



UMASS
EXTENSION



Vegetable Notes

For Vegetable Farmers in Massachusetts

Volume 18, Number 6

June 14th, 2007

CROP CONDITIONS

Harvest of radishes, Chinese cabbage, green onions, and early broccoli has begun, while lettuce and greens continue and asparagus nears the end of its harvest time. Succession planting continues. Crops are growing well and so are weeds. Weather has been variable with several days of passing thunderstorms. Generally, the rains have not limited field work and it has been possible to do cultivations in a timely fashion.

Growers are topdressing nitrogen in sweet corn. Use the pre-side dress nitrate test to determine whether the soil has enough nitrate-N present to feed the crop for the rest of its growth. Samples sent to the Soils Lab (413-545- 2311) will be processed within one or two days.

Reminder: Next IPM Field School will be Tuesday, June 19 at Warner Farm in Sunderland, 4-7 pm. For directions see last week's newsletter and flyer.

FLEA BEETLES IN BRASSICAS

Flea beetles are busy feeding in spring plantings of Brassica crops. On farms where Brassica crops are grown season-long in succession plantings, this insect has changed from a minor to a major and very destructive pest. Some growers depend on row covers for managing it in early crops, while others depend on sprays. Crop rotation is an effective strategy and it is not too late to incorporate rotations into your planting scheme for the rest of the season.

Crucifer and striped flea beetles feed on all Brassica crops as well as weeds that are in the same family, such as yellow rocket or wild mustard. The crucifer flea beetle is uniformly black and shiny, longer than it is wide, about 2 mm in length, while the striped flea beetle has two yellow stripes on its back. Potato flea beetle (found on eggplant, tomato and potato) is also black, but is covered with fine hairs and somewhat more blocky in shape.

Flea beetle adults feed on leaves and stems, resulting in numerous small holes, or 'shot-holes.' Eggs are laid in the soil starting in mid May, and beetle larvae feed on roots. The non-waxy or 'glossy' greens (arugula, bok choy, 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. However, high populations of flea beetles can cause severe injury, stunting, or plant death even in the waxy types of Brassicas.

Crop rotation is a key strategy for keeping numbers down. To reduce and delay flea beetle invasion of spring crops, move them as far away as possible from the fields that were used for fall Brassica crops. Fields that are isolated by distance (the farther the better) and by roads, woodlands, houses, or fields with other crops will have lower numbers and be colonized later. Beetles overwinter in field borders near last year's crop. Planting close by ensures a high population in the spring.

Crop rotation also works to reduce damage to fall brassica crops. The second flush of adults, emerging from underground where they fed on roots and formed pupae, begins sometime in late July. These adults are heavy feeders. Fall crops planted close to spring crops will be heavily damaged, but those planted in a field that is isolated from spring crops will have much lower populations and less damage.



Crucifer flea beetle on a cotyledon

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 be distorted leaves that are typical of TPB feeding, which injures leaf tissue when leaves first emerge.

One of the most effective 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. Lighter weight covers should be used when the summer heat arrives; heavy covers can reduce yield if used under during temperatures.

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 an average of 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. It is most important to scout your own crop and assess the numbers of beetles, amount of damage, crop stage, and market needs.



Brassica flea beetle on greens

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. 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 organic growers, spinosad (Entrust) is effective in suppressing flea beetles and reducing damage. A supplemental label has been issued in Massachusetts for flea beetle suppression in Brassicas and fruiting crops. 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.

Last year, as part of a three-state SARE Partner Grant, we tested a Perimeter Trap Crop (PTC) system for controlling flea beetles. We used more attractive greens (*Brassica rapa* types) as a trap crop for cabbage, collard, kale or broccoli (*Brassica oleracea*). Komatsuna was 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. However, other long-lived *B. rapa* types including Chinesse Cabbage could be possible. Borders were sprayed with spinosad. If growers are interested in trying this in later-

season plantings, please call Pam Westgate or Ruth Hazzard at (413) 545-3696.



Brassica flea beetle damage on cabbage

CATERPILLARS IN BRASSICA CROPS

Imported cabbageworm is active in Brassica crops now. We are finding a range of caterpillar sizes on cabbage, collards, kale, and broccoli and other cole crops. Diamondback moth has also been observed, though numbers appear to be low. Diamondback moth and imported cabbageworm have several reproductive cycles each year, and this is probably the first generation. There has been no sign of the third major caterpillar pests of Brassica crops, the cabbage looper, which usually does not appear until mid July or August when it migrates into the region.

