UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

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In this issue:

Phytotoxicity from azoxystrobin (Quadris) applied to high tunnel tomatoes. Photo: K. Campbell-Nelson

Crop conditions

Early summer squash and zucchini are being picked, and the first high tunnel cucumbers are coming in. Kohlrabi, carrots, and beets are getting bunched for CSAs and on retail shelves now. The first peas are coming in as well. Field tomatoes have green fruit, and some peppers and eggplant have just begun flowering while others are still being transplanted. We are beginning to see disease issues in field crops, but our UMass plant disease diagnostician is noting that most of the samples she seems to be getting are abiotic disorders. We are seeing phytotoxicity and nutrient issues in high tunnel tomatoes, crops burned from unfinished compost applications, and other nutritional disorders in the field. Read the article in this issue by Gordon Johnson at University of Delaware to understand how to best use foliar feeding to avoid phytotoxicity on crops.

According to the National Agricultural Statistics service, most locations around Massachusetts are 3-4 degrees cooler than normal and have received 1-4 inches less than normal rainfall since April 1st of this year. So, even though most areas of Massachusetts received 0.5 to 1.0 inch of rain at the beginning of last week, Essex, Middlesex, and Worcester Counties showed up as "Abnormally Dry" on the U.S. Drought Monitor released on Thursdays. If you like having this type of detailed agricultural weather information, sign up to receive the New England Crop Progress and Conditions Reports. Despite the rain forecasted yesterday, we saw lots of irrigation being moved around and set up to get crops to germinate or establish young transplants.

Having trouble calibrating your sprayer? Not sure what volume of liquid to use for the size of your crop, or which nozzle to use? Come to our June 25th, 4-7pm Fruit and Vegetable Twilight Meeting in Pepperell, MA at Kimball Fruit Farms where we will cover these topics with a demonstration by the veteren Extension Educator, George Hamilton of UNH. Also covered at this twilight meeting will be spotted wing drosophila updates with UMass small fruit specialist Sonia Schloemann, and farmer Carl Hills showing us his hydroponic tomato system. All of this is followed by supper and discussion. See the Events section to register.

Pest alerts

Brassicas:

Flea beetles are still everywhere in large numbers. In a trial plot at UMass, Katie Campbell –Nelson learned that trap crops only work if you treat the trap crop to kill the pest, or else they will move into the cash crop too! See the New England Vegetable Management Guide for organic and conventional treatment options.

Crop	Stage	% Infested Plants
Cabbage & Broccoli, Cauliflower	pre-cupping (before head formation begins)	35%
Cabbage & broccoli	head formation to maturity	15%
Cauliflower	after heading	10%
Kale, collards & other greens	all stages	10-15%

Imported cabbageworm caterpillars are growing and starting to cause damage in a Worcester Co., MA field. There are 3-4 generations per year in MA and future generations can often build up in long season brassicas, so scout regularly to keep on top of this pest. Action thresholds in brassicas are in Table 1 (see page 1).

Chenopods:

Leaf miner: Freshly laid eggs were found on unsprayed beets in Berkshire Co., MA. All other chenopods on this farm were sprayed and infested leaves removed and destroyed. This was somewhat surprising because we assumed that the first generation flight was over. This pest has a 30-40 day life cycle with 3-4 generations per year in MA. The eggs hatch in 2-3 days, so the treatment window for most materials is very short. Spray before larvae hatch and enter into the leaves.

Cucurbits:

Striped cucumber beetle damage and beetles were found in Berkshire and Franklin Cos., MA but not yet at threshold of one per plant. Keep on top of this pest and control when plants are small to protect crops from bacterial wilt, which is vectored by the striped cucumber beetle. For spray recommendations see the New England Vegetable Management Guide.

Squash vine borer has not yet been captured in MA (Figure 1 next page), but moths are active in NH and Chittenden Co., VT. Do not rely on trap captures from nearby farms for treatment thresholds, as populations of this pest are very localized. Rather, use data from nearby locations to determine when to scout for eggs in your own fields. Or better yet, set up your own traps—you can get all the traps and pheromones you need here: http://www.greatlakesipm.com/

Solanaceous:

Colorado Potato Beetle: Eggs are beginning to hatch and 1st and 2nd instar larvae were observed feeding on potatoes in Franklin Co., MA, and on high tunnel eggplant in Berkshire Co., MA. Treating larvae when they are small is most effective, and controlling the first generation of CPB will result in fewer CPB to deal with in the next generation which occurs in early July.

