UMASS EXTENSION

VEGETABLE IPM MESSAGE

JUNE 26, 2003 VOLUME 14, NUMBER 6

Crop conditions

First the deluge, then the heat. We had another wet weekend, this time with 1-3 inches of rain. In some areas of western Mass, Sunday's storm also brought heavy winds and hail. Days in the 90's and nights in the mid- 60's have followed and are expected to continue into the weekend. Warm-weather crops are taking off in response, which is good news for everyone who is struggling with late crops. Tomatoes have green fruit, peppers are finally growing, potatoes are blossoming, corn is putting out tassels and silk. But – see the following article on nitrogen leaching!

Zucchini, summer squash and cucumber harvest is underway in earnest. For strawberry harvest, sunny weather is especially welcome and hopefully will stick around for the weekend to help PYO operations and farmers markets.

Some fields are still too wet to plant, or to cultivate after planting. Growers that have had to delay planting are still putting in winter squash and pumpkins in hopes that conditions will allow these crops to catch up and reach maturity in the fall. Corn, brassicas, lettuce, radishes and cucumbers are also being planted.

In the heat, all those insect eggs that have been piling up are hatching --fast. That includes Colorado potato beetles in eggplant and potato, and European corn borers in corn. Careful scouting will help you determine if sprays are needed and time applications to target young larvae and prevent crop damage.

Nitrogen leaching

There is little doubt that much of the nitrogen (N) that was applied at or prior to planting was leached due to heavy rains. Growers who only applied starter N at planting haven't lost much, but if large amounts were broadcast, it is likely that most is gone. This can also be true for fields where hairy vetch was plowed down, because most of the N is released within a week or two of soil incorporation. Plastic mulch protects N from leaching, but we have seen some losses where excess moisture moves in from the sides or down through the plant holes.

In most cases, additional N is needed, but how much? What happens if you apply more N than is needed? Some crops such as corn don't appear to be harmed by some extra N, but others such as peppers, tomatoes and cucurbits can suffer reduced yields and quality problems when N levels are excessive. Even with crops that are not affected by some excess N, there are cost and water quality factors to consider. As we have mentioned many times, the pre-sidedress soil nitrate test can help you decide weather you need to add additional N (see June 19th issue). Research continues to show that when nitrate-N levels are 30 ppm or higher, there is no benefit from applying more N and that additional applications can be harmful. With warmer and less wet soils, N will be released from soil organic matter. Depending on the soil, this can supply a significant amount of the required N. Under ideal conditions, it is common for the organic matter to release more than 40 lbs of N per acre for each per cent organic matter.

When plastic mulch is used, N can easily applied through a trickle irrigation system, using a fertilizer injector. Without such a system it is a real challenge to get N into the root zone. Small amounts of liquid fertilizer can be poured into the planting holes, but this is labor intensive and will not meet the needs for the season. N can also be applied along the edges of the plastic, but it will take time for the roots to grow out and reach it. N can be applied as a foliar spray, but only in small amounts (1 to 3 lb/A). This is not generally practical except as a short-term stop gap, especially while waiting for soil applied fertilizer to become available. In some cases, N can be combined with fungicides or insecticides, but BE SURE TO CHECK THE PESTICIDE LABEL REGARDING COMPATABILITY. Also be sure to use a material that dissolves easily in water.

Physiological Problems

The cool, wet weather has caused some physiological problems and more can be expected. Some tomatoes have fruit set on plants that may be too small to adequately handle the load. If you can, it would be advisable to pick some fruit to balance the load with the size of the plant. Otherwise you may likely end up with a lot of fruit too small to bother with. I haven't seen any specific numbers for this, but most growers have a good idea of typical fruit loads from experience.

The sudden onset of hot weather is putting stress on plants. During cool, wet weather, root systems do not grow as much as they would normally, and now with the sudden demand for moisture due to heat, some crops are wilting during the day. In most cases, the soil hasn't become too dry, but the root system simply isn't big enough to handle the demand. This could cause some stress related problems such as blossom end rot or tip burn of leafy crops. There is little you can do but wait for the roots to develop further. Don't aggravate the problem by adding too much fertilizer.