If you are scouting for cabbageworm, you may also find a very interesting drama taking place! A parasitic wasp that was released in 1990 in Massachusetts is gaining ground and producing high levels of parasitism in imported cabbageworms seventeen years ago. Dr. Roy Van Driesche of the UMass Dept of Plant, Soil, and Insect Science introduced *Cotesia rubecula*, a small wasp that lays its eggs in small imported cabbageworms (first and second instars). One immature wasp grows inside each caterpillar, then crawls out and spins a small white cocoon. Soon another adult wasp emerges from the cocoon and seeks out more caterpillars. When you scout your fields, if you see caterpillars that look somewhat lighter green (especially in the mid section) and somewhat sickly, they may be destined for an early death, because a parasite is growing inside. Some growers have also observed what looks like a strange, pale predator feeding on the cabbageworm: this is probably the immature wasp crawling out, ready to make a cocoon. Dr. Van Driesche has been conducting a survey of cole crop fields in the Connecticut Valley. Eighty percent or more of the cabbageworms that he has found are parasitized. This is good news for cole crop growers, who have a helping hand in combating this pest. This is a good reason to use selective products if you do need to spray for caterpillars.

Quick ID Cues:

Diamondback moth caterpillar: very wiggly when poked, pointed on both ends, not fuzzy, only grows to about ½ inch. You may find white silken cocoons, with a green full-grown caterpillar or a brown pupa inside.

Imported cabbageworm: gray-green, slightly fuzzy, and sluggish. Grows to > 1 inch and favors the center of the head as it gets larger. Leaves wet green frass (droppings). Eggs single, light green or yellow.

Cabbage looper: light green, smooth, ‘loops’ up like an inchworm as it moves, grows 1 ½ to 2 inches. Eats big holes in leaves.

Cross-striped cabbageworm: Gray with black tubercles, as it grows becomes bluish-gray with numerous transverse black bands. There is a yellow line along each side of the caterpillar.

Scout undersides of leaves to look for fresh damage and notice caterpillars when they are small and damage is slight. Check heading crops as soon as heads start to form. Greens should be scouted at all growth stages. The following action thresholds are based on checking 25 plants. If you find one caterpillar per plant, it’s considered “infested”; spray if the threshold is reached or exceeded. See *2006-2007 New England Vegetable Management Guide* for insecticides. Use selective products to maintain

the natural enemies that keep aphids in check –and also to conserve parasites of imported cabbage-worm!



Imported cabbageworm at two stages with parasitoid cocoon

Action thresholds for caterpillars in Brassicas

<u>Crop & Stage</u>	<u>% 'Infested' Plants</u>
Cabbage & Broccoli, Cauliflower	
pre-cupping (before head formation begins)	35%
Cabbage, & broccoli head formation to maturity	15%
Cauliflower After heading (before tying)	10%
Kale, collards & other greens	10-15%

POTATO FLEA BEETLE

From the perspective of a farmer surveying the crops, different types of flea beetles do not look much different – they all look small and black, they all hop away when you approach the plant, and they all make small round holes in the leaves. Eggplant and tomato transplants and young potatoes can be hit hard by flea beetles, which appear as soon as plants are set out or emerge from the ground. In New England, this damage is usually caused by the **potato flea beetle**, *Epitrix cucumeris*. This flea beetle has also been reported to feed on cucurbit crops as well as bean, lettuce, radish, turnip and sunflower. It feeds on solanaceous weeds (jimsonweed, ground cherry, black nightshade) plus non-solanaceous weeds including redroot pigweed and lambsquarters.

The potato flea beetle is black with orange legs and antennae, about 1.5-2.0 mm long, and its back is covered with fine hairs and small pits. In contrast to crucifer flea beetle, the potato flea beetle is shorter and broader (more 'chunky'), has a more pitted and hairy body surface, and is less shiny, though both are all black. They also have a distinctly different diet, as crucifer flea beetle feeds only on Brassicas. Their life cycle is very similar: adult beetles spend the winter in leaf litter near the crop where they were feeding in late summer, and search out new food plants in the spring. Eggs are laid in the soil, larvae feed on roots, and after a pupal stage a new flush of adult beetles will emerge. These feed and then move to a protected spot for the winter. Thus a single generation results in two major flushes of damaging adults.