Flea beetle damage has been heavy on eggplant transplants in Middlesex Co. and in a high tunnel in Berkshire Co., MA. Make sure to take care of this pest early on in eggplant. Treat newly set transplants if they have 2 flea beetles per plant, seedlings 3" to 6" tall if they have more than 4 beetles per plant, and plants over 6" tall if they have 8 beetles per plant. See the New England Vegetable Management Guide for treatment options.

Sweet Corn:

European corn borer (ECB): Despite reaching peak flight in parts of the state at 631 GDD base 50°F, trap counts are mostly very low in MA (Figure 1 next page). Traps in NY and NH are still catching ECB in the teens and above, so we are not sure why populations in MA have dropped. For the first generation of ECB, use trap counts to tell you when to start scouting for damage in field. Before tassels emerge, there is no point in spraying because ECB lays eggs deep inside the whorl, where pesticides cannot reach them. After tassels emerge and prior to silking use a 15% infestation spray threshold. If you wait until the tassels are completely open, it will be too late to spray as caterpillars will bore down into the stem where they can't be reached. During silking, caterpillars will move into the ear when the silk begins to dry. Therefore, critical times to scout and pay attention to trap counts are when your crop is just showing tassels and beginning to silk.

Fall armyworm: In locations where FAW traps have been set up in MA and NH, we are only capturing false wainscot moths (see photos to the right) which are attracted to the FAW lures, but do not cause damage in corn. Do not be alarmed, and use this handy ID guide to check if you are properly identifying moths in your traps.

False wainscot moth. Photo by Loren and Babs Padelforth

Fall armyworm moth, Photo by Peter Homann

Other crops:

Damping off caused by *Fusarium* in pepper (in the field) and basil (in a high tunnel) on one farm and **caused by *Pythium*** in sweet peas and field peas on another farm were diagnosed this week. Symptoms were not obvious in transplants or when planted in the

field 3 weeks ago, but the cool and rainy weather last week exacerbated the problem. These pathogens attack the roots and base of the stem, and plants appear stunted or wilted. However, more irrigation will only worsen the problem, making conditions favorable for pathogen growth and disease spread.

Damping off can be caused by several common soil-borne fungi like *Rhizoctonia* spp. and *Fusarium* spp., and by oomycetes like *Pythium* spp. and *Phytophthora* spp. It's important to note that fungicides that work on fungi do not always work on oomycetes and vice-versa. Thiram, fludioxinil, and captan are commonly used to control soil-borne fungi while mefenoxam is commonly used to treat soil-borne oomycete pathogens. For organic growers, biopesticides that include *Trichoderma* spp. (e.g. Rootshield), *Streptomyces* spp. (e.g. Mycostop), or *Bacillus* spp. (e.g. Serenade) can provide come suppression of both fungal and oomycete pathogens in soil.

