UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

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In this issue:

Planting Red Gold potatoes in a trial at the UMass South Deerfield Research Farm with a single row Checchi & Magli planter. Photo: K. Campbell-Nelson

Crop conditions

Summer squash harvests have begun, successions of fall brassicas are going in, garlic is scaping, and the first potato fields are blooming. As soon as the rain stopped last week, concentrated efforts to control weeds took off. However, heat and wind also picked up, causing sandblasting on sensitive crops like cucumbers and onions, and also increasing risk of herbicide drift. A report of clomazone drift was confirmed this week from a cucurbit field onto perennial fruit crops in a residential neighborhood. In our densely populated state, growers know to take extra precautions when using herbicides to avoid drift. Although, some materials like clomazone can bleach chlorophyll in sensitive plants up to ¼ mile away! Avoid making applications when windspeed is above 5 mph and increase droplet size by lowering spray pressure (15-30psi) and choosing the right nozzle. Some herbicides are *microencapsulated (ME or MT)* or in *capsule suspension (CS)*, reducing their volatility and lengthening their efficacy in soil. These formulations are nearly insoluble in water and require agitation to remain in suspension. Micro-Tech, Prowl H2O, and Command are formulated in microcapsules.

Dormant crops, riddled with wirestem worsened by the cool wet weather and chlorotic from lack of growth have finally taken off. One grower just commented: "Everything is finally the right color of green!"

Pest alerts

Allium

Onion thrips are still below threshold of 1-3 thrips per leaf in several fields scouted across MA this week. We did notice that thrips numbers were higher on onions growing in black versus matte silver plastic, in a field scouted in Bristol Co., MA last week. In Providence Co., RI, thrips numbers were even higher and some pelting rain injury was also noted which can be confused with scratching damage caused by thrips feeding.

Thrips and scraping damage on onion Photo: UMass

Pelting rain injurny on onion Photo: S. Lewins

Garlic Potyvirus was diagnosed on the varieties 'M. Zemo' and 'Doc German' in Hampshire Co., MA. Symptoms include heavily sprouted tops, poor germination, and increased winter injury. Do not save seed from garlic with these symptoms.

Botrytis Neck Rot and White Rot have been confirmed at different locations in Eastern NY. Both diseases form sclerotia and may be confused for one another. Botrytis is a more manageable disease, while white rot can last many years in the field, therefore, properly identifying these 2 diseases is important (see photos next page).

Botrytis (sclerotia is visible at the soil line and grey, fuzzy, mycelia with conidia is seen above the soil line) Photo: C. Stewart

White rot (mycelia is visible below ground with small poppy seed sized sclerotia imbedded within)Photo: E. Grundberg

Brassica

Downy Mildew was diagnosed by the UMass Plant Diagnostic Lab this week on red cabbage and broccoli from Franklin Co., MA. The pathogen is favored by cool, moist conditions. There is some evidence that *H. parasitica* may be seed-borne; Hot Water treatment of seed would eliminate this possible source of primary inoculum.

Cucurbits

Striped cucumber beetle has started reaching threshold in many more fields this week (Norfolk and Hampshire Cos., MA and Providence Co., RI), pushed along with hot temperatures. Beetle feeding spreads bacterial wilt to young plants, especially before the 5-leaf stage. Treat when populations reach 1 beetle per 2 plants.

Potato

Colorado potato beetle adults were seen causing severe damage in a field of eggplant planted next to last year's potatoes—even a short rotation of 500 ft. with a wooded barrier in between proved to be effective at one farm, since these beetles cannot fly far to find a host plant when they emerge in spring. We are just starting to see eggs begin to hatch this week with the warmer weather. . We are just starting to see eggs begin to hatch this week with the warmer weather. A treatment should be considered if the number of adults or larvae or defoliation levels reach one of these thresholds: 10% defoliation; 25 adult beetles/50 plants; 4 small larvae /plant; or 1.5 large larvae /plant or / stalk. CPB develop resistance to insecticides very quickly so it is important to change chemical classes with each spray. In addition to the pyrethroids (Irac Group 3A) and neonicitinoids (IRAC Group 4A) to which resistance problems are known, there are also spinosyns (e.g. Entrust or Radiant, IRAC Group 5), indoxacarb (Avaunt, IRAC Group 22), chlorantraniliprole (Coragen, IRAC Group 28), and azadiractin (e.g. Azaguard, IRAC Group un), cryomazine (Trigard, IRAC Group 17) or novaluron (Rimon, IRAC Group 16B), though these latter three do not control adults or large larvae but must target small larvae. Similarly, there is a new OMRI-approved Bt product, Trident, which can be used effectively by targeting small larvae. Only use 3 qt/A rate when small populations of larvae of uniform age or size are present. Use of an adjuvant may improve efficacy, but avoid mixing with silicone-based surfactants.