The chilly weather with temperatures in the 50's many nights and some days, can affect flower cluster formation in tomatoes. This process happens at a microscopic level weeks before you can see the flowers. Cool temperatures during this time cause distortions of the fruit (cat facing) later on. When this happens to small plants in the greenhouse, early clusters are affected, and when it happens in the field, later clusters will exhibit the problem.

In the greenhouse tomatoes, the prolonged cloudy weather may result in blotchy ripening or gray wall. Many factors that slow the growth of plants can cause this disorder. The problem is usually evident two to three weeks after the event occurs.

-John Howell

GET READY TO IRRIGATE!

Here's a note from Bob Precheur in Ohio that applies very well to us:

Get Ready To Irrigate! Now how crazy does that sound. With biblical rains, (rain for 40 days out of the past 49 days), it is hard to believe we should be thinking about irrigation. However, all this cool, wet weather has led to poorly developed and shallow root systems. This week for the first time this season we finally have had 4 or 5 days of bright sun and warm temperatures. With the sun at it's strongest this time of year and a cloudless sky, evapotranspiration is very high. Plants with limited root systems can easily be placed into a stress situation that can lead to quality issues latter at harvest. Small amounts of irrigation may be appropriate to relieve stress without returning soils to a waterlogged situation. Watch your crops closely if we continue to have bright, sunny and windy weather.

- Robert Precheur, VegNet Vol. 10, No. 8, 6/25/03, Ohio State University Extension Vegetable Crops

DIAGNOSING HERBICIDE INJURY

With the recent stretch of cool and wet weather, plants have been looking yellow and stunted. Many growers have questioned whether herbicide applications may be the cause. This is especially true in a year when many new products are on the market and growers are using them for the first time.

Following is a summary of new products and herbicide injury symptoms.

Strategy. This is a premix of ethalfluralin (Curbit) and clomazone (Command). Curbit has the potential to cause swollen stems at the soil line and short stubby roots. Roots will appear very white and healthy but will just be very short and fat. The result of this injury is stunted plants and is usually worse when soils are cool and rainfall is heavy, especially just after seeding and before the crop is up. Command causes complete loss of chlorophyll and thus turns leaves white. Any result on plant growth is related to how white the crop is. It is not uncommon to see some white leaves after using Strategy.

Sandea (halosulfuron). As with Strategy, the potential for injury is increased with cool soils and heavy rains. With a preemergence application to the crop, the primary symptom is stunting. Heavy rains following application but before crop emergence in cold soils is the trigger. When a postemergence application is used, symptoms will appear in 3-5 days and generally last for a week or two. Symptoms include yellowing of the growing point and young leaves as well as leaf crinkling.

Prowl (pendimethalin). Prowl injury is expected to be worse when soil are cool and should lessen as soil temperatures warm. Rates should also be lower when soils are cool. Prowl causes stunting, root pruning (roots will be white but short and stubby), and sometimes causes a failure of the leaves to unroll.

Dual Magnum (metolachlor) and Lasso (alachlor). The following symptoms could also be caused by Bicep which is a premix of metolachlor and atrazine. Symptoms in cold soils include stunting, leaf crinkling, rough leaf margins (edges), and twisted and bent leaves.

Sometimes herbicide injury occurs in bands where the spray boom may have overlapped, in wetter areas where the tractor may have moved more slowly due to slippage, or in areas with lighter soils where the rate may have been too high. Take all of this into consideration.

In conclusion, many crops this year have not looked good just because of the weather but could also show some symptoms of herbicide injury. Once soil and air temperatures warm, plants should outgrow both the cold weather problems of yellowing and stunting as well as much of the herbicide injury. If plants do not respond after this week of very warm temperatures, good soil moisture, and plenty of sun, look for the symptoms described above.

