UMASS EXTENSION

Vegetable Notes

For Vegetable Farmers in Massachusetts

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In this issue:

Crop conditions

Welcome rainstorms soaked nearly every part of the state at least once this past week. The northeast corner of Massachusetts came up short, and some areas of western Massachusetts received un-welcome hail. Overall it has been a great week for growing. Harvest of early summer squash and zucchini picked up, and harvest of peas, broccoli, beets, spring onions and strawberries filled out the greens and lettuce that have been underway for several weeks. Pumpkins and winter squash are up and running, off to a good start. Insect pressure is normal for this time of year – we saw the first corn borer caterpillars in corn, first hatch of CPB larvae, first caterpillars in cabbage. Also the first silk appeared in some of the earliest sweet corn fields – always a sign that summer is arriving! If the hours of daylight were any longer, growers would get no sleep at all.

Spider mites in eggplant

Two-spotted spider mite. Photo: Dave Ferro

The two-spotted spider mite is the most common mite species that attacks vegetable and fruit crops in New England. Spider mites can occur in tomato, eggplant, potato, vine crops such as melons, cucumbers, and other crops. Two-spotted spider mites (TSSM) are one of the most important pests of eggplant. They have up to 20 generations per year and are favored by excess nitrogen and dry and dusty conditions. Outbreaks are often caused by the use of broad-spectrum insecticides which interfere with the numerous natural enemies that help to manage mite populations. TSSM tend to be prone to pesticide resistance.

An outbreak of two-spotted spider mites was observed this week in an eggplant crop that was recently transplanted to the field. It is likely that the infestation began in the greenhouse where the transplants were grown. In case other growers have a similar problem, we are sending out information on spider mites and encouraging growers to keep an eye out. Scout by checking undersides of leaves for symptoms, webbing, or (especially with a 10X hand lens) the mites themselves. As with most pests, catching the problem early will mean easier control.

Two-spotted spider mite damage on eggplant. Photo: Jude Boucher

Watch for spider mites in greenhouses where there are vegetable transplants growing, and on eggplant in the field. Adult females are approximately 1/50-inch long, slightly orange or pale green in color with two dark spots on their body. All mobile stages are able to pierce plant tissue with their mouth-parts and remove plant fluids. Saliva injected during feeding may also cause discoloration, necrosis

or abnormalities on leaves, stems and fruits. Most spider mites are found on the underside of leaves. A 10X hand lens is key for identifying the mite species, but injury, webbing, and the tiny adults can be seen with the naked eye.

Feeding injury often gives the top leaf surfaces a mottled or speckled, dull appearance. Leaves then turn yellow and drop. Large populations produce visible webbing that can completely cover the leaves. Eggs are laid singly, up to 100 per female, during her 3- to 4-week life span. Eggs hatch into larvae in as few as 3 days. Following a brief larval stage, several nymphal stages occur before adults appear. Egg to adult cycle can be completed in 7-14 days depending on temperature.

In the field, spider mites are favored by hot dry weather, which also aggravates injury by stressing the plant. Damage is often underestimated since the wounds and the pest are not apparent to our eyes without close inspection. Leaves become blotched with pale yellow, reddish brown spots ranging from small to large areas on both upper and lower leaf surfaces. Other symptoms caused by either severe or constant attack include distorted leaves, overall loss of plant vigor (in spite of adequate moisture and nutrition), whitening or spotting of leaves, yellowing of the plant or some of the leaves, and in some cases loss of foliage and death

Overhead irrigation or prolonged periods of rain can help reduce populations. Do not over-fertilize. Avoid weedy fields and do not plant eggplant adjacent to legume forage crops. Avoid early season, broad-spectrum insecticide applications for other pests.

For control, use selective products whenever possible. Selective products which have worked well in the field include Agrimek (abamectin, derived from a soil bacterium) and Acramite (bifenazate,a long residual nerve poison). See the 2008-2009 New England Vegetable management Guide for additional products. With most miticides (not bifenazate), use 2 applications, approximately 5 to 7 days apart, to help control immature mites that were in the egg stage and protected during the first application. Alternate between products after 2 applications to help prevent or delay resistance.

