UMASS EXTENSION

Vegetable Notes

For Vegetable Farmers in Massachusetts

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Crop conditions

Growers have been working fields up in anticipation of this weekend's heavy rains, which might make them less accessible for a while. Late April and early May brought colder temperatures and frosts in some higher and northern areas. Nonetheless, early-planted corn is growing well, with corn under plastic reported to be over eight inches in the Connecticut Valley, and even bare ground corn up to 3-4 inches. Winds have been strong, strong enough to lift plastic off early corn – reburying plastic has been an unexpected spring chore this year. Fortunately we have not had the intense heat that forces growers to take up the plastic early, nor have we had widespread late frost, though we still have the rest of May to get through. Early cole crops and lettuce are growing well. Potato planting is going strong, some growers are nearly finished. Winter survival of garlic was good. Hoophouse greens, both overwintered greens and new plantings, have grown well in strong sun and have provided numerous early harvests. Asparagus harvest is going strong. Soils will remain cool after the current stormuntil the next warm spell arrives, so seeding of cucurbit crops may be on a fairly 'normal' timetable after all.

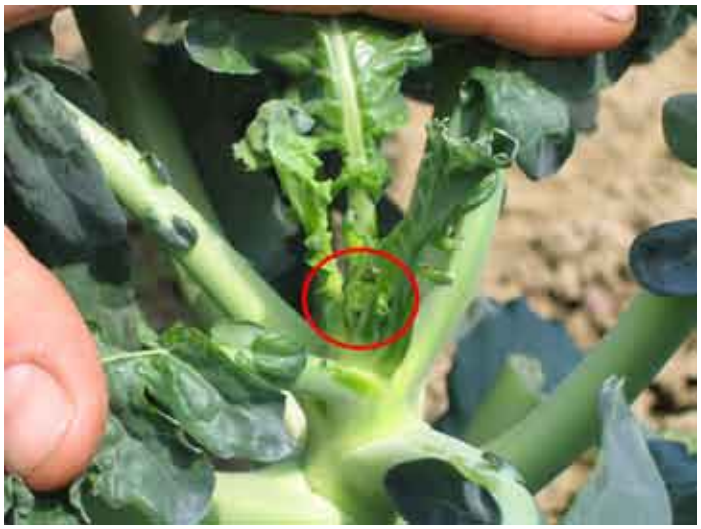
The first pest alerts are, as usual, flea beetles and cabbage root maggot fly on brassica crops. There are also reports of cutworms, and of an unexpected pest, pillbugs, in greenhouse tomatoes (see articles below).

Heat stress and heat tolerance in broccoli for late summer harvest

Many vegetable growers in central and southern New England avoid growing summer broccoli because head quality suffers from the heat. Some grow broccoli all summer, but have to deal with lower quality and more head rot during the hottest part of the summer. As part of a SARE-funded project on Brassica crops, we are looking at possible variety and planting schedule combinations for a late August or early September broccoli harvest. Growers in this project see a good market potential for broccoli and would like to harvest in late summer, around Labor Day. This means the crop will begin developing heads during hot weather.

Research done by Thomas Bjorkman at Cornell University, using the cultivar Galaxy, found that the critical period for heat sensitivity in broccoli only lasts for roughly ten days. This 'window' of sensitivity corresponds to the time when the growing tip shifts from vegetative growth to flower bud initiation. This is a period of about 10 days prior to when a tiny crown is visible in the center of the plant. Temperatures above 35 degrees Celsius (95 degrees Farenheit) for more than four days during that period causes uneven bud development at the bud initiation stage, resulting in heads that were uneven and poorly shaped. Other references suggest that temperatures above 85 degrees can cause heat injury.

At the UMass Crops Research and Education Center (new name for the South Deerfield Research Farm) last summer, we monitored two plantings of eight different varieties of broccoli to determine how quickly each variety reaches the critical stage, and how long each variety takes to reach harvest after the critical period has passed. We selected varieties that are considered to have some degree of heat tolerance (see Table 1). We took harvest samples and compared the severity of heat damage across the different varieties and planting dates. This allowed us to asses the quality of each variety and planting date for a late summer broccoli harvest.



