UMASS EXTENSION

Vegetable Notes

For Vegetable Farmers in Massachusetts

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CROP CONDITIONS

Strawberries and spring broccoli harvesting is winding down from a busy spring. A few growers are picking sweet corn for farm stands in anticipation for heavy sales this Fourth of July weekend. Sweet corn fields are silking and potatoes are in full bloom. Warm weather crops such as peppers, summer squash and zucchini are growing well with the hot, wet and humid weather. Fruit set is good on peppers and eggplant. While corn pests such as European corn borer are at a low for the moment, and some other pests that have a midsummer gap between generations are also at lower levels, we are seeing the arrival of mid summer migratory pests such as potato leafhopper and (very sporadically) Corn earworm. Watch for Mexican bean beetle, Japanese beetle, sap beetle, tarnished plant bug, spotted cucumber beetle. Summer emergence (a new generation) of flea beetles, Colorado potato beetles, striped cucumber beetle (whose pupae have been underground) can be expected to start within the next couple of weeks.

- Amanda Brown, UMass Extension

DOES SPRAYING FOR APHIDS CONTROL VIRUS? WHEN SHOULD I SPRAY FOR APHIDS?

At this point in the season, aphids are showing up in many crops, and growers are concerned about whether and when to spray. Many growers feel they must have a rigorous spraying program for aphids to protect their crops from virus diseases. All too often this practice is not effective in preventing the occurrence of virus diseases, but it is expensive and time consuming.

This article will briefly review some of the basics of how viruses are spread. Virus diseases require a living host, and when the host plant dies, any virus within the host plant cannot survive. (An exception is tomato/tobacco mosaic, which can survive in dead host tissue.) For the most part, viruses survive the winter in certain perennial weeds. During the growing season, viruses can be transmitted from perennials to a susceptible vegetable crop.

Most vegetable virus diseases that are important in New England are spread by insects. Cucumber beetles, thrips, leafhoppers, and nematodes can spread certain viruses, but aphids are the most important vectors (carriers). Viruses can be classified as persistent and nonpersistent. This is related to the manner in which they are spread by insects and is important in choosing an appropriate management strategy.

An insect must feed for a minimum of ten minutes to an hour to pick up a persistent virus from an infected host. The virus must then undergo a dormant period of at least 12 hours within the insect before it can be transmitted to another plant. Aphids will remain infective (able to vector a virus) for at least a week and maybe throughout their life. A good insect management program including pesticides can be very helpful in dealing with persistent virus diseases.

Aphids pick up nonpersistent viruses by merely probing (exploring) an infected leaf. This happens rapidly--within seconds or minutes. A dormant period is not required and the aphid can immediately transmit the virus by probing another plant. Aphids remain infective with nonpersistent viruses for a short time (minutes).

Winged aphids stop on many types of plants and probe to determine if the plant is the 'right one' for them – if it is their host plant. If it does not 'taste right', they will fly away. During the few seconds it tastes the plant, any viruses that it is

carrying can be transferred. No insecticide works fast enough to prevent this transmission. Insecticides do not prevent virus transmission in most vegetables and any application of insecticides to prevent viruses does more harm than good by killing natural enemies.

Systemic materials are generally the most effective insecticides available for aphid control. Systemic insecticides are taken into the plant and become present in the plant juices. Aphids feed by sucking juices from the plant, and when they do so they also ingest some of the insecticide. However, when probing a leaf an aphid is not feeding and does not ingest plant juices or insecticide. In fact, the presence of an insecticide may actually stimulate probing and cause aphids to move from plant to plant in an effort to fine a suitable feeding site. This can increase the spread of nonpersistent viruses.

Nonpersistent viruses are very difficult to manage. We have no pesticide that kills viruses and, as we have seen, insecticides may actually make matters worse. Eradication of perennial weeds around fields can reduce the source of the virus. The green peach aphid is not the only aphid that transmits viruses, but it is important because it is a universal vector. Prunus species (peaches, cherries etc) are attractive to green peach aphids. Removal of wild prunus such as wild cherry trees from around fields can make the area less attractive to green peach aphids.

