



UMASS  
**EXTENSION**



# Vegetable Notes

For Vegetable Farmers in Massachusetts

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*Sudex cover crop absorbing excess nitrogen at the border of a fertilized potato field*

lent throughout the northeast on potato and tomato this time of year, and was diagnosed on tomato fruit in Rhode Island. Symptoms include dark sunken spots on fruit that can be easily confused with Anthracnose. *Septoria* leaf spot can also be severe on tomatoes and was diagnosed in Franklin Co., MA and Washington Co., RI. Sterilizing tomato stakes will slow the spread of this disease in future crops. *Phytophthora capsici* has been confirmed on pepper and cucurbits in Hampshire and Franklin Cos., MA this past week, by members of the UMass Diagnostic Lab who are conduct research on genetic variability among Phytophthora species across the state. Other hosts of this pathogen include: tomato, eggplant and beans. *Bacterial canker* has been confirmed on tomatoes in Middlesex Co. and Worcester Co. MA and was also observed in Norfolk Co., MA this week. See article in this issue for management tips.

**Cucurbits:** *Cucurbit downy mildew* is still a low risk for New England growers according to [CDM-IPM-PIPE](#). New outbreaks were reported this week on cantaloupe and pumpkin in MD and on cucumber in NC. Southern

## CROP CONDITIONS

The first week of August brought sunny days, cool nights and some long periods of dew, lingering fog, and leaf wetness despite very little rain. Fruiting crops are ripening at full tilt. Early potatoes are being dug while later crops are still blooming. Some onions are maturing and tops are falling over, fresh bulb onions are being harvested for fresh market, and on some farms, plans are underway for harvest and curing the bulk of the crop. Winter squash and pumpkins are growing well. As fields come open after harvest, it's time for a short-season fall crop or a winter cover crop – see article in this issue on the many choices you have, and the benefits of each. Farmers and crews might be getting a bit tired. Is August the home stretch, or the heartbreak hill of the growing season? Take a break to come out for a tour of Foppema's Farm in Northbridge next Wednesday August 13, or Grafton Community Harvest Project on August 27, or one of the many on-farm meetings around the region – see Upcoming Events.

## PEST ALERTS

**Solanaceous crops:** *Late blight* continues to spread across MA and now VT; it has now been confirmed in Bennington Co. VT and Norfolk Co. MA this week and was also found infesting high tunnel tomatoes in Hampshire Co. MA. Weather conditions have been favorable for spread of this disease, even in high tunnels. For a map of late blight reports and photos of symptoms, see [usablight.org](http://usablight.org). Continue to apply protectant and targeted LB fungicides. Get spray recommendations tailored to your local weather conditions and fungicide program using the MA DSS website [here](#). If late blight is in the area and your high tunnel often has humidity >85%, it's advisable to protect high tunnel tomatoes with fungicides. *Early blight* (see image) is preva-

*Early blight on tomato*



©T.A. Zitter

NJ is its northern limit thus far. [Powdery mildew](#) has been observed in winter squash and summer squash across MA. [Bacterial wilt](#) is a bacterial disease vectored by striped cucumber beetle (transmitted into the plant through their feeding wounds, and picked up by other beetles that feed on infected plants) This disease has been confirmed on zucchini in MA, and in cucumbers in Rhode Island, and is fairly common elsewhere, but not usually causing major losses. Early and effective control of striped cucumber beetles is the best management strategy for this disease and will also reduce scarring on squash, pumpkin and cucumber fruit later on.

**Sweet Corn:** [Corn earworm](#) captures remained low in eastern and central MA with higher counts in the Southeast. See CEW threshold table and insecticides in the NE [Vegetable Guide](#). The onset of [European Corn Borer](#) second flight has been late this season and somewhat erratic, but flight went up at half of our scouting locations across the state this week. When so much silk is present, ECB flight (sum of 2 traps, both Iowa and New York lures) is > 12 moths and CEW is not driving the spray schedule, sprays on a weekly basis are needed to protect developing ears. ECB moths lay eggs on leaves near the ears, and small ECB caterpillars may make their way through the silks down into the ear -- undetected by scouting because they don't bore in through the side. Scout pre-silk stages and spray if >15% are infested with ECB or [fall armyworm](#).

**Brassicas:** [Caterpillar pests](#) on fall brassicas should be scouted at this time as damage can be particularly harmful on pre-heading crops. Watch for [cross-striped cabbageworm](#) especially in Southern and Central New England. Treat plants between the start of heading and harvest if 20% or more of the plants are infested. Imported cabbage-worm larvae and diamondback moth pupae were found in cabbage,

broccoli and Brussels sprouts in Chittenden Co. VT but the field was treated with Dipel and very few larvae were present. [Black rot](#) was reported on Brussels sprouts in RI this week, but was absent from sprouts scouted in Middlesex and Norfolk Cos., MA. This bacterial disease can be seedborne, and hot water

seed treatment is effective for preventing this method of dispersal. Tilling under infected plant material immediately after harvest helps prevent spread from infected crops and overwintering survival.