Visible, tiny crown signals the end of flower bud initiation

The first planting was transplanted on June 28, 2005. For most of the varieties, we first saw tiny crowns forming on August 8th. We can assume that most of the plants reached the critical period about 7-14 days prior to that point. Looking back at the maximum temperatures during that period, we saw days well into the 90's; so we were looking forward to seeing some nasty broccoli. Conditions were good for detecting differences in heat tolerance between the varieties! The two longer season varieties – Concord and Marathon – started showing head development about a week later, and the plants made the shift from vegetative to reproductive growth over a much longer period of time. Looking back at the temperature record, we can see that these plants were also exposed to high temperatures during the critical period.

The second round of transplants went into the ground on July 22. These plants started showing head formation around August 26th, with Marathon and Concord again coming in behind the pack by about a week. Temperatures had again spiked into the 90's about a week prior to this, so we were expecting to have another round of broccoli that had experienced exposure to high temperatures.

Variety	Days to Harvest	Source
BL 10	75	Rupp
Concord	85	Rupp
F71-29A	58	Know-You
Gypsy	58	Johnny's
Asmodeus	56	Johnny's
Hepathlon	NA	Noresco
Marathon	80	Rupp
Windsor	63	Harris

The majority of the first planting was harvested between 8/22 and 9/5, except for Marathon and Concord, which came in between 9/12 and 9/19. Those two varieties took about a week longer to initiate head development, and took roughly an additional week to go from head initiation to harvest, compared to Asmodeus, Gypsy, Hepathlon, F71-29A, BL 10, and Windsor.

Severe heat damage: dead flower buds

We harvested, scored, and weighed the heads roughly every three days throughout the harvest period. Heads were scored for several different heat-related injury factors such as bud evenness, head evenness, bud damage, and number of leaves in the head. We also rated the head as wholesale quality, farmers market quality, or unmarketable. We based these categories on personal observations of the quality available in each market.

Out of the first planting, a variety called F71-29A had the least heat damage. This seed came from Know-You Seeds, a Taiwanese company. Unfortunately, we haven't had much luck securing a steady supply of their seeds in the US yet, but we will keep trying and post the information when and if it becomes available. Asmodeus, Gypsy, Hepathlon, and Windsor all performed reasonably well, though due to some unevenness and the propensity for leaves to form in the head, many heads from all of these varieties may have only been suitable for farmers markets. BL10, Concord, and Marathon were highly susceptible to all forms of heat damage – particularly Concord and Marathon. We saw very few decent heads from these varieties until the end of the second planting

Heat damage on Marathon: uneven crown, uneven buds, dead and diseased areas, leaves in the head.

In the second planting, Gypsy, Asmodeus, F71-29A and BL10 led the pack in terms of quality. In Windsor and Heptathlon, heads were fairly even but were plagued by a large number of leaves developing within the head. In Concord and Marathon heads were large but very poor quality until the the final week of harvest (see photo).

Overall, of the varieties that are readily available in the US, the most consistently good head quality was found in Gypsy. Windsor and Asmodeus suffered modest damage in both plantings, especially leaves in the head. Heptathlon performed better in the first planting, while BL10 did better in the second planting. Concord and Marathon suffered severe damage in both plantings; these appear to be more suited to cooler fall conditions.

In 2006 we will repeat the broccoli trial, using an early planting date to ensure that harvest begins well before Labor Day. We may also include a late season planting with different varieties, to see how we can push the season on the other end. As always, we'll keep you posted on what we find out.

Other factors in addition to heat can cause reduced head quality and increased susceptibility to disease. Uneven or inadequate soil moisture exacerbates heat stress. Trickle irrigation may be helpful for supplying water on a regular, steady basis without increasing the risk of water sitting on the head. When individual buds or areas of the head are killed by heat stress, this allows entry of pathogens. Uneven heads also allow water to remain longer on the surface of the head, which encourages pathogens. In our 2005 trial, the first planting suffered flooding from heavy rainstorms in July, and was irrigated using overhead sprinklers. Both of these may have influenced the degree of injury from heat stress.