Sweetcorn

European corn borer: So far the first flight of both the NY and IA strains have been small (Table 1). Egg hatch has begun across the state (450 GDD base 50 F, see Table 2), but treatment thresholds are likely not being reached yet. Begin scouting tasseling corn in a zigzag pattern across the field and look at 15-105 plants at random. For pre-tassel to green tassel corn, treat if 15% or more of plants have one or more ECB caterpillars or show fresh feeding damage. Scout again in four to seven days and treat again if still above threshold. If infestation is high (greater than 50% infested), two sprays four to five days apart may be needed to bring infestation below threshold. Trichogramma ostriniae wasps should have been released by now to parasitize eggs. Get a free download of the Sweet Corn Insect Management Field Scouting Guide for more instructions on scouting.

Table 1 Location	ECB Weekly Total
Western, MA	
Amherst	0
Whately	6
Central, MA	
Leominster	3
Eastern, MA	
Millis	0
Sharon	1
Swansea	4
Dover	2
Seekonk	0
NH	
Litchfield	8
Hollis	0
Mason	0
Washington County, NY	0
Albany, NY	1

Table 2. Accumulated Growing Degree Days: 1/1/17 - 6/15/17

Location	GDD (base 50°F)
Western, MA	
Amherst	564
Westfield	618
South Deerfield	532
Central, MA	
Leominster	582
Stow	625
Eastern, MA	
Sharon	609
Seekonk	610
Hollis, NH	566
Burlington, VT	595
Newport, RI	487
Castleton, NY	654

Multiple

Potato leafhopper has been reported across the Northeast causing damage in multiple crops including potato, eggplant, beans, and apples. Leafhoppers were above threshold for treatment in potato in Hampshire Co., MA. See article this issue for identification, treatment thresholds, and management.

POTATO LEAFHOPPER ACTIVE IN MULTIPLE CROPS

Potato leaf hopper adult on eggplant. Photo: UMass

Hopper burn in beans. Photo: UMass

Potato leafhopper (PLH) adults have arrived and the first adults and nymphs are now being observed across MA. PLH affects a wide range of vegetable and fruit crops including potatotes, eggplant, beans, raspberry and apple, where it is implicated in the spread of fire blight. Because low numbers of adults or nymphs cause injury and reduce yield, it is important to protect plants before adult numbers are high and before nymphs build up. Left uncontrolled, PLH populations will continue to grow rapidly. Plant injury and yield loss can be significant. In potato, yield loss occurs even before the development of obvious symptoms. Green beans are very susceptible, especially when they are infested prior to flowering.

Identification. Adults are about 1/4 inch long, light yellow-green, and fly up from foliage when it is disturbed or shaken—they look like tiny, chartreuse sparks flying away from the plants. PLH overwinters in the southern US and the adults move north annually. Once adults arrive they mate, lay eggs, and nymphs hatch after 10 days. Nymphs hang out on the underside of leaves; they are tiny, light green, wedge-shaped and very fast-moving. They tend to move sidewise, crab-like, on the leaf surface. Presence of nymphs indicates an established population.

