UMASS EXTENSION

Vegetable Notes

For Vegetable Farmers in Massachusetts

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CROP CONDITIONS

A lot of crops a looking a little hungry, which is not surprising considering the amount of rainfall received in June and the fact that some were undergoing major growth spurts during the rainy period. PSNT tests thus far have showed a need for nitrogen (see article below on side-dressing and PSNT). Even the wettest fields have become workable in the past week, allowing for late plantings to go in. More corn is in silk, but the highly valued '4th of July corn' will be rare. Asparagus season is over and fronds are growing out. Potatoes are setting tubers, we've found 1-2 inch tubers in many fields and the final hilling has been done in some fields. Insect pests are active in many crops but not always over threshold; sometimes our scouting work shows that the actual numbers from a 25-plant sample are lower than we first thought when we walked into the field. But sometimes they are higher! Its always worth checking each crop on a regular basis to avoid missing a problem and finding it too late. Get help by training field workers what to look for, so they can be extra eyes for any farmers who happen to have only two of their own. It seems that the public's passion for local food remains strong, retail markets are busy, and news media continue to feature local farms – all for the good.

PEST ALERTS

Powdery mildew of cucurbits was found on two farms this week, in the first (oldest), fruit-bearing plantings of summer squash and zucchini – as is typically the case. Scout these plantings on your farm, looking for white, powdery fungal growth especially on older leaves, shaded lower leaves, lower or upper leaf surfaces. Finding it anywhere in the planting triggers addition of powdery-mildew specific fungicides, along with protectants that may have been used to date. It is important to select the most effective sequence of products! See article in this issue. Winter squash and pumpkins currently are at lower risk because they are in a young, vegetative, pre-fruiting stage; finding PM on early squash does not mean that all cucurbits on the farm need PM sprays at this time.

The Spotted Wing Drosophila (SWD) statewide trapping network has reported few positive trap captures to date. In most cases, only single female SWD have been found, and only in 4 out of 15 locations. The same has been true in neighboring states (CT, NY), however, RI is starting to report higher numbers (up to 4 females per trap in ripening raspberries). Growers should monitor raspberries and blueberries very closely now to determine when to begin their spray programs (both organic and conventional). Strawberry growers should renovate fields where harvest is complete as soon as possible to reduce the likelihood of SWD building up on residual fruit and increasing the risk to other susceptible crops. - *Sonia Schloemann, UMass Small Fruit Specialist*

Two rows of beet greens seeded on the same date. One row was sidedressed, the other was not.

Table1. GDD and BLITECAST output for Late Blight Management			
DATE: 6/19/2013	GDD Base 50F	Accumulated LB Severity Values - 7 days	Recommended Spray Interval (days)
Location			
Pittsfield	575	7	5
Ashfield	596	3	10 -14
S. Deerfield	760	2	10 -14
Belchertown	773	3	10 -14
Bolton	789	7	5
Dracut	766	2	10 -14
Boston	786	5	7
East Bridgewater	772	4	10
Sharon	771	1	10 -14
Seekonk	902	3	10 -14

Late blight was reported in tomato in New Jersey on 6/26/13. Growers should continue applying protectant fungicides to tomato and potato. The late blight forecasting model shows much lower accumulated weekly SV for the past week and therefore more extended spray intervals in most locations (10-14 days). Locations with shorter spray intervals had more favorable conditions (longer periods of RH over 90%, more rain, or optimum temperatures. Protectant fungicides should be applied in advance of rainy periods, allowing several hours drying time before rain begins. Scout fields, especially shady or low areas for signs of LB. See NEVegetable Guide for products. Organic fields should be protected with an OMRI-approved copper-based fungicide. For more information and to track the progress of late blight please see USAblight.org.

Purple blotch of onion was found in the Connecticut Valley this week. See article in this issue for more details. See article in this issue on Onion and Garlic Diseases

White mold (Sclerotinia sclerotiorum) was found this week in high tunnel tomatoes. It is favored by long periods of soil moisture (10 days or more) and has a wide host range including snap beans, tomato, lettuce, cabbage and carrot. Look for white, fluffy mycelia and small black hard nuggets called sclerotia. Also look for the closely related Allium-specific **white rot** (Sclerotium cepivorum) with smaller poppy seed sized sclerotia. See article in this issue on Onion and Garlic Diseases

Striped Cucumber Beetle is still very active on young and emerging summer and winter squash, gourds, melons, pumpkins, and cucumbers. A lot of damage can happen very fast. Seed and systemic treatments seem to be protecting the seedling stage; foliar treatments should be based on scouting using a 1-2 beetles per plant threshold (lower for more wilt-susceptible crops) till the 5- leaf stage.