-Rich Bonanno, Weed Specialist, University of Massachusetts

TOMATO DISEASES

Tomato plants are now growing well and setting fruit. During June we've had several extended leaf wetness periods ranging from 16-40 hours. With respect to many foliar diseases – including **early blight of tomato** and **Septoria leaf spot** – the good news is that the temperatures were cool during these periods – between 53 and 60 degrees F. These pathogens develop hardly at all below 55 F, and more slowly at the temperature range of 55-60 F, compared to warmer temperatures. This week, nighttime temperatures have risen into the 60's, which favor more rapid germination of spores and development of early blight lesions. At the same time, foliage is getting thicker and fruit load puts more nutrient demands on the plants. Regular applications of protectant fungicides are recommended in tomato. *The following recommendation from Mary Hausbeck, Michigan State University, also applies here:* "**Bacterial diseases** may also develop and be severe under these (wet and cool) conditions, especially **bacterial speck**. Growers should consider applying copper to tomatoes and peppers every 5-7 days to limit bacterial spread. While copper has its limitation in controlling a severe bacterial outbreak, it is our primary tool and requires diligent use to prevent severe loss. " In Massachusetts, **bacterial canker** is more widespread than bacterial speck, but the same recommendation applies, especially on farms where canker has been a chronic problem in past years.

-R. Hazzard ,with quote from M. Hausbeck, Plant

SWEET CORN

Sweet corn has taken a great leap forward this week. Plastic corn has reached silk stage, while bare ground corn is pushing tassels out of the whorl. **European corn borer** (ECB) flights increased in cooler parts of the state but have started to decline in warmer areas such as the Connecticut River Valley. Eggs are hatching fast and first-instar larvae can be found in the new tender young tassels that are poking up out of the whorl. For **silking corn**, the recommendation is the same as last week: spray for ECB, because those new larvae will move straight into the ear if not controlled. They are difficult to detect with scouting, and you won't necessarily see them in tassel if corn is already in silk. Make a second applications 6-7 days later, if ECB flight remains high. **For corn just reaching pretassel stage,** sprays should begin based on scouting for young larvae in the emerging tassel. The threshold for ECB and armyworms at tassel emergence is 15% infested plants. Sampling 50-100 plants in groups of 10 takes 20-30 minutes. For corn borers, look down into emerging tassels for tiny larvae (white with black heads, often found inside the succulent florets of the tassel) or frass (white to brown material about the size of fine sand). 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 actual infestation level. Use a material that is easy on natural enemies (Spintor, Avaunt, Dipel ES or DF) to conserve natural enemies and help prevent aphid outbreaks later.

--

Weekly Trap Captures of European Corn Borer in Sweet Corn					
Town	**Date**	**ECB Z1**	**ECB E2**	**TOTAL ECB**	**% Pre Tassle**
Walpole, NH	6/25	0	0	0	
Plainfield, NH	6/25	3	0	3	
Conn. River Valley (North to South)					
Westminster, VT	6/25	25	13	38	11%
Hatfield	6/26	47	16	63	6%
South Deerfield	6/26	36	6	42	
Sunderland	6/26	8	29	37	
Hadley	6/26	89	42	131	
East/Central MA (North to South)					
Still River	6/26	31	39	70	
Dighton	6/25	26	21	47	
Rehoboth	6/25	56	37	93	
Sharon	6/25	8	34	42	

-R. Hazzard, with contributions from D. Rose, J.Galonka, A. Duphily, P. Westgate, R. Pestle, P. Willard, A. Seaman

Vegetable Notes, Ruth Hazzard, Editor. Nicholas Connor, Assistant Editor. *Vegetable Notes* is published weekly from May to September and includes contributions from the UMass Extension Vegetable Program faculty and staff, growers, and private IPM consultants. Authors of articles are noted; author is R. Hazzard if none is cited.

Where trade names or commercial products are used, no company or product endorsement is implied or intended. Always read the label before using any pesticide. The label is the legal document for product use. Disregard any information in this newsletter if it is in conflict with the label.