Leek moth cocoon (above) and damage (below)

**Alliums:** Purple blotch, downy mildew, sour skin and Botrytis are all foliar pathogens of onions which can impact sizing up and storage quality and have been reported in MA, RI and VT. [Thrips](#) continue to be widespread and were at threshold in a crop in Burlington, VT. [Leek moth](#) is a pest of onions not found in MA or RI, but was reported causing damage to 57% of an onion field scouted in Burlington, VT. See image to identify the damage and pupal stage of this pest.

**Bean:** [Bacterial blight](#) in bean was diagnosed on two farms in Vermont. Damage from

**Table 1. European corn borer (ECB), fall army worm (FAW), and corn earworm (CEW) trap captures for the week ending 8/7/14.**

Location	ECB	FAW	CEW
<b>Western, MA</b>			
South Deerfield	8	-	1
Hadley	11	1	0
Feeding Hills	6	0	1
<b>Central &amp; Eastern MA</b>			
Spencer	2	0	0
Tyngsborough	6	0	0
Concord	30	1	1
Millis	0	-	5
Sharon	14	-	7
Lancaster	14	0	0
Seekonk	8	-	23
<b>NH</b>			
Litchfield	0	1	0
Hollis	0	4	1
Mason	1	0	1
<b>Burlington, VT</b>	<b>2</b>	<b>-</b>	<b>0</b>

**Table 2. Spray intervals for Corn Earworm**

Moths/Night	Moths/Week	Spray Interval
0 - 0.2	0 - 1.4	no spray
0.2 - 0.5	1.4 - 3.5	6 days
0.5 - 1	3.5 - 7	5 days
1 - 13	7 - 91	4 days
Over 13	Over 91	3 days

[Mexican bean beetle](#) has been observed in Middlesex Co., MA, and the pest is moving into later plantings.

For [Spotted Wing Drosophila](#) updates, see the UMass Fruit Advisor website, where you will also find a [map](#) of trap captures as they come in from around the state.

## BACTERIAL CANKER OF TOMATO: A HIGHLY DESTRUCTIVE DISEASE

Bacterial canker epidemics occur sporadically, but when this disease does show up it can cause up to 100% yield loss. The disease has been confirmed on two farms in MA this past week, and other Northeastern states are reporting high incidence of canker this year, in spite of increased awareness of the disease and increased use of preventive measures. There is no cure for bacterial canker and no simple solution. Growers who have struggled with this disease in the past have become diligent about using clean seeds and transplants, rotating to clean fields, sanitizing stakes, and spraying copper regularly. These practices are essential to prevent an epidemic, but occasionally the disease strikes nonetheless, as it can take as few as one infected seed in 10,000 to cause an outbreak. Bacterial canker is one disease for which it really pays to be proactive; scout regularly, and get suspicious plants diagnosed so that you can remove sources of inoculum and be better prepared to prevent disease next season.

### Where Does it Come From?

Bacterial canker is caused by *Clavibacter michiganensis* pv. *michiganensis* (Cmm). The bacterium is known to persist on the surface of **seeds** as well as within the seed coat. When infested seed is used for transplant production, those **transplants** will develop systemic infections and may wilt and die, fail to set fruit, or may show no symptoms at all. Warm, humid conditions in the **greenhouse** are extremely conducive to disease development and spread. Often, plants infected in this manner do not show symptoms until they have been planted in the field or greenhouse and have begun to flower. The bacterium also survives in **crop residues** in the field which can persist for 2-3 years. During the rotation out of tomatoes, it is imperative to control Solanaceous **weeds** in order to prevent the pathogen from surviving in the field. The bacterium has been shown to survive on wooden stakes and spread through clean fields from there.

### How Does it Spread? What are the Symptoms?

Cmm spreads in two ways, systemically through the plant vascular system and superficially, on leaf or fruit surfaces. When an infested seed is planted, a primary, systemic infection results, and the bacteria move up from the infested seed through the plant vasculature. Primary, systemic infections may not cause symptoms until the plants begin to flower. Plants begin to wilt starting from the lower leaves and progressing upward. Early symptoms include one-sided wilting of leaves, and downward cupping of leaves. Later, stems may develop adventitious roots, external brown streaks, or may split open revealing internal discoloration of vascular tissue. The discoloration is yellowish to brown at first but becomes dark reddish brown and eventually the stem pith also becomes discolored and rotten.