Potato flea beetles are gorging on young eggplants and feed on all sizes and stages. See June 13 issue for more details.

Colorado Potato Beetle first generation adults are nearly gone, the tail end of egg laying leaves some final egg masses to hatch out. Damaging populations may still be present but don't try to control every beetle in the field; 1.5 large or 4 small larvae per stalk are thresholds to prevent damage. Full grown larvae will drop to the soil, dig down and pupate. In 10-14 days the summer adults will begin to emerge.

Mexican Bean Beetle was active in Central MA where adults and eggs were found, but no larvae. The biocontrol parasitic wasp, Pediobius foveolatus may be released now.

Sweet Corn update. Many farms have fresh silking corn and early blocks with developing ears. Corn earworm traps should be up in fields with fresh silk, two traps per farm are recommended to keep a rotation into fresh silk. Corn earworm moths were captured (2 per week) at threshold levels for insecticide in Sharon and zero in Cape Cod. Traps are not out yet for other parts of the state. European corn borer flights were lower into this week indicating the tail end of the first flight. We found corn borers in fields in pretassel or green tassel, some above and some below the 15% threshold. Scout any corn where tassels are beginning to poke up out of the whorl. Look for feeding damage, frass, or the small black-headed larvae. If you pull out the tassel and its tightly-wrapped leaves you may see tiny feeding holes. Borer cat¬erpillars are usually in one of the layers of whorl leaves, or inside feeding on the young tassel. When 15% of plants are infested, a spray is recommended. The best

Table 2. Weekly Sweet Corn Trap Captures	
Location	Total ECB
CT Valley	
South Deerfield	0
Hadley	3
Hatfield	7
Central & Eastern MA	
East Falmouth	1
Seekonk	0
Rehoboth -1	0
Rehoboth -2	8
Millis	4
Sandwich	1
Sharon	1

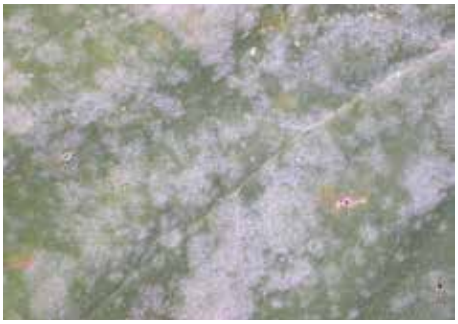
time to control ECB is as the green tassel pokes up out of the whorl. Borers are moving out of the tassel at that time, and easily reached by pesticides

Thrips numbers have increased in some fields. Scout and spray at a threshold of 1/leaf to avoid yield losses.

Potato Leaf Hopper nymphs were found in potato and beans many areas even in fields where adults were low. Nymphs are found under leaves and first instars are about the same size as aphids but skitter sideways when disturbed. The threshold is one nymph/every ten leaves to spray. Plants withstand damage better when they have adequate water and nutrients.

MANAGING CUCURBIT POWDERY MILDEW SUCCESSFULLY IN 2013

Effectively managing powdery mildew is essential for producing a high-quality cucurbit crop. This foliar, fungal disease is common in the northeast because the pathogen produces an abundance of asexual spores 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. The pathogen is adept at evolving new strains that are resistant to specific fungicide chemistries that overcome genetic resistances. It is more difficult for new pathogen strains to develop when an integrated program is used, and effective control is more likely.



Powdery Mildew on leaf top

Resistant varieties are now available in most crop groups with new varieties released most years. Select melons with resistance to pathogen races 1 and 2. They provided good suppression in 2012. There are many types of resistant melons now. Select squash and pumpkins 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' to generally refer to homozygous and heterozygous resistance, respectively. Degree of disease suppression obtained with a variety also depends on modifying genes present. Resistant squash and pumpkin varieties have not provided as effective control in recent years as before. But they remain an important tool. Plant breeders are actively searching for new sources of resistance to powdery mildew.

