UMASS EXTENSION

Vegetable Notes

For Vegetable Farmers in Massachusetts

Volume 18, Number 5 June 7th, 2007

CROP CONDITIONS

The state was blanketed with rainfall of 1-2 inches early in the week, and crops are growing well. Harvest of lettuce has picked up. Rhubarb, spinach, salad mix, bok choi, radishes, green garlic and other early crops are being harvested. CSA's have made their first share delivery. Strawberry harvest is just beginning. Fruiting crops have established well, and winter squash and pumpkins are planted and emerging. Overall, the season is off to a good start. Watch for cucumber beetles – its time for them to arrive and they have started showing up in large numbers at field edges.

The next IPM Field School is Tuesday, June 19th at Warner Farm in Sunderland. See flyer for more details, or the UMass Vegetable Program website, www.umassvegetable.org.

The New England Vegetable Management Guide is available online at www.nevegetable.org. This site has updated information on fungicides, herbicides and insecticides for 2007. There are many new chemistries and new products or changes in use each year.

PROTECTING HONEY BEES FROM PESTICIDES

Honey bees are vulnerable to many of the insecticides used to control damaging pest species by fruit, vegetable, nut, and seed growers. Growers dependent on honey bees for the pollination of their crops must constantly maintain a delicate balance between protecting their crops from pests and pathogens and protecting the insects that are necessary to pollinate these crops.

The recent dramatic die-off of tens-of-thousands of honey bee colonies has left many beekeepers devastated and possibly many growers without the quantity and quality of bees needed to pollinate crops this spring and summer. A research group, the Colony Collapse Disorder Working Group (see www.maarec.org) is trying to determine what factors are responsible for these unprecedented colony losses. Chemical contamination is one of the possible contributing factors that is being investigated. This includes chemicals being used within the hive for mite and disease control as well as chemicals pesticides used on crops that may inadvertently find their way into hives. Until we have more documented information, it is advisable to use pesticides with care, erring on the precautionary side.

The neonicotinioids (Group 4A) are a relatively new class of insecticides that impact the central nervous system of insects. They act either as contact insecticides or they are translocated throughout the plant tissue, making all parts of the plant toxic to pests that ingest them. While imidacloprid, registered in 1992, is the best-known insecticide in this class, there have been a number of new neonicotinoids introduced since then (clothianidin, acetamiprid, thiamethoxam, etc.). Their use has increased dramatically over the past few years and they are now the most widely used group of insecticides in the US. Their many uses include: seed treatments for corn, cotton, canola and sunflowers; foliar sprays of fruit, vegetable, nut and coffee crops; granular, and liquid drench applications in turf, ornamentals, fruit crops and in forests; and in California the number one use of imidacloprid is for the control of structural pests.

There is conflicting information about the affects of neonicotinoids on honey bees, and different chemicals in this class are known to vary in their toxicity to bees. However the EPA identifies both imidacloprid and clothianidin as highly toxic to honey bees. For example: "Clothianidin is highly toxic to honey bees on an acute contact basis (LD50 > 0.0439 µg/bee). It has the potential for toxic chronic exposure to honey bees, as well as other non-target pollinators, through the translocation of clothianidin residues in nectar and pollen. In honey bees, the affects of this toxic chronic exposure may include lethal and/or sub-lethal effects in the larvae and reproductive effects in the queen" (EPA Fact Sheet on Clothianidin). Documented sublethal affects of neonicotinoids include physiological affects that impact enzyme activity leading to impairment of olfactory memory. Behavioral effects are reported on motor activity that impact navigation, orientation and feeding behavior. Additional research has found that imidacloprid impairs the memory and brain metabolism of bees, particularly the area of the brain that is used for making new memories (Decourtye et al., 2004). Recent research done on imidacloprid looked at crops where imidacloprid was used as a seed treatment. The chemical was present, by systemic uptake, in corn and sunflowers in levels high enough to pose a threat to honey bees (Bonmatin et al., 2003 and 2005). In 2002 a broad survey for pesticide residues in pollen was conducted across France. Imidacloprid was the most frequently found insecticide and was found in 49% of the 81 samples (Chauzat et al., 2006).

In addition, there is concern about the practice of combining certain insecticides and fungicides. A North Carolina University lab study found that some neonictinoids in combination with certain fungicides synergized to increase the toxicity of the neonicotinoid to honey bees by over 1,000 fold (Iwasa et al., 2004). Both the neonicotinoids and the fungicides (Terraguard and Procure) are widely used. This synergistic effect needs to be looked at more carefully.