Secondary systemic infections may occur when a plant is wounded at a branch tip, as when clipping apical buds, and the pathogen gets into the plant and moves rapidly downward toward the base, killing the plant.

The bacterium also successfully colonizes the external plant tissue and can cause superficial infections on leaves, stems, and fruits. This superficial, secondary spread is quite common and is responsible for the rapid spread of disease and for some of the most characteristic symptoms. Secondary spread is primarily by splashing water, rain, forceful sprays, contaminated equipment (trays, pots, stakes etc.), workers handling plants or pruning/cutting. Marginal scorch or “firing” occurs when bacteria on the leaf surface enter leaves via guttation droplets that form at night on the leaf’s edge. Guttation droplets form when there is high soil moisture and no transpiration occurring - as on cool, moist, summer nights. Under these conditions, water is forced out of the hydathodes and is then sucked back into the plant when transpiration begins again after the sun comes out. In this way, bacterial cells can actually be sucked into the leaf and cause the classic leaf scorch or “firing” associated with bacterial canker. Superficial infections



Bacterial canker on fruit (above. credit R.Wick) and leaf scorch (below. credit: R.Pitblado)

also cause spots on leaves and fruit. In the greenhouse, small, white, blister-like spots surrounded by dark rings form on leaves of young plants. On older greenhouse grown tomatoes, leaf lesions appear as pale yellow-green interveinal chlorosis or whitened dead patches. “Bird’s-eye spots” may form on green or ripe fruits in the greenhouse and field. These spots have raised dark centers surrounded by whitish haloes.

### **How Can I Prevent It?**

**Seed:** Avoidance is key with this pathogen, and starting with disease free seed is the first step in preventing bacterial canker. Buy certified disease-free seed. Many companies test seed lots and can detect 1 out of 3-10,000 seeds. Hot water seed treatment of seeds has been shown to be very effective at killing bacterial cells on and within the seed and, through generous donation from Meg McGrath at Cornell University, UMass now has the precision water baths necessary to successfully hot water treat seeds. Contact the UMass Extension Vegetable IPM Program if interested in using this equipment.

**Greenhouse:** In the case that any bacteria have survived the seed treatment process, diligence in the greenhouse is key, as this warm humid environment is ideal for disease development and one infected plant can spread disease to your whole tomato crop. Be sure to **sterilize** benches, media, pots and trays, and pruning tools. It has been shown that regular watering of transplants in the greenhouse is enough to spread the disease via splashing water. Make sure you only **water** enough to promote healthy growth and allow for foliage to dry before nightfall. Treating plants with **bactericides** such as copper, streptomycin, and/or Actigard in the greenhouse is an effective way to eliminate bacterial cells on plant surfaces, and has been shown to reduce the impact of canker on yield and quality.

**Field:** In order to prevent disease you must start with a clean field. After any tomato crop but especially one where an outbreak of canker occurred, mow and plow **residue** immediately. The pathogen can survive in the soil only when there is residue present, so anything you can do to speed up the decomposition process will help. **Rotate** out of tomato and pepper for 2-3 years. Eliminate Solanaceous **weeds**, especially black nightshade, as they can serve as alternate hosts and allow the pathogen to survive in the field despite your rotation. Be sure to sanitize wooden stakes before staking tomatoes ([see Penn State fact sheet here](#)). New stakes should be used after an outbreak has occurred.

### **What Can I Do if I Have an Outbreak?**

Scout tomatoes regularly and rogue out affected plants, plus a border of healthy-looking plants around the affected ones. This will remove large sources of inoculum and will reduce the spread of disease throughout the field. Chemical control using copper compounds as well as Actigard and Agrimycin is recommended to limit the spread of disease and protect healthy-looking plants, but where large portions of the field are affected, chemical control may not be effective. Furthermore, copper products will only affect bacterial cells on the plant surface, and will not have any impact on seed-borne infections or once the pathogen gets inside the plant through wounds or hydathodes. Using high-pressure sprayers may actually increase spread of disease, as bacterial cells are blown from plant to plant with enough force to penetrate leaf tissue. Work in affected areas of the field last, in order to avoid spreading bacteria into clean parts of the field. Disinfect tools regularly or better yet, use your hands to prune, as they are less effective at transferring the bacteria. After the crop harvest is complete, mow, disk, and plow residues quickly to begin the decomposition of infested plant material.

There is no simple solution for bacterial canker of tomato, but understanding the disease and following the preventive management steps listed above will increase your chances of avoiding the disease altogether or reducing its impact on crop quality and yield.