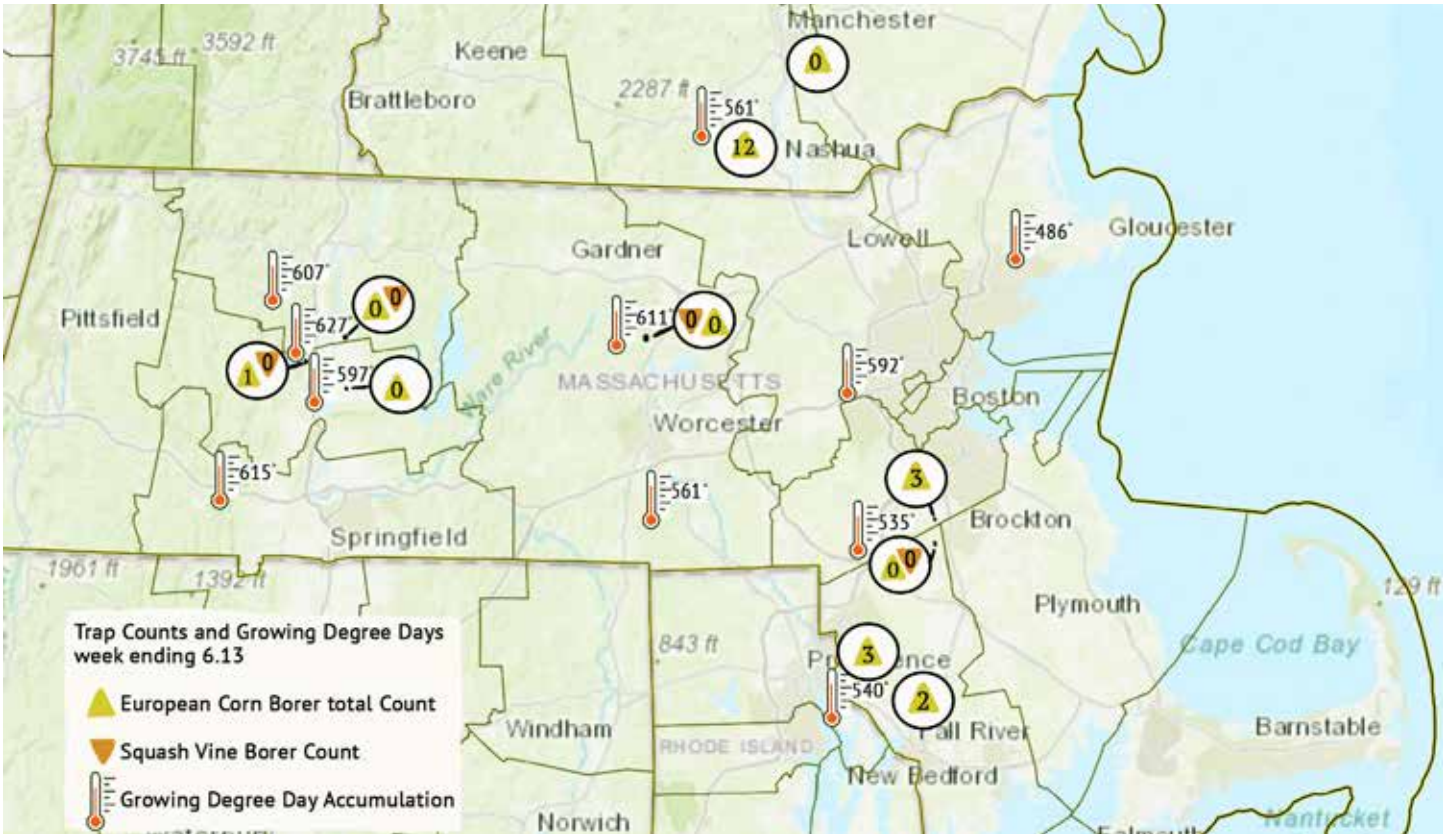


Figure 1. *Trap captures for the week ending 6/13/2018 and Growing Degree Days base 50F since Jan. 1, 2018. Map by: Annalisa Flynn, UMass Extension Vegetable Program*

DISEASES OF ONION

Onions and garlic are subject to numerous leaf and bulb diseases caused by fungi and bacteria which occurr both in the field and in storage. In the past week, the NEWA onion disease forecast tool has been rating conditions as slightly to extremely favorable for the development of botrytis leaf blight, downy mildew, and purple blotch in many parts of MA. Be on the lookout for disease symptoms and treat if these diseases have been problematic on your farm before, they can all survive in crop residues and cull piles

Fungal Diseases

Botrytis Leaf Blight (*Botrytis squamosa*) overwinters in onion cull piles, on onion leaf debris, or as sclerotia (small masses of fungal tissue that act as survival structures) in the soil. Under favorable conditions (leaf wetness and moderate temperatures around 72-75˚ F) infection occurs, spores are produced on the leaf tissue and are then spread by wind. Disease incidence increases with longer periods of leaf wetness. Early symptoms are small, gray to white oval spots on leaves. The spots have a distinctive silvery-white "halo" with uneven margins. The centers of many spots become

Early symptoms of Botrytis leaf blight -- small white to gray oval spots on leaves. Photo by L. du Toit.

Purple blotch lesions develop concentric rings as they develop. Photo by S.B. Scheufele.

Onion downy mildew lesions develop dark sporulation like purple blotch, but lack concentric rings. Photo by K. Campbell-Nelson

sunken and straw-colored. Eventually the whole leaf may be covered in spots and the leaf will die back. Older or dying leaves are more susceptible to this blighting. Yield losses occur because premature leaf senescence prevents bulbs from sizing up.

Purple Blotch (*Alternaria porri*) has been reported on onion, garlic, and leek and probably occurs on other *Allium* species as well. The pathogen overwinters on infected bulbs and debris in the field, and can be seed-borne in onion. Symptoms first appear on leaves as small water-soaked lesions with white centers. Growing lesions develop concentric rings, with surrounding tissue turning yellow and lesion centers appearing brown to purple. In moist weather, the surfaces of the spots usually develop a brown-black, powdery fungal growth. Leaves with large spots turn yellow and die. Leaves with wounds from thrips feeding injury or abrasions from sandblasting that can occur during windstorms are more susceptible to purple blotch. Older leaves and older plants 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. The pathogen may enter bulbs at harvest through the neck or wounds. Bulb decay first appears 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 wine-red and dries to a papery texture.