Reflective mulch such as aluminum foil on paper have been used successfully to repel aphids and can be effective in reducing virus problems. However this material is expensive and tears easily when laying. Some of the light colored plastic mulches may be worth a try. Row covers such as Remay can keep aphids off a crop, but they are generally used during the cool days of spring whereas aphids are most active during warm weather.

Resistant varieties. The most effective way to reduce the incidence of viruses is to plant virus resistant varieties, wherever possible. Managing weeds in and around vegetable fields will also help reduce aphid populations.

Direct damage from aphids: Besides spreading virus diseases, aphids in high numbers can cause economic damage by their feeding activities. Leaf curling and yellowing or deposits of honeydew on leaves or fruit can affect crop quality or yield. For this reason it is important to manage aphids even if virus is not a concern. However, beneficial insects such as ladybeetles, lacewings, and parasitic wasps often keep numbers low enough to prevent direct damage. Beneficials move in shortly after aphids arrive, and bring the population down. Early sprays targeting aphids may actually result in further aphid outbreaks, because the natural enemies that keep them in check have been killed. Where possible, use selective insecticides that have minimal impact on beneficials.

Scouting across the field gives you an estimate of current numbers. If aphids are present, check back in a few days to see if the numbers are increasing or decreasing. Note which natural enemies are present. Check undersides of leaves, including lower and mid level leaves. The following thresholds can be used to determine if insecticides are needed (sampling routine in parenthesis):

Pumpkin and winter squash: 20% of leaves have more than 10 aphids (based on 50 leaves).

Pepper: 10 per leaf (based on 4 leaves per plant, 25 plants).

Tomato: 6 per leaf (based on 2 leaves per plant, 25 plants).

Potato: 4 to 10 per leaf (based on 25-50 compound leaves; higher threshold near harvest).

Sweet corn: 50% of plants with >50 aphids at emerging tassel (based on 100 plants).

- Ruth Hazzard, John Howell, and Rob Wick, University of Mass., with except from Beth Bishop, Michigan State

BACTERIAL DISEASES OF CUCURBIT CROPS

Cucurbits are subject to three diseases caused by bacteria - Angular Leaf Spot (*Pseudomonas syringae* pv. *lachrymans*), Bacterial Spot (*Xanthomonas campestris* pv. *cucurbitae*), and Bacterial Wilt (*Erwinia tracheiphila*). Angular leaf spot and Bacterial spot are diseases of the foliage and fruit; their symptoms are similar and easily confused with each other and with those of Downy mildew. Bacterial wilt is a systemic disease of the vascular (water-conducting) system of the plants and is vectored by the striped cucumber beetle. Management of this disease is dependent upon control of the insect vector.

Angular leaf spot (ALS) is the most widespread bacterial disease of cucurbits, occurs worldwide on a wide variety of

hosts, and is most serious in warm, humid weather or regions. Symptoms first appear as small, water-soaked lesions which expand until they are limited by secondary veins, often accompanied by a clear to milky exudate. Lesions dry, turn brown, and may fall out giving leaves a tattered appearance or be surrounded by yellow margins. The bacteria can also infect petioles, stems, and fruit and the exudate may be present here. Fruit lesions can penetrate deeply causing an internal rot and allowing the invasion of secondary soft rot organisms. Symptoms of Bacterial leaf spot appear similar to those of ALS and the disease occurs sporadically on squash, cucumbers, gourds and pumpkins in temperate areas of the world. Severe outbreaks of this disease on jack-o-lantern pumpkins can result in total crop loss. Lesions can be overlooked because of their small size. Fruit lesions vary in size and appearance depending on rind maturity and the presence of moisture. Initial small, slightly sunken, beige lesions with a dark brown halo can expand, become sunken, and cause the cuticle and epidermis to crack. Fruit rot in the field or in storage may be significant.