*-Susan B. Scheufele, UMass Extension. Sources include Compendium of Tomato Diseases and Pests, 2nd ed.*

## **LATE SUMMER COVER CROPS**

A well-established late season cover crop increases organic matter, improves soil structure, scavenges remaining nutrients, chokes out weeds, and prevents soil erosion. Grains and grasses can provide all of these functions and legumes can add additional nitrogen. Each has strengths and weaknesses. Below is a list of several good choices for this time of year, depending on your specific goals and field conditions.

**Grasses** can reduce erosion and return a significant portion of organic matter and other nutrients to the soil if planted

after removal of a seasonal crop and given enough time to mature. Kill grasses before maturity in the spring or mix with a legume to reduce the C:N ratio and supply more nitrogen for the following year's crop.

**Winter or Cereal Rye (*Secale cereale*)** is the most common cover crop used by growers in Massachusetts. It is inexpensive, easy to get and to establish, and can be seeded until 2 weeks before a killing frost. However, it is best planted before September 15th in order to recover the available N from soil and to produce enough canopy to protect soil from erosion and outcompete weeds. It consistently overwinters here and will continue to grow in the spring, producing up to 7,000 lbs/A of biomass contributing to soil organic matter. It should be seeded with a legume to keep the C:N ratio low making more N available in the spring. Some growers are hesitant to use this cover crop because of the longer decomposition rate and allelopathy against spring seeded crops. **\*Seeding rate:** 90-120 lbs/A broadcast; 60-120 lbs/A drilled; 50-60 lbs/A mixed with a legume.

**Annual or Italian Ryegrass (*Lolium multiflorum*) and Perennial Ryegrass (*Lolium perenne*)** are used by some growers because of the dense root system that outcompetes weeds and protects against erosion. Annual ryegrass can tolerate some flooding while perennial ryegrass is more cold-hardy. Both are shade tolerant. These cover crops should be planted at least 40 days before the fall frost date. The seed is small and light, so specialized equipment such as a Brillion seeder will be needed if seeding a large area. **Seeding rate:** 20-30 lbs/A broadcast; 10-20 lbs/A drilled; 8-15 lbs/A mixed with a legume.

**Oats (*Avena sativa*)** can be seeded in the late summer, will come up quickly, and are best planted before September 15th similar to winter rye. Unlike winter rye, oats will winterkill in Massachusetts, making for simpler field preparation in the spring, however, with less organic matter contribution and weed control. To maximize nitrogen carry-over to the following crop, mix with a legume that will overwinter such as hairy vetch. **Seeding rate:** 110 – 140 lbs/A broadcast; 80-110 lbs/A drilled; 60-90 lbs/A mixed with a legume.

**Winter Wheat (*Triticum aestivum*)** is increasingly being used as a cereal grain and as a cover crop. It is winter hardy, but does not grow as tall or mature as quickly as rye so there is no rush to kill it in early spring and risk compacting wet soils. Wheat is excellent for erosion control, scavenging N, P and K, building soil organic matter and improving tilth. Plant it in late summer to early fall, before September 15th. Best growth will be in well-drained soils with moderate fertility. Rye is a better choice on wet soils. Wheat works well as a nurse crop for legumes such as hairy vetch, clover, or peas. **Seeding rate:** 90-160 lbs/A broadcast; 60-120 lbs/A drilled; 60-90 lbs/A mixed with a legume.



*Oats and tillage radish seeded for fall cover*

**Triticale (*X Triticosecale*)** can be seeded as early as August and can produce more fall growth than winter wheat, providing more weed suppression and erosion control. **Seeding rate:** 90-100 lbs/A broadcast; 75-80 lbs/A drilled; 60-90 lbs/A mixed with a legume.

**Legumes** are a good choice if you are interested in adding nitrogen to the soil, however it is important to inoculate seed before planting with the appropriate root-nodulating bacteria that will fix nitrogen from the air. Some growers use Coca-Cola or sugar water to help the inoculum stick to the seed and plant while still wet to keep the bacteria alive. Bacterial inoculants are specific to certain legumes and therefore must be used with the correct plant groups in order to establish. Inoculum groups are: 1) red and white clovers, 2) crimson and berseem clovers, 3) alfalfa and sweet clover, 4) pea, vetch and lentils, 5) annual medics, 6) cowpea and lespedeza. If well managed, legume cover crops can provide as much as 100 to 150 lbs nitrogen per acre to the following crop. Imagine the fertilizer cost savings!

**Hairy Vetch (*Vicia villosa*)** usually benefits from being grown with a nurse crop such as rye, oats or wheat to help reduce matting during spring and to keep weeds down. Both the vetch and the grain can be mixed together in the seed drill. In the spring, vetch is incorporated at early bloom, typically in late May. If the vetch is planted in late July or early August, it is less likely to survive the winter, which can be a good thing if you've ever struggled with self-seeded vetch. With a good flail mower, vetch can be used in a deep zone tillage system without matting and tangling in the equipment. **Seeding Rate:** 25-40 lbs/A broadcast; 15-40 lbs/A drilled, 15-20 lbs/A mixed with a grass.