Preventative releases of the predatory mite, Phytoseiulus persimilis, may suppress TSSM populations in vegetable fields, as they do in strawberry fields. Amblyseius fallicis is a predatory mite that is widely used in greenhouses.

-- Ruth Hazzard, UMass Extension. Source: 2008-2009 New England Vegetable Management Guide

EARLY SEASON BACTERIAL DISEASE MANAGEMENT FOR TOMATO AND PEPPER

One of the most important management practices for bacterial diseases is regular scouting for symptoms. Growing resistant varieties is a key cultural practice for managing this disease and has made a big difference in crop losses, especially in bell peppers. Even when you are growing resistant pepper varieties, leaves still need to be examined because of the potential for development of a new race of the pathogen that is able to overcome resistance. For some specialty peppers there are no resistant varieties available. Look for this disease early in the season, as symptoms may show up in a few plants soon after transplanting. Bacterial leaf spot (BLS) can be particularly destructive in pepper because severely infected leaves drop off the plant leaving the fruit exposed to sun, thereby increasing the potential for sunscald, as well as reducing the plant's photosynthetic ability. Detecting symptoms very early is critical because bacterial diseases are extremely difficult to manage with chemicals, especially if the environment remains conducive and/or the disease is well established before treatment begins. Preventive applications of copper are recommended before or immediately after a rainstorm, especially when heavy rain and wind is predicted, as these provide favorable conditions for movement of bacteria and can create wounds that provide an entrance place for bacteria. Additional products to consider using with copper are Tanos and EBDC fungicides (e.g. maneb, which enhances the action of the copper). Tanos is labeled for suppression of bacterial diseases. A series of cool nights, below 60F, will suppress the disease, while hot and damp conditions will enhance the disease.

There are 3 bacterial diseases that can affect tomato foliage: speck, spot, and canker. Actigard is registered for treating speck and spot on tomatoes. Note that Actigard is not registered for use on pepper because of phytotoxicity. To be successful, applications of this material need to be started before bacterial diseases begin to develop. This is because it has a unique mode of action: it induces host plant resistance to speck and spot. Unfortunately it is not effective for canker. The label directions state to begin applying within one week of transplanting. A 14-day interval is recommended for a maximum of six applications. There is a 14-day preharvest interval. Since Actigard does not have bactericidal activity, disease-causing bacteria can continue to survive and multiply on tomato plants sprayed with Actigard. Therefore copper plus

EBDC fungicides should also be used and could be combined with Tanos.

- adapted from Meg Mcgrath, Long Island Horticultural Research Center, Cornell University.

INSECTS IN BRASSICA CROPS

Imported Cabbage Worm Egg

Early cabbage and broccoli crops are beginning to form heads, which means caterpillar injury will have more impact on the marketability of the crop. This week we found both diamondback moth and imported cabbageworm in one field of cabbage in the Connecticut Valley, which suggests that these pests are becoming active and its time to scout your fields. In the early season the numbers tend to be lower than late season, but keeping the first heads clean is key.

Flea beetles have a habit of being unpredictable and this season is no exception; reports vary from 'worse than ever' to 'nowhere to be seen'. New fields that were previously sod may have high numbers, because flea beetles do well on weedy plants such as wild mustard and yellow rocket. Keep an eye out on newly seeded crops to be sure that flea beetles don't destroy the cotlyedons before you notice.

The major caterpillars on Brassicas – generally known as 'worms in cabbage' – include three species that differ in size and feeding habits, as well as how susceptible they are to certain insecticides. Getting acquainted helps you to know what kind of damage to expect and what to look for.

Imported cabbageworm; cabbage butterfly (Pieris rapae). This familiar white butterfly can be seen in daytime fluttering around cole crop fields. Each forewing has a dark border and one or two round black spots. Eggs are laid singly on the underside of leaves, about 1/8 inch in length, light green and slightly elongated, standing upright. The larvae, called imported cabbageworm, is gray-green, slightly fuzzy, and sluggish. Feeding and resting occur on the underside of leaves, and larvae feed more heavily in the head of cabbage or broccoli as they grow. The overwintering stage is the crysalis (pupa), which is green or brown, smooth with three pointed ridges on its back. There are 3-4 generations per year.