Powdery Mildew on underside of leaf

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 with protectant fungicide to manage resistance development and avoid control failure if resistance occurs, and also to comply with label use restrictions. 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. 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. If the threshold is inadvertently missed, to minimize the reduction in control that will occur, consider starting the program with a DMI fungicide or Torino; do not use Quintec in this situation. 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 4 chemical groups, and apply with protectant fungicide to manage resistance development and avoid control failure if resistance occurs, and also to comply with label use restrictions.

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 and PHI is 0 days. Torino is not registered in NY, but is registered in MA.

Quintec (FRAC Code 13) has been consistently effective in fungicide evaluations. Activity is limited to powdery mildew. Labeled crops are pumpkin, winter squash, gourd, and melon. The crop rotational restriction is 12 months. Recent crop additions to the Quintec label have increased the options of what can be planted within 12 months of the last application. The Quintec label specifies no more than two consecutive applications plus a crop maximum of four applications. It is the only fungicide in this chemical group available in the USA. REI is 12 hr. PHI is 3 days.

DMI fungicides (FRAC Code 3) include Procure, Rally, Tebuzol, Folicur, and Inspire Super. Resistance is quantitative. Highest label rate is recommended because the pathogen has become less sensitive to this chemistry. Efficacy has varied in fungicide evaluations. 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. Powdery mildew is the only labeled cucurbit disease for these fungicides, except for Inspire Super, which contains another active ingredient (Code 9) and is labeled for additional diseases. PHI is 7 days.

Carboxamide fungicides (FRAC Code 7) currently registered are Pristine, Fontelis, and Luna fungicides (labeled for use only on watermelon so far; there are 4 Luna formulations). Strains of the powdery mildew pathogen resistant to Pristine have been detected and likely are the reason its efficacy has varied. The newer fungicides in this group are recommended instead of Pristine as they are considered to be more active. All are labeled for additional diseases. Fontelis can be applied 4 times at highest labeled rate with no more than 2 consecutive applications. REI is 12 hr. PHI is 1 day.

In a fungicide evaluation conducted in 2012 in NY, Quintec was very effective, Procure was moderately effective, while Pristine and Fontelis were ineffective when 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). Very good to excellent control was achieved with Quintec applied 3 times alternated with Procure and Pristine or twice alternated with Torino and Luna Sensation for a total of 5 applications.

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 in NY where monitoring is being conducted.

Recommended protectant fungicides. Chlorothalonil, sulfur, copper, oils (mineral and botanical), potassium bicarbonate, and biologicals. Melons are sensitive to sulfur especially when hot; there are tolerant varieties. There are many fungicides with contact activity for powdery mildew. Mancozeb is an exception.

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 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. Note that some products mentioned are not yet registered for use on cucurbits. Check labels for use restrictions. Any reference to commercial products, trade or brand names is for information only; no endorsement is intended.

- Margaret Tuttle McGrath, Department of Plant Pathology and Plant-Microbe Biology, Cornell University

DISEASES OF ONION AND GARLIC

Onions and garlic are subject to numerous leaf and bulb diseases, occurring both in the field and in storage, and caused by both fungi and bacteria. Below are descriptions of several diseases. Symptoms of some of these are beginning to show up in MA onion fields. As garlic approaches harvest, bulb diseases become especially important.

Fungal Diseases

Onion Botrytis

Botrytis Leaf Blight caused by *Botrytis squamosa* overwinters in onion cull piles, on onion leaf debris, or as sclerotia (survival structures) in the soil. The pathogen sporulates and conidia (spores) are spread by wind; if there is sufficient leaf wetness and moderate temperatures (72-75˚ F) infection occurs. Infection frequency increases with the increasing leaf wetness duration. Older or senescent leaves are more susceptible to blighting. Severely affected fields will appear blighted with most leaves dead and desiccated. Losses in yield occur because of smaller bulb size resulting from premature leaf senescence.

Onion Purple Blotch

Purple Blotch caused by *Alternaria porri* has been reported on onion, garlic, and leek and probably occurs on other Allium species. The pathogen overwinters on infected bulbs and debris in the field, and can be seedborne in onion. Symptoms first appear on leaves as small water-soaked lesions with white centers. Zones may appear as the spot enlarges and the lesion turns brown to purplish. Red or purple margins often encircle the purplish centers and are surrounded by yellowish tissue. In moist weather, the spot's surface usually becomes covered with a brownish black, powdery fungus growth. Leaves with large spots turn yellow and are blown over by the wind. Susceptibility of onion leaves to infection is influenced by thrips feeding injury or by sand or dust during windstorms. Older leaves are more susceptible, and plants approaching maturity are more susceptible than young plants. Spores require rain or persistent dew to cause infection. Optimum temperatures are 77 to 81°F. Almost no infection occurs below 55°F. Bulbs may be attacked at harvest through the neck or through wounds. Decay shows first as a watery rot around the neck and is particularly noticeable because of the yellowish to wine-red discoloration in the neck region. As the fungus moves through onion scales, the tissue turns yellow then a wine-red and dries to a papery texture.