**Red Clover (*Trifolium pratense*)** is a short-lived perennial that is somewhat tolerant of soil acidity or poor drainage. Mammoth red clover produces more biomass for plow-down than medium red clover, but does not regrow as well after mowing. Mammoth will often establish better than medium in dry or acid soils. Sow in early spring or late summer. Red Clover can be undersown in mid-summer into corn or winter squash before it vines, and into other crops such as fall brassicas if soil moisture is plentiful. **Seeding rate:** 10-15 lbs/A broadcast; 6-15 lbs/A drilled; 6-10 lbs/A mixed with a grass.

**White Clover (*Trifolium repens*)** is a low-growing perennial, tolerant of shade, moisture and slightly acid soil. Ladino types are taller and live longer than the Dutch or New Zealand types. The clovers do not compete well with weeds unless mowed to improve lateral growth and establishment. Thus, they are suitable for use in mowed walkways or alleys. Seed tends to be expensive, although stands can last for many years, especially if mowed or grazed, since the laterally-growing stolons continue to root. **Seeding rate:** 7-14 lbs/A broadcast; 10-12 lbs/acre drilled; 2-6 lbs/A in a mix.

**Sweet clover (*Melilotus officinalis*)** is a biennial crop, except for the annual types called Hubam. It is deep-rooted and adapted to a wide range of soils and thus is a good soil-improving crop, as a provider of free N and “biological subsoiling”. Yellow sweet clover is earlier maturing and somewhat less productive than white sweet clover. Sow before August 30th for best results. Heavy growth is produced in spring after overwintering. The tall, lush growth may be difficult to incorporate without proper equipment. This should be done in late spring, or by mid-summer at flowering since growth will cease after that. **Seeding rate:** 20-30 lbs/A broadcast; 10-20 lbs/A drilled; 6-10 lbs/A in a mix.

**Other species** may be used as cover crops in disease management or in the case of the forage radish, for improving water drainage and soil structure. Mustards should not be planted following any brassica crops since they are in the same family.

**Radish (*Raphanus sativus*)**, known as Daikon, tillage, forage or oilseed are also appropriate biological subsoilers, often producing 8-14 inch tap roots. With its deep roots, this crop can recover N, P, S, Ca and B for the following season, but must be planted into a crop early in the spring or else these nutrients are lost through fast decomposition and the deep root holes. This cover crop can be planted 4-10 weeks before a killing frost and typically winterkills in December or January. It can be used as animal forage. **Seeding rate:** 10-13 lbs/A broadcast; 7-10lbs/A drilled.

**Brown Mustard (*Brassica juncea*)** found in many of the ‘Caliente’ seed mixes is a biofumigant planted to combat root knot nematode and a variety of soil-borne fungal pathogens including Fusarium, Verticillium, Rhizoctonia, Pythium and *Phytophthora capsici*. It is also allelopathic against weeds. If allowed to flower, this crop is highly attractive to honey bees. Successful biofumigation with this cover crops is achieved by following these steps: 1) Apply adequate fertility (50lbs N/A and 20 lbs S/A); 2) Allow it to flower 2 weeks before incorporation; 3) flail mow; 4) disc under; 5) Roll or pack the soil; 6) Add irrigation to enhance fumigation. Plant this in late August through September. Other brassica cover crops include rapeseed or canola and turnips, which are often used as livestock forage. **Seeding rate:** 10-15lbs/A broadcast; 8-12 lbs/A drilled.

Keep in mind it is always best to plant a cover crop, as leaving a field bare over winter is very damaging to soil structure, increasing erosion and reducing long term fertility. Though it may take several growing seasons or a lifetime to perfect the art of cover cropping, your soil will thank you.

### Cover Crop Resources:

[A Comprehensive Guide to Cover Crop Species used in the Northeast United States](#). prepared by: Shawna Clark.

[Managing Cover Crops Profitably: 3rd ed.](#). Published by the Sustainable Agriculture Network, Beltsville, MD.

[Cover Crop Plant Guides](#) prepared for the USDA by: NRCS, RMA and FSA.

\* **Note:** seeding rate recommendations may vary with regional differences.

- Katie Campbell-Nelson adapted from work by R. Hazzard & F. Mangan, UMass; Vern Grubinger , UVM and Thomas Bjorkman, CU. Resources: *Managing Cover Crops Profitably*, 3rd edition, published by Sustainable Agriculture Network; *New England Vegetable Management Guide* ([www.nevegetable.org](http://www.nevegetable.org)).

