The number that follows the (+/-) indicates how much the population tends to vary around that average. The following table indicates the cumulative GDD initial, partial and complete overwintering generation.

Growing Degree Day Cabbage Maggot Stages <i>(Model by: J.L. Jyoiti and A.M. Shelton)</i>	
Stage	Accumulated Degree Days
1st Emergence	161 +/- 8.1
25 percent	204 +/- 2.8
50 percent	251 +/- 7.9
75 percent	304 +/- 36.6
95 percent	387 +/- 7.7



*Maggot eggs at the base of a plant*

Comparison of peak flight of key maggot fly pests using seasonal degree day accumulation. Peak flight is when 50% of the population has emerged. Base temp. 40 deg F			
Generation	Seedcorn	Onion	Cabbage
1st Peak	200	700	250
2nd Peak	600	1960	1475
3rd Peak	1000	3240	2650

**Monitoring cabbage for eggs.** If you have transplants hardening off in a cold frame or outdoors, flies may find them and lay eggs in the flats. To check for eggs in the field or in flats, look for the 1/8-inch long, torpedo-shaped white eggs that are laid along the stem, or on the soil next to the stem of young transplants. Often eggs are laid in neat rows, or inserted into the soil. They may be under a small clod of dirt near the stem. A pencil point or knife helps stir the soil to look for them. A reliable field scouting method is to check 25 or more plants, in groups of 2-5 plants, scattered around the field. If you find an average of 1 egg/stem or more, it is likely to be a damaging population and a banded soil drench is recommended. Eggs may be more abundant in wetter areas of the field. Egg numbers may build up rapidly after the first eggs are seen.

**Soil Drench.** Target the seed furrow or the base of the plants after transplanting, and use at least 100 gallons of water per acre to help the insecticide penetrate to the root zone. Insecticide options are limited. Two organophosphate (Group B) insecticides, chlorpyrifos (eg Lorsban 4E, 75 WG, or 15G) and diazinon (Diazinon AG500) labeled for control of cabbage maggot fly in Brassicas (check label for specific crops allowed and other restrictions). They can be used as soil drench on direct seeded and transplanted crops, or a transplant drench for transplants. This material does not move readily in soil after the application is made, so it is important to provide adequate water so that the material penetrates several inches into the soil when it is applied. Under dry soil conditions, additional water may be needed to penetrate the soil.

One relatively new insecticide product is Ecotrol G. See the article on seedcorn maggot for details. See also the 2010-2011 New England Vegetable Management Guide (available online at [www.nevegetable.org](http://www.nevegetable.org)). If you make several plantings,

scout each planting (it takes about 15 minutes) 4-7 days after transplanting to determine if there is need for a soil drench.

**Floating row covers provide an effective barrier against this pest.** Place the cover as soon as the transplants are set. Use in a rotated field, as flies overwinter in soil after late season crucifers and could emerge under the cover if the same field has spring brassicas. Replace cover after weeding operations. As soil temperatures rise, the first flight ends and crops grow large, covers can be safely removed.

**Cultural practices and natural controls.** Crop rotation contributes to keeping populations low; greater distances are more effective. Fall tillage to bury crop residues and to expose over-wintering pupae is also important. For onions, bury or haul away onion cull piles. In vigorous Brassica crop, cultivation that brings soil up around the stem may help encourage formation of adventitious roots from the stem, which can help compensate for root loss even if maggots are present.

Naturally-occurring fungal diseases occasionally will reduce onion maggot numbers significantly, particularly when flies are abundant and relative humidity is high. During a fungal epidemic dead, diseased flies, can be seen clinging to the highest parts of plants along field edges. Predaceous ground beetles, which eat onion maggot eggs, larvae and pupae, can also be important in reducing maggot numbers. Because these soil-inhabiting beetles are susceptible to insecticides, broadcast soil insecticide treatments should be avoided whenever possible.

**Nematodes for biological control.** One alternative method that has shown promise but has not been widely field-tested is soil application of entomopathogenic nematodes, especially *Steinernema* spp. *Steinernema feltiae* has been found to be more effective compared to other *Steinernema* or *Heterorhabditis* species in attaching to and penetrating cabbage root maggot larvae at low temperatures (10C) which is an important trait for use in spring when soils are cold. Common application methods include suspension of nematodes (infective juveniles) in water and application of water to transplants prior to setting in the field (as a spray or soaking drench), in transplant water used in the water wheel transplanter, as a drench after transplanting, or a combination of pre-plant and post-plant applications. Rates of 100,000 to 125,000 infective juveniles per transplant have been shown to be needed to achieve reduction in damage.