White Rot, mostly caused by *Sclerotium cepivorum*, is one of the most widespread and destructive fungal diseases of *Allium* species and may become a limiting factor for continued production. This disease occurs wherever onions are grown, especially when a significant part of crop growth occurs during cool temperatures favored by the pathogen. Fungal activity is favored by cool soils and is restricted above 75°F. *Sclerotium cepivorum* produces hardy sclerotia which persist in the soil for years. Disease is spread by movement of infested soil and infected sets or transplants. When *Allium* crops are planted in infested fields, sclerotial numbers increase rapidly and it becomes very difficult to grow *Allium spp.* successfully. Seedling death is not common, but if it occurs, it is very rapid. Pathogen activity increases with root development and foliage symptoms develop after the pathogen grows into the stem plate or bulb. Leaves yellow and die prematurely, plants become stunted, and rapid death of all foliage follows. When there is high infestation, plants may die suddenly in large areas. A fluffy mycelium on the stem plate and bulb is seen and small sclerotia (0.02 inch, or about the size of a poppy seed) form in and on the surface of affected bulb parts, often around the neck. White rot can continue to decay infected bulbs in storage if humidity is not kept low. Note that the closely related *Sclerotinia sclerotiorum* and *S. minor* have also been reported to cause white mold in Allium but they have broad host range including tomato, lettuce, cabbage, carrot and bean.

Fusarium basal rot caused by *Fusarium oxysporum f. sp*. cepae attacks *Allium* species including onion, garlic, shallot, and chives. The fungus is commonly found in the soil and persists there for long periods. The pathogen is disseminated widely by infected onion sets and infected garlic cloves. Plants can be infected at any stage of growth; disease incidence increases with injury of roots, basal plate, or bulb by the onion maggot and other insects. Infected bulbs break down in storage. The first symptoms are yellowing, curving, and necrosis of leaves beginning at leaf tips and progressively developing downward. Infected plants may wilt and affected bulbs may appear discolored or red to purple discoloration on stems and bulbs may be seen. Affected bulbs appear brown and watery when cut open. The disease progresses from the stem plate up to storage leaves and the roots will eventually rot. Bulbs may exhibit no disease at harvest, but subsequently decay in storage. A basal rot of garlic caused by *Fusarium culmorum* also occurs. Symptoms include preemergence decay of cloves and seedlings as well decay of storage leaves and stem plate during the growing season, and postharvest decay of stored bulbs. The most important control measure is the use of resistant cultivars. In a Malheur County, OR test, these cultivars had less basal rot: 'Golden Cascade', 'Cima', 'Oro Grande', 'Valient', and 'Cashe'. Other onion cultivars de-

scribed as tolerant are ‘Bronze Reserve’, ‘North Star’, ‘Sassy Brassy’, and ‘Sentinel’.

Bacterial Diseases

Slippery skin is a bacterial disease caused by *Pseudomonas gladioli pv alliicola*. In the early stages of the disease, affected bulbs may show no external symptoms except softening of neck tissue. If the bulb is cut longitudinally, inner fleshy scales are soft and water-soaked. The rot progresses from the top of the infected scales downward and eventually the whole internal tissue may rot. The bacterium is primarily a wound pathogen and attacks leaves and bulbs in the field or after harvest. Infection often occurs just before or at harvest time. The disease is more severe when tops are damaged by high winds and hail. Mature bulbs are very susceptible. To control this disease, onions should be harvested just after tops lodge. Avoid wet and rainy conditions at harvest. Preventing injury, drying bulbs after topping, and storing bulbs at 32-34 F will help reduce disease.