Downy mildew of onions, shallots, leeks, garlic, and chives is caused by the air-borne oomycete (a fungal-like organism) *Peronospora destructor*. This disease is not as common as Botrytis leaf blight or purple blotch, but when conditions are favorable for downy mildew, it can destroy an onion crop very quickly. The first symptoms are irregular pale green or yellow patches on the leaf. Later the pathogen produces spores which start out clear and then become gray to purplish, and can resemble purple blotch. The lesions girdle onion leaves and they often become bent at the yellowed spot. Disease often starts in patches in a field or in a certain variety and is favored by cool (less than 72°F), humid weather. The pathogen overwinters as mycelium in crop debris or cull piles and spreads from there when conditions are favorable. Because the pathogen is an oomycete and not a true fungus, fungicides that control Botrytis or purple blotch may not control downy mildew.

Fluffy white fungal growth characteristic of white rot. Photo by G.Q. Pelter

White Rot (*Sclerotium cepivorum*) is one of the most widespread and destructive fungal diseases of *Allium* species. This disease occurs wherever onions are grown, especially when a significant part of crop growth occurs during cool temperatures, which favors the pathogen. *Sclerotium cepivorum* produces hardy sclerotia—small masses of fungal tissue, surrounded by a dark rind—that persist in the soil for years. Disease is spread by movement of infested soil and infected sets or transplants. Symptoms include leaf yellowing and premature leaf dieback. Plants become stunted, and rapid death of all foliage follows. In fields with bad infestations, plants may die suddenly in large areas. Infected plants will develop fluffy fungal mycelium on the stem plate, and small sclerotia (about the size of poppy seeds) will form in and on the surface of affected bulb parts, often around the neck. White rot can continue to spread 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*. They have broad host range including tomato, lettuce, cabbage, carrot and bean while *S. cepivorum* is specific to alliums.

Fusarium Basal Rot affects *Allium* species including onion, garlic, shallot, and chives. This disease is primarily caused by *Fusarium oxysporum* f. sp. *cepae*. The fungus pro-

Wilting and foliar dieback, caused by Fusarium basal rot (above). Bases of bulbs appear purple-brown and watery when cut open (below). Photos by H. Schwartz

duces long-lived survival spores that can persist in the soil for many years, and can be spread on infected onion sets and garlic cloves. Plants can be infected at any stage of growth. Disease incidence increases with injury to roots, basal plate, or bulbs by onion maggots and other insects. Above-ground symptoms of root infections include leaf yellowing and curving. Leaves will begin to die back from the tip downwards. Infected plants may wilt, and affected bulbs may turn red to purple and appear brown and watery when cut open. This 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. The most effective methods of control is using resistant varieties and planting only healthy onion sets/garlic bulbs.

Bacterial Diseases

Bacterial diseases occur when bacterial cells enter leaf tissue via wounds caused by thrips damage, sandblasting by wind, or during harvest. Bacteria move into the bulb and are often not evident until the harvested crop is stored and used. Therefore, controlling onion thrips is very important, especially in storage onions, as their feeding damage can be an entry point for these pathogens. Control measures should include proper maturing of the crop, rapid drying after harvest, topping only after necks have dried fully, and proper storage at 32-34 °F.

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 scales are soft and water-soaked. The rot progresses from the top of the infected scales downward and eventually the whole bulb may rot. The bacterium enters via wounded leaf tissue and attacks leaves and bulbs in the field just before or at harvest time. Mature bulbs are very susceptible.

Sourskin (*Burkholderia cepacia* – previously *Pseudomonas cepacia*) causes 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, and is favored by high temperatures. Onions are relatively resistant to infection before bulb formation.

Symptoms of slippery skin. Photo by H. Schwartz

Sourskin causes individual bulb scales to rot. Photo by D.B. Langston

Disease Management

- **Practice long rotations with non-allium crops**. Plant alliums into disease-free soil.
- **Plant high quality onion seed, slips, and transplants free of contamination.**
- **Use resistant varieties where available** (look for resistance to Fusarium diseases and Purple Blotch).
- **Control weeds.**
- **Control onion thrips.** Conventional and organic insecticides are available. See the New England Vegetable Management Guide for recommendations.
- **Conventional and organic fungicides can be effective in controlling *Botrytis*, purple blotch, and downy mildew.** See the New England Vegetable Management Guide for the latest recommendations.
- **Destroy onion debris after harvest.**
- **Sanitize harvest tools regularly to prevent spreading bacteria.**
- **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 wet-

ness and risk of fungal pathogens.