Resistant	Tolerant	Susceptible
Elba: Very late, white	Green Mountain: Late, white	Superior
Kin Harry: Early, white	Snowden: Very late, white	Red Norland
	Ontario: Very late, white	
	Katahdin: Late, white	
	Marcy: Late, white	
	Keuka Gold: Medium-late, yellow	
	Red Maria: Late, red	

Relative resistance of potato varieties to potato leafhopper

Damage. Adults and nymphs feed by inserting a needle-like beak into the plant and sucking out sap. They also inject a toxin into the plant, which causes yellowing, browning, and curling of leaves. In potato, leaf margins turn brown and brittle first, followed by death of entire leaves, a condition known as 'hopperburn.' In eggplant, leaf margins and tips turn yellow and curl up. Feeding can reduce yield before damage is visible. Damage can be severe on early-season and red varieties of potato, as well as in green beans, eggplant and raspberries. Long-season cultivars tend to be more tolerant (see table for resistant and more tolerant potato varieties). Beans are more susceptible when they are young (e.g. before flowering) than at later stages. Field crops such as alfalfa, clover, soybean, sunflower and tobacco are also hosts.

Scouting and thresholds. It is difficult to count adults since they fly quickly when foliage is shaken or disturbed. Sweep nets can be used to detect adults—treat if more than 1 adult is found per sweep. If you see one adult per plant when you shake the foliage, you are in that range. Once nymphs develop, they can be monitored by visually inspecting leaf undersides on lower-canopy leaves. Treat if more than 15 nymphs are found per 50 leaves. Use a threshold of 1.5 leafhoppers per leaf in eggplant.

Conventional products. In potato and eggplant, some materials registered for Colorado potato beetle adults will also control leafhopper, including neonicotinoid foliar sprays such as Admire Pro or Assail. These and several other carbamate, synthetic pyrethroid and organophosphate products are also registered for leafhopper in potato, eggplant and snap beans. Refer to the New England Vegetable Management Guide for registered products. While the classes of insecticides listed above generally have high toxicity to bees, there are variations within classes; for example, Assail (acetamiprid) has a

lower toxicity to bees (rated as 'medium') while most neonics are rated as highly toxic to bees. Sivanto (flupyradifurone) is a new product in a novel class of chemistries, the butenolides, that works against sucking pests, including PLH. It is also labeled for CPB control. This new active ingredient is being touted as an alternative to neonicotinoids, and has been given a bee toxicity rating of 'low.'

Organic products. PyGanic EC 5.0 (pyrethrin) has been shown to be the most effective product for reducing leafhopper numbers and damage. Good coverage is important, especially of the leaf underside where nymphs are found. Pyganic breaks down quickly in sunlight, so the residual period is short. Spraying late in the day or in the evening may provide better control than spraying early in the morning. Don't wait for numbers to build up. Row cover can be used to delay PLH infestation in beans until flowering, when plants are less susceptible to damage. Using row cover is recommended on young eggplant, as it protects from flea beetles, Colorado potato beetle and PLH.

Pollinators and other beneficials. Although bees do not forage extensively in beans or potatoes, they may be active in the field when these crops or the weeds within the crop fields are flowering. During that time, selection of products with lower toxicity to bees is advised. Look for toxicity information on the label, and also in the New England Vegetable Management Guide (Table 28, and in the products listed for each crop & pest).

For conservation of both native pollinators and honeybees, control weeds in the crop and avoid drift onto flowering borders or crops. Encouraging some flowering areas in the margins is good for supporting pollinators before and after crops bloom. These can also be a nursery and refuge for beneficial predators and parasites of insect pests.

—UMass Extension Vegetable Program

LEAF SPOTS OF CUCURBITS

There are several diseases that cause leaf spots on these crops and they can often be hard to tell apart. Below are descriptions of some of the more common fungal and bacterial leaf spots found on cucurbit crops in MA that we hope will help you tease them apart in the field. Of course a diagnosis from a trained pathologist in the lab is ideal, but we understand it is not always possible to test every spot you encounter.