Leaves that are heavily fed may be riddled with holes. Growth may be stunted, delayed, or plants may succumb altogether. Potatoes, once well established, can withstand considerable feeding damage. Eggplants are more vulnerable even at later stages.

Damage is probably the best measure of flea beetle populations, since they often feed on the underside of leaves and hop away when disturbed. The point where sprays are needed to reduce yield depends on the crop, crop stage, and other stresses on the plant.

Floating row covers, well sealed, can protect eggplant seedlings. Covers should be placed over hoops or other supports to prevent crop injury.

Most insecticides registered to control Colorado potato beetle, including spinosad, will control FB. Neonicotinoid insecticides used as a soil drench or transplant drench will give early season control, or may be applied as a foliar spray. Do not use neonicotinoids for both soil and foliar applications. Kaolin (Surround WP) protects seedlings by acting as a feeding deterrent. We have observed effective control from applications of a mixture of kaolin and spinosad, but have not documented whether this is better than either one alone. Several synthetic pyrethroid and carbamate insecticides can be used. See the *2006-2007 New England Vegetable Management Guide* for specific products (also available at www.nevegetable.org).



Potato flea beetle on eggplant

CUCURBIT UPDATE

Summer squash and zucchini are growing well, and the earliest plantings have an excellent fruit set. Winter squash and pumpkin crops are coming up. One grower from central Massachusetts wondered why cucumber beetles had not showed up yet – where are they?? In the Connecticut Valley, they made their appearance last weekend. If another hot spell arrives, they will be out in force.

WATCH FOR LEAFHOPPER IN BEANS AND POTATOES

Watch fields for **potato leafhopper**. Several growers have reported seeing leafhoppers in potato. Adults are about 1/4 inch long, light yellow-green, and fly up from foliage when it is disturbed or shaken. Nymphs are found on the underside of leaves, light green, wedge-shaped and very fast-moving. Damage can be severe on early-season varieties of potato, as well as in green

beans. Beans are more susceptible when they are young than at later stages.

Adults and nymphs feed by inserting a needle-like beak into the plant and sucking out sap. They also inject a toxin into the plant, which causes yellowing, browning, and curling of leaves. In potato, leaf margins turn brown and brittle first, followed by death of entire leaves. In beans, the leaf turns mottled brown as if infected with a disease before dying completely. Both adults and nymphs cause damage. Plant injury and yield loss can be significant.

It is important to protect plants when leafhoppers first arrive, before nymphs build up. In potato, the threshold is based on insects per leaf: one nymph or adult per 10 leaves is a damaging population and should be controlled. Check 25 compound leaves throughout the field to determine numbers per leaf. University of Connecticut has established a threshold of 1.5 leafhopper per leaf in eggplant. In potato, some materials registered for Colorado potato beetle adults will also control leafhopper, including neonicotinoids. Other carbamate, synthetic pyrethroids, and organophosphate products are also registered. Refer to the *New England Vegetable Management Guide* for recommended materials. An update list can be found at www.nevegetable.org (select crops/potato)

For organic potato growers, pyrethrin (PyGanic EC5.0) has been shown to be the most effective product for reducing leafhopper numbers and damage. Good coverage is important. The residual period is short. Spraying late in the day or in the evening may provide better control than spraying early in the morning. Don't wait for numbers to build up.

BROWN MARMORATED STINK BUG FOUND

IN MASSACHUSETTS

The Brown Marmorated Stink Bug (*Halyomorpha halys*) was found for the first time in Massachusetts in March 2007. The insect was collected by a homeowner in Bridgewater (Plymouth County). The brown marmorated stink bug (BMSB) was also reported from a Rhode Island home in April this year.

This insect, a native to Asia, was first found in Allentown, Pennsylvania in 1998. Since that time the BMSB has been discovered

in New Jersey, Oregon, Maryland, South Carolina, Virginia, and Delaware. This insect is an excellent hitchhiker and may



Brown Marmorated Stink Bug Adult Halyomorpha halys
David R. Lance, USDA APHIS PPQ, www.insectimages.org

have moved to the US in packing crates from Asia. While adult insects can fly, their spread can be aided by hitchhiking in vehicles or containers. In Maine the BMSB was found in November in new RVs being shipped from an infested county in Maryland. I also witnessed BMSB hitchhikers squashed on an educational exhibit that had recently been in Pennsylvania.