- **Avoid excess (greater than 200 pounds per acre) or late (after July 15) applications of nitrogen.** Split nitrogen applications are recommended.
- **Avoid moving contaminated soil between fields.** Clean tractors and equipment between fields.
- **Do not irrigate within 10 to 14 days of harvest.** Avoid harvest after heavy rains.
- **Avoid mechanical injury and bruising of bulbs during production and harvest.**
- **Undercut crop prior to harvest** to sever all roots and prevent larger wounding during harvest.
- C**ure in a well-ventilated area at 70-80˚F.** Under wet conditions when bulbs cannot be cured adequately, artificial drying with forced hot air followed by normal storage should be considered.
- S**tore bulbs with good ventilation at 32-34˚F with 70-75% relative humidity.** Regulate humidity to prevent condensation from forming on bulbs.

-UMass Vegetable Program, revised 2018

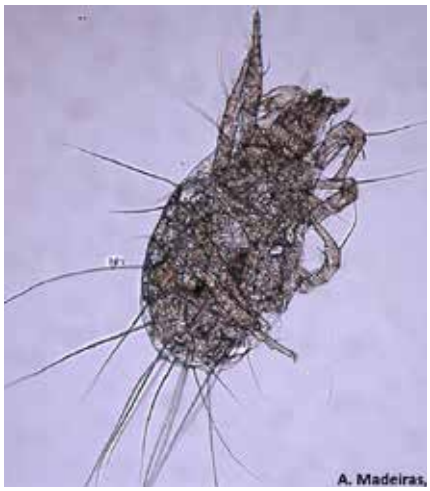
BULB MITES IN GARLIC

Two genera of mites are known to infect species of *Allium*. The dry bulb mite (*Aceria tulipae*) is an eriophyid mite that survives on cultivated *Allium* species. Bulb mite species in the genus *Rhizoglyphus* can also be troublesome on alliums.

These mites can overwinter in the soil, especially in soils with high levels of decaying organic matter, and also survive in stored garlic. They can damage garlic in the field, but are particularly troublesome in storage. Their feeding can cause desiccation and creates wounds that provide an ingress for soft-rotting bacteria and pathogenic fungi such as *Fusarium* (causing basal plate rot) and *Penicillium* (causing blue mold). In addition, dry bulb mites can transmit garlic allexiviruses. Infected seed is the most common way that bulb mites are introduced into a field.

Sunken brown spots on garlic cloves and basal plate damage from bulb mite feeding. Photo by E. Sideman

Symptoms: Infested seed may fail to germinate. Plants grown from infested seed may lack vigor and produce stunted, deformed leaves. Plants may outgrow the damage if the infestation is not heavy, but mites may increase in number over the growing season and will remain in the harvested garlic. Viral symptoms may be seen. In the field, mites feed mainly on the roots and basal plate. In storage, the mites move into the garlic bulb, where their feeding activity causes sunken tan to brown spots to form on cloves. Desiccation may occur. Soft rot bacteria or fungi may also be present.



Rhizoglyphus mite at 10x magnification. Photo by A. Madeiras.

Identification: Adult *Rhizoglyphus* mites are 0.5-1.0 mm long, have four pairs of legs, and are bulb shaped. Their legs are brown. Eriophyid mites like the dry bulb mite are usually less than 0.3 mm long, have two pairs of legs near the front of their bodies, and are somewhat more conical or cigar-shaped. The bodies of both species are off-white to pale yellow in color and may be visible with a hand lens.

