UMASS EXTENSION

Vegetable Notes

For Vegetable Farmers in Massachusetts

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July 9th: Pumpkins, Sharon, MA

July 23rd: same Pumpkins, Sharon, MA

Crops took off durring the week of hot weather

CROP CONDITIONS

Many growers took advantage of the hot dry weather last week to harvest and begin curing their garlic or catch up on some much needed weed cultivation. Peach harvest is just beginning and it continues to be a bumper year for blueberries. Sweet corn and now tomatoes, peppers and new potatoes are hitting market shelves. New potatoes are particularly popular in farmers' markets and CSAs. Eggplant harvests are good but this crop struggles to find a home in the hearts and bellies of Commonwealth residents. Insectivorous sandpipers have been spotted in several freshly cultivated fields feeding on remnant agricultural pests. Summer cover crops such as Sorghum Sudangrass (Sudex) are filling in fields after a spring crop came out or in fields being prepared for production next year. Some are experimenting with the mustard "Caliente" as a covercrop following strawberries or peppers and summer cucurbits to combat soil borne pathogens such as root knot nematode or Phytophthora capsici. Tuesday brought a welcome rain event (0.5 to 4 inches) to most parts of the state. The heat wave has also subsided with temperatures dropping into the 60's at night this past week.

PEST ALERTS

Late blight spread more slowly this past week but a new outbreak was confirmed on potato in Chittenden County, Vermont. Weather conditions continue to be conducive to disease development and late blight models recommend a 5 day spray interval. Track disease progress at USA BLIGHT. Fees for late blight diagnosis have been waived this year so if you suspect you have an infected plant contact the UMass Plant Diagnostic Lab at 413.545.3209. Once symptoms are confirmed, destroy infected plants and maintain a weekly spray program to help prevent the spread of this disease through your community.

Cucurbit downy mildew (CDM). New CDM outbreaks have been confirmed in Suffolk County, New York on cucumber. In the past week additional reports of CDM have been confirmed across the south and mid-Atlantic as well as in Ohio. As of July 23 the CDM IPM-PIPE disease forecast model predicts a high risk of CDM development for Southern New England and low risk for the rest of the Northeast region. Cucurbit growers in this region should consider switching from broad spectrum protectant fungicides to those containing oomycete-specific materials. Resistance management is important in this disease system so fungicides should be rotated (use different FRAC groups) and mixed with broad spectrum fungicides such as chlorothalonil to delay resistance development. Mefenoxam and metalaxyl (FRAC group 4) strobi-

lurins (FRAC group 11) should not be used as resistance has already developed. Organic growers should employ a preventative spray program using any OMRI approved copper product.

Powdery Mildew on Cucurbits and Tomato have been diagnosed in the area. See the article below for fungicide resistance management of powdery mildew in cucurbits.

Squash Vine Borer adults, eggs and larvae were found causing damage in several fields across the state. In some cases the larvae had already moved on to pupate in the soil where they will over winter. For the most part, trap captures are still above the 5/trap threshold: Deerfield, 2, South Deerfield, 15, Dover, 50 and Nashua, NH 27. However, scout carefully before making any insecticide applications, as larvae may have already pupated and therefore applications will be ineffective. Till fields deeply after harvest to remove source for next year's flight.

Table 1. GDD and BLITECAST output for Late Blight Management

DATE: 7/25/2013	GDD Base 50F	Accumulated LB Severity Values - 7 days	Accumulated Rainfall - 7 days (in)	Recommended Spray Interval (days)
Pittsfield	1205.6	8	0.91	5
Ashfield	1291.1	1	1.90	10 - 14
Deerfield	1534.6	4	3.07	7
Belchertown	1541.8	6	2.16	5
Harvard	1490.1	10	2.90	5
Dracut	1507.1	9	0.21	5
Boston	1536.5	7	1.98	5
East Bridgewater	1537.4	13	0.25	5
Sharon	1810.0	7	2.45	5
Seekonk	1591.4	7	0.47	5

Colorado potato beetle adults were seen on Eggplant. Threshold for spraying plants greater than 6 inches are 4 small or 2 large larvae/plant.

Flea beetle on Eggplant rarely effects yields on fully grown plants, however, several fields have been spotted with these pests. The threshold for plants greater than 6 inches are 8 flea beetles/plant.