See Table 1 for a summary of the chemical and brand names of the commonly used neonicotinoids and their toxicities to

honey bees.

We are asking growers who are using these materials and who are dependent on honey bees for pollination to use caution when selecting and applying these materials.

Recommendations for Growers

• Know the pesticides you are using and their toxicity to bees (do not depend on third party to provide this information).

• Read the label and follow the label directions.

• Never use a neonicotinoid pesticide on a blooming crop or on blooming weeds if honey bees are present.

• The use of a neonicotinoid pesticide pre-bloom, just before bees are brought onto a crop is not recommended. If one of these materials MUST be used pre-bloom (for example at pink in apples), select a material that has a lower toxicity to bees (acetamiprid or thiacloprid) and apply only when bees are not foraging, preferably in late evening.

• Do not apply these materials post-bloom (e.g. at petal fall until after the bees have been removed from the crop.

• Blooming time varies depending on varieties. Bees pollinating one variety or crop may be at risk while another post-bloom crop or variety is being treated. Also, while crops may have completed blooming, bees may be visiting blooming weeds and around crops. Be aware of these situations and avoid the application of pesticides on a non-blooming crop if there is risk of drift onto blooming crops and weeds if bees present. If a spray must be applied, use the least toxic material and apply when bees are not foraging.

• Protect water sources from contamination by pesticides. If necessary, provide a clean source of water close to colony locations prior to their arrival in the orchard or crop.

Table I. Neonicotinoids' Toxicity to honey bees

Chemical	Brand Name	Acute Contact	Acute Oral
thiamethoxam	Actara, Platinum, Helix, Cruiser, Adage, Meridian, Centric, Flagship	highly toxic	highly toxic
clothianidin	Poncho, Titan, Clutch, Belay, Arena	highly toxic	highly toxic
imidacloprid	Admire, Advise, Alias, Confidor, Couraze, Encore, Gaucho, Imida, Impulse, Ledgend, Leverage, Macho, Merit, Nuprid, Pasada, Prey, Provado, Premise	highly toxic	highly toxic
acetamiprid	Assail, Intruder, Adjust	toxic	toxic
thiacloprid	Calypso	toxic	toxic
dinotefuran	Safari, Venom	highly toxic	highly toxic

For more information on CCD visit the Mid-Atlantic Apiculture Research and Extension Consortium website at www.maarec.org. For more information on pesticide toxicity and protecting bees from pesticides, please visit the online publication, How to Reduce Bee Poisoning from Pesticides, at extension.oregonstate.edu/catalog/pdf/pnw/pnw591.pdf.

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MEXICAN BEAN BEETLE: A CHANCE FOR BIOLOGICAL CONTROL

First plantings of snap beans are up and growing well. There is no sign yet of Mexican bean beetles, but if they have historically been a problem on your farm, you will very likely see them again this year. The coppery brown, round, spotted adults, which look like large ladybeetles, lay yellow-orange egg masses on the underside

Mexican bean beetle adults and larvae.

of bean leaves. These hatch into bright yellow, spiny oval larvae, which feed, molt several times as they grow, and pupate on the underside of leaves. Feeding damage of adults and larvae can reduce yield and injure pods if numbers are high. There are several generations per season.

A beneficial insect, Pediobius foveolatus, is commercially available for Mexican bean beetle control and has a good track record in the mid-Atlantic states and among Massachusetts growers who have tried it. (Pediobius is pronounced "pee-dee-OH-bee-us"). It is mass-reared and sold by the New Jersey Dept of Agriculture and is also available from other beneficial insect suppliers. This small (1-3mm), non-stinging parasitic wasp lays its eggs in Mexican bean beetle larvae. Wasp larvae feed inside the MBB larva, kill it, and pupate inside it, forming a brownish case or 'mummy'. About twenty five adult wasps emerge from one mummy. Control continues and in fact gets better as the season progresses and successive generations of the wasp emerge and search out new bean beetle larvae. This makes it well suited to our succession-planted snap bean crops. After a release in the first plants, it is advisable to leave that planting intact for a while, until the new generation of wasps has emerged from their mummies.