--R Hazzard. References: *Network for Environment and Weather Applications (NEWA) of NYS IPM Program; Univ of Wisconsin Degree Day Calcuator (<http://www.soils.wisc.edu/asigServlets/asos/SelectDailyGridDD.jsp>); Ontario Ministry of Agriculture, Food and Rural Affairs online fact sheet ; University of Minnesota Veg Edge, Schroeder et al 1996, Journal of Economic Entomology 89:1109-1115; Chen et al, 2003, BioControl 48: 713-724; IPM Labs, Lockwood, NY.*

## **SEEDCORN MAGGOT AND WIREWORM IN SEEDS AND SEEDLINGS**

The emergence of maggot flies from the soil is one of the earliest pest events of the vegetable season. In the field if you find wilting, stunted plants or poor emergence and no clues of insect feeding or diseases on the above-ground parts, then dig up the plant and check for maggots and wireworms inside the seeds and stems. Cold soils can worsen the problem, delaying emergence of seedlings and allowing a longer period for direct feeding on seeds. The current wet and cold conditions may be hard on seeds and transplants, but are favorable for wireworms and maggot flies. Should warmer, drier weather arrive, the reverse will be true.

**Seed corn maggot** attacks seeds - especially larger seeds like corn, beans and peas – as well as seedlings of a wide variety of plants. The fly is nearly identical to cabbage and onion maggot flies, but it becomes active somewhat earlier in the season. Flies spend the winter as pupae in the soil and adults emerge in spring. Swarms of flies may be seen over freshly plowed fields. Female flies lay eggs on soil surface near sprouting or decaying seeds, organic plant residue, or organic soil amendments such as manure or seed meals. Eggs hatch in 2-9 days depending on temperature, and maggots burrow down to find food. The maggot is yellowish-white, legless, with a pointed head and is about ¼ inch long when fully grown. Damage may be to the seed itself or to roots, stems or cotyledons.

Maggot flies (including also cabbage and onion maggot) are well adapted for early season success! They have a ‘base temperature’ – that is, the threshold at which they become active -- of 40 degrees F. This is 10 degrees cooler than most insects and most plants. Degree days are calculated on a daily basis by using the formula: (Max temp – Min temp)/2 – 40F (or (Max temp – Min temp)/2 – 50F if 50 is the base temp). In Minnesota, research has shown that peak emergence of the first three generations occur when 200, 600 and 1000 degree days have accumulated.

**The wireworm** is slender, jointed, usually hard-shelled, with three pairs of legs, and tan brown in color. This is the immature stage of the click beetle, which deposit eggs on soil during May and June. Grasses, sod and sorghum-sudangrass are favorite egg-laying sites. Eggs hatch to become wireworms that feed below-ground on seeds, roots, tubers and other plant tissue. Wireworms feed for several years before pupating and emerging as adults. Thus, a wireworm problem in the spring probably means there was an attractive grass crop present sometime in the past 3-5 years. Wireworms also prefer wet soils and moderate temperatures; they migrate up to reach warmer soils, but down to avoid excessive cold, heat, or drought.



*Wireworm feeding damage on pea seeds*

**Organic matter to feed...maggots and wireworms.** Unfortunately, practices that enhance organic matter in the soil may actually worsen seedcorn maggot and wireworm problems. Lush, thick cover crop growth that is tilled under in spring attracts seedcorn maggot. Reduced tillage systems may also enhance these pests. Where possible, delay planting for 3-4 weeks after a cover crop is incorporated to give it time to break down and make it less attractive to the flies.

**Row Covers.** Row covers exclude maggot flies, but only if don't emerge from the soil right underneath the cover. Both pests overwinter in soil, especially where there is a lush cover crop, and they will seek out food and egg-laying sites as soon as they become active in spring. That includes your prized transplants!

**Replanting.** If you discover after planting that a field is infested with seedcorn maggot or wireworm, not much can be done to cure the problem except to wait until the maggots have past their active stage, then replant. If the maggots are not full grown (smaller than ¼ inch long), wait 10 days to replant; if they are full grown, it should be safe to replant after 5 days. If wireworms are found, wait to replant until soil temperatures are above 70 degrees F, which forces them deeper into the soil.