Potato Fields are going down across the state with a variety of issues including hopper burn, early blight, black dot, black leg or natural senescence of mature plants. Thankfully, no late blight has been reported on potato in MA yet and many fields are nearing harvestable yields.

Calcium disorders were seen in tomato and celery due to difficulties with transpiration during the hot and humid period. Correct these issues by maintaining adequate water and air circulation in fields.

Spotted Wing Drosophila numbers are increasing significantly. Hampshire County traps have caught between 10 and 100 males and 10-30 female SWD. Other counties are reporting somewhat lower numbers, but they are expected to increase quickly as they have in Hampshire County. The main crops at risk now are summer raspberries and blueberries. Some growers are reporting infestations in sweet/tart cherries too. Day neutral strawberries and tomatoes may also be at risk. Growers should set out and monitor traps in their fields to know what is happening on their farms. The heat of last week slowed reproduction down temporarily, but now favorable temperatures have returned. Remember to harvest frequently (daily if possible), and thoroughly and avoid allowing fruit to fall to the ground if possible. Transport harvested fruit as quickly as possible to refrigeration. Spray recommended materials (organic or conventional) on a tight schedule (5-7 days).

SWEET CORN REPORT

After a few weeks of relatively low European corn borer trap counts, the numbers this week have increased throughout the state, with counts in the 20s in some sites, and as high as 102 in Rehoboth indicating that the second flight of ECB has begun in earnest. Locations in the CT valley have seen an increase in corn earworm counts as well, necessitating 4 to 6 day spray schedules.

Growers report that their most recent harvests have been clean for the most part, with some tip injury, but many note that previous harvests showed sap beetle damage, some having loads rejected due to the feeding damage of beetle larvae. Sap beetles are common secondary pests of sweet corn usually associated with damage caused by other pests. They are attracted to decaying plant tissue and may invade corn borer tunnels or areas with other insect or bird damage. Growers have

reported that Japanese beetles, which feed on corn silks and can allow sap beetles entry into the ear tip, have been pests in corn fields this season. Additionally, the period of high heat ripened succession corn quickly, and growers may be struggling to keep up with harvests. Redwing blackbirds are starting to be a problem, especially in this near over-ripe corn, damaging corn tips and again creating feeding and egg-laying sites for sap beetles.

Sap beetles feed on pollen or silks, and 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. Sprays for ECB and CEW usually control sap beetles, but with lower caterpillar pressure and therefore fewer sprays, this pest seems to have proliferated.

Beyond facilitating sap beetle damage, birds can be pests of corn in their own right. Application of repellants, which make sweet corn unpalatable to birds, should begin when birds begin feeding or crop begins to ripen. 'Rejex-it Migrate' is liquid bird repellent whose active ingredient is Methyl Anthranilate (MA), extracted from Concord grapes. It is not phytotoxic, is safe to use, and is labeled for use in sweet corn up to the day of harvest. Get good coverage of the plant, and use repeat applications or higher rates if populations are high. Apply in the evening rather than the heat of the day. Repellents are likely to be most effective if combined with other tactics, such as visual and auditory scare devices, distress and raptor calls, or topping of the corn plant above silking corn after pollination.

We received one report of suspected Northern Corn Leaf Blight on a planting of a non-resistant variety. See June 7 issue of VegNotes for more information on this disease.

- L. McKeag and R. Hazzard, University of Massachusetts Vegetable Extension

Table 2. MA Corn Trap Counts 7/17/13 - 7/24/13

Location	Total ECB reported	CEW Nightly Average	CEW Weekly Total	Spray interval for CEW
CT Valley				
South Deerfield	5	n/a	n/a	-
Sunderland	26	0.0	0	*no spray*
Hatfield	4	0.6	4	*5 days*
Hadley-1	25	0.3	2	*6 days*
Hadley-2	25	1.6	11	*4 days*
Feeding Hills	12	0.1	1	no spray
Central & East MA				
Spencer	5	0.0	0	*no spray*
Tyngsborough	4	0.0	0	*no spray*
Lancaster	4	0.0	0	*no spray*
Concord	9	0.0	0	*no spray*
Millis	10	0.1	1	*no spray*
Sharon	n/a	n/a	n/a	-
Northbridge	10	0.0	0	*no spray*
Seekonk	12	0.1	1	*no spray*
Rehoboth -2	102	0.3	2	*6 days*
Sandwich	3	0.4	3	*6 days*
East Falmouth	20	n/a	n/a	-
NH				
Litchfield	13	0.0	0	*no spray*
Hollis	4	0.3	2	*6 days*

Sap Beetle

Sap beetle larva

PEPPER MAGGOT FLY & EUROPEAN CORN BORER

Pepper maggot fly (*Zonosemata electa*) adults emerge in mid to late July and are active for several weeks, so this is the time to watch for their activity. The fly is confined to solanaceous plants, including ground cherry, horse nettle, tomato, pepper and eggplant. Pepper is the preferred host and green bell peppers and cherry peppers are especially susceptible to Pepper maggot fly damage.