Inadequate nutrients and improper nutrient balance affect both head and stem quality. Boron deficiency increases likelihood of hollow stem, which is often not noticeable until harvest. However, hollow stem can also be exacerbated by excessive nitrogen fertilizer, imbalance of nitrogen and boron, or rapid growth after head initiation. Cauliflower, turnip and rutabaga are also very sensitive to boron deficiency. Please refer to the *Nutrient Management for Brassica Crops* article in this issue of Vegetable Notes for more information.

-- Andy Cavanagh, Ruth Hazzard, John Howell, University of Massachusetts Vegetable Team

NUTRIENT MANAGEMENT FOR BRASSICA CROPS

Soil pH should be in the range of 6.5 to 7.0. Use ground limestone in fall or spring as recommended by a soil test. If the test report recommends over four tons per acre, it is best to split the application, applying some in the spring and some in the fall. If club root is a concern, the soil pH should be increased to 7.2. To achieve such high soil pH, use an additional 1,500 lbs of hydrated lime per acre along with ground limestone. Organic growers can use 1,500 lb of pulverized lime instead, since hydrated lime is prohibited. Pulverized lime, also called supper fine lime, is limestone ground to a mesh size of 200 or smaller and is very fast acting. The liming materials should be thoroughly incorporated and mixed into the soil by harrowing or rototilling. The soil test lab normally makes lime recommendations based on target pH of 6.8. A grower can request that this be based on a target pH of 7.2.

Calcium (Ca) and Magnesium (Mg): These two nutrients are commonly supplied in limestone. Liming materials vary in their contents of calcium and magnesium. Dolomitic lime contains high amounts of Mg, while calcitic lime is high in Ca and low in Mg. Tip burn of leaves has occasionally been a problem with some Brassicas, including cabbage, cauliflower and kale, but no crop is immune. Internal tipburn may occur in cabbage, in the inner layers of the head. This is caused by an insufficient amount of calcium reaching developing (younger) leaves. To prevent this, there should be adequate levels (high) of calcium in the soil and a steady and adequate soil moisture level. Avoid using urea, and maybe, ammonium sources of nitrogen for sidedressing (see nitrogen below). The base saturation as reported on the soil test should be as follows: potassium (K) 2-5%; magnesium (Mg) 5-15%; and calcium (Ca) 60-85%. If the Ca is lower and/or the K or Mg is higher than these levels, the possibility of tip burn is increased, but it won't necessarily happen. A long term goal should be to bring these nutrients within these ranges. Continued use of dolomitic lime leads to a decline in the Ca level of a soil. Alternating use of calcitic lime (if available) is recommended to supply more Ca. Gypsum can be used to supply additional Ca without changing pH.

Nutrient levels: Phosphorous (P), potassium (K), calcium (Ca) and magnesium (Mg) should be maintained in the high or optimum level in most soils. Soils with high cation exchange capacities (above 15) can handle higher levels. In most soils, higher levels can lead to nutrient imbalances and may cause environmental problems. When soil levels of a nutrient are above optimum, avoid adding any more until the level comes down. This may take several years. Lower than optimum levels can reduce yield and quality. If levels are below optimum, make an effort to add materials that will increase the nutrient(s) of concern. Once levels are in the high or optimum range moderate amounts can be added regularly to replace what is removed from the field at harvest. If soils are tested every one or two years, you can take action to prevent any potential deficiencies or excesses well before they cause a problem.

Phosphorus (P): Routine applications of phosphorous fertilizers, animal manure or compost will tend to build up P levels. As a result, many fields have very high (excessive) levels. This is a growing concern because excess P can move into water bodies and cause environmental

roblems. For this reason, some states have begun to regulate the use of P containing materials. When P is in the very high/excessive reange, additional applications should be avoided until the soil level comes down to the high/optimum range. This may take a number of years. If P is below high/optimum, it can be supplied with a number of materials including super phosphate and ammonium phosphate. Rock phosphate can be used but the P is very slow to become available. Some growers have applied large amounts of rock phosphate to speed the availability P early on only to end up with excess levels over time. Most fresh manures are excellent sources of readily available P. Fall application is usually needed to meet the 120 day limit for organic certification. Fall-applied manure should be immediately incorporated and a winter cover crop should be planted. Compost is a good source of P which is available at a moderate rate. If compost contains manure, it must be made according to NOSB guidelines if it is to be used in organic production within 120 of harvest. The use of compost over time can build P. However soils should be tested regularly to avoid building excess levels.