Diamondback moth (Plutella xylostella) caterpillars are smaller, light green, appear more segmented and more pointed in shape. When disturbed they wiggle vigorously and may drop off the plant on a string of silk. Feeding causes small, round holes and tends to be spread across the foliage and not necessarily concentrated in the head. The adults are tiny (<1/2 inch), light brown, and rest with their wings folded together like a tent. They overwinter in crop residue, but may also enter the region by migrating from southern states.

Cabbage looper. Cabbage looper usually does not survive the winter in New England, and arrives in migratory flights from farther south. Generally numbers are not significant until late July. However, earlier flights do occur, probably as a result of early migratory flights. Adult moths are mottled gray-brown, about 3/4 inch long, with a distinct round silver-white mark on each fore-wing. Since they fly at night, they are rarely seen unless monitored with pheromone traps. The cabbage looper caterpillar is light green, with wavy white or light yellow lines down the back and sides. Full-grown larvae reach 1 ½ to 2 inches. At rest or when disturbed, cabbage loopers of any size will raise the middle of their body in a characteristic "loop" shape. Eggs are round, light green or yellow, and laid underneath the foliage. Monitor caterpillar activity by field scouting (below). Feeding tends to create ragged, large holes in foliage, on both frame leaves and heads.

Diamondback moth larvae. Photo: Jude Boucher

Field Scouting for caterpillars: It is especially important to check cabbage or broccoli plantings as they begin forming heads. Greens such as collards, kale, and Chinese cabbage should be scouted earlier, since all leaves are marketed. Check at least 25 randomly-selected plants throughout the field looking for caterpillars on the top or underside of leaves. Feeding damage can be found on the underside of leaves or in the center of the plant where heads are forming. Look for tiny feeding holes, clustered together. Often it is easier to spot the

feeding damage first, then find the caterpillar. Classify plants as infested (has one or more caterpillar) or non-infested, and calculate the percent of plants infested. Spray if the threshold is reached. Use selective products to protect beneficials that keep aphids under control – they also eat insect eggs and small caterpillars!

Crop & Stage	Threshold - % Infested Plants
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%

Action thresholds for caterpillars in crucifers

It should be noted that these thresholds do not imply that 10 or 15 % of the harvested crop will be infested! They are based on research trials that showed that use of the thresholds produces 98-100% clean heads, the equivalent of weekly sprays but with far fewer insecticide applications.

Corn report

Sweet corn has been growing well in response to the weather across the state. Many early fields are in pre-tassel and a few are even silking. European corn borer trap counts seem to be declining or staying steady in most locations. Adult moths have laid eggs and are still busy laying more. Egg mass scouts were conducted in fields where Trichogramma ostrinea wasps were released revealing that eggs have been laid and parasitized by the biological control. These borer eggs will never hatch but instead will give rise to more Trichogramma that will then search out more egg masses to parasitize, cutting down on the overall population of borers in the field. Scouting tassels is another way to judge efficacy of the wasps. For more information on releasing Trichogramma on your farm visit our website or call Amanda Brown at the Vegetable IPM Lab, 413-577-3976.

The first field scouts were made this week in tasseling and silking sweet corn fields. Infestation levels were very low, around 2-5% with the exception of one field that was just above the 15% threshold and warranted spray at 17%. European corn borers that were found were small, 1st and 2nd instars indicating that hatch most likely occurred within the past few days. Beneficial insects are thriving in these fields as well right now and are taking care of aphids. This is something you may want to keep in mind when and if you are deciding to spray for borers. By choosing an insecticide that is less toxic to non-targets such as Spintor or Avaunt, you will conserve the population of natural enemies therefore reducing if not eliminating the need for aphid and other secondary pest control later in the season.