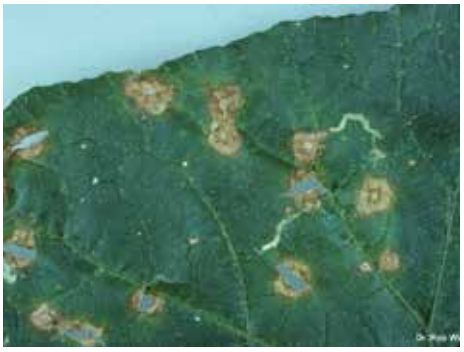
Angular leaf spot Photo: S. Scheufele

Angular leaf spot. This disease can affect all cucurbits, but cucumbers are most commonly affected. It is caused by the bacterium *Pseudomonas syringae* pv. *lachrymans*. This disease is usually among the first to show up because it is seed-borne. It will start to appear in the early to mid-season. Small, round water-soaked spots appear on leaf tissue, and expand until they are confined by veins, giving them the characteristic angular look. Under moist conditions a milky white exudate containing bacterial cells may ooze out of the lesion on the lower leaf surface. These wet-looking spots will dry out and turn yellow-brown or the dead tissue may fall out leaving a "shot-hole" appearance. Yellowing of the leaf between lesions may occur where disease severity is high. Similarly, water-soaked spots may appear on stems and petioles, drying out to form a whitish crust. Spots can also appear on fruit, where they are tiny and water-soaked but dry to form whitish, chalky, spots. These spots cause internal decay of fruit, and fruit that is infected early may be deformed. Affected plants will grow poorly, produce less fruit, and affected fruit is unmarketable.

As with other bacterial diseases, outbreaks of angular leaf spot are often initiated from infected seed. Bacteria proliferate in warm, moist weather and are spread from plant to plant by water, commonly in the form of splashing rain or runoff, as well as by insects or workers moving through the field.

Use drip irrigation to reduce spread of bacteria by overhead irrigation. Don't work in wet fields or work in clean sections of the field first and infected sections last to avoid spreading the disease to unaffected areas or to new plantings.

If you catch the disease early, before it is widespread and severe, copper may be effective in reducing its spread. Till in residues quickly after harvest to get that infected tissue breaking down quickly. Bacteria survive on residues as long as it is present, up to two years. Resistant varieties are available.



Anthracnose Photo: T. Zitter

Anthracnose. This disease affects mostly melons, watermelons and cucumbers; squash and pumpkins are less susceptible. The disease is caused by the fungus *Colletotrichum orbiculare* which, like other anthracnose fungi, causes characteristic black, sunken lesions on affected fruit. Leaf spots are light brown or reddish and appear near veins so may cause leaf distortion. These lesions dry out and the dead tissue may fall out, again leaving a "shot-hole" appearance. On stems and petioles, lesions are elongated and tan. The fruit lesions are large, circular, sunken areas that turn black and may produce a pink ooze under humid or moist conditions.

The fungus can be seed-borne and also survives on crop residue or volunteer plants (maybe in your compost or cull pile?). Humid, rainy weather is necessary for disease to occur. There are three races of the fungus that affect different crops. Resistant cucumber and watermelon varieties are available, but there are not resistant melon varieties. There are many fungicides labeled for control of anthracnose, please see the New England Vegetable Management Guide for recommendations.

Alternaria on canteloupe Photo: G. Holmes

Alternaria leaf spot. This disease affects all cucurbit crops but is most common on cantaloupe. The disease is caused by the fungus *Alternaria cucumerina* which, like other *Alternaria* species, can cause a characteristic target-like spot. Usually, leaf spots are small and start out as tan flecks that enlarge and merge together. These larger spots (up to a half inch) may exhibit the concentric rings common of *Alternaria* fungi.

This disease usually occurs in mid-season and can reduce late-season fruit production. Fruit lesions may also occur–they appear as zonate, sunken lesions with dark, olive-green, felt-like sporulation present. The fungus survives on crop residue in the soil as long as it is present. A two year rotation away from cucurbit hosts is usually sufficient.

Septoria on cucumber Photo: R. L Wick

Septoria leaf spot. This disease is less common, occurring in cool summers or late fall. The disease is caused by the fungus *Septoria cucurbitacearum* which causes small, almost white round spots on leaves and superficial raised tan bumps on fruit. The fungus survives on crop residue in the soil which persists one to two years. Spores are spread from plant to plant via splashing rain or overhead irrigation.

Scab Photo: T. Zitter

Scab. This disease can be a significant problem for summer and winter squash, pumpkin, melon, and watermelon. Lesions may occur on leaves, stems, petioles, and fruit, with fruit spots being the most damaging. Leaf spots are small, pale-yellow to white, and again the dead tissue in the center of the lesion may fall out leaving a "shot-hole" appearance. Leaf lesions may not occur. Lesions on stems are elongate and light colored, and if numerous may cause the internodes to shorten, giving the plant a deformed virus-like appearance. Scab lesions on fruit are sunken, irregular cavities with corky margins, and may produce a golden brown ooze which dries into brown beads. Sporulation on lesions may occur, giving them an olive-green, felt-like appearance.