If Phosphorus is in the low or medium (below optimum) range on a soil test, lack of P may inhibit the crop growth. To help in the short term, put a P fertilizer close to plants as a starter. Liquid starters high in P can be safely applied when transplanting (follow label directions). Granular starters can be applied in bands a few inches away from the seed row. Bone meal is good source of readily available P and may be used as a starter by organic growers. Its cost makes it uneconomical to broadcast over the field. This can be applied close to roots without risk of burning. For direct seeded crops, use some mechanism for applying a concentrated band near the seeding band, and mix it in to a depth of at least two inches. For beds for transplants, incorporate bone meal with light tillage after the bed is made.

Potassium (K): Brassicas have a little higher requirement for potassium than other crops; you should aim for well up into the high range. Broadcast K in the spring after plowing, then harrow it in. Don't plow it under because that might put it too deep and out of reach of the roots. Sidedressing is not the preferred method of application. Remember that K does leach somewhat, so it is better not to apply in the fall. Leaching is less likely when the cation exchange capacity is around 10 or higher and more likely when cation exchange capacity gets down below 5. K is a component of many blended fertilizers. K is commonly available as muriate of potash, potassium sulfate and sup-po-mag. Muriate of potash contains 60% actual K2O. Potassium sulfate from natural sources and sul-po-mag are allowed by organic standards. Potassium sulfate is 50% actual K2O. Sul po mag is another source of readily available K. It contains 22% soluble K2O, 11% Mg and 23% sulfur. If you are using compost and it tests high in K, you can figure that into the total K being applied. The K in compost is readily available. A full compost test is available from the UMass Soil and Tissue Testing Lab for $30.00 (see http://www.umass.edu/plsoils/soiltest/services1.htm)

If K is low to medium, apply 150-125 lb actual K2O/A. If it is in the high range, then add approximately 50-100 lb/A to keep it in the high or 'optimum' range.

Nitrogen (N): Nitrogen is a special case. Crops such as cabbage, broccoli and cauliflower require about 130 to 150 lb/A of N. Short season crops such as greens, turnips and rutabagas require less for a single crop. However these short term crops are usually part of a double or triple cropping system. Taken as an aggregate of crops, the seasonal need for N for double or triple-cropped brassicas would be about the same as for a single long term crop. Much if not all the needed N (some times too much N) can be supplied by soils with good levels of organic matter. As the OM breaks down, N and other nutrients are released. This is most rapid (and most N is released) when the soil temperature is over 70 degrees F, the soil pH is above 6.0, the soil is well aerated and there is adequate soil moisture. Under good conditions N release can be 30 to 40 lb/A for each per cent soil organic matter. Thus a soil with 4 to 5 % OM can supply the seasonal needs of Brassicas if the above conditions are good. N levels reported on regular soil tests taken in the fall, winter or spring when soils are cool are of little value in predicting the need for N application. A soil nitrate test (PSNT) can be used in June to check the N level in a warm soil. If the level is 30 ppm or greater, there should be adequate N. If tip burn (mentioned above) is a concern, avoid using urea for sidedressing because it converts to ammonium which can interfere with Ca uptake. Ammonium nitrate is a somewhat safer choice, because only half of the N is in the ammonium form. Calcium nitrate is the safest choice, but is more expensive. Organic sources of N do not generally aggravate tip burn.

Nutrient release is slow in the spring when soil temperature are cool. A small amount (20 lb/A) of soluble starter N may be helpful for early planting. There are many choices of starter fertilizers for non-organic growers. For organic growers blood meal or fish emulsion are readily available sources of N which can be helpful. Compost tea may be useful, but might not provide enough N.

Lower than optimum levels of N can reduce yield and quality. However, excess nitrogen (N) can leach and contaminate drinking water. High levels of nitrate-N in drinking water are a serious health hazard. Lower levels may limit crop growth and affect quality.