Sourskin is caused by Pseudomonas (Burkholderia) cepacia. Losses appear in storage, but infection usually occurs in the field. Primary symptoms include a light brown decay and breakdown of one or a few inner bulb scales. The bulbs appear intact and remain firm, but rot proceeds internally. The bacterium is a versatile organism, found in soil and water or as a pathogen of plants and/or animals. The bacteria exist as pathovars or strains. Onions are relatively resistant to infection before bulb formation. Infection occurs through a wound either when free water causes water congestion of the bulb, when onion tops are cut at harvest, or when wounds occur when the foliage falls at maturity. Disease can also begin when contaminated water flows down the neck, but plants remain symptom-less until bulb formation. P. cepacia development is favored by high temperatures. The disease is usually more severe where tops have been damaged by high winds, hail, or wet, rainy conditions just before or at harvest. Contaminated irrigation water is a potential source of the pathogen and agent of its spread. Methods of irrigation have a large impact on disease incidence. Season-long overhead irrigation provides a favorable environment for P. cepacia. Control measures consist of proper maturing of the crop, quick drying after topping and harvest, and proper storage at 32-34 °F.

Disease Management

- Practice long rotations with unrelated crops; plant into disease-free soil.
- Plant high quality onion seed and transplants free of contamination.
- Use resistant varieties where available (look for resistance to Fusarium diseases and Purple Blotch).
- Avoid onion cull piles near production fields. Destroy onion debris after harvest.
- Clear curing, topping and packing areas of debris and clean well.
- Reduce the duration of leaf wetness periods by planting in rows oriented with prevailing winds, and maintain good weed control.
- Closer in-row spacing (4” instead of 6 or 8 “) has been shown in trials to reduce incidence of bacterial bulb decay at harvest but may increase leaf wetness and risk of fungal pathogens. See http://www.newenglandvfc.org/2011_conference/pdf/onion-hoepting.pdf
- Protect plants from insect, fertilizer, or other injury.
- Follow fertility recommendations carefully and avoid excess (greater than 200 pounds per acre) or late (after July 15) applications of nitrogen. Split nitrogen applications are recommended
- Avoid the movement of soil contaminated with sclerotia of White Rot into new fields by cleaning equipment.
- Do not irrigate within 10 to 14 days of lifting. Avoid harvest after heavy rains.
- Avoid mechanical injury and bruising of bulbs during production and harvest.
- Properly cure bulbs. Cure in a well ventilated area at 70-80˚F. Practices that hasten curing include undercutting bulbs to sever all roots, avoiding nitrogen fertilization later than two months after seeding, and proper plant spacing. Under wet conditions when bulbs cannot be cured adequately, artificial drying with forced hot air followed by normal storage should be considered.
- After storage, manage air supply to prevent the condensation of water on bulbs.
- Store bulbs with good ventilation at 32-34˚F with 70-75% relative humidity.

- There are no effective chemical controls for the soil-borne diseases Fusarium Basal Rot and White Rot.
- Purple Blotch and Botrytis leaf Blight may be controlled with regular applications of recommended fungicides. Fungicides containing copper, chlorothalonil, mancozeb, pyrimethanil, propiconazole, iprodione, and strobilurins (azoxystrobin, pyraclostrobin) are registered for use on onion and garlic. See http://www.nevegetable.org/ for more details.

- Adapted by S. Scheufele, UMass Vegetable Extension

STEM AND BLOAT NEMATODE OF ONION AND GARLIC: A RE-EMERGING PEST

Like so many problems the best cure is prevention; this is one to keep off the farm! Bloat nematode has been in the United States since the 1930s but, in 2010, severe damage to garlic was reported in a New York garlic field. Since then bloat nematode has been confirmed in Canada and throughout New England.

Nematode damage on garlic

Symptoms and Damage. Severely infected garlic plants grown from infected seeds exhibit stunting, yellowing and collapse of leaves, and premature defoliation. The bulbs of infected plants initially show light discoloration, but later the entire bulb or individual cloves become dark brown in color, shrunken, soft, light in weight and eventually exhibit cracks and various decay symptoms due to the additional activities of numerous saprophytic soil organisms. However it can be very difficult to distinguish nematode infected bulbs from other problems. If you suspect that you have a problem send a sample to the UMass Plant Diagnostic Lab.

Bloat nematode. Soil nematodes are microscopic round worms. Some of these round worms feed on plants, others feed on bacteria, fungi or other microscopic organisms. The bloat nematode, a plant feeder, lives some of its life cycle in the soil. For much of its life it lives and feeds inside leaves, stems, and bulbs of onion and garlic. It can survive for several years in infected plant tissue or soil because it has a special stage of its life cycle where it can withstand very dry conditions. The nematode can only move small distances through the soil on its own but it is easily spread through infected seeds and plant material, irrigation water or surface run off, contaminated equipment or other soil movement.