This disease usually occurs in mid-summer and is favored by cool dry days and rainy or dewy nights. The pathogen survives in crop residues which persist one to two years in soil. Tolerant varieties of cucumber are available. Chlorothalonil, mancozeb, or polyoxin D can be used preventively, at the first sign of disease.

--Written by Susan B. Scheufele, UMass Vegetable Program, 2015

MANAGING CUCURBIT POWDERY MILDEW SUCCESSFULLY IN THE NORTHEASTERN USA IN 2017

- by Margaret Tuttle McGrath Plant Pathology and Plant-Microbe Biology Section, SIPS, Cornell University Long Island Horticultural Research and Extension Center (LIHREC) 3059 Sound Avenue, Riverhead, NY 11901; mtm3@cornell.edu

Effectively managing powdery mildew is essential for producing a high-quality cucurbit crop. This foliar, fungal disease is common wherever cucurbits are grown, including in the northeastern U.S. This is because the pathogen produces an abundance of asexual spores (the powdery growth) easily dispersed by wind, thus it can spread widely, and the pathogen can produce a sexual spore in fall that enables it to survive over winter. Leaves affected by powdery mildew die prematurely which results in fewer fruit and/or fruit of low quality (poor flavor, sunscald, poor storability).

Powdery mildew is managed with resistant varieties and fungicides. An integrated program with both management tools is the best approach for achieving effective control because the pathogen is adept at evolving new strains resistant to individual tools such as resistant varieties or a specific fungicide. It is more difficult for new pathogen strains to develop when an integrated program is used, and effective control is more likely. Powdery mildew management program often needs adjustments as the pathogen and management tools change.

Resistant varieties are now available in most crop groups with new varieties released most years. Resistance in cucumber is standard in modern varieties and is so strong it is easy to forget this cucurbit type is susceptible until an Heirloom type is grown. Resistance in other cucurbit crop types is not adequate used alone (without fungicide applications) to prevent impact of powdery mildew on yield. Melon varieties with resistance to pathogen races 1 and 2 have exhibited very good suppression in experiments conducted at LIHREC until recently. Squash and pumpkin exhibit a moderate to low degree of resistance. Select varieties with resistance from both parents (homozygous resistance) when possible. This term is used in a few catalogues (for example Outstanding Seeds) whereas others use terms like 'high resistance' and 'intermediate resistance' or 'tolerance' to generally refer to homozygous and heterozygous resistance, respectively. Degree of disease suppression obtained with a variety also depends on modifying genes present. Plant breeders are actively searching for new sources of resistance to powdery mildew.

Fungicide program. The most important component of an effective management program is an effective fungicide program. And the key to that is using mobile fungicides targeted to powdery mildew. Mobile fungicides are needed for control on the underside of leaves. Because these fungicides have targeted activity, additional fungicides must be added to the program when there is a need to manage other diseases such as downy mildew and Phytophthora blight.

Alternate among targeted, mobile fungicides and apply them with a protectant fungicide to manage resistance development and avoid control failure if resistance occurs, and also to comply with label use restrictions (most mobile fungicides are not permitted used exclusively). The powdery mildew pathogen has a long history of developing resistance to fungicides (it was the first occurrence of resistance in the USA), thus a diversified fungicide program applied to resistant varieties when possible is critical for success. Always implement a resistance management program; do not wait until there is a problem. The goal is to delay development of resistance, not manage resistant strains afterwards.

When to apply fungicides. The action threshold for starting 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. Powdery mildew usually begins to develop around the start of fruit production. Protectant fungicides applied before detection will slow initial development. After detection, continue applying fungicides weekly. Conditions are favorable for powdery mildew throughout the growing season.