Boron (B): Trace or minor elements are generally not a problem with the exception of boron (B). If soil test levels

are not in the normal soil range (as indicated on the test), boron should be applied at 1 to 2 lb/A actual B (5 lb/A for cauliflower) for most Brassicas. There a number of soluble sources of boron, including Solubor and Fertibor, which are OMRI listed. Solubor is 20% B so you'd need 10 lb per acre to achieve 2 lb actual. If you are broadcasting an organic blended fertilizer, ask if your supplier will add boron to the mix. Another way to apply it is to mix it in water, spray it on the soil with a boom sprayer, and mix it in. Lack of adequate boron causes hollow stem in broccoli.

-- John Howell
consultant, UMASS Extension Vegetable Team

NEV&BGA PROJECT ON ALTERNATIVES TO SYNTHETIC PYRETHROIDS FOR CONTROL OF INSECT PESTS IN CORN

2005 Project Report

Growers are continuing to use carbamate and pyrethroid insecticides, which pose human health (mixer/loader/applicator) and environmental (avian, aquatic, beneficial organism) risks, as the mainstays for sweet corn insect management. Many growers also depend regional insect trapping counts rather than their own on-farm scouting data.

This project, funded by EPA in a grant to the New England Vegetable and Berry Growers Association, intended to increase the adoption of a field scouting program in the use of biopesticides and reduced-risk pesticides to minimize use of carbamates and pyrethroids among New England sweet corn growers. The project had 2 objectives:

1. Implement and support scouting program with sweet corn growers in ME, MA, NH, CT; and

2. Coordinate use of reduced risk and biopesticides with scouting program for participating growers

A total of 34 growers participated, which is more than we had originally planned for. 100 acres were sprayed with Avaunt, 80 with Spintor, and 34 were treated with Trichogramma. 675 new acres were scouted. Most growers used either Lannate (carbamate) or Warrior (pyrethroid) as their main insecticides. Other materials mentioned were Larvin, Spintor, Dipel, Entrust, Match, and Permethrin.

All growers felt that on-farm scouting was the preferred method of deciding when to spray. This was preferred over relying on trap counts published in Extension newsletters, although this has worked well in the past. About 60% of growers hired a scout and the remainder scouted themselves. Growers also said that on-farm scouting resulted in fewer sprays needed, better overall control, and less ear damage. Growers also saved money and made more profit, and that they experienced fewer machinery repairs and maintenance due to less spraying. In general growers who scouted on-farm reduced the overall number of sprays per acre from 5 to either 3 or 4 on average. Earlier in the season, when pressure was lower, growers consistently saved 2 sprays per acre.

Growers found that, when properly timed, both Avaunt and Spintor worked as well as Lannate or Warrior for control of European Corn Borer. For Fall Armyworm, Avaunt worked better than the other materials. Growers who used Avaunt for this pest said that they would prefer to use Avaunt in the future. Several growers raised concerns about the cost of the reduced-risk materials (Spintor and Avaunt) and said that cost would be a deterrent to using them on a consistent basis for control of European Corn Borer. 15% of growers said that they would use Spintor at least once per year for European Corn Borer resistance management.

Trichogramma worked well for control of European Corn Borer. Timing was critical, and some releases were too late to provide control in the target field. However, Trichogramma wasps were able to move by themselves to later plantings and provide control of this pest, saving sprays. Use of wasps reduced tractor time and soil compaction.

All scouting information generated on these 34 farms became part of the weekly pest messages published by the various state Extension services. This information reaches growers representing 80% of the sweet corn acreage. Overall, at least 20% of the acreage is treated based on the results published in these weekly messages.

The greatest savings were on farms of direct participants (675 acres of sweet corn) in the four-state region. In the early part of the season, these growers saved 2 insecticide applications per acre ($18/acre X 675 acres = $12,150). The amount of pesticide use reduction was 506 pounds of the higher risk materials. This information was also passed to other growers (2818 acres) who saved 1 spray ($50,724). The additional amount of high-risk pesticide pounds reduced was 1057 pounds. Overall reduction in high-risk pesticides was 1563 pounds.

Later in the 2005 season, there was a very high peak in earworm numbers. This work reduced culling of ear-damaged corn. Through our participating growers and the weekly pest messages, this information was quickly passed to growers. With sweet corn selling for $4-5 per dozen, and production at 1000 doz/acre, we estimated the overall impact was eliminating 100 doz culled ears per acre on 675 acres ($270,000) and more modest impact on farms that used the pest messages at $1,127,200. Over total positive impact on these farms was $1,397,200.