**Insecticides.** Soil insecticides for control of seedcorn maggot and wireworm are most effective when made prior to planting or laying plastic. Registered active ingredients include chlorpyrifos (eg, Lorsban 4E), phorate (Thimet 20-G), and clove + cinnamon + thyme oils (Ecotrol G) (OMRI listed). Thiamethoxam (Cruiser 5FS) is also labeled as a seed treatment and is available on commercial seed of some crops. See 2010 New England Vegetable Management Guide for specific crops. Using transplants generally avoids these pests EXCEPT where plants are set under row cover or in areas that are already heavily infested. Note that the Guide gives a single product for each crop & pest as an example, but products with the same active ingredient are available. For example, chlorpyrifos products include Govern\*, Lorsban\*, Nufos\*, Saurus\*, Warhawk\*, Whirlwind\* and Yuma\* (\*= restricted use insecticide).

Ecotrol G is a relatively new product that is allowed in certified organic production and is labeled for cutworms, wireworms, symphylans, and maggot flies on onion, Brassicas, cucurbits, carrots, parsnips, sweet corn and other vegetables. It contains a mixture of botanical oils (clove + cinnamon + thyme oil). The G formulation is a granular to be applied as a band or with seeds at or after planting at depths of 2 to 6 inches depending on the target pest. Note that this is NOT the same active ingredients as Ecotrol EC or Ecotrol, which contains rosemary and peppermint oil and is labeled for various foliar pests.

*--R. Hazzard; thanks to updates from Becky Sideman and Alan Eaton, UNH*

## **BIOLOGICAL CONTROL OF ECB WITH *TRICHOGRAMMA OSTRINIAE* IN SWEET CORN: BE READY FOR EARLY RELEASES!**

A tiny wasp – smaller than the dot at the end of a sentence – that will search out and kill the egg masses of one of our major sweet corn pest – can this really work? A number of sweet corn growers around the state have been testing *Trichogramma ostriniae* parasitic wasps and have found that they do help to control European corn borer (ECB) in both corn and peppers. The use of these wasps in commercial sweet corn fields in Massachusetts has resulted in the reduction or elimination of foliar insecticide sprays, saving time, labor, pesticides, and fuel, reducing soil compaction, and maintaining and improving ear quality. This method is an ideal IPM practice because it prevents the emergence and feeding of caterpillars in the first place, as opposed to rescuing the corn with sprays after the caterpillars have become a problem. Using *Trichogramma* to control ECB in early corn (corn to be harvested in July) is especially useful because timing sprays in the early corn can be tricky. Also, most of the caterpillar damage in early sweet corn is from ECB - thus, wasp release control

measures are not complicated by the need to control other major caterpillar pests. *Trichogramma* can also be used for second generation ECB, which attacks both peppers and corn. Even though corn earworm can become the major pest in late season corn, ECB also causes a lot of ear damage and corn is cleaner when ECB is controlled.

**Biology.** *Trichogramma* species are tiny parasitic wasps, smaller than the period at the end of this sentence. Female wasps lay their eggs in the egg masses of host insects. *Trichogramma* larvae feed and pupate inside the egg, killing the egg and preventing hatch. *Trichogramma ostriniae* lays its eggs in ECB egg masses. As they mature, unparasitized ECB egg masses turn from a cream color to white, to white with a black head mass in the center of each egg. When parasitized by *Trichogramma*, the entire egg turns black. *T. ostriniae* have excellent dispersal and ability to search for egg masses in the field. They do not overwinter but they will reproduce and contribute to the control of ECB throughout the season.

**Release timing.** While some native species of *Trichogramma* persist in the wild, *T. ostriniae* need to be reared at an insectary, shipped to the farm and released each season. Since *Trichogramma* control ECB by parasitizing egg masses, knowing when to release the wasps requires knowing when the ECB moths are laying eggs. Thus, knowing when ECB flight begins, reaches a peak, and ends in a given field is key to the proper timing of *Trichogramma* releases. You can use regional information about flight activity; however, to get the best coordination of timing on your farm, we recommend that you monitor ECB flight in your own fields.

ECB moths have two generations per growing season in Massachusetts; the first one emerges in late May or early June, while the second generation begins to emerge in late July and early August. Time the first release of *T. ostriniae* to the beginning of ECB egg laying, which will begin within a week after the first ECB moths are caught in traps. If the corn is less than 6 inches high, you may want to wait a few days. For corn maturing in the middle of moth flight, target releases to corn that is in the 4-6 leaf stage (12-16 inches tall). To help align the concentrated presence of *T. ostriniae* with ECB host egg laying we recommend three releases, each approximately 7 days apart. Our current recommended release rates in early corn are 60,000 wasps per acre per release.