## **LEAF CURL (ANTHRACNOSE): A NEW DISEASE OF CELERY**

The first occurrence of Celery Leaf Curl caused by *Colletotrichum acutatum* was observed in Massachusetts recently. The disease was detected in Michigan and Pennsylvania in 2010 and has also been reported in Canada and Australia. *C. acutatum* has a broad host range infecting pepper, tomato, bean, spinach, strawberry, apple, peach, and blueberry. It is not known if strains of the fungus infecting different hosts can infect celery and vice versa. The pathogen is most important on strawberry, but may become more important on pepper in Massachusetts because it infects pepper fruit at all stages of maturity and is very aggressive, unlike the more common anthracnose pathogen, *C. coccodes*. See Pepper Diseases from [July 31, 2014 issue of Vegetable Notes](#) for more on *C. acutatum* in pepper.

Symptoms on celery include curled leaves, occasional discoloration of leaf margins, twisted petioles, and lesions on petioles. Leaves remain green but often appear fan-like and curl downward. Leaf curl is often the most prominent symptom observed and can resemble injury from growth regulator type (i.e. 2,4-D) herbicides. Infected plants are stunted with small, malformed, cupped leaves which become brittle and crack. The fungus advances into the stalks which become twisted with reddish to light brown lesions developing on the outside and inside of the stalks or inside the crown. Symptoms may easily be confused with black heart, a physiological condition of celery related to poor calcium assimilation and fluctuating water levels. Celery may become infected at any stage of growth in both the greenhouse and field, and plants become disfigured and unmarketable.



*Anthracnose on celery (credit: OMAFRA)*

*C. acutatum* is known to overwinter in the soil, in association with plant debris, or in infected weeds in several plant families. The fungus can remain for long periods in dead plant material on the surface or buried in the soil. It can penetrate through all plant parts, but the crown is often preferred due to the relatively humid conditions there. Conidia (spores) are easily spread in splashing water and wind driven rain; disease can develop rapidly under favorable conditions. The pathogen grows best at warm temperatures (greater than or equal to 77°F), but can be active from 59°-86°F. Leaf wetness duration of greater than 12 hours results in the most severe disease although infection can occur with shorter leaf wetness periods.

*C. acutatum* can be carried from the greenhouse into the field: practice strict sanitation in both areas. Start with clean flats and growth medium. Scout plants twice a week for symptoms; remove and destroy affected plants. In the greenhouse, provide good ventilation with horizontal fans, and heating and venting, especially when warm days are followed by cool nights. Use irrigation practices that promote rapid drying and make sure water does not pool anywhere in the greenhouse. In the field, removal of crop debris after harvest and plowing under crop residue will limit pathogen carryover from year to year. A 3-4 year crop rotation with non-host plants should be followed. Avoid working the fields when the plants are wet, work in fields with a history of the disease last, and power wash equipment between fields. Research has shown that the strobilurin fungicides are most effective (i.e. Quadris, Quadris Top, Cabrio, Reason). These fungicides should be rotated with a protectant fungicide; chlorothalonil, mancozeb, and copper are registered on celery. Other fungicides registered for celery include Switch 6.25 WG, Inspire Plus, Fontelis, OSO 5% SC, and Procure. See the [New England Vegetable Management Guide](#) for more information.

-Bess Dicklow, UMass Extension Disease Diagnostic Lab

## **IRREGULAR GROWTH IN VEGETABLES GROWN UNDER PLASTICULTURE**

-Gordon Johnson, Extension Vegetable & Fruit Specialist; [gjohn@udel.edu](mailto:gjohn@udel.edu). Reprinted from University of Delaware Cooperative Extension Weekly Crop Update Volume 22, Issue 19 (August 1, 2014).

Each year we see fields where vegetable growth in drip irrigated plastic mulched beds is irregular. While root diseases, nematodes, or soil insect feeding can cause variable growth, the following are other potential causes due to water quality problems, cultural practices, or irrigation system issues.

## **Plugged Emitters**

Drip emitters can become plugged with fine particles, mineral deposits, or biofilms. When emitters become clogged, the plants nearest the clogs will receive less water and have more water stress and grow less or be stunted. This is seen most commonly in higher density planted crops such as peppers.

A common cause of plugged emitters is water containing high levels of dissolved iron. This often causes a proliferation of iron-utilizing bacteria. These bacteria can form heavy biofilms on the inside of the drip tube. They also oxidize the iron in the water (as part of their metabolism) and leave behind iron precipitates that can plug emitters. Chlorination of drip lines is needed to control iron bacteria.

Another common problem in some aquifers, is well water with high levels of calcium and magnesium (“hard water”). In high water pH conditions, these can precipitate out as calcium or magnesium carbonates that will clog emitters. If you look inside the drip tubing you will see a white or chalky film. In addition, if soluble phosphorus fertilizers are put into water with high levels of dissolved calcium or magnesium salts, they can precipitate out as calcium or magnesium phosphates, also plugging emitters. Acidification of water can reduce or eliminate this problem. Also, avoid running phosphorus through the drip if you have hard water.