2006 Project: Do you want to participate?

This project will continue in the 2006 season. The UMass Vegetable Program is contacting growers who are

interested in trying the alternative materials or Trichogramma wasps, or want to learn how to scout their corn. Based on last year's results, we encourage additional growers to try these products and to try more scouting on your own farm if you have not done so in the past. Please contact us if you would like to participate. While our resources are limited, we would like to include as many growers as possible in this project. Please call Amanda Duphily at (413) 577-3976.

Trichogramma wasps are now commercially available from **IPM Laboratories, Inc**. Main St, Locke, NY, Phone (315) 487-2063. Place your order two or three weeks in advance! Cost is $15 per acre (plus shipping) for a release of 30,000 wasps per acre. UMass recommends at least two releases per block, one week apart. A higher rate of 50-60,000 wasps per acre may provide better control and more reduction in the need to spray. Plan to make the first release at whorl stage, after European corn borer flight has begun, and the second release just at tassel emergence. If you have questions about how to use Trichogramma, please call Pam Westgate at (413) 545-3696.

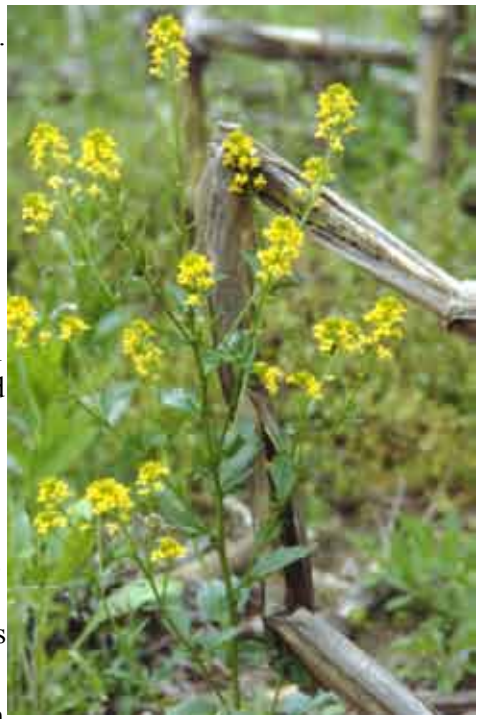
We appreciate the financial support of US EPA Strategic Ag Initiative, as well as Helena Chemical, Dow Agrosciences, and Dupont, who facilitated the distribution of products.

--A. Richard Bonanno, and Ruth Hazzard, Vegetable IPM Program, UMass and vegetable specialists in CT, NH, and ME

CABBAGE AND ONION MAGGOT FLIES

A good indicator of the start of cabbage root maggot flight is blooming of the common roadside weed, yellow rocket. This weed started blossoming last week in the Connecticut River Valley. (see photo) Root maggot flies have been captured on yellow sticky traps placed in brassica crops for the past two weeks at the UMass Research Farm in South Deerfield. Onion (*Delia antiqua*) and cabbage maggot (*Delia radicum*) flies look nearly identical but are likely to be found only near their host crop – brassicas, for cabbage maggot, and aliums (primarily onion), for onion maggot. There is a period of time (6-10 days) after flight begins before eggs are laid. Eggs were found in cabbage fields near the Connecticut River this week. In degree-day accumulations, the Conn. River Valley is ahead of many areas of the state, but provides a good 'early warning' that wherever your are, it's time to test your eyesight, and begin to scout cabbage and onion fields for root maggot eggs.

Flies spend the winter as small brown pupae in the soil. Adults emerge in spring and adults can travel considerable distance in search of host plants (1/2 to 1 mile). 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 brassica or onion plants to lay eggs at the base of the stem. Cool, moist soil conditions favor survival of the eggs. By mid to late June, the soil temperatures in the upper ½ to 1 inch are usually so high (>100 degrees F) that soil temperature itself provides control.



When eggs hatch, larvae feed on roots and can cause complete destruction of the root system. In brassica root crops such as turnips, radishes and daikon, feeding tunnels make the root unmarketable. In crops such as broccoli or cauliflower the first sign of a problem is wilting of the plant on sunny days and yellowing of outer leaves. Later, plants collapse, wilt down, and die. If you pull one up you will see that the roots are gone. You may still find the little white maggots feeding, or the small brown, oblong pupae.