- Amanda Brown, UMass Extension

Location	Z1	EII	Total ECB
Bershires/Champlain Valley			
Pittsfield	0	0	0
CT Valley			
South Deerfield	6	3	9
Sunderland (1)	-	-	-
Sunderland (2)	1	11	12
Whatley	2	15	17
Hadley (1)	2	13	15
Hadley (2)	3	12	15
Amherst (1)	2	4	6
Amherst (2)	0	2	2
Granby	3	0	3
Easthampton	2	0	2
Nantucket County			
Nantucket	0	2	2
Central & Eastern MA			
Dracut	-	-	-
Rehoboth	6	35	41
Still River	1	3	4
Concord	-	-	-
Leicester/Spencer	-	-	-
Northbridge	-	-	-
Tyngsboro	-	-	-
Lancaster	5	0	5

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PRE-SIDEDRESS NITRATE TEST: NOW IS THE TIME FOR SAMPLING

Many crops have reached or will soon reach the stage when it's time to decide whether, and how much, nitrogen to apply as a side dress or top dress. The pre-sidedress nitrate test (PSNT) (also known as the June Nitrate Test) can help you to determine the current level of nitrogen in the soil. If you have a soil probe, the sampling takes about 20 minutes per field (probes are available from many ag suppliers for $40 to $75.) The amount of nitrate-N (reported as parts per million N03-N) in the soil is a good indicator of whether more N will be needed to complete crop growth.

To take a sample for nitrate testing, take 10 to 15 subsamples or cores from the field. Sample slices or cores should be taken to a depth of twelve inches if possible. Avoid sampling fertilizer bands or other areas which have high concentrations of N fertilizer. Generally the best place to sample is between the rows. If plastic mulch is used, samples should be taken from under the plastic. With a soil probe you can just sample through the plastic, leaving small holes that cause no problem. Be sure to avoid any trickle irrigation tape under the plastic. Mix all the samples together and submit about one cupful to the UMass Soil Testing Lab, West Experiment Station, University of Massachusetts, Amherst MA 01003. You may contact the soil testing lab 413- 545-2311 or consult their website at www.umass.edu/plsoils/soiltest

Cloth bags are ideal for sending PSNT samples to the Soil Testing Laboratory. These bags are more convenient to use because it is not necessary to dry the samples, as long as the laboratory receives them within four days. With plastic bags you should dry the samples unless you can deliver them within 24 hours, and ship overnight, or next-day delivery. The lab will do the PSNT within one working day of receipt and inform you of the results. The charge for this test is $6.00 (include a check made out to the University of Massachusetts). Be sure to request a Nitrate (PSNT) test.

The PSNT is a tool growers can use to optimize N application. Research conducted for several years at UMass, along with several years of on-farm experience, showed that an appropriate threshold for peppers and winter squash is about 30 ppm nitrate-N. Above this level, sidedressing or topdressing supplemental N would be of no value and will likely decrease yield of butternut squash and peppers. Research in Connecticut has shown similar results in pumpkins. There is increasing agreement that a threshold of 30 ppm is appropriate for most vegetables except for sweet corn, for which the threshold is 25 ppm. Using the PSNT can save money and time, improve crop yield, and reduce the likelihood of N leaching and water contamination. Barring unusual weather conditions, PSNT levels in a field tend to be fairly consistent from year to year. Once these values are known for a field, a grower probably does not need to test every year. As a tool, the PSNT should be used along with a grower's experience and knowledge of fields. Interpretation of PSNT results should be made with regard to weather conditions such as leaching rains or soil temperatures.

-John Howell, Frank Mangan, and Ruth Hazzard, University of Massachusetts

MEASURING INSECTICIDE FOR BACKPACK SPRAYERS AND SMALL PLANTINGS

Growers with diverse crops and small plantings often need to be able to apply pesticide to beds or plots of several hundred square feet. It can be difficult to figure out how to calibrate a backpack sprayer for a spraying a small area. Some labels give rates for backpack sprayers (ie amount per gallon of water) and some only provide rates per acre (ie amount per land area treated). Rates may have to be calculated by converting from the rate per acre (ie, per 43,560 sq ft) to rates for a few hundred square feet. Careful division gives you the amount you need. However, it is also critical to properly calibrate your sprayer by determining how much water you use to cover a given area.