Degree days (DD) can help with timing. Using a base temperature of 50 degrees F, the first spring moths will emerge at 375 DD50 (this coincides with the time when Bridal Wreath Spiraea is in full bloom), and the first eggs are laid at 450 DD50 (when Pagoda dogwood is in late bloom). Eggs require 100 degree days to hatch. Releases should be made when eggs are in the field, but before eggs hatch. Degree day information for many locations in MA can be obtained through the NEWA website (see related article).

**Handling *Trichogramma*.** *Trichogramma* are shipped from the insectary as pupae inside protective cards. They are ready to emerge upon arrival, although there will be a range of pupal age so they will emerge gradually, over 1-7 days, depending on temperature. It's best to put the cards out in the field the same day as they arrive. If you cannot release them upon their arrival, keep the cards in their shipping box in a cool location at about 50°F – not in the refrigerator! The insects are alive: avoid exposing them to extreme temperatures (below 40°F or above 90°F) so they will still be alive and in good shape when you put them in the field.

**Releasing *Trichogramma*.** Place the proper number of cards to provide the desired release rate in the center of the field, or at regular intervals through the field, away from the field edges. *Trichogramma* wasps will disperse well throughout the field - one to four release sites per acre is adequate. Tie cards securely to corn leaves or on a stake. Do not put them on the ground. Leave the packet stapled shut so that other insect predators do not consume them.

**Scouting release fields.** Where *Trichogramma* has been released, you can scout as usual. Eggs that were parasitized and did not hatch will never reach the larval stage, resulting in a lower rate of infestation with caterpillars. Use the standard ECB threshold (15% infestation in caterpillars or fresh damage) to decide whether to spray.

**Spraying release fields.** *T. ostriniae* will suppress ECB, but will not always provide complete control. In addition, an early corn earworm flight may arrive during silking. Thus, insecticide applications may still be needed to achieve high levels of clean corn. Use selective insecticides with low impact on natural enemies (aka beneficials). *Trichogramma* that are inside host eggs are somewhat protected from the spray and many will survive, but adult wasps may be killed by insecticides that are harsh on beneficial organisms.

**Ordering *Trichogramma*.** PLACE YOUR ORDER NOW! *Trichogramma ostriniae* may be ordered from IPM Laboratories in Locke, New York. PH: 315-497-2063 | FAX: 315-497-3129 | Email: [ipminfo@ipmlabs.com](mailto:ipminfo@ipmlabs.com) To ensure that you will be able to receive *Trichogramma* this year you must call IPM labs as soon as possible. When placing your order, have the number of acres you wish to release in and the size and number of plantings you have for early corn. For more

information about Sweet Corn IPM, see Using IPM In the Field: Sweet Corn Insect Management available online at: <http://www.umassvegetable.org>.

-Amanda Brown & Ruth Hazzard, Extension Vegetable Program, University of Massachusetts-Amherst

## **UPCOMING MEETINGS**

### **Mushroom Inoculation Workshop**

**Brook's Bend Farm, Montague MA**

**April 23 9am-5pm.**

Take home an inoculated log and grow you own shitake, oyster, and stropharia mushrooms! Register at [http://fingerlake-spermaculture.org/?page\\_id=467](http://fingerlake-spermaculture.org/?page_id=467) or by calling 607-527-0607.

### **High Tunnel Berry Production Workshop.**

**Manchester NH. Center of NH-Radisson hotel**

**April 26, 8:30 registration, program 9am-4pm**

Cost: \$30, includes lunch. 2 PAT credits. Program includes the following. Oline registration is encouraged. To register online, visit: [https://www.events.unh.edu/RegistrationForm.pm?event\\_id=8398](https://www.events.unh.edu/RegistrationForm.pm?event_id=8398)

### **Workshops for Beginning and Established Farmers presented by UMass Vegetable Program Extension Educators**

**Nuestras Raices Farm, 24 Jones Ferry Rd, Holyoke, MA**

**Weed Management - Rich Bonanno, UMass Extension Weed Management Educator.**

**April 30 2011, 10:00am-12:00pm**

Participants will learn to identify different types of weeds, plastic mulch application, flamer use, and other weed control techniques Saturday.

To register call Amy at 413-535-1789

**Insecticide Application and Pesticide Safety - Ruth Hazzard, UMass Extension Vegetable Production Educator.**

**May 14 2011, 10:00am-12:00pm**

Participants will learn how to identify damaging pests, and the basics and safety of choosing an insecticide for application.

To register call Amy at 413-535-1789

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