The New Jersey Dept of Agriculture Insectary recommends two releases, two weeks in a row, timed for the beginning of egg hatch. Wasps will lay eggs in larvae of any size, but it is best to target the young MBB larvae, before damage has been done. Thus, timing is important. Watch for eggs and time the shipment for first hatch. The release rate should be at least 2000 adult wasps per field for less than an acre, or 3,000 per acre for fields of one acre or more. Cost from NJDA is $30 plus shipping for 1000 adults, or $15 for 20 mummies (pupal parasites inside dead MBB larvae) from which about 500 adults will emerge. If you already have MBB larvae, order adults. Ship for overnight delivery. Instructions for handling and release will come with the wasps.

Wasps reproduce in the field and are still present when the second generation of MBB hatches out. Thus, it should not be necessary to make more than two releases. Like beans, Pediobius wasps are killed by frost.

Contact information for New Jersey source: Tom Dorsey, 609-530-4196 or 530-4192; address NJDA Phillip Alampi Insect Lab, State Police Drive, W. Trenton, NJ 08628. You'll also get advice on how to use the wasps from this office.

Pediobius should also be available from the following suppliers: Green Spot Ltd., NH., www.greenmethods.com 603-942-8925; IPM Laboratories, NY 315-497-2063; ARBICO, 800 -827-2847 (AZ), http://www.arbico.com/; Biocontrol Network (TN), 615-370-4301, http://www.biconet.com/ ; Rincon Vitova (CA), 800-248-2847, http://www.rinconvitova.com/.

--R. Hazzard

European corn borer trap in grassy weeds.

SWEET CORN

European corn borer trap captures climbed this week into the double digits at most locations. We are on the rising curve of emerging adults and egg laying. Where row cover was just removed, corn that was well protected from ECB will now be very attractive for egg laying.

Fields started under plastic or row cover will be very attractive to egg-laying moths because the plants are larger than those in bare ground fields. We have found that using the usual tassel emergence scouting and thresholds do not work in corn started under plastic or row cover. An alternative approach that has worked well in trials New York State is to use pheromone trap catches to time sprays in row cover or plastic corn. Growers waited until there was a significant increase in the ECB trap catches in their area and then timed sprays to coincide with egg hatch. Eggs require 100 degree days to hatch (base 50 F). See last week's issue for calculations.

Corn grown under plastic may be in whorl, early pretassel, or even emerging tassel depending on where it is in the state. Based on degree days in the Connecticut Valley this week, eggs may be hatching in 6-7 days. It is time to scout for ECB feeding damage as the pretassel begins to form.

Look for pinhole feeding damage, frass, or the small black-headed larvae. To scout, pull out the emerging tassels to look for tiny black-headed white larvae or frass (white to brown material about the size of fine sand). Or, pull back the leaves to search tassels. Before any insecticides have been applied, scouting is fast and easy because any sign of feeding is an almost sure sign of live larvae, so it's not necessary to spend time finding the larvae. After the initial insecticide application, feeding damage may be from a larva that has already been killed, so finding the critter is more important for an accurate estimate of the number of infested plants. A spray is recommended if >15% of the plants have borers. The ideal time to control ECB is as the green tassel pokes up out of the whorl. Borers will leave the tassel as it opens up, and move down the plant looking for protected feeding sites. At that time, they are exposed and are more easily reached by pesticides. Before that time, borers are protected inside the whorl and after, may be protected inside the stalk

Scout again 3-4 days after spraying. At high levels of infestation, where new eggs are still hatching, or in fields with uneven development, it often takes two sprays 5-7 days apart to bring the population under control. One spray may be when approximately 25-50% of the tassels have emerged, and the second 5-7 days later or after 75-100% of the tassels have emerged, if the field is still over threshold.

Trap Counts for June 7th, 2007

Location	Z1	EII	Total
South Deerfield	2	6	8
Deerfield	0	15	15
Whately	6	50	56
Hadley (1)	9	2	11
Hadley (2)	11	36	47
Amherst (1)	5	3	8
Amherst (2)	12	14	26
Granby	3	2	5
Easthampton	29	41	70
Southwick	12	4	16
Lancaster	3	14	17
Rehobeth	3	12	15
Litchfield, NH	2	6	8
Hollis, NH	0	32	32
Mason, NH	0	0	0

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

MANAGING COLORADO POTATO BEETLE

Colorado potato beetles (CPB) adults and eggs are being found in potato and eggplant crops. The bright yellow eggs are laid in clumps that average 30-35 eggs, generally on the undersides of leaves. This is the most serious insect pest of potatoes and has the capacity to develop resistance to insecticides. Based on a fifty-year track record, we can expect that any insecticide that is used repeatedly on the same population of Colorado potato beetles (that is, those in the same field or a farm with nearby fields) will lose its efficacy within 2-4 years. One insecticide after another has been lost to resistance, and we are now seeing this happen with Admire. In some areas, CPB has become resistant to spinosad (Spintor and Entrust). Carbamates and synthetic pyrethroids have been ineffective for years in Massachusetts, due to high levels of resistance that developed in the 1970's and 1980's.