Both ALS (*P. syringae* pv. *lachrymans*) and Bacterial leaf spot (*X. campestris* pv. *cucurbitae*) are seedborne and can cause a cotyledon spot. ALS survives in infected crop residue and in dry leaves for up to three years. Very little is known about the biology of Bacterial leaf spot, although attempts to isolate it from the soil have been unsuccessful. Both diseases are spread within the field by splashing rain, windblown sand containing infested debris, insects, humans, and equipment. Spread is enhanced when the foliage is wet from rain, dew, or irrigation. Neither foliage disease is normally a serious threat to cucurbit production. The most effective method for control is planting certified, disease-free seed. Crop rotation is also helpful. Application of copper compounds in the early stages of fruit development may reduce symptomatic pumpkins. Copper applications after these diseases are well established are largely ineffective.

Bacterial wilt (*E. tracheiphila*) is a serious disease of cucumbers and muskmelons and is becoming more of a concern on other cucurbit crops. Initial symptoms consist of wilting of a few to several leaves, individual runners or stems, or throughout a plant's foliage. Wilting foliage becomes dark green, then yellows and dies. In advanced stages of the disease, entire plants collapse and die. Fruit infections can occur and appear as small, irregular water-soaked lesions. Wilt is most severe in young, succulent plants. Because this bacterium is transmitted by the cucumber beetle, copper sprays are of no value. The pathogen does not survive on seed, in the soil, or within the insect vector. It is thought that infected weed or volunteer cucurbit hosts are the original source of inoculum. Rotate cucurbits to reduce beetle numbers, rogue infected plants, or use Spun-bonded row covers to exclude beetles. Manage cucumber beetle to prevent losses from bacterial wilt as well as from direct feeding damage. In recent years we have seen increasing incidence of bacterial wilt in squash and pumpkins. The most susceptible period is from crop emergence to the four true leaf stage. Scout at least 25 plants to monitor the number of beetles and damage. An action threshold of one per plant has been used with success in crops that have low susceptibility to wilt and rapid early growth, including butternut and pumpkin. At later growth stages, the crop should be treated if there is extensive damage to fruit. Where possible, avoid insecticide applications during flowering to protect bees; if sprays are needed, treat at night and use products that have low impact on bees. **Perimeter trap cropping:** plant Blue Hubbard or buttercup squash or another Cucurbita maixma variety in one or two rows to create an unbroken perimeter around the field (always use two rows near woods or last year's fields). These crops will concentrate beetles in the border because they are generally more attractive to beetles than winter squash and pumpkin, which are Cucurbita moschata or Cucurbita pepo types. Beetles should be killed in the border, either by applying foliar insecticide when beetles first arrive or using a systemic insecticide at planting. This can reduce or eliminate the need for controls in the main crop. Repeat perimeter sprays as needed. Perimeter trap cropping may be more effective for squash than for pumpkins. Note that many giant pumpkin varieties are Cucurbita maxima. Do not use a crop that is highly susceptible to bacterial wilt in the border.

Consult the New England Vegetable Management Guide (online at www.nevegetable.org) for specific recommendations on chemical controls.

- Bess Dicklow, UMass Extension

EARLY BLIGHT OF TOMATO AND POTATO

Early blight caused by *Alternaria solani* occurs wherever potatoes and tomatoes are grown. Uncontrolled, the disease may cause serious defoliation, resulting in decreased yield and quality. *Alternaria solani* survives between crops on infected plant debris, soil, other solanaceous host weeds and can be carried on tomato seed and infected tubers. The fungus enters the leaves directly or through wounds. Primary infection can occur on older foliage early in the season, but most secondary spread occurs as the plants age. Actively growing, young tissue and vigorous plants with adequate nitrogen generally

do not express symptoms. Infection is favored by mild, rainy weather.