The pepper maggot fly is found throughout eastern North America and in New England, the range of pepper maggot has been creeping northward and now extends into southern NH and throughout Massachusetts. Populations are spotty and rather unpredictable – pest status varies on a farm-by-farm or field-by-field basis without any clear reason for high or low populations in a particular place. The best way to detect activity is to look for stings on the fruit, and these are easiest to spot on cherry peppers.

Pepper Maggot, *Zonosemata electa*, adult fly.

Pepper maggot flies are smaller than a house fly, bright yellow with three yellow stripes on the thorax, green eyes, and clear wings with a distinct banding pattern. Flies aggregate in forested field edges and enter the field during the day to lay their eggs. Females insert eggs directly into immature pepper fruit and leave a small dimple – an ovipositor sting or scar. Eggs hatch after about 10 days and the legless white maggots then feed and tunnel inside the fruit, especially in the placenta, causing soft spots on the wall of fruit and brown mines within. Maggots reach about ½ inch in length over a period of about two weeks, and do not have a distinct head capsule. When they are ready to pupate, they exit at the blossom end, leaving tiny round exit holes, usually in the end of August or in early September. These holes allow for the entry of soft rot bacteria into the fruit. Sometimes the oval brown pupae can be found inside the fruit. Often damage is detected only because of premature ripening or decay of the fruit.

Pepper maggot monitoring: Maggots prefer to lay eggs in the small (1-3 cm in diameter) round fruit of cherry peppers. When these are planted in the border rows they work very well as indicator plants. The egg-laying stings appear as depressions or scars and are easy to find on these small, round fruit. By timing insecticide applications with the first occurrence of the stings on the indicator plants' fruit, damage to the main crop can be avoided with a minimum of spraying. If cherry peppers are not part of your crop mix, look for stings on bell peppers.

If this pest is a concern for your farm, consider using perimeter trap cropping which is very effective. Two or three rows of hot cherry peppers can be planted around the perimeter of the pepper crop, encircling it like castle walls. These peppers are more attractive to the maggot flies than the sweet bells, so the flies will build up in the perimeter, allowing for a perimeter spray that will reduce pest populations and protect the main crop. Perimeter trap crop systems can be as effective as whole field sprays while dramatically reducing pesticide costs and protecting beneficial insects within the main crop.

Pepper maggot threshold: If stings are observed on fruit, make two insecticide applications, 10-14 days apart, with a material labeled for pepper maggot. Pepper maggot fly activity can be very localized, and varies by farm, by region, and by year. Many farms never have a problem with this pest. Some may have it and not realize it, because it is possible to confuse maggot damage with damage caused by European corn borer. Check nearby fruit carefully for proper identification if fly has been captured. If a given farm has a history of pepper maggot activity, then it is recommended that an insecticide be applied on that farm. Farms that have never had a problem with this pest generally do not need to be concerned; however, the range of this pest seems to be expanding.

When the activity of European corn borer and pepper maggot fly overlap, use of Orthene at 8-10 day intervals for control of ECB will also provide control of pepper maggots. However other, selective insecticides for ECB will not control pepper maggot. Insecticides labeled for pepper maggot fly include Dimethoate, Malathion, Mustang (zeta-cypermethrin), and GF-120 Naturalyte (spinosad). GF-120 Naturalyte is allowed for organic production. When using Naturalyte, a large spray droplet size of 4-6 mm is recommended to optimize the duration of this bait's attractiveness to the flies. See Vegetable Management Guide for more details on using these products.