Management options:

- Plant clean seed. Buy from a trusted source and inspect all seed lots. If you suspect any issues, get a diagnosis before planting.
- If you do have a mite infestation in your garlic seed, hot water treatment before planting can reduce the population. However, hot water treatment of garlic seed can also decrease germination and is difficult to do on a large scale, as temperatures need to be regulated closely. Use 4-5 parts water to 1 part garlic cloves. Preheat seed in 100°F water for 30-60 minutes, then transfer seed to 120°F water for 20 minutes. Stir constantly. Monitor and regulate temperature closely. Temperatures above 125°F will cook

the garlic. After treating, immediately immerse treated cloves in room temperature water (66-71°F) for 10-20 minutes. Allow seed to dry for 1-2 days in a well-ventilated area. Do not store treated seed for more than a week, as treatment can increase the occurrence of fungal diseases. Please note that we have not tested this procedure ourselves. Hot water treatment of seeds garlic will also reduce populations of stem and bloat nematodes which may be present. For more information see: http://www.omafra.gov.on.ca/english/crops/hort/news/hortmatt/2014/22hrt14a1.htm

- Soak seed for 24 hours in 2% oil or fat based soap (not detergent) and 2% mineral oil prior to planting.
- Mild mite infestations are often mitigated by the process of curing bulbs before storage.
- Rotate out of alliums for at least four years. Control wild Allium species in the vicinity.
- Mites can survive on the residues of a number of crops. Plant only in fields where crop residue is thoroughly decomposed.
- Avoid planting alliums directly after brassicas, corn, grain, or grass cover crops.

-Angela Madeiras, UMass Plant Disease Diagnostic Lab

FOLIAR FERTILIZATION OF VEGETABLE CROPS

Written by Gordon Johnson, Extension Vegetable & Fruit Specialist, University of Delaware Cooperative Extension. First published in Weekly Crop Update, June 8, 2018 Issue

I recently looked a several vegetable plantings that showed severe damage from foliar fertilizers. The extended cloudy weather set up conditions where the plants were more susceptible to salt injury (thinner leaves with less developed waxy cuticles). With plant injury in mind, I thought it would be good to revisit the use of foliar fertilizers in vegetable crops.

Growers will apply most (>90%) of their plant nutrients for vegetable crops as soil applications (preplant, sidedressed, fertigated) based on soil tests and crop nitrogen needs.

To monitor vegetable nutrient status during the growing season, tissue testing is recommended just prior to critical growth stages. Growers can then add fertilizers to maintain adequate nutrient levels during the growing season or correct nutrient levels that are deficient or dropping.

Foliar fertilization is one tool to maintain or enhance plant nutritional status during the growing season. Often quick effects are seen and deficiencies can be corrected before yield or quality losses occur. Foliar fertilization also allows for multiple application timings post planting. In addition, there is reduced concern for nutrient loss, tie up, or fixation when compared to soil applications.

However, foliar fertilization has limitations. There is the potential to injure plants with fertilizer salts, application amounts are limited (only small amounts can be taken up through leaves at one time), multiple applications are often necessary (increasing application costs) and foliar applications are not always effective, depending on the nutrient targeted and plant growth stage.

Where foliar fertilization does have a good fit is for deficiency prevention or correction, particularly when root system function is impaired. This commonly occurs when there is extended rainy weather and soils are waterlogged. Foliar fertilization is also necessary when soil conditions, such as low pH, causes the tie up of nutrients so that soil uptake is limited. Foliar fertilization can also be used to target growth stages for improved vegetable nutrition thus improving color, appearance, quality, and yield.

Foliar fertilizers are applied as liquid solutions of water and the dissolved fertilizers in ion or small molecule form. Foliar nutrient entrance is mostly through the waxy cuticle, the protective layer that covers the epidermal cells of leaves. Research has shown that there is limited entrance through the stomata. While the waxy cuticle serves to control water loss from leaf surfaces, it does contain very small pores that allows some water and small solute molecules to enter into the underlying leaf cells. These pores are lined with negative charges. Fertilizer nutrients in cation form or with neutral charges enter most readily through these channels: this includes ammonium, potassium, magnesium, and urea (NH_4^+, K^+, Mg^{++}, CH_4N_2O respectively). In contrast, negatively charged nutrients (phosphate-P, sulfate-S, molybdate-Mo) are much slower

to move through the cuticle (they must be paired with a cation). Movement through the cuticle is also dependent on molecular size, nutrient concentration, time the nutrient is in solution on the leaf, whether the nutrient is in ionic or chelated form (complexed with an organic molecule), and the thickness of the leaf cuticle.

Another factor in foliar fertilizer effectiveness is what happens once the nutrient enters into the leaf area. Some smaller molecules or those with less of a charge are readily transported in the vascular system to other areas of the plant (NH_4^+, K^+, Mg^{++}, Urea). Other larger molecules and more strongly positive charged nutrients stay near where they enter because they bind to the walls of cells in intercellular areas that contain negative charges. Tightly held nutrients include Calcium, Manganese, Iron, Zinc, and Copper (Ca^{++}, Mn^{++}, Fe^{++}, Zn^{++}, Cu^{++}). Therefore, when applied as foliar fertilizers, calcium does not move much once it enters plant tissue, the negatively charged nutrients such as phosphorus and sulfur are very slow to enter the plant, and iron, manganese, copper, and zinc are slow entering and do not mobilize once in the plant.