Biorational Insecticides

Pesticides vary in their toxicity and in their potential ecological impact. Pest control materials that are relatively non-toxic to people with few environmental side-effects are sometimes called 'biorational' pesticides. These fit well into an integrated pest management strategy which relies on monitoring for early detection of pests and seeks to maximize ecological health of the farm and minimize negative effects on beneficial insects that suppress pests. Some, but not all, biorationals are approved for use on certified organic crops. "Bio-rational" does not necessarily mean 'less effective'! Some have rapid activity, either via contact or ingestion, and are very effective on the first application. They always work best, however, as part of an attentive, holistic approach to crop health. They may need to be used preventatively, before pest numbers are high, or require more than one application. The long-term benefits of conserving natural enemy populations can turn into savings in fewer sprays needed against secondary pest outbreaks. The major categories of biorationals include botanicals, microbials, minerals, and synthetics.

Botanicals are plant-derived materials. Botanicals are generally short-lived in the environment, as they are broken down rapidly in the presence of light and air. Rotenone, pyrethin, sabadilla and ryania have long been used in organic farming although the latter two are now limited in registered uses and availability. Nicotine, although naturally derived, is not considered biorational nor is it allowed under organic certification, due to its high mammalian toxicity. Rotenone is also quite toxic to people, to fish, and to other non-target organisms. Products derived from the seeds of the Neem tree, including azadiractin and neem oil, are more selective and have low mammalian toxicity.

Garlic Barrier and Hot Pepper Wax are brands of botanical insecticides with names that reflect their active ingredients, garlic and capsaicin. They act primarily as repellents and thus need to be reapplied as long as pests are present. They are registered for use on a wide range of crops and pests. Check labels to ensure that use in commercial crops is allowed.

Vegetable oils can also be considered botanicals. Some vegetable oils, specifically corn and soybean oil, are exempt from tolerance and pesticide registration requirements. Golden Natur'l Spray Oil is a soy oil product is labeled for use in vegetables.

Microbial pesticides are formulated from microorganisms or their by-products. They tend to have advantages over botanicals in that they are generally more selective, so specific pests may be controlled with little or no effect on non-target organisms. Microbial insecticides include bacteria (*Bacillus thurengiensis* and spinosad) and fungi (*Beauvaria bassiana*). See Table 1 for more details. While these active ingredients are generally approved for organic crops because of their natural origin, specific trade names may be prohibited because of inert ingredients used in formulating the product or because of genetic engineering was used to modify the microorganism.

Other microbial products include beneficial fungi and bacteria that attack or compete with plant pathogenic fungi (*Streptomyces, Gliocladium, Trichoderma harizanum*). A new category of non-toxic pesticide is based on naturally occurring proteins called harpins that are produced by bacteria and other microbes. Pathogenic bacteria need harpins to infect their host plants. When applied to plants, synthetic harpins stimulate the plant's own defense systems. They do not have any direct pesticidal effect, but reduce disease progress by strengthening plant defenses. (see Table 1 for more details)

Minerals. Some biorational pesticides are minerals, mined from the earth and minimally processed. Minerals that are heated, chemically reacted, or mixed with surfactants may be considered synthetics. Kaolin clay, insecticidal soap, horticultural oils, and iron phosphate are examples of insecticides and sulfur, potassium bicarbonate, and copper compounds control fungal and bacterial diseases. Iron phosphate is the active ingredient in a molluscicide (Sluggo) that is labeled from use in a wide range of vegetables and fruits. It is exempt from tolerance and has a zero hour reentry interval due to its low toxicity to people and wildlife.

Low-risk Synthetics. The Environmental Protection Agency recognizes certain synthetic materials as posing a low risk to human and environmental health and allows faster registration of these products under the 'reduced risk' track. This means that many new chemistries that are being introduced as pesticides are safer for handlers and for the environment than older insecticides. They often have lower use rates per acre than older products, as well.