Early blight occurs on the foliage, stem, and fruit of tomato. It first appears as small brown to black lesions on older foliage. The tissue surrounding the initial lesion may become yellow, and when lesions are numerous entire leaves may become chlorotic. As the lesions enlarge, they often develop concentric rings giving them a 'bull's eye' or 'target-spot' appearance. In the late summer when conditions are favorable for disease development, lesions can become numerous and plants defoliated, reducing both fruit quantity and quality. Fruit can become infected either in the green or ripe stage through the stem attachment. Lesions can become quite large, involve the whole fruit, and have characteristic concentric rings. Infected fruit often drop and losses of 30-50% of immature fruit may occur. Foliar symptoms on potato are quite similar, though defoliation rarely results. Tuber lesions are dark, sunken, and circular often bordered by a purple to gray raised tissue. The underlying flesh is dry, leathery, and brown. Lesions can increase in size during storage and tubers become shriveled.

Use resistant or tolerant cultivars. Start with disease-free seed, transplants, and seed tubers. Use long crop rotations, eradicate weeds, and eliminate volunteer plants and cull piles. Plow under plant debris after harvest. Fertilize properly and keep plants growing vigorously. Handle seed tubers carefully to prevent wounding. Permit tubers to mature in the ground before harvesting and avoid bruising when handling. Spray regularly with fungicides. Spray applications should be scheduled by spore trapping or forecasting systems (TOM-CAST) to be most effective. Early season applications often fail to control secondary spread of the disease.

Chemical recommendations:

azoxystrobin (Quadris): 0 dh, REI 4 h, Group 11. Do not apply more than two sequential applications before alternating with a fungicide with a different mode of action.

chlorothalonil (Bravo Ultrex 82 WDG): 0 dh, REI 12 h, Group M5. Good rotation partner for Quadris.

famoxadone plus cymoxanil (Tanos): 3 dh, REI 12h, Groups 11 & 27. Must be tank mixed with an appropriate contact fungicide. Do not alternate with other Group 11 fungicides like Quadris, Flint, or Cabrio.

fenamidone (Reason 500 SC): 14 dh, REI 12h, Group 11. Do not alternate with other Group 11 fungicides.

maneb/mancozeb (Maneb, Penncozeb, Manzate, Dithane): 3 dh, REI 24 h, Group M3.

mancozeb plus zoxamide (Gavel): 5 dh, REI 48h, Groups M3 & 22. Add Latron surfactants to improve performance.

pyraclostrobin (Cabrio EG): 0 dh, REI 12, Group 11. Do not apply more than 6 applications per season or rotate with Quadris.

- Bess Dicklow, UMass Extension

SAP BEETLES

Sap beetles are usually secondary pests of sweet corn generally associated with damage caused by other pests. Sap beetles overwinter as adults or pupae in crop refuse, decomposing corn ears, or decaying fruit on the ground. Eggs are laid in spring. There are several generations per year. They are more likely to be a problem on farms producing a variety of vegetable and fruit crops. They can also be pests of strawberry.

Dusky sap beetle is black and plain (3.5-4.5mm long), while four-spotted sap beetle (also known as picnic beetle) is black with four irregular yellow spots (5-6mm long). (3 photos; see photos credits for authors)

Adults are first noticed about the time that tassels appear. They may invade corn borer tunnels or areas with other insect or bird damage, feed on pollen or silks, and may lay eggs in these sites or in silks at the tip of ears. Eggs are milky white and resemble tiny grains of rice. The larvae are small, pinkish white or creamy colored grubs about ¼ inch long. They may hollow out kernels of the upper half of the ear.

Monitoring. Sample for sap beetles when silks begin to wilt. Inspect the silk area at the tip of 20 ears at each of five sites and determine the percent of ears infested with adults, eggs, or larvae. Sprays for other ear pests usually control sap

beetles, but if other pests are absent and more than 10% of ears are infested with sap beetles, treat for sap beetles. Insecticides used to control ECB and CEW,including synthetic pyrethroids, may reduce sap beetle. Insecticides will not completely control heavy infestations.