Recommended targeted fungicides. Alternate among targeted, mobile fungicides in the following five chemical groups (principally the first two), and apply with protectant fungicide to manage resistance development and avoid control failure if resistance occurs, and also to comply with label use restrictions. The first two products are the newest and thus are the most important ones to have in a fungicide program. The pathogen population has been subjected to more pressure to develop resistance to the other three fungicide groups, which are listed in order based on product efficacy in recent fungicide evaluations. The first three fungicides are the only ones in these chemical groups available in the USA. See "Mobile Fungicides for Mildews and Phytophthora Blight" for more information about these and other targeted fungicides. Federal pesticide labels can be viewed and downloaded at: http://www.cdms.net/labelsmsds/lmdefault.aspx. New York state

labels are available at: http://pims.psur.cornell.edu/ProductName.php.

Vivando (FRAC Code U8) is a new fungicide with a new mode of action. Cucurbits are on a supplemental label. It has exhibited excellent control in fungicide evaluations conducted recently. Activity is limited to powdery mildew. Do not mix with horticultural oils. It can be applied three times per year with no more than two consecutive applications. REI is 12 hr. PHI is 0 days.

Torino (FRAC Code U6) is a new fungicide with a new mode of action. It has exhibited excellent control in fungicide evaluations conducted recently. Activity is limited to powdery mildew. It can only be applied twice to a field in a 12-mo period. Consecutive applications are not recommended. REI is 4 hr. PHI is 0 days.

Quintec (FRAC Code 13) has been consistently effective in fungicide evaluations. However, insensitivity to a high concentration of Quintec (similar to the dose when applied in the field) was detected in several of the pathogen isolates collected from fungicide-treated research and commercial fields at the end of the 2015 growing season. Therefore, Quintec is now recommended to be used less than the label permits, which is a crop maximum of four applications, and no more than two consecutive applications. Activity is limited to powdery mildew. It is the only mobile fungicide that does not move into leaves: it redistributes to foliage where spray was not directly deposited, including the underside of leaves, through diffusion and a continual process of absorption and desorption in the cuticular waxes of foliage. REI is 12 hr. PHI is 3 days.

DMI fungicides (FRAC Code 3) include Proline, Procure, Rally, and Inspire Super. Additional products are registered for use outside NY. Resistance is quantitative—meaning it develops slowly over time as opposed to all-or-nothing control. Highest label rate is recommended because the pathogen has become less sensitive to this chemistry. Efficacy has varied in fungicide evaluations. Proline is thought to have the greatest inherent activity and Inspire Super the least. Procure applied at its highest label rate provides a higher dose of active ingredient than the other Code 3 fungicides. Five applications can be made at this rate. REI is 12 hr. PHI is 0 days, 7 days for Proline and Inspire Super. Powdery mildew is the only labeled cucurbit disease for Procure and Rally. Proline is also labeled for Fusarium blight and gummy stem blight. Inspire Super, which contains another active ingredient (Code 9), is also labeled for Alternaria blight, anthracnose, gummy stem blight, Plectosporium blight, and Septoria leaf spot.

Carboxamide fungicides (FRAC Code 7) include Luna fungicides (Luna Privilege, Luna Experience, and Luna Sensation), Fontelis, Pristine and Merivon. Pristine and Merivon also contain the same QoI fungicide (Code 11), which is no longer effective for powdery mildew. Powdery mildew pathogen strains resistant to Pristine have been detected since 2008 and likely are the reason its efficacy has varied. Cross-resistance was documented between Pristine, Merivon, and Fontelis, but not Luna fungicides, which therefore are the best choices in this group. Luna Privilege and Luna Experience (also contains tebuconazole) are recommended. REI is 12 hr for Luna fungicides and PHI is 0 days, 7 days for Luna Experience.

Fungicide evaluations conducted each year on pumpkin at LIHREC include fungicides at risk for resistance tested alone (this is neither a labeled nor recommended commercial use pattern for these fungicides; it is done in efficacy evaluations to determine if resistance affects control). In 2016 Quintec and Procure were as effective as an alternation program while Pristine was substantially less effective. In 2015 Quintec, Pristine, and Vivando were as effective as an alternation program (69-78% control on lower leaf surfaces). Quintec and Vivando were the most effective of the targeted fungicides evaluated in 2014 (96 and 98% control); Pristine was moderately effective (54%); Procure was slightly but not significantly better (70%). In 2013 Quintec, Pristine, and Procure provided excellent control (93-99% control). In 2012 Pristine and Fontelis were ineffective (albeit treated pumpkins were numerically less severely affected by powdery mildew than the non-treated plots) while Quintec was very effective (96%) and Procure was moderately effective (57%). This documents year-to-year variation in the pathogen population.