Wherever possible, growers should rotate classes of insecticides and avoid using the same chemistry on more than once per year or better, once every **other** year . Do not use the same chemical class on successive generations in the same year. There are enough different classes to allow this, if you plan carefully. Note that in the New England Vegetable Management Guide, as well as on all pesticide labels, each insecticide has a Group Number, which indicates which class it is in. Avoid using insecticides from the same group.

Groups and products registered for Colorado potato beetle include:

Group 4 (Neonicotinoids):thiomethoxam (Platinum, Actaram, Cruiser), imidacloprid (Admire 2F or Admire Pro, Provado 1.6F, Gaucho), dinotefuran (Venom 70SG), acetamiprid (Assail 30SG), imidacloprid + mancozeb (Gaucho MZ)

Group 6:Abamectin, (AgriMek 0.15EC, Abba* 0.15EC)

Group17: (Insect growth regulator) cyromazine (Trigard)

Group 16B: (Insect growth regulator)novaluron (Rimon 0.83EC)

Group 5: spinosad (SpinTor 2SC, Entrust)

Group 11:*Bacillus thuringiensis tenebrionis* (Novodor FC)

Group 18:azadirachtin (from Neem) (Neemix 4.5)

Group 9B: cylolite (Kryocide),

Group 3A: cyfluthrin (Baythroid* 2), deltamethrin (Decis* 1.5EC), esfenvalerate (Asana* XL), permethrin (Pounce*) and pyrethrin (PyGanic EC5.0) (synthetic pyrethroids and pyrethrin) (note: CPB is resistant in Massachusetts)

Group 2A: endosulfan (Thionex* 50W) (carbamate)

Group 1A: oxamyl (Vydate* L):

Group 26: indoxacarb, (Avaunt):

Group 1B: phorate (Thimet* 20G)

To prevent resistance, alternate among classes of insecticides in each generation, and throughout the season. If you used Admire or another neonicotinoid at planting, **do not use foliar applications** of another neonicotinoid such as Provado or Actara.

One strategy would be to use a material such as spinosad, which control adults and larvae for the first spray, followed by Novodor, Rimon or Trigard to kill emerging young larvae, and if needed a third spray of the one you did not use before or Agrimek to control all stages of larvae.

The following insecticides each have a different mode of action and provide good options for alternate insecticides that provide effective control:

Spinosad (SpinTor 2SC, a liquid formulation or Entrust, an organic formulation, dry powder) gives excellent control of all stages of CPB at a 3.5 to 4.5 fl oz rate. Will control adult CPB and also European corn borer if a grower has that pest on early potatoes. It is currently the only effective CPB insecticide approved for organic growers.

Abamectin (AgriMek 0.15EC) is mainly a contact material, which controls larvae. It may be best used early in the season, when good coverage is easier to obtain. Rates of 5-6 fl oz per acre gave effective control in commercial fields in trials on Long Island. The lowest labeled rate is 8 fl oz.

Novaluron (Rimon) is a relatively new pesticide chemical belonging to the class of insecticides called insect growth regulators (IGR). IGRs slowly kill the insects over a period of few days by disrupting the normal growth and development of immature insects. Novaluron acts as an insecticide mainly by ingestion, but has some contact activity. IGR insecticides are comparatively safer to beneficial insects and environment. Target applications to the beginning of egg hatch when larvae are small. Use higher rates for larger larvae. Does not control adults.

Cyromazine (Trigard) Insect growth regulator for small larvae just after egg hatch. Does not control adult beetles. Low rate will provide suppression only.

***Btt, Bacillus thuringiensis subspecies tenbrionis* (Novodor FC)** controls small larvae, through the third instar. Time applications to begin when 30 percent of the eggs have hatched. Where fields are densely populated and eggs are hatching continuously, reapply every 5 to 7 days. Currently there are no formulations of *Bt tenebrionis* products that are approved for organic use under the National Organic Program. You can check with the MASS organic certification program (MICI, 978-297-3644) for more details.