European Corn Borer damage

European Corn Borer (ECB) is a resident pest that has 2 generations per year in southern and central New England and 1 generation in northern New England. Pepper is one of over 200 crop and weed host plants of this pest. The severity of ECB in peppers varies in MA and around New England. Some farms – typically in areas where farming is less dense and ECB populations have not built up – do not see much damage from this pest. In the Connecticut Valley and in Southeastern MA, an unsprayed pepper field is likely to have anywhere from 10 to 100% of the fruit infested. In some cases, it seems that sweet corn – which ECB prefer over peppers – helps to draw ECB away; in other cases, presence of sweet corn near peppers provides no benefit at all. Use flight counts and historical experience to help you decide which applies to you. Getting good ECB control is especially critical when you want to sell ripe, colored peppers.

Larvae overwinter in stalks of corn and other host plants and pupate in the spring. Adult moths emerge in late May or early June and mate in weedy or grassy areas. The moths are about 3/4" long light brown in color with lighter bands on

the wings. Three to 7 days after emergence (depending on temperature), females begin to lay flat, white egg masses on the underside of leaves. Eggs hatch in about 5 to 7 days (100 degree days, with a base temperature of 50°F).

ECB larvae are light colored, with a pattern of small dark spots on each segment. The head capsule is flattened and black or dark brown. Newly hatched larvae are 1/8" long and full-grown larvae are 3/4" to 1" long.

In southern and central New England, ECB generally does not become a pest in peppers until the appearance of the second generation in late July or early August. Apply insecticides when second generation moths become active. Check state sweet corn IPM reports for flight activity, or use pheromone traps for monitoring adult flight activity. Make first application 1 week after moth count equals or exceeds 7 moths per week and fruit are present on the plants. Discontinue sprays 1 week after moth counts drop below 21 moths per week. The spray interval depends on the residual period of the insecticide used as well as weather conditions and pest pressure. Use shorter spray intervals during peak flights and while pheromone trap catches exceed 150 moths per trap weekly. Choose selective/microbial products such as Bacillus thuringiensis aizawai or kurstaki strains whenever possible to preserve beneficials and reduce the chance of aphid outbreaks. Pyrethroids may cause aphid outbreaks by eliminating their natural enemies.

Using Trichogramma wasps for biological control of ECB in pepper. Sweet corn is not the only crop where ECB can be controlled with the parasitic wasp, Trichogramma ostriniae. Most of what you have read about using Trichogramma in corn applies to peppers, with a few important differences. Peppers are susceptible to the second generation of ECB, because that is when the plants are fruiting. ECB will invade fruits that are > ½ inch across. Trichogramma attacks only the egg stage, so timing is critical. We recommend that you begin releases the week that flight begins and continue weekly releases for a total of 4 weeks. Release 90,000 to 120,000 wasps per acre and spread the cards out throughout your pepper block. Higher rates are needed in peppers compared to sweet corn because the tolerance for damage is virtually zero and ECB larvae attack the fruit directly. Four releases are needed because the egg laying period for the second generation is longer than for the first generation of ECB. Fortunately, peppers are also a higher value crop and worth the extra cost. After four releases, Trichogramma will have reproduced in the field and biocontrol should continue.

Wasps can be ordered from IPM Laboratories, at www.ipmlabs.com or by phone, 315-497-2063. Wasps can also be used in combination with insecticide; if so, choose a selective material (see above) that will not kill wasps.

-R. Hazzard, University of Massachusetts with source material from J. Boucher, University of Connecticut Extension

FUNGICIDE RESISTANCE MANAGEMENT OF CUCURBIT DISEASES

At this point in the season, we have seen bacterial wilt, angular leaf spot, powdery mildew, plectosporium, Phytophthora capsici and various viruses in cucurbit fields across Massachusetts. Downy Mildew alert is high for southeastern New England with confirmed cases in Lancaster County, PA and Suffolk County, NY. Some information about the life cycle and resistance profiles of the organisms causing these various diseases can help with selecting an effective control strategy. While there is some overlap in the effectiveness of certain materials against the suite of diseases affecting cucurbit crops, there are many cases where the most effective treatment for one disease will be mostly or completely ineffective against others. For this reason proper identification of the pathogen is critical for effective control. Some of these pathogens are developing resistance to fungicides that had given good control for years, but are now almost completely ineffective. Powdery Mildew (Podosphaera xanthii) and Downy Mildew (Pseudoperonospora cubensis) are two of the most damaging pathogens of cucurbits in New England and are capable of rapidly developing resistance to selective fungicides. Chemical control of these diseases must include a rotational program using both broad-spectrum and selective materials in order to preserve the efficacy of these materials for the long term.