Cultural practices. Ears with exposed tips, especially super sweet and Bt varieties are susceptible to infestation. To prevent or reduce damage, select varieties that have good tip cover, use clean cultivation, control ear-infesting caterpillars and remove or bury decomposing fruit on a regular basis. Sanitation is important to prevent successful overwintering and reproduction during the season. Bury corn residue especially decomposing ears; remove or bury alternate hosts such as rotting tree fruit or discarded vegetables. Burial should be deeper than 10 cm.

SCARAB BEETLES

Japanese Beetles have emerged and are showing up in various crops and non-crop habitats. Oriental Beetles are also active and, though less damaging, may appear in vegetable fields as well. Asiatic Garden Beetles become evident mostly through their damage, because they feed at night. All species are feeding and starting to lay eggs now.

There are four species of scarab beetles that are common in New England turf, fruit and vegetable crops. These were all introduced to the US. Japanese beetles are the most common and widely distributed but Oriental and Asiatic Garden beetles are expanding their range and activity. Below are brief descriptions.

JAPANESE BEETLE adults are about half an inch long, with a metallic green head. The wings are shiny copper or bronze color, and there are a few tufts of white "fur" along the side of each wing when it is folded back over the body. The adults are active in daylight and feed on many different kinds of trees, fruit and flower crops. Fruit and ornamental plants are preferred, but beetles can congregate in vegetables also. In vegetables, adults can cause silk clipping in corn, and leaf damage in sweet basil, collards, other greens, green beans, eggplant, asparagus, rhubarb, and peppers. Though numbers may be high, there is no need to treat unless actual feeding damage is significant. In corn, if there are more than two Japanese beetles per ear and corn is less than 50% pollinated, an application may be warranted to reduce clipping and ensure adequate pollination.

ASIATIC GARDEN BEETLES are about half as long as a Japanese beetle adult, and somewhat more "plump" or domed in appearance. They are reddish-brown or copper-colored. They often are found near roots of plants when one is weeding. Adults tend to cause more damage to vegetable crops than Oriental Beetle, but less than Japanese beetles. Because they feed at night, one may find damage without seeing the beetles. During the day they hide in the loose soil or mulch around the base of the plants. Scout with a flashlight at night, or sift through soil to find them. Larvae feed on beet, carrot, corn, lettuce, onion, Swiss chard and strawberry. Adults feed on carrot, beet, parsnip, pepper and turnip. One grower reported heavy beetle feeding on peppers that were held under row cover through the end of June: this could be the result of Asiatic garden beetles that emerged under the cover. He could not find beetles, only damage. Beware the events that occur under row cover while unsuspecting farmers are looking the other way!

Asiatic Garden Beetle
photo:Mike Reding & Betsy Anderson, USDA Agricultural Research Service

Oriental Beetle
photo:Natasha Wright, Florida Department of Agriculture and Consumer Services

ORIENTAL BEETLES fly at night, but are very active during the day as well. The beetles are smaller than Japanese beetles, and usually are a rather mottled gray with black splotches. The pattern and color varies. Occasionally an individual will be almost all black or almost all gray. The antennae are branched and are quite striking if you take a close look. Oriental beetles have a long flight period – through early August – and are very mobile. Adults tend not to feed heavily in vegetable crop foliage. Grub damage may be worse in drought years and in weedy fields, but is not commonly a problem in vegetable fields and crops, though

this is not well studied.

A fourth species may also be found: **EUROPEAN CHAFERS**, which are slightly larger than Japanese beetles and are a fairly dull brown or tan in color. They are night fliers but can be seen in large numbers just at sunset, when they congregate in large numbers in favorite trees (such as locust or willow). Adults are not foliage feeders and grubs are mostly a turf problem. Feed through October or November