Inadequate filtering is another possible cause of plugged emitters. While this is most common when using surface water from ponds, ditches or streams it can also occur in wells that have fine particles in the water.

## **Improperly Designed or Maintained Drip Systems**

Improperly designed drip systems can lead to over-watering or under-watering portions of the bed and cause variable crop growth. This most commonly occurs when systems cover zones that are too large or have supply lines that are too small. When the length of run is too long, or pressure and volume is too low, the ends of the drip line will have much less water than the beginning of the run and will lead to a gradient of plant growth. Leaks in drip lines will also cause lower water delivery past the leak, leading to reduced plant growth.

## **Variable Depth of Planting and Transplant Handling**

Many transplanted crops will show variability due to depth of planting. This is most common when the root ball is left partially exposed and dries out. If these plants survive they often will be stunted or will have reduced growth compared to plants around them. Planting too deep can also lead to variability in some plants. Rough handling or root ball disturbance can slow establishment of sensitive transplants leading to variability.

## **Variable Bed Formation**

Variability in bed density and plastic laying can cause differences in plant growth. This is most common when plastic is laid in cloddy soils. This results in variable bed densities affecting root growth and water movement and variability in plastic contact with the soil surface leading to warm and cool spots thus slowing or speeding plant growth.

## **UPCOMING EVENTS & DEADLINES**

[UMass Extension Vegetable and Fruit Twilight Meeting: Food Safety, IPM and the Commonwealth Quality Program](#)

**When:** August 13th, 2014 4-7 pm

**Where:** Foppema's Farm, Northbridge, MA, 1605 Hill St, Northbridge, MA 01534

Join UMass Extension faculty and staff and the Foppema family to learn about how the farm is using food safety and IPM strategies in their vegetable, tree fruit and berry crops.

Foppema's Farm is a 75 acre fruit and vegetable farm located in Northbridge, Massachusetts. The farm is family owned and operated by the Ken Foppema family. Ken and Lisa and their four sons (along with a wonderful staff of employees) grow and sell produce from the farm out of a beautiful post and beam farmstand built in 1998. They sell wholesale and at farmers markets, and through pick-your-own, especially at nearby Keown Orchards which is now part of their farm.

The farm participates in the **Commonwealth Quality Certification Program** and they are taking steps to increase their implementation of the **food safety standards** as well as the **sustainability and IPM standards** that are part of this program. We will tour their wash room and packing area, and discuss specific steps that help to ensure food safety when

**field packing greens.** Mike Botelho from the Mass Dept. of Ag Resources will talk about the Commonwealth Quality Program (CQP), its food safety standards, and the market access that can be gained through CQP. You'll see some of the CQP promotional materials, that can be customized to highlight aspects of your farm.

On the IPM side:

- Rich Bonanno, UMass Extension weed specialist, will discuss **weeds**: types of weeds, how they grow, how to identify them, and how to manage them on a very diverse farm like Foppema's.
- UMass Extension small fruit specialist, Sonia Schloemann will give a **Spotted Wing Drosophila** management update.
- Jon Clements will tour the apple orchard and discuss the **fire blight** outbreak of 2014, and how to manage fire blight.
- Ruth Hazzard, UMass Extension Vegetable specialist with Lisa McKeag, Extension Assistant and Ken Foppema will discuss how the Foppema's are using **IPM in onions** to solve a key disease problem.

### **Upcoming UMass Extension IPM Field Walks**

**When:** August 14th, 2014 3:30-6:00 pm

**Where:** [High Meadows Farm](#), 742 Westminster West Rd., Putney, VT

High Meadows Farm is Vermont's oldest certified organic farm. They specialize in growing organic potted herbs year round in over 12,000 sq ft of greenhouses. They have over 65 rolling acres and are proud to show visitors around. They retail their crops at the Brattleboro Farmers Market and wholesale their crops throughout New England. This field walk is being organized by NOFA-VT and will feature: Ann Hazelrigg, UVM extension plant pathologist and director of the Plant Diagnostic Clinic; Mollie Klepack, UVM Extension Summer Vegetable scout; and Katie Campbell-Nelson, UMass Extension Vegetable Educator. Space is limited; pre-registration is required (RSVP to info@nofavt.org or 802-434-4122). \$10 NOFA-VT & VVBGA members, \$20 non-members.