What can you do to prevent and manage bloat nematode?

- Plant Only Nematode-Free Seeds. Infected planting materials is the major source for introducing this important pathogen into new production areas, thus it is critical to use only clean seeds to prevent the establishment and damage of this nematode.
- Hot Water Treatment of Planting Materials. Considerable information is available in the literature on various hot water treatment protocols against the bloat nematode in garlic bulbs and plant materials of other crops. It appears that the most used protocol is dipping for 20 minutes at 120 F. However, water temperature above 122 F appears to injure garlic tissues. Also, dipping garlic bulbs in hot water alone without other additives (sodium hypochlorite, avermectin, formaldehyde, various fungicides, or other chemicals) were not as effective. Hot water treatment should be considered only when clean bulbs are not available, as even the best hot water treatment does not completely eliminate the nematode and may also increase other disease problems.
- Avoid infested Sites or Treat the Soil with an Appropriate Control Product. Nematode-free seeds should be planted in soil free of infestation with the bloat nematode. If there is any question, the soil of the target site should be sampled and analyzed for the presence of the bloat nematode. A population of as low as 10 bloat nematodes/500 cc soil has been reported to cause damage in many crops. Pre-plant soil fumigation with registered nematicides will control this nematode as well as other plant-parasitic nematodes, where needed and if cost-effective. Mixed results have been reported in the literature with the use of non-fumigant-type nematicides in controlling the bloat nematode and only limited evaluations have been conducted to-date in New York.

For more detailed information see Dr. George Abawi's report in the Mid Atlantic Fruit and Vegetable Convention Proceedings 2013: http://extension.psu.edu/plants/vegetable-fruit/news/pdfs/bloat-nematode

-Adapted from an article by Tianna Dupont, Penn State Extension Educator

SUMMER NITROGEN MANAGEMENT

After several weeks of rain, with some parts of our state receiving over 10 inches in a week, it is likely that nitrogen availability is too low for healthy crop growth- especially in sandy soils low in organic matter. Routine soil tests are not good predictors of nitrogen (N) availability because plant available N fluctuates greatly throughout the season. Perhaps you have already considered this possibility and taken a Pre-sidress Nitrogen Test (PSNT) to determine whether or not your crop should receive any additional nitrogen to improve growth. Consult Table 1 for suggested crop stages when to sample for a PSNT test. Sampling instructions can be found at the UMass Soil Testing Lab website: http://ag.umass.edu/services/soil-and-tissue-testing-laboratory. Having received your PSNT test results, you are now left with questions about how much N to apply and in what form.

Interpreting PSNT results: The PSNT is a tool growers can use to optimize N management, matching crop nitrogen needs for the time of greatest crop growth. The PSNT measures the current level of nitrate-N in the soil in parts per million (ppm), which is a good predictor of what will be available for the remaining period of crop growth. The test helps growers avoid the use of excess nitrogen fertilizers, thus eliminating potential run-off and providing cost savings in labor and fertilizer. Broadcast and preplanting nitrogen applications can be reduced or avoided entirely if nitrogen is supplied to plants at key periods of growth. The test is especially useful in soils that are high in organic matter or have had a cover crop or manure turned under before planting since microbes will be mineralizing nitrogen for use by plants throughout the season. This test has been used successfully with corn, potatoes, peppers, cucurbits and some brassicas.

Research conducted by the University of Massachusetts and Connecticut indicates that an appropriate threshold for most vegetable crops is about 30 ppm nitrate-N (NO3-N) and 25ppm for sweet corn. Above this level, sidedressing or topdressing supplemental N would be of no value and may even decrease yields. As a tool, the PSNT should be used along with a grower's experience and knowledge of fields. For example, a field high in organic matter will continue to release nitrogen for crop growth throughout the season. Research indicates that for each 1% organic matter, we can expect 20 to 40 lb of N per acre per year to be mineralized when conditions are favorable. Reduce sidedressing amounts to reflect the nitrogen credit coming from organic matter. Interpretation of PSNT results should be made with regard to weather conditions such as recent leaching rains that reduce available N, or high soil temperatures that increase mineralization and therefore available N. Weather conditions should also be considered before making N applications to avoid runoff, leaching and volitalization.