Table 1: Bacillus thuringiensis-*based bioinsecticides for major vegetable crops: 2003 Updates*

Source B.t. Strain	B.t. kurstaki								Bt aizawi		*Bt tenebrionis*
Trade Name	*Crymax*	**Deliver**	*Deliver*	**Lepinox**	**Dipel***	**Biobit**	**Javelin**		**Agree**	**Xentari**	**Novodor**
Manufacturer	Certis	Certis	Certis	Certis, FMC	Valent	Valent	Certis		Certis	Valent	Valent
Formulation(s)			LC	WDG	DF, ES, 10G, ES-CPI, SG Plus	HP	WG		WG		
Crop & Pest											
Broccoli, Cabbage and Cauliflower, other brassicas											
Cabbage looper	X	X		X	X	X	X			X	
Diamondback moth	X	X		X	X	X	X			X	
Imported cabbageworm	X	X		X	X	X	X			X	
Sweet Corn											
Armyworms (general)	X	X	X	X	X	X	X			X	
Fall armyworm				X	X						
Corn earworm	X	X		X	X						
European corn borer	X	X	X	X	X		X			X	
Lettuce, endive, escarole											
Cabbage looper	X			X							
Pepper											
European corn borer	X	X	X	X	X		X		X	X	
Spinach											
Cabbage looper	X			X							
Tomato											
Colorado potato beetle											X
Cabbage looper	X		X	X							
Tomato fruitworm	X	X		X	X	X			X	X	
Tomato hornworm	X			X							
Eggplant											
Colorado potato beetle											X
Potato											
Colorado potato beetle											X
European corn borer	X	X	X	X	X		X		X	X	

Not all formulations are labeled for all pests listed. Check label for each formulation.

Updated April, 2003. The information here is correct to the best available knowledge at the time of printing, but always read and follow the label. No company or product endorsement is implied or intended. Always read the label before using any pesticide. The label is the legal document for product use. Products may be labeled for additional vegetable crops or additional pests; refer to label for details. Disregard any information if it is in conflict with the label.