No longer recommended. Resistant pathogen strains are sufficiently common to render the following fungicides ineffective: Topsin M (FRAC code 1; MBC fungicide) and QoI fungicides (Code 11), which include Quadris, Cabrio and Flint. Resistant strains continue to be detected commonly every year on Long Island where monitoring is being conducted.

Recommended protectant fungicides. Many fungicides have contact activity for powdery mildew; mancozeb is an exception. They include chlorothalonil, sulfur, copper, oils (mineral and botanical), potassium bicarbonate, and biologicals. Many of these products are approved for organic production (see list below). Sulfur is one of the most effective and least expensive products. Its activity is limited to powdery mildew, thus it is especially useful early in disease development when other diseases are not a concern, including as a preventive application. Melons are sensitive to sulfur especially

when hot; there are tolerant varieties.

Organic fungicides. Products labeled for cucurbit powdery mildew, in addition to several formulations of copper and sulfur, include:

Actinovate AG. 0.0371% *Streptomyces lydicus* strain WYEC 108. For best results with applications to foliage, label indicates to use a non-ionic spreader-sticker. OMRI-listed. EPA Reg. No. 73314-1. Monsanto BioAg.

BacStop. 2.0% thyme, 2.0% clove & clove oil, 1.5% cinnamon, 1.0% peppermint & peppermint oil, and 1.0% garlic oil. Recommended used with EF400. Exempt from EPA registration. USAgriTech, Inc.

Companion. 0.03% *Bacillus subtilis* strain GB03. EPA Reg. No. 71065-3. Growth Products, Ltd.

Double Nickel 55 LC and WDG. *Bacillus amyloliquefacinens* strain D747, 98.8% and 25%, respectively. OMRI-listed. EPA Reg No. 70051-107 and 108, respectively. Certis USA, LLC.

EF400. 8.2% clove, 8.1% rosemary, and 6.7% peppermint. Exempt from EPA registration. No Ag Label. USAgri-Tech, Inc.

JMS Stylet-oil. 97.1% paraffinic oil. OMRI-listed. EPA Reg. No. 65564-1. JMS Flower Farms, Inc.

Kaligreen. 82% potassium bicarbonate. OMRI-listed. EPA Reg. No. 11581-2. Arysta LifeScience North America LLC.

KeyPlex 350 OR. 0.063% yeast extract hydrolysate from *Saccharomyces cerevisiae*. Combination of defensive proteins (alpha-keto acids) and secondary and micronutrients. Elicits systemic acquired resistance in plants against fungal and bacterial pathogens. Labeled for general disease control in vegetables with specific mention of bacterial leaf spot in tomato. EPA approval for organic production. EPA Reg. No. 73512-4. KeyPlex.

Mildew Cure (formerly GC-3 Organic fungicide). 30% cottonseed oil, 30% corn oil, 23% garlic extract. OMRI-listed. Exempt from EPA registration. JH Biotech, Inc.

MilStop. 85% potassium bicarbonate. OMRI-listed. EPA Reg. No. 70870-1-68539. BioWorks, Inc.

Organocide. 5% sesame oil. OMRI-listed. Exempt from EPA registration. Organic Laboratories, Inc.

OxiDate. 27% hydrogen dioxide. OMRI-listed. EPA Reg. No. 70299-2. BioSafe Systems, LLC.

Procidic. 3.5% Citric acid. NOP compliant; registered for use in organic agriculture with Washington State Dept of Ag. Exempt from EPA registration. Greenspire Global, Inc.

Promax. 3.5% Thyme oil. OMRI-listed. Exempt from EPA registration. Bio Huma Netics.

Regalia. 5% Extract of *Reynoutria sachalinensis*. OMRI-listed. EPA Reg. No. 84059-2. Marrone Bio Innovations, Inc.

Serenade ASO. 14.6% *Bacillus subtilis* strain QST 713. OMRI-listed. EPA Reg. No. 264-1152. Bayer CropScience.