For some products, spraying small areas may mean that you need to measure extremely small amounts. Some labels provide conversions of volume to weight, but many do not. For example, if you are using spinosad (Entrust formulation, a dry powder) you may need to weigh product in grams . If gram scale is unavailable, then it is possible to measure Entrust by volume. Based on repeated samples, we found that, on average, the volume was 1.7 gm per teaspoon (shaved level and tamped slightly) of Entrust powder. One ounce (dry weight) equals 28.45 grams.

Liquid measure in (fluid) ounces is already a volume so it is easier to measure. One fluid ounce equals 29.6 milliliters (ml). An inexpensive measuring device for ml can be found in the children's medicine section of drug stores. Nicotinoids call for very low rates per acre and may need to be measured in ml.

Even if you are using pesticide products that are relatively safe, always store in a safe place, handle carefully, and use the

required protective gear for mixing, spraying, and cleaning your sprayer.

Why does it matter? Why do you need to be careful about these rates?

1. Effective control of the pest depends on correct rates.

2. You are legally responsible for following the label instructions.

3. Safety of applicator and workers depends upon using proper protective gear and adhering to restricted entry periods.

4. Safety of the consumer depends upon using labeled rates and adhering to required pre-harvest intervals, as well as following other procedures the label.

Read the label. Find and follow the following instructions:

--Personal protective equipment required for mixing and spraying.

--Agricultural Use Requirements describes the Worker Protection Standard rules that are required for each product.

--Crops and pests listed.

THE PESTICIDE MUST BE LABELED FOR THE TARGET CROP

--Restricted Entry Interval (REI), during which workers must wear protective gear to work in the field.

--Days to Harvest (DH) – crop may not be harvested until this interval has passed.

--Rate per acre or per gallon of spray

--Directions for use and mixing instructions.

When calibrating and using your sprayer, be consistent. The amount of spray you apply to an area will depend on four variables: your walking speed, the pressure you select, your spray swath width, and the nozzle tip you've chosen. If you change any one of these, you change the amount of spray you apply.

Walking speed. This constant walking speed should be one that you can comfortably maintain over the entire time you intend to spray. It also must be the same speed at which you calibrate the sprayer. If you double your walking speed while maintaining pressure and swath width, you'll apply half as much spray. You would then require twice as much pesticide per gallon (that is, a greater concentration) to apply the same amount of pesticide per acre.

Pressure. If you change the pressure while you spray, you change output. Increased pressure results in higher output; the exact relationship depends on your nozzle type.

Nozzle tip selection. The proper tip will depend on the situation. Tips are available that cover a wide range of output volumes, spray widths, and pressures. Most backpack sprayers come with a single flat fan nozzle, but a cone tip may be more appropriate for coving foliage.

Swath width/nozzle height. Tips are designed for use within certain heights and pressures. Within these ranges, some tips deliver narrow bands; others, like flooding tips, provide swath widths up to 7 feet. The wider each swath width, the less time the operator spends walking up and down fields. The height at which you hold the spray tip above the target influences the swath width. Spraying as close to the target as is practical minimizes drift and operator contact.

There are different ways to calibrate and mix backpack sprayers. Below are two examples One is based on adjusting the concentration to match the amount of water you use to spray a given crop area. The other is based on covering a fixed amount of crop area with a known amount of water by adjusting your walking speed.

Mixing Method 1: Amount of insecticide per gallon to cover the amount of water used to spray a given crop area.

1. Select the spray tip or boom that provides the desired output (this information should be available from the manufacturer or an equipment supplier).

2.Add water, and spray the ground or dry pavement as if you were spraying your field. Now check the spray pattern for uniformity (and proper spray pattern overlap if you're using a boom). Adjust nozzle spacing and/or height until you achieve the desired pattern. Be certain you're getting uniform coverage before you proceed! Check fittings and hoses for leaks. Try to calibrate in the same field or under the same conditions as where the spray application will occur.