The following is a list of the major plant nutrients that are effective as foliar applications, fertilizer forms best used for foliar applications, and recommended rates:

- **Foliar applications of nitrogen (N)** can benefit most vegetables if the plant is low in N. Urea forms of N are the most effective; methylene ureas and triazones are effective with less injury potential; and ammonium sulfate is also effective. Recommended rates are 1-10 lbs per acre.
- **Foliar potassium (K)** is used on fruiting vegetables such as tomatoes and melons. Best sources are potassium sulfate or potassium nitrate. Recommended rate is 4 lbs/a of K.
- **Foliar magnesium (Mg)** is used on tomatoes, melons, and beans commonly. The best source is magnesium sulfate and recommended rates are 0.5-2 lbs/a of Mg.
- **Foliar calcium (Ca)** is often recommended, but because it moves very little, it must be applied at proper growth stages to be effective. For example, for reducing blossom end rot in tomato or pepper fruits, foliar calcium must be applied when fruits are very small. Best sources for foliar calcium are calcium nitrate (10-15 lbs/a), calcium chloride (5-8 lbs/a) and some chelated Ca products (manufacturers recommendations).
- **Iron (Fe), manganese (Mn), or zinc (Zn)** are best applied foliarly as sulfate forms. Rates are: Fe, Mn, 1-2 lbs/a, and Zn ¼ lb/a. While these metal micronutrients are not mobile, foliar applications are very effective at correcting local deficiencies in leaves.
- The other micronutrient that can be effective as a foliar application is **boron**. Boron in the Solubor form is often recommended at 0.1 to 0.25 lbs/a for mustard family crops such as cabbage as a foliar application. Boron is very toxic to plants if applied in excess so applying at correct rates is critical.

For foliar fertilizers to be most effective they should remain on leaves or other targeted plant tissue in liquid form as long as possible. Urea and ammonium nitrogen forms, potassium, and magnesium are normally absorbed within 12 hours. All other nutrients may take several days of wetting and rewetting to be absorbed. Therefore, it is recommended that foliar fertilizers be applied at dusk or early evening when dew is on the leaves, in high volume water, and using smaller droplets to cover more of the leaf. Applications should also be made when temperatures are moderate and wind is low. While foliar fertilizers are sometimes applied with pesticides, for best effectiveness and reduced phytotoxicity potential it is recommended that they be applied alone. Use only soluble grade fertilizers for foliar applications (many are already provided in liquid form) and adjust water pH so it is slightly acidic.

Foliar fertilizers are most effective when applied to younger leaves and fruits. Research has shown that as leaves or fruits age, cuticles thicken, and these thicker cuticles absorb significantly lower amounts of nutrients such as potassium. However, younger plant tissue is also the most susceptible to potential fertilizer burn.

Because foliar fertilizers are in salt forms they can damage plant tissue if applied at rates that are too high. Generally, a 0.5-2% fertilizer solution is recommended. Certain vegetables are more sensitive to fertilizer salt injury than others. Vegetables with large leaves with thinner cuticles (such as muskmelons) have greater risk of salt injury when compared to crops, such as cabbage, that have thick cuticles. Apply foliar fertilizers at recommended rates and dilutions for each specific vegetable crop.

In addition, some fertilizer sources are much more likely to cause injury than others. In the past this was given as the salt index for a fertilizer, the lower the salt index the less osmotic stress the fertilizer would place on the plant tissue. A better

index would be the osmolality values for the fertilizer material. For foliar nitrogen materials, osmolality values (mmol/kg) for common N sources are as follows: Urea = 1018, UAN-28 = 1439, Ammonium sulfate = 2314, Potassium nitrate = 3434. This shows that potassium nitrate has over 3x the osmotic stress potential compared to urea when applied as a foliar fertilizer. This means that potassium nitrate has much more potential to cause salt injury to plants than urea and must be used at lower rates.

Events

Twilight Meeting Summer Series

This series of Twilight meetings is an opportunity to learn from fellow farmers and find out what's new in Extension research. A light meal will be provided at each program.