LIFE CYCLE

The life cycle of the Japanese beetle fits most of the species of grubs we encounter in New England, with minor variations depending on the species and the location. They have a one-year life cycle, with adults emerging from the soil in early July in most of Massachusetts (later farther north) to feed and mate. The females burrow into the soil (often in or near wide expanses of grass or sod) to lay eggs, usually beginning in late July. Eggs hatch into tiny grubs (cream-colored larvae, C-shaped, with brown heads). The first grubs usually appear around late July or early August and begin feeding on roots of grasses and other plants (especially corn). After about two weeks of feeding, the grubs molt to a second "instar", and feed for another three weeks. The grubs molt once more, to the "third instar" (or large grub) around the middle of September, and continue feeding until the soils begin to cool down. In late fall the grubs migrate downward through the soil profile, staying below the frost line throughout the winter. In the spring as the soils warm up, the grubs move back into the root zone and resume feeding for about six weeks. By the middle of June, most grubs have completed their feeding requirements and pupate (still in the soil) for about a week before emerging as new young adults.

CONTROLS

On turf, insecticide controls normally target young grubs just as they begin to emerge from eggs. In vegetables, managing the grub stage may not be feasible (or necessary) since the grubs are most likely feeding elsewhere. Vegetable growers could run into problems withgrub damage if turf or sod is plowed under in fall or spring and followed by a spring vegetable crop. Insecticides may be needed to control adult beetles if numbers are high and damage is significant. The 2008-2009 New England Vegetable Management Guide lists products for Japanese and/or Oriental Beetles in basil and sweet corn. For controls in a crop where these beetles are rarely a pest and therefore not mentioned in the Guide, check the label of commonly used broad spectrum synthetic pyrethroids, carbamates, and neonicotinoids (as foliar spray). Organic options include neem products and pyrethrin.

-R. Hazzard, adapted from Pat Vittum, Turf Entomologist, UMass, Beth Bishop, Michigan State University, Michael Seagraves, Cornell Cooperative Extension, and Ann Hazelrig, University of Vermont.

CORN REPORT

The fourth of July is here and a few growers are able to hand pick ears for farm stands. Those who are lucky enough to have corn will be getting six dollars a dozen if not more for their early corn. The first generation of European corn borer flight is over in most locations with trap counts at zero or slightly above. Scouting of pre-tassel and tasseling corn continued this week. Many fields are below threshold but "clean up" from the first generation may be needed. All corn where tassels are beginning to emerge from the whorl should be scouted. This is the best time to control ECB before populations start moving down stalks into the ears. Look for feeding damage, frass or ECB larvae. Make sure to check the entire stalk of plants to see if borers are starting to move down towards the developing ears. Drop nozzles can be used to hit silks directly to control borers before they enter the ears. If 15% or more of plants are infested a spray is warranted. Scout again 3-4 days after spraying. It may take two sprays 5-7 days apart to bring infesting populations under control.

Location	Z1	EII	Total ECB
CT Valley			
South Deerfield	0	0	0
Sunderland (2)	0	2	2
Hadley (1)	1	1	2
Hadley (2)	0	1	1
Amherst (1)	0	0	0
Amherst (2)	0	1	1
Granby	0	1	1
Easthampton	2	1	3
Central MA			
Lancaster	0	0	0
NH			
Litchfield, NH	0	8	8
Hollis, NH	0	0	0

Corn earworm traps are up in silking fields. Low levels of flight have been caught but no serious flight has been capturedf anywhere. Corn earworm migrates to New England on storm fronts that move up the coast line and river valleys in mid July through September. Heaviest numbers are typically found on the coast but ear worm can be a devastating pest anywhere in late season corn. Watching flight is a critical component to controlling corn ear worm. Flights of two or more moths per week are an indication that a damaging population of ear worm is present. Monitoring on your own farm is the best way to know when corn earworm has arrived. Place two traps per field in areas where fresh silk is present. Move traps weekly to ensure that they remain in fresh silk in order to attract adult moths as soon as they arrive. Remember to changes lures every two weeks. Watch for coastal storms which may bring greater numbers up to the Northeast.

-Amanda Brown & Courtney Huffman UMass Extension

Vegetable Notes, Ruth Hazzard, editor and Amanda Brown and Andrew Cavanagh, 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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