Powdery mildew underside of leaf

Powdery Mildew (*Podosphaera xanthii*) infections result in fewer fruit and/or fruit of low quality (poor flavor, sunscald, poor storability). The action threshold for starting fungicide applications is one leaf with symptoms out of 50 older leaves examined. Examine both surfaces of leaves. Starting treatment after this point will compromise control and promotes resistance development. An important component of fungicide programs is using materials which can move to the lower leaf surface (systemic or

translaminar) because this is where powdery mildew will likely infect. Systemic fungicides, due to their single site mode of action, are prone to become ineffective due to resistance development. Powdery mildew fungi have demonstrated the ability to develop resistance to these classes of fungicides: benzimidazoles (FRAC Group 1), demethylation inhibitors (FRAC group 3), and strobilurins (FRAC group 11). Avoid using these products in your rotation. Under low disease pressure, demethylation inhibitors (FRAC group 3) may be used effectively since they exert a more gradual selection pressure on the organism, as opposed to the high selection pressure exerted by FRAC group 1 and 11 materials. **Organic materials** OMRI listed for control of Powdery mildew do not have a single-site mode of action and so are not likely to select for resistant pathogen strains. These materials include oil (mineral and botanical types, eg JMS Stylet-oil, GC-3 Organic fungicide, Organocide), sulfur (Microthiol Disperss), and copper (eg. Champ WG). These materials have been found to work well in some studies. Please note that copper and sulfur products can cause phytotoxicity in some cucurbit crops, and do not apply sulfur when temperatures exceed 90° F, as plant injury may occur.

Downy mildew, underside of leaf

Downy Mildew does not affect fruit directly, but infected leaves die prematurely which results in fewer fruit and/or fruit of low quality. At this point in the season, risk for downy mildew development in New England is increasing and cucurbit growers may want to switch from broad spectrum protectant fungicides to those containing oomycete-specific materials. Presidio (fluopicolide, FRAC group 43) and Previcur Flex (propamocarb HCl, FRAC group 28) are both effective materials. Presidio continues to be the best fungicide against downy mildew, but it exerts a high selective pressure on the pathogen population to overcome its single-site mode of action and resistance can develop quickly. The label requires tank mixing with a fungicide with a different mode of action and sequential applications of this material should not be made. If you are including this material in a rotation that already includes chlorothalonil (Bravo or Echo) you are meeting this requirement. Note that carrots, potatoes, sugar beets, and leafy Brassicas have an 18 month plant back restriction after the last Presidio application. Both Presidio and Previcure Flex are also effective against late blight on tomatoes and downy mildews on a host of other vegetable crops. Resistance to mefenoxam and metalaxyl (FRAC group 4) and to strobilurins (FRAC group 11) is sufficiently common that fungicides with these active ingredients (e.g. Ridomil and Cabrio), which used to be highly effective, are now ineffective and should not be applied for managing downy mildew. **Organic control** options for Downy mildew in cucurbits are limited. Copper products are probably the most effective material available to organic growers, but may cause phytotoxicity in some cucurbit crops. Resistance is unlikely to develop towards copper fungicides since they have a complex mode of action and exert low selective pressure. There are also numerous biological and biorational materials labeled for organic production, though their efficacy may be more variable. Check with your certifier for information about which formulations are currently approved for organic production.

See table on page 8 for a detailed sellection of Cucurbit Powdery Mildew and Downy Mildew fungicides. Resistance management and fungicide use are not the only effective measures of control for other cucurbit diseases, therefore, consider these cultural practices to avoid disease issues in the future:

1. **Plant disease resistant seed**. Select powdery mildew resistant or tolerant seed varieties of squash, pumpkin or muskmelon and downy mildew resistant cucumber.
2. **Rotate fields** out of cucurbits for 3 years to avoid gummy stem blight (aka Black Rot), angular leaf spot, bacterial wilt, or Plectosporium blight and 4 years to avoid P. capsici. Field rotation is not an effective control option for powdery mildew or downy mildew because these pathogens are airborne and infect fields yearly.
3. **Insect Management**. Focus on Striped cucumber beetle management to avoid the spread of bacterial diseases such as gummy stem blight and bacterial wilt.
4. **Scout fields** for disease and track downy mildew as it moves into New England here: http://cdm.ipmpipe.org/
5. **Get proper diagnosis** of symptoms if the preventative measures you have taken have failed by submitting samples to a diagnostic lab. UMass Diagnostic Lab: 413.545.3209
6. **Apply** targeted fungicides tank-mixed with protectant fungicides weekly and alternate among available chemistries based on FRAC code. Add new fungicides to the program when they become available; substitute new for older product if they are in the same FRAC group.