Monitoring. Flies are attracted to bright yellow color – the same yellow that is used for the tractor tire rims on a John Deere! To a fly, this yellow is essentially the same color as a green leaf. Yellow sticky cards are inexpensive and easy to use; attach them with small wire stakes and place near the soil. Its best to check traps twice weekly, as they often get coated with dust when left out for a whole week. This will tell you when the flight peaks, and when it declines. In cabbage, flight typically declines after mid-May so that some late May or June plantings do not need a soil drench.

Monitoring cabbage for eggs. To check your field for eggs, 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 (see photo) 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 helps stir the soil to look for them. Check 25 or more plants, in groups of 2-5 plants, scattered around the field. If you find more than an average of 1 egg/stem, it is likely to be a damaging population and a banded soil drench is recommended. Eggs may

Cabbage maggot eggs at base of stem.

be more abundant in wetter areas of the field.

Soil Drench. Target the base of the plants and use at least 200 gallons of water per acre to help the insecticide penetrate to the root zone. At present, chlorpyrifos (Lorsban) is the only option. 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. See the 2006-2007 New England Vegetable Management Guide for more details (available online at www.nevegetable.org).

Re-scout the field five to 7 days after application to note whether eggs have hatched; if there are few maggots active, then the application was effective. Because the materials are quite persistent in the soil, a second application is usually not needed.

If you make several plantings, scout each planting (it takes about 15 minutes) to achieve the best timing for a soil drench. You'll be able to apply it when it is needed, and you can save the cost of application when it is not needed. In the Connecticut Valley, fields planted after May 15 often do not need treatment.

Floating row covers provide an effective barrier against this pest. 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.

Other cultural practices. Crop rotation contributes to keeping populations low. Fall tillage to bury crop residues and to expose over-wintering pupae is also important. Organic growers don't have an insecticide for this pest. However, if there is healthy growth of the 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. Natural enemies in the soil may also help to suppress the population of maggot eggs and larvae.

–R. Hazzard, University of Massachusetts; selections drawn from Eric Sideman, Maine Organic Farming and Gardening Association.

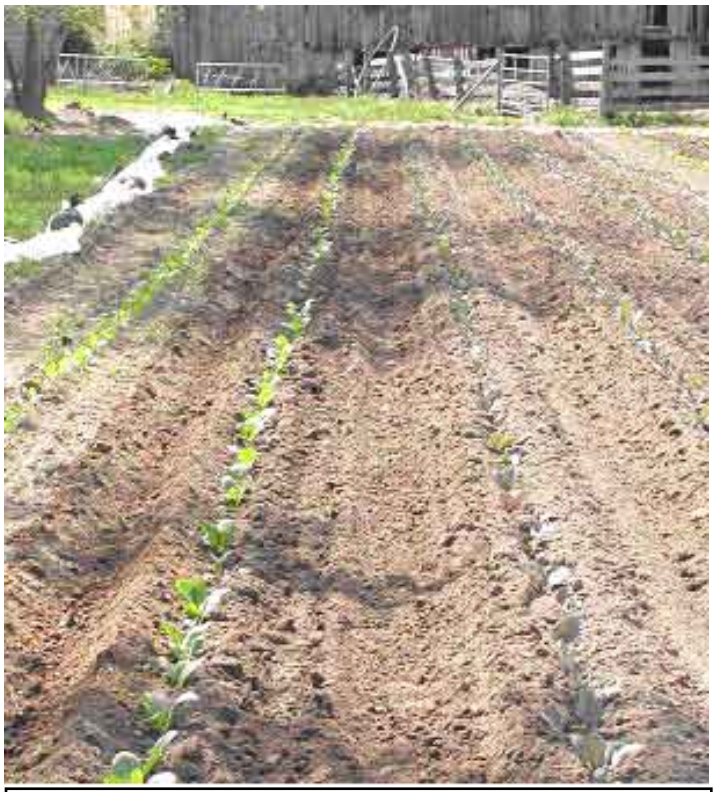
FLEA BEETLES IN BRASSICAS

Flea beetles are busy feeding in spring plantings of brassica crops. Numbers are likely to rise in coming weeks as beetles move out of field borders where they spent the winter. Crucifer and striped flea beetles feed on Brassica crops as well as weeds that are in the same family, such as yellow rocket or wild mustard. The crucifer flea beetle *(Phyllotreta cruciferae*) is uniformly black and shiny, about 2 mm in length, while the striped flea beetle (*Phyllotreta striolata*) has two yellow stripes on its back.