The BMSB attacks a long list of hosts including fruits (apple, peach, pear), ornamentals (*Paulownia*, butterfly bush, honeysuckle, Norway maple), and vegetables (beans).

Their feeding causes small necrotic areas on leaves and fruit but can also cause "cat-facing" on fruits rendering them unmarketable. BMSB is a nuisance species that invades homes in the fall much like its relative the western conifer seed bug.

A few characters that help identify the adult BMSB are its shield-shaped body, white bands on the antennae, and alternating white and dark bands on the rear edge of the abdomen. For photographs and more information see the MA fact sheet: <http://massnrc.org/pests/pestFAQsheets/brownmarmoratedstinkbug.html>

The western conifer seed bug (*Leptoglossus occidentalis*) has flattened hind legs and no banding on its antennae. These characters will also help you to distinguish this bug from the new invader on the scene, Brown Marmorated Stink Bug. For photographs of bugs that look similar to the BMSB see the Rutgers website: <http://njaes.rutgers.edu/stinkbug/similar.asp>

If you suspect you have found a Brown Marmorated Stink Bug, please collect the insect in a container and report it via the plant pest hotline (617.626.1779) or on our website (<http://www.massnrc.org/pests>). If you have access to digital camera and can send a photo of the specimen you captured via our on-line pest reporting, that would be ideal.



Western conifer seed bug adult Leptoglossus occidentalis
David Cappaert, Michigan State University,
www.insectimages.org

-Julie Callahan, Plant Pest Survey Coordinator, MA Dept. of Agricultural Resources

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Trap Counts for June 14th, 2007

Location	ZI	EII	Total ECB
South Deerfield	5	7	12
Deerfield	29	45	74
Hadley (2)	3	13	16
Whately	12	51	63
Hadley (1)	4	2	6
Amherst (1)	9	6	15
Amherst (2)	6	4	10
Granby	0	7	7
Southwick	22	2	24
Lancaster	12	32	44
Still River	3	5	8
Rehobeth	25	10	35
Litchfield, NH	0	7	7
Hollis, NH	2	22	24
Mason, NH	1	3	4

--Thanks to our scouting network: R.Hazzard, P.Westgate, A.Brown, A.Lopez-Swetland, D.Rose, J.Golonka, S.Pepin, G.Hamilton

two sprays, 5-7 days apart to bring the population under control. Earlier scouting and spraying (at the whorl stage) does not give improved control compared to timing.

Growers are especially concerned about protecting their earliest corn, started under plastic, which is especially costly and especially valuable. Corn that is entering silk stage now may need to be protected during silking, even if the tassel stage was not infested. We know that ECB eggs are still hatching. Eggs may not have hatched early enough to cause feeding in the whorl or tassel, but larvae may head straight for the ear. Use one or two sprays during silking, at weekly intervals. For any corn that is just now showing tassels deep in the whorl, scout for ECB as described above.

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SWEET CORN

The earliest sweet corn is starting to show silk. These fields are in warmer parts of the state, where plastic, row cover and/or transplants were used. Most corn is in whorl stage or entering pretassel. Succession planting will continue for several more weeks.

European corn borer flights declined this week at some locations and rose in others. We are about at the time of peak flight. European corn borer eggs have hatched into borers and are feeding in within the whorl and in the developing tassel. Some fields were over threshold and in those fields, growers are applying their first insecticide sprays. Selective products such as Avaunt and Spintor (Entrust) give good control while being somewhat easier on natural enemies.

Scout any corn where tassels are beginning to poke up out of the whorl. Look for feeding damage, frass, or the small black-headed larvae. If you pull out the tassel and its tightly-wrapped leaves, you may see tiny feeding holes. Borer caterpillars are usually in one of the layers of whorl leaves, or inside feeding on the young tassel. Photos show tiny borers at several stages and locations.

At 15% of plants infested (or more), spray. The best time to control ECB is as the green tassel pokes up out of the whorl. Borers are moving out of the tassel at that time, and easily reached by pesticides. Scout again 3-4 days after spraying. At high levels of infestation or where new eggs are still hatching, it often takes

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Vegetable Notes is funded in part by a grant from the EPA Region I Environmental Stewardship Program, through the New England Vegetable and Berry Growers Association.



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Vegetable Notes, Ruth Hazzard, editor and Amanda Brown and Martha Powers, assistant editors. *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.

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