Table 2. Biorational Insecticides

Insecticide	Target Pests	Labeled Crops	Comments
Azadiractin (Neemix 4.5,0.25; Aza-Direct) **(botanical)**	aphids, leafminers, thrips, whitefly, leafhoppers, true bugs, beetles, flies	Many vegetables, including brassicas, cucurbits, fruiting and bulb vegetables, root and tuber vegetables, herbs	Acts by contact or ingestion., as a repellent, anti-feedant, or insect growth regulator to disrupt growth of immature stages. Use preventatively before pests reach damaging levels. Repeat applications needed.
Bacillus thuringiensis subsp *kurstaki* **(microbial)**	Caterpillars, including imported cabbageworm, diamondback moth, cabbage looper, European corn borer, tomato hornworm	Many vegetables; specific crops vary with product(see Table 1))	Must be ingested with foliage; apply when pests are actively feeding. For best results get good coverage of both leaf surfaces, use at temperatures above 60 F, and target smaller caterpillar stages.
Bacillus thuringiensis subsp *aizawi* **(microbial)**	caterpillars	Many vegetables (see Table 1)	Same as above. Use in rotation with *Bt kurstaki* to prevent resistance.
Bacillus thuringiensis subsp *tenebrionis* **(microbial)**	Colorado potato beetle larvae	potato, tomato, eggplant	Same as above. Target CPB larvae that are less than half grown.
Beauvaria bassiana Strain GHA (Botanigard 22WP) **(microbial)**	Aphids, whiteflies, thrips. Also has been shown to suppress Colorado potato beetle	Labeled for all vegetables, herbs, fruits. Active ingredient is exempt from tolerance requirements.	This fungus penetrates the insect cuticle, fills its body, kills it, & releases more spores. Apply in the evening and target coverage of lower leaves, as spores are inactivated by sunlight. Use preventatively based on monitoring, before pests reach high levels.
Cyolite (Kryocide, Prokil Cryolite) **(mineral)**	Colorado potato beetle (larvae only), cucumber beetle, flea beetle, cutworms, some caterpillars	potato, tomato, eggplant, pepper, cucurbits, cole crops, tomato and eggplant.	May cause extensive wear of nozzles.
Extract of neem oil (Trilogy) **(botanical)**	Primarily labeled for (but not limited to) mite control	Many vegetables, including brassicas, cucurbits, fruiting and bulb vegetables, root and tuber vegetables, herbs	Broad-spectrum fungicide/miticide which acts as a repellent and insect growth regulator that interferes with molting. Can be used to control mites on eggplant. For best results use when population levels are low to prevent build-up. Repeat applications are needed.
Indoxycarb (Avaunt) **(synthetic)**	Caterpillars. In apples, tarnished plant bug, leafhoppers	Broccoli, cabbage, cauliflower, lettuce, sweet corn (pre-silk), pepper, tomato	Selective insecticide which must be ingested to be toxic to pest. Causes cessation of feeding, paralysis, death. Very effective against caterpillars including armyworms, loopers.
Tebufenozide (Confirm 2F) **(synthetic)**	Caterpillars including cabbage looper, imported cabbageworm, beet armyworm, but not diamondback moth.	Fruiting vegetables, leafy vegetables, brassicas, turnips	Insect growth regulator (IGR) that mimics insect hormone that induces molting must be ingested induces premature molt within hours, feeding stops within 24 hours. Long residual - reapply at 10-14 day intervals.
Insecticidal soap (M-Pede)	Aphids, leafminers, mites, thrips, whiteflies		Suffocates soft-bodied insects. Apply directly onto exposed insects to get good control. Soaps can be phytotoxic to some crops, test on small plot. May also harm some beneficials
Kaolin (Surround WP) **(mineral)**	Flea beetle, striped cucumber beetle, thrips, leafhopper	Tomato, eggplant, pepper, onions, cucurbits	Interferes with insects' ability to recognize their host, particles cling to cuticle. Plant leaves turn white but growth is not inhibited. Reapply after heavy rain. To avoid lumps in mixing, form a slurry, then dilute. Maintain agitation.
Potassium salts of fatty acids (M-Pede) **(mineral)**	Aphids, leafminers, mites, thrips, whiteflies.	Vegetables, ornamentals	Works on contact. Good coverage is needed. Avoid treatment when plants are stressed. Certain cucurbits may be sensitive; spot treat first. Repeat applications may be needed. Also active against powdery mildews
Pyrethrin (PyGanic EC5.0) **(botanical)**	List includes beetles (cucumber beetles, asparagus beetle, blister beetle, flea beetles, Mexican bean beetle); potato leafhopper; many caterpillars; aphids, stink bugs	Most vegetables including root and tuber vegetables and their leaves; bulb, leafy, fruiting cucurbit & oriental vegetables, herbs & spices.	Botanical insecticide with broad-spectrum activity. Contact toxin with rapid knockdown but short period of activity (non-persistent). Highly toxic to fish. Derived from a chrysanthemum species cultivated in Africa. Approved for organic crops.
Soybean oil (Golden Natur'l Spray Oil) or corn oil **(botanical)**	Primarily soft-bodied insects	Many vegetables including corn	Kills soft-bodied insects and egg masses on contact. May be used as a barrier treatment in silking corn (0.5 ml per ear) to prevent entry of corn earworm (see sweet corn section). Approved for organic crops. Contains an emulisifier.
Spinosad (Spintor 2SC, Entrust)	caterpillars including European corn borer, imported cabbageworm, cabbage looper, diamondback moth; Colorado potato beetle larvae and adults; leafminers; thrips.	brassicas, lettuce, sweet corn, pepper, tomato, potato	Acts both as a contact and stomach toxin. Selective; easy on beneficial insects**.** Entrust formulation meets National Organic Standard. Rotate with other selective biorationals to prevent resistance.

Updated June, 2003. The information here is correct to the best available knowledge at the time of printing, but always read and follow the label. No company or product endorsement is implied or intended. Always read the label before using any pesticide. The label is the legal document for product use. Products may be labeled for additional vegetable crops or additional pests; refer to label for details. Disregard any information if it is in conflict with the label.