Further Reading regarding other cucurbit diseases:

"Cucurbit Disease Management Strategies for 2013" (T. A. Zitter, Cornell University)

"Cucurbit Disease Scouting and Management Guide" (UMass Extension):

- updated by Katie Campbell-Nelson with credit to A. Cavanagh, & B. Dicklow, UMass Extension and M. McGrath (Cornell), T. A. Zitter (Cornell) Andy Wyenandt (Rutgers); Meg McGrath (Cornell)

TOMATO LEAF ROLL

Tomato leaf roll is a problem with a variety of causes that we have been seeing a lot of this year. Tomato leaf roll starts with upward cupping at the leaf margins followed by inward rolling of the leaves. Lower leaves are affected first, and can recover if environmental conditions and cultural factors are adjusted to reduce stress. Not all leaves on a plant roll, but eventually the rolling can involve most leaves on a plant and last through the season. In severe cases, whole plants can be affected. The margins of adjacent leaflets may touch or overlap. Rolled leaves become rough and leathery but are otherwise normal in size and appearance. There is no discoloration of leaf veins associated with this problem. The good news is that leaf roll rarely affects plant growth, fruit yield, or fruit quality.

Leaf roll is often seen just after plants are heavily pruned during dry soil conditions. If the tomato plant's top growth is more vigor¬ous than root growth and we are hit with a dry hot period the foliage may transpire water faster than the root system can absorb it from the soil, and the plant will respond by rolling its leaves to reduce the transpiration surface area. Another cause of this disorder is growing high-yielding cultivars under high nitrogen fertility programs. Oddly enough leaf roll disorder also has been found to be caused by excess soil moisture coupled with extended high temperatures. Leaf roll severity appears to be very cultivar dependent. Cultivars selected for high yield tend to be the most susceptible. Indeterminate cultivars seem to be more sen¬sitive to this problem than determinate cultivars.

It has been found that sugar and starch accumulating in the lower leaves cause the leaf to roll; the more they accumulate the worse they roll. Leaf roll is usually something we see when we have hot dry conditions in June or July, when plants are most actively growing. Leaf roll seldom affects yield, therefore no corrective measures are needed. However, it is important to distinguish leaf roll from other problems that affect tomato leaf shape. Some viruses or herbicide injury can look similar to tomato leaf roll, but if the symptoms appear suddenly, involve many of the plants in a field, and largely affects the lower leaves, it is probably leaf roll. You can reduce symptoms by maintaining consistent, adequate soil moisture of about 1 inch per week during the growing season. This will also help with calcium up-take, reducing blossom end rot problems. Growers also should not prune heavily during hot dry conditions or over-fertilize with nitrogen.

- Jerry Brust, IPM Vegetable Specialist, University of Maryland; jbrust@umd.edu

Tomato leaf curl

2013 Fungicide Resistance Management Guidelines for Cucurbit Downy Mildew and Powdery Mildew Control in the Mid-Atlantic & Northeast regions of the United States