Serenade Opti. 26.2% *Bacillus subtilis* strain QST 713. New formulation; see above products. OMRI-listed. EPA Reg. No. 264-1160. Bayer CropScience.

Sonata. 1.38% *Bacillus pumilus* strain QST 2808. OMRI-listed. EPA Reg. No. 69592-13. Bayer CropScience.

Sporatec AG. 18% rosemary oil, 10% clove oil, and 10% thyme oil. OMRI-listed. Exempt from EPA registration. Brandt Consolidated, Inc.

Thyme Guard. 23% thyme oil extract. Determined to be NOP compliant by Washington State Dept of Ag. Exempt from EPA registration. Agro Research International.

Trilogy. 70% clarified hydrophobic extract of neem oil. OMRI-listed. EPA Reg. No. 70051-2. Certis USA, LLC.

TriTek. 80% mineral oil. OMRI-listed. EPA Reg. No. 48813-1. Brandt Consolidated, Inc.

Before purchase for organic production, confirm product is acceptable for agricultural use with your certifier or your NYS DEC regional office.

In summary, to manage powdery mildew effectively in cucurbit crops: 1) select resistant varieties, 2) inspect crops routinely for symptoms beginning at the start of fruit development, and 3) apply targeted fungicides weekly with protectant fungicides and alternate amongst available chemistry based on FRAC Group code, starting at the action threshold of 1 affected leaf out of 50 older leaves. Add new fungicides to the program when they become available; substitute new for older product if they are in the same FRAC group.

Please Note: The specific directions on fungicide labels must be adhered to -- they supersede these recommendations, if there is a conflict. Check state registration for all products and approval with certifier for organic products. Check labels for use restrictions. Any reference to commercial products, trade or brand names is for information only; no endorsement is intended.

Events

Hands on Biological Controls Workshop for Greenhouse Growers

When: Thursday, June 22, 2017 from 8:45 am to 3:30 pm

Where: Floriculture Classroom 101, UConn Floriculture Greenhouses, 1395 Storrs Rd, Unit 4067, Storrs, CT 06269

In this hands-on biocontrol workshop, you'll learn about: Quality assessment of biological control agents in the classroom and with hands on activities. You will receive a color copy of Grower Guide: Quality Assurance of Biocontrol Products compiled by Rose Buitenhuis, PhD, Research Scientist, Biological Control, Vineland Research and Innovation Centre, 2014 for your reference, and we will follow along the steps in this manual. Greenhouse Demonstrations, including use of cutting dips, sachets, thrips banker plants, and supplemental foods for beneficials and discussion of costs and benefits will be held.

Featured speakers include:

- Suzanne Wainwright Evans, Buglady Consulting
- Doug Barrow, Biobest
- Debbie Palumbo-Sanders, Bioworks
- Shelley Durochuer, UConn Floriculture Greenhouses

Space is limited, so be sure to register early! Registration Deadline is June 16th! Final lunch count is needed by the caterer!
For more information, contact Leanne Pundt, UConn: Leanne.pundt@uconn.edu or call 860-626-6855.

Water Management Twilight Meeting

When: Wednesday, June 28, 2017 from 4pm-6pm with dinner to follow!!

Where: Tangerini's Spring Street Farm, 139 Spring St, Millis, MA 02054

FSMA and drought got you down? Come to this Twilight Meeting at Tangerini Farm in Millis, MA. Tour the newly installed irrigation system for orchard and vegetable crops built with funding support from NRCS with the designer, Trevor Hardy of Brookdale Farm, Irrigation and Row Crop Supply. Find out water sampling protocols and lab requirements for FSMA from the UMass Food Safety Specialist Lisa McKeag and about grant opportunities for irrigation and food safety improvements. Other industry representatives will be available for consultation and **dinner will be provided** following the tour.

We will cover: irrigation water sources, sampling for FSMA requirements, ins-and-outs of drip irrigation, overhead irrigation in corn, strawberry and direct seeded crops, irrigation under FSMA, and orchard irrigation.

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NEW ENGLAND VEGETABLE & BERRY GROWER'S ASSOC.

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The Biopesticide Company

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

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.

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