Fruit and Vegetable Twilight Meeting

Featuring: Carl Hills and Kimball Fruit Farm's hydroponic tomato greenhouse.
George Hamilton, UNH Extension, will demonstrate and discuss proper boom sprayer calibration for fruit and vegetable crops.

Sonia Schloemann, UMass Extension, will provide an update on managing spotted wing drosophila.

**1.5 Pesticide recertification credits have been approved for this meeting

When: Monday, June 25th, 2018 from 4:00 pm to 7:00 pm

Where: Kimball Fruit Farm, 184 Hollis St. Pepperell, MA 01463

CLICK HERE TO REGISTER: https://www.surveymonkey.com/r/MDYZCFP

Click here to request special accommodations for this event.

Organic Weed Management

Featuring: Langwater's Kevin O'Dwyer and their flame weeder and leaf mulching techniques. Invited presenters include: Katie Ghantous (UMass Vegetable Weed Technician) with a vinegar weed injector, on-farm trial and information on weed ecology; Sonja Birthisel (UMaine PhD candidate studying Weed Management) with results of her research using occulation and solarization, and farmer Tyson Neukirch with his experiences using silage tarps in a reduced tillage system for weed management.

When: Tuesday, July 24th, 2018 from 4:00 pm to 7:00 pm

Where: Langwater Farm, 209 Washington St., North Easton, MA 02356

CLICK HERE TO REGISTER: https://www.surveymonkey.com/r/X9WLFYS

Click here to request special accommodations for this event.

UMass Extension Vegetable Program Research Tour and Round Table

Featuring: Sue Scheufele's research on cucurbit downy mildew resistance, pollinator protection in butternut squash, effects of different mulches on broccoli pests, and natural predators of cabbage aphid. Also, Madelaine Bartlett's research on corn genetics and the importance of genetics in crop development and improvement, Omid Zandvakili's research on lettuce nutrition, Kelly Allen's research on Fusarium wilt of basil, presentations on pollinators & agriculture and solar & agriculture, and more! Research presentations will be followed by dinner and a round table discussion.

When: Tuesday, August 14th, 2018 from 4:00 PM to 7:00 PM (Rain date: August 16th)

Where: UMass Crop and Animal Research and Education Farm, 89-91 River Rd., South Deerfield, MA 01373

CLICK HERE TO REGISTER: https://www.surveymonkey.com/r/X3JYR55

Click here to request special accommodations for this event.

Reduced Tillage and Transplanters for Vegetable Farmers

Featuring: Farmer Jim Ward and his reduced till vegetable cropping systems which he has practiced for over 10 years with the help of an Unverferth Deep Zone Tiller, Davidian Farm's two-row Monosem vacuum precision planter

mounted with Dawn Biologic roller crimpers (first ones in the state!), the UMass Research Farm's grain drill and roller crimper, and Brookdale Fruit Farm's new line of no-till transplanters from Checchi-Magli. There will also be demonstrations on Soil Health with Maggie Payne, Soil Scientist at NRCS.

When: Tuesday, August 28th, 2018 from 4:00 PM to 7:00 PM

Where: Ward's Berry Farm, 614 S Main St., Sharon, MA 02067

CLICK HERE TO REGISTER: https://www.surveymonkey.com/r/XF8JQYD

Click here to request special accommodations for this event.

Respirator Train-the-Trainer Course for Farmers, Beekeepers, and Other Employees who Need to Use Respirators

UMass Extension is offering a series of Respirator Train-the-Trainer workshops in 2018. Farmers, beekeepers and other who need to wear respirators, required by pesticide labels, can benefit from the workshop. Participants will learn how the fit test a respirator and select, use, clean, maintain and replace respirators. All handlers must be trained under the EPA Worker Protection Standard (WPS) Respirator Requirement if they apply any pesticide that requires a respirator. Several organic approved (OMRI) pesticides and some miticides used by beekeepers require respirators.

The respirator train-the-trainer workshops are 2 hours long and will be held in Marlboro, Taunton, Hadley, and Marlborough. The registration fee is $30.00 per person. Participants will received a Certificate of Attendance, a check list for respirator training, and a fit test protocol. This is an hands on workshop. Bring your respirator or use one of ours.

There is one workshop left in this series.

When: Tuesday, June 19, 2018 from 1:15 PM to 3:45 PM

Where: Best Western Royal Plaza Hotel, 181 Boston Post Road West, Marlborough, MA 01752

REGISTER HERE: https://www.regonline.com/registration/Checkin.aspx?EventID=2267202

Click here to request special accommodations for this event.

THANK YOU TO OUR SPONSORS:

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

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