**When:** August 22nd, 2014, 3-5 pm

**Where:** [The Farm School](#), 488 Moore Hill Road, Athol, MA 01331

The Farm School has a day camp program for elementary students, a middle school, and an adult apprenticeship program. The apprentices grow food for a 175 member CSA, Farmers' Market, and manage 150 acres of forest land. The adult program's teacher/growers, Tyson Neukirch and Carlen Rigrod partnered with UMass Extension to train their students in IPM and scouting techniques. This field walk will feature IPM scouting and management practices in apples, raspberries, and multiple vegetable crops with UMass Extension staff: Ruth Hazzard (vegetable), Katie Campbell-Nelson (vegetable), Sonia Schloemann (small fruit), and Arthur Tuttle (tree fruit).

### **Enter Your Prize Winning Tomatoes in the 30th Annual Massachusetts Tomato Contest!**

**When:** Monday, August 18th from 9:30 am – 1 pm

**Where:** The new location of the [Boston Public Market Farmers' Market](#), 136 Blackstone Street, Boston (on the Greenway).

Tomatoes will be judged by a panel of experts on flavor, firmness/slicing quality, exterior color and shape. Always a lively and fun event, the day is designed to increase awareness of locally grown produce. Farmers who want to submit their tomatoes can bring them to the Boston Public Market Farmers' Market between 9:30 am and 10:45 am on August 18th or drop their entries off with a corresponding registration form to one of the locations designated around the state. For the complete details, including contest criteria and a registration form, [click here](#) or at [www.mass.gov/agr](#).

The contest is sponsored by the New England Vegetable and Berry Growers Association in cooperation with the Massachusetts Department of Agricultural Resources and [Mass Farmers Markets](#), and is hosted by the [Boston Public Market Association](#). This friendly contest is open to commercial tomato growers and is designed to increase consumer's awareness of local agriculture.

### **Apply Now for the Massachusetts Agricultural Food Safety Improvement Program (AFSIP): Applications Open till August 20.**

The Agricultural Food Safety Improvement Program (AFSIP) supports agricultural operations that are looking to up-

grade their food safety measures and thereby maintain or increase their competitive market access while reducing food safety risks. Participants selected to participate in the program will be reimbursed up to \$20,000 or 75% of their total project costs.

AFSIP will fund practices that help minimize the risk of microbial contamination and food-borne illnesses. In addition, eligible upgrades will increase competitive market access by meeting buyer demands for demonstrated practices that work towards protecting public health and food safety.

Projects will be broken into a produce category and an aquaculture category. Some examples of projects in the produce category include wildlife fencing, packing shed walls, ceilings and light fixtures, field harvest systems, hand washing sinks, restrooms, drainage systems, and water systems. Some examples of projects in the aquaculture category include ice machines, harvest gear, and testing/monitoring equipment.

For more information and to access application forms please visit the [MDAR website](#) or contact Laura Maul, laura.maul@state.ma.us, (617)-626-1739.

### UMass Extension Vegetable Twilight Meeting: Building Farms and Food Networks for Hunger Relief

**When:** Wednesday, August 27, 4-7 pm

**Where:** Community Harvest Project, Brigham Hill Community Farm, 37 Wheeler Rd, North Grafton, MA 01536

**Sponsored by:** UMass Extension Vegetable Program

**Hosts:** UMass Extension faculty and staff, and Ken Dion, Operations Director of Comm. Harvest Project

Massachusetts is seeing a rise in the number of farms managed by non-profit organizations with a strong social or educational mission. Community Harvest Project, Inc. is a 501(c)3 non-profit organization whose mission is “To build an engaged and healthier community by bringing volunteers together to grow fresh fruits and vegetables for hunger relief.” At Community Harvest Project, thousands of volunteers come every year to help plant, tend and harvest fresh fruits and vegetables for their neighbors in need. Produce is distributed through partner agencies including Worcester County Food Bank’s network of hunger relief organizations which serve over 100,000 people. In 2013, Community Harvest Project donated over 324,000 lbs. – or 1.1 million servings – of fresh fruits and vegetables. Come and learn about how this farm and organization is succeeding and making a difference in the food systems of the Worcester region!

We will tour the automated irrigation system, new greenhouse, hay-blower for mulching, and ethnic crops trials, and learn about how CHP operates, how food gets distributed, how the volunteer farming program works, and how nutrition education is integrated with food distribution.

Refreshments will be served including Sancocho, a traditional Central American soup.

Pesticide applicator recertification credits (up to 2 contact hours) will be offered.

For more information and directions see: <http://www.community-harvest.org/>

Contact Frank Mangan, fmangan@umass.edu or Ken Dion, phone: 508-951-3466 or kdionfly@verizon.net

*Vegetable Notes. Ruth Hazzard, Katie Campbell-Nelson, Lisa McKeag, Susan Scheufele, co-editors. Vegetable Notes is published weekly from May to September and monthly 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.*

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