Flea beetle adults feed on leaves and stems, resulting in numerous small holes, or 'shot-holes'. Eggs are laid in the soil starting in late May, and beetle larvae feed on roots. The non-waxy greens (arugula, bok choi, tatsoi, mustard, Chinese cabbage, komatsuna) are preferred to the waxy cabbage, kale and collard types of brassicas. In brassica greens, beetles feed on the whole surface of the leaf, and will continue feeding from the seedling stage until harvest. Waxy crops are most susceptible at the cotyledon and seedling stage and feeding is more limited to leaf margins on older plants.

Occasionally in tender greens such as arugula, tarnished plant bug feeding may be confused with flea beetle feeding. In addition to the shot holes from flea beetles, there may also distorted leaves that are typical of TPB feeding, which injures leaf tissue when leaves first emerge.

Crucifer flea beetle on cotyledon



Komatsuna border around red cabbage main crop.

To reduce and delay flea beetle invasion of spring crops, move them as far away from the fields that were used for fall Brassica crops as possible. Beetles overwinter in field borders near last year's crop. Planting close by ensures a high population in the spring.

One of the best ways to protect Brassica crops from flea beetles is to place a floating row cover over the bed or row. It is critical to seal the edges immediately after seeding, because Brassica seeds germinate quickly and beetles rapidly find the cotyledons. Flea beetles can fit through extremely tiny cracks. Edges of the cover must be sealed on all sides using soil, black plastic bags filled with soil, or some other method.

There are a number of synthetic pyrethroids and carbamates, which are labeled for flea beetle in Brassicas and which can give effective control of flea beetles for conventional growers. Imidacloprid (Provado 1.6F) is also labeled for foliar application to control flea beetles in brassicas. (See 2006-2007 New England Vegetable Management Guide for more details)

Thresholds for treatment will vary with brassica species and the quality demanded by your market. The threshold for greens is obviously much lower than for cabbage. One study in Colorado found that 5 or more flea beetles on seedling broccoli reduced subsequent head size. Cornell and Rutgers Universities recommend a threshold of one flea beetle per plant on seedlings up to the 5 leaf stage, or injury and 1 beetle/plant on 50% of the stand.

For organic growers flea beetles spinosad (Entrust for organic) is proving to be an effective in suppressing flea beetles and reducing damage. A supplemental label has been issued in Massachusetts for flea beetle suppression in brassicas; other states may also have this, but in all states the product is labeled for use in brassica crops. Pyrethrin (Pyganic EC 5) showed poor to moderate efficacy in trials, and has a short residual period. Some growers have reported a good knockdown with this product.

This year, with funds from a SARE Partner Grant, we are testing a Perimeter Trap Crop (PTC) system at several farms in NY, MA and VT. We are using more attractive greens (*Brassica rapa* types) as a trap crop for cabbage, collard, kale or broccoli (*Brassica oleracea*). Komatsuna is our choice for the perimeter trap because it is highly preferred compared to cabbage, seed is inexpensive, growth is rapid, and the crop continues to produce new, attractive foliage over a long period. Borders are being sprayed with spinosad when beetles first arrive. Our first week of observations show promising results: heavy feeding in the komatsuna, and virtually none in the cabbage. We'll keep you posted! We have also gained the insight that woodchucks prefer cabbage over komastuna. In fact, they won't even touch that nasty light green crop, but will walk right past it to chomp down cabbage seedlings.

If you are interested in trying PTC for cabbage, kale, collard, or broccoli please feel free to call Pam Westgate or Ruth Hazzard at (413-545-3696) for more information.

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Vegetable Notes, Ruth Hazzard, editor and Kate Reidel, Assistant Editor. Vegetable Notes is published weekly from May to September and at intervals 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; author and photographer is R. Hazzard if none is cited.