Neo-nicotinoid insecticides (see list above) may be soil or trickle applied, foliar applied, or applied to seed pieces. In the Connecticut Valley, there are fields where CPB resistance to imidacloprid (Admire) is 300 times that of susceptible populations. Control requires higher rates, does not last as long, or does not happen at all. There is cross-resistance among products in the neo-nicotinoid group. For resistance management, do not use a product in this group on more than one generation per year. A single foliar application is less likely to cause resistance than a soil applied systemic, because it only affects part of the population and only one generation.

Now is the time to scout for adults, eggs and egg hatch. Walk your fields and look for CPB adults and eggs. The economic threshold for adult beetles in potato is 1 beetle per 2 plants (or per 2 stalks, in midseason). Damage to eggplant seedlings from adult feeding is often severe enough to warrant control of the adults. In potato, adult damage may not be significant, so you can wait for egg hatch to kill both adults and larvae.

Look on the undersides of leaves for the orange-yellow egg masses. The fresher the eggs, the brighter orange the eggs will appear. Eggs hatch in 7-10 days, depending on temperature. If you want to know when the earliest eggs are hatching, you can flag the earliest egg masses you find with bright tape or flags, and then keep an eye on the hatch. Hatched larvae go through four stages before they become adults. In the first stage, the larvae are about the same size as the eggs and in the second stage they are about an eighth of an inch long. As the larvae get bigger, they do more feeding. The fourth, or largest, stage does 85% of the feeding damage. It's a good idea to prevent beetles from ever reaching the fourth instar!

After larvae complete their growth, they drop to the ground and burrow into the ground to pupate. Ten days later the next generation of adults emerge and feed. If they emerge before August 1, they will lay more eggs. After August 1, they feed and head to overwintering sites.

Spray timing and thresholds.

If you are using a product that only controls small larvae (Bt's, Insect growth regulators), you want to make the first application when 20-30% of the eggs have hatched and the largest larvae are less than half grown. If you are using spinosad (Spintor 2SC or Entrust, the organic formulation), Provado, or AgriMek, you can wait until more larvae (grubs) are hatched, when the oldest larvae reach the beginning of the fourth stage (instar), and are about 1/3 inch long. Applications made at this time will kill all the larvae that have hatched up to this point.

The **threshold for potatoes**: small larvae is 4 per plant; for large larvae, 1.5 per plant (or per stalk in midseason), based on a count of 50 plants or stalks. Thresholds established in the Northeast for **eggplants** from seedling to fruiting stage include: 15 CPB per 10 plants (Rutgers) or 2 small/1 large larvae per plant (<6 inches) or 4 small larvae /2 large per plant>6 inches) (Cornell). In eggplant, in addition to defoliation, beetles sometimes clip the stems of flowers or flower buds. This directly reduces fruit formation and marketable yield. On the other hand, potatoes can tolerate 20% defoliation without reduction in yield (or even more, depending on time of the season and cultivar).

Cultural Controls

Crop Rotation is the single most important tactic for CPB management is to rotate potatoes or eggplant to a field that is at least 200 yards from the previous year's fields. Barriers such as roads, rivers, woodlands, and fields with other crops are helpful. Rotated fields tend to be colonized 1-4 weeks later in the season. Also, the total population of adult beetles is lower, producing fewer larvae to control.

Perimeter treatments or perimeter trap cropping can be applied to potato. One approach is to plant a barrier crop between overwintering sites and this year's crop and get it in *earlier* than the main crop; then control early-arriving beetles with a systemic or foliar insecticide. Another approach is to plant three to five rows of potatoes treated with a systemic insecticide

(for example, Admire or Platinum– assuming resistance is not a problem) in a perimeter around the field to be planted to potato, tomato, or eggplant; this treated crop will kill up to 80% of the colonizing beetles. In eggplant or tomato, the perimeter border can be an Italian eggplant type, which is more attractive to both CPB and flea beetles. Treat only the border, as soon as beetles arrive.

Late planting

Another strategy for beating the beetle is to plant late. CPB adults that do not find food leave the field in search of greener pastures. Planting after mid- June, using a short season variety, often avoids CPB damage and eliminates the need for controls.

Straw mulch

If potato or eggplants are mulched with straw, fewer Colorado potato beetle adults will settle on the plants and fewer eggs will be laid. This can be accomplished by strip planting in a rye mulch, followed by mowing and pushing the rye straw over the plants after they emerge. Straw may also be carried in.

- R Hazzard; thanks to sources including: D Ferro (UMass Amherst), J. Mishanec (CornellUniversity), J Boucher (Univ. of Connecticut).

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