3.If all is well, add exactly 2 gallons of water to the tank. (Note: You can use any amount of water, but remember to substitute your figure whenever you see "2 gallons" in the example that follows Step 9.)

4.Mark your starting spot.

5.Spray the water as if you were actually spraying your field. Remember, you must maintain constant pressure, constant walking speed, and consistent nozzle height.

6.When the water is gone, stop and mark the spot.

7.Measure the area you sprayed and calculate square feet (length of swath x width).

8.Calculate how much of an acre you covered: number of ft2 you sprayed

---------- = acres sprayed

43,560 ft2 /acre

9.Calculate how many gallons/acre you sprayed:

2 gal sprayed

---------- = gal/acre

acres sprayed

Mixing Method 2: Amount of insecticide per gallon when sprayer covers 330 sq ft per gallon.

If you calibrate your walking pace to use the desired amount of water on the desired amount of land area, then you can measure both water and product to match your pace and your target area. This requires that you use a consistent pace and spray pattern to achieve this rate of coverage.

Test and adjust your pace so that you walk and spray at a rate that uses 1 gallon per 330 sq ft.

1. Fill sprayer with 1 gallon.

2. Mark an area 330 square ft (eg, 110 X 3 ft., 55 X 6 ft, or 30 X 11 ft). Walk and spray the area evenly. Use the desired amount. If you are off, try it again and change your pace. Repeat until you achieve consistent results.

Spray the area that you need, walking at your measured pace.

1. Calculate the area of the beds or rows you want to spray in square feet (length X width = square feet). This is the sprayed area, so it should not include the space between beds or rows, only the area that is covered by the spray band.

2. Divide the area to be sprayed by 330 square feet to get the amount of water needed, in gallons.

3. If the pesticide rate is given as rate/acre, divide the area to be sprayed by 43,560 sq ft/acre. Multiply this fraction by time the pesticide rate per acre.

4. Mix the amount of insecticide needed to cover the area you want to cover, following label instructions.

5. Spray at your measured pace.

--Ruth Hazzard and Pam Westgate, University of Massachusetts Extension Vegetable Program. Sources include Calibrating and Using Backpack Sprayers, C.G. Landgren, Oregon State University, Washington State University, University of Idaho. See http://extension.oregonstate.edu/catalog/html/pnw/pnw320/ for more details.

CUCURBIT DISEASE PROGRAM

The UMass Vegetable Program has received support from the EPA and the NEVFGA to work on helping growers deal with cucurbit diseases. We'll be using this funding for the following activities:

- We'll be talking with growers in the early part of the season to help them develop a plan for managing the cucurbit issues that they're likely to see, apply appropriate cultural methods, and make recommendations for effective use of fungicides.
- During the season we'll be able to make site visits, pick up disease samples, scout fields and make fungicide recommendations.
- Disease samples generally cost $50, but we'll be able to cover the cost of the first 50 samples. Send your samples in!
- We will be testing irrigation water for contamination with Phytophthora capsici, including the Connecticut and Merrimack rivers and several farm ponds.
- We'll be apprising growers of the status of the annual downy mildew migration by posting information twice per week on our website and including alerts in the Vegetable Notes newsletter when the threat level is high.
- There will be two twilight meetings where we provide growers with hands on IPM training with a focus on cucurbit disease ID and treatment. One will be at Verrill farm in Concord in mid August and the other at Rich Bonnano's farm in Methuen in mid September – stayed tuned for more details).
- We will be testing field populations of powdery mildew, downy mildew, Plectosporium blight, and Phytophthora capsici for resistance to commonly used fungicides
- We're working with the University of Florida to help test a breeding line of butternut squash that is potentially carrying genes for resistance to Phytophthora.

If you would like advice on your cucurbit spray programs and disease management, or if you have a disease sample you would like diagnosed, please call or email Andy Cavanagh at 413-658-4925 or acavanagh@psis.umass.edu. As always, results of our research projects will be posted in this newsletter as well as online at www.umassvegetable.org.

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