How much N should I sidedress based on PSNT results? If soils have 0-25 ppm nitrate, apply the full sidedress amount recommended by the New England Vegetable Management Guide. For crops other than sweet corn, at 25-30 ppm nitrate you can cut the sidedress rate in half. Above 30 ppm no additional N is needed and could hurt yields. Consult Table 1 for sidedress rates of specific crops.

What form of Nitrogen should I use? Nitrogen is available in a number of forms; consult pages 37-38 of the Nutrient Management Guide for New England Vegetable Production for nitrogen options for organic and non-organic growers: http://preview.tinyurl.com/la3l9yf Common sources of fertilizer N include urea, ammonium nitrate, monoammonium phosphate, diammonium phosphate, calcium nitrate and potassium nitrate. Sulphur coated urea is a material which releases N more slowly over a period of several weeks. In the soil, urea is converted by hydrolysis to ammonium, which in turn is converted through nitrification to nitrate. In warm soils these reactions usually happen fairly quickly if soil pH is over 6.0 and soil moisture and aeration are adequate. For organic growers options include: manure, meals and emulsions, or animal byproducts such as dried blood and feather meal. Not all of these forms are readily available to the crop, and selecting rapidly available forms of nitrogen may be preferable for sidedressing. Nitrate is the predominant form of N taken up by most plants, but any of these fertilizers can be used because they will be converted to nitrate eventually. Many growers use calcium nitrate and sometimes potassium nitrate for topdressing or sidedressing N on crops subject to calcium related disorders. When a slow release form of urea is used, only a small amount of ammonium is present at a given time and is unlikely to cause a problem with calcium nutrition, but N may not be available quickly enough to meet the demands of a rapidly growing crop.

How much will the Nitrogen cost me? Cost of the various nitrogen materials vary considerably. Be sure to compare the costs of materials on the cost per pound of N, not per ton of material. The way to do this is as follows:
Cost per lb N = (Price per ton material) divided by (lbs of N in a ton of material).
For example, one ton of urea costs $598 and contains 920 lbs N (2000 x 46%N)
Therefore cost per lb N = ($598) ÷ 920 lbs N = $0.65/ lb N.

In Summary: Nitrogen is easily leached from the soil. If this happens, money is wasted and ground water may be contaminated. Nitrogen applications should be timed to meet crop demands. Large pre-plant broadcast N applications should be avoided. A PSNT should be used to determine the need, if any, for additional N during the growing season. If needed, additional N can be applied by topdressing, sidedressing or injection into a trickle irrigation system.

- Adapted by K. Campbell-Nelson, UMass Vegetable Extension from J. Howell, UMass Extension and Joseph R. Heckman, Ph.D., Extension Specialist in Soil Fertility

Table 1. Suggested times for soil sampling vegetable crops to conduct PSNT from and Sidedress Nitrogen needs of crops

Crop	Soil sampling time for PSNT	Sidedress N in Lbs/A
Sweet corn	When plants are 6-10" tall	60-90
Cabbage **Cauliflower** **Broccoli** **Brusselsprouts**	2 weeks after transplanting	60, cabbage, broccoli, brusselsprouts 30, cauliflower
Celery	2 weeks after transplanting. Sample again 3-4 weeks later.	40 applied twice 3-4 weeks apart
Lettuce **Endive** **Escarole**	2 weeks after transplanting or after thinning if direct seeded (2- to 4-leaf stage)	30-50
Beets	After thinning (2-4 leaf stage)	30
Pumpkin **Winter Squash** **Cucumber** **Muskmelon**	Before vines are 6" long	40-50, pumpkin and winter squash 40, cucumber and melon
Spinach	2- to 4- leaf stage. Sample again after cutting.	30
Irish Potato	Before plants are 6" tall	40-60*
Pepper **Tomato** **Eppplant**	3-4 weeks after planting. Sample again 3-4 weeks later.	50, pepper 3 wks after planting and 40Lbs, at fruit set. 30, tomato applied twice 3-4 weeks apart. 30-50, eggplant
*Potatoes also need 50-125lbs/A Potassium depending on soil test results.		
Adapted from: Rutgers Cooperative Extension Bulletin, "Soil Nitrate Testing as a Guide to Nitrogen Management for Vegetable Crops" and The New England Vegetable Management Guide.		

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