Fungicide	Active Ingredient(s)	FRAC Code*	Risk Rating**	REI / PHI***	Powdery Mildew	Downy Mildew	General Fungicide Resistance Management Guidelines****
Kocide 3000 or OLF	fixed copper(s)	M1	L	48hr/0days	+		FRAC code M fungicides are low risk, protectant fungicides. Use alone, or tank mix with high-risk fungicides to improve control
Microthiol or OLF	sulfur	M2	L	24hr/	++		
Manzate, Dithane or OLF	EBDC	M3	L	24hr/		++	
Bravo, Echo or OLF	chlorothalonil	M5	L	24hr/	++	++	
Topsin M	thiophanate methyl	1	H^R	24hr/	+		**Always read product labels before use**
Rally	myclobutanil	3	M^R	12hr/0days	++		Select fungicides with at least ++ rating. Rotate among fungicides with different FRAC codes. Tank mix high risk fungicides with FRAC code M product if the product is not formulated with a FRAC code M fungicide.
Procure	triflumizole	3	M^R	12hr/0days	++		
Folicur	tebuconazole	3	M	12hr/0days	++		
Inspire Super	difenconazole + cyprodinil	3 + 9	H	12hr/7days	++		
Ridomil Gold Copper	mefenoxam + copper	4 + M1	H^R + L	48hr/5days		+	
Ridomil Gold Bravo	mefenoxam + chlorothalonil	4 + M5	H^R + L	48hr/0days		+	
Fontelis	penthiopyrad	7	M - H	12hr/1day	++		
Luna Experience[a]	fluopyram + tebuconazole	7 + 3	M	12hr/	+++		
Luna Sensation[a]	fluopyram + trifloxystrobin	7 + 11	M	12hr/	+++		When resistance is qualitative (FRAC code 1 and 11 fungicides), resistant pathogen strains are completely insensitive and cannot be controlled with the fungicide.
Pristine	boscalid + pyraclostrobin	7 + 11	H^R	12hr/0days	++	+	
Quadris	azoxystrobin	11	H^R	4hr/1day	+	+	
Cabrio	pyraclostrobin	11	H^R	12hr/0days	+	+	
Flint	trifloxystrobin	11	H^R	12hr/	+		
Reason	fenamidone	11	H	12hr/		+	With quantitative resistance (FRAC Code 3 fungicides), pathogen strains exhibit range in fungicide sensitive and efficacy depends on level of insensitivity. Better control can be obtained with high label rates and tight spray intervals.
Tanos	famoxadone + cymoxanil	11 + 27	L - M	12hr/3days		+	
Quintec	quinoxyfen	13	H	12hr/3days	+++++		
Ranman	cyazofamid	21	M - H	12hr/0days		+++	
Gavel	zoxamide + mancozeb	22 + M3	M + L	48hr/5days		++	
Curzate	cymoxanil	27	L - M	12hr/3days		++	
Previcur Flex	propamocarb HCL	28	L - M	12hr/2days		+++	
Alliete	aluminum tris	33	L	12hr/12hr		+	[a]Luna fungicides are labeled for watermelon only.
Phosphonates	phosphorous acid salts	33	L	4hr/		+	
Forum	dimethomorph	40	L - M	12hr/		+++	[b]Revus is poor on cucumber. Presidio has exhibited poor control when the pathogen originated from the southeast.
Revus[b]	mandipropamid	40	L - M	12hr/0days		+/+++	
Presidio[b]	fluopicolide	43	H	12hr/2days		+/++++	
Zampro	ametoctradin + dimethomorph	45 + 40	M	12hr/0days		++++	
Torino	cyflufenamid	U6	M	4hr/0days	+++++		

Efficacy Ratings: + = poor (not recommended), ++ = poor to good, +++ = good, ++++ = very good, +++++ = excellent

* FRAC code: M = multi-site mode of action (MOA), numbered groups = fungicides with similar MOA

** Risk Ratings: L = low risk, M = moderate risk or H = high risk for fungicide resistance to develop

*** Restricted Entry Interval / Pre-Harvest Interval

**** See fungicide label for specific crops, rates and instructions on use

^{R} = resistance known; (+) control failures detected in the mid-Atlantic and Northeast regions

Fungicides with the same color belong to the same FRAC code

Andy Wyenandt (Rutgers); Meg McGrath (Cornell); Beth Gugino (Penn State); Kate Everts (Univ. MD); Steve Rideout (VA Tech); Nathan Kleczewski (Univ. DE)

EVENTS: UPDATES AND CORRECTIONS

The following two Feld Walks have been approved for two contact hours for those who hold a vegetable or small fruit private applicator pesticide license. Also, please note the address correction for the Field Walk at Bars Farm on July 31st.

Field Walks: Integrated Pest Management
You are invited to join the UMass Fruit and Vegetable Team to identify pests and discuss control strategies on two diversified fruit and vegetable farms. We will scout the fields together. Bring a hand lens and clip board if you have one.
Two contact hours for the Vegetable or Small Fruit Pesticide License will be available.

When: Wednesdays from 3pm-5pm

July 31st: The Bars Farm, 146 Mill Village Rd, Deerfield, MA
http://www.thebarsfarm.com/contact.html

August 14th: Powisett Farm, 39 Powisset Street, Dover, MA
http://www.thetrustees.org/places-to-visit/greater-boston/powisset-farm.html

Vegetable Notes. Ruth Hazzard, Katie Campbell Nelson, Lisa McKeag, Susan Scheufele, co-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.