



UMass
Extension

Vegetable Notes

For Vegetable Farmers in Massachusetts since 1975



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Flattened corn from Hurricane Isaias on Howden Farm in Sheffield, MA. Photo: B. Howden

CROP CONDITIONS

Tropical storm Isaias caused strong winds that brought down trees, knocked plants around, and flattened acres of corn across the region. Wind can quickly spread diseases, especially bacterial ones. Wounded crops are more susceptible to disease as well, so preventive sprays are broadly recommended in tomatoes, peppers, cucurbits, brassicas, or where bacterial diseases were present or if crops were damaged. The storm did not bring a lot of rain though, and many areas remain dry, especially to the south and east. The [MA Drought Task Force](#) information may be valuable to growers, with general information on drought conditions and how water supplies may be affected. The [current drought status webpage](#) provides an overview of the conditions across the Commonwealth. We are excited to announce a new twilight meeting series we will be hosting in late-September on managing water resources on the farm in the age of climate change and FSMA—see the events section for details.

We shared last week that MDAR is holding a [public hearing tonight](#) on the agency's draft regulations related to the state produce safety program. We have gotten a few questions about what this hearing is, so wanted to provide a little background. Following passage of the Food Safety Modernization Act Produce Safety Rule in 2015, FDA entered into cooperative agreements with most of the US states (44 to-date) such that enforcement of the produce safety rules would be the responsibility of the designated state agency – in Massachusetts, MDAR is that agency. States could then encode their authority in their own state statutes and promulgate regulations in support of the statutes. State rules must be in keeping with federal regulations; they can't be less strict, but they may add elements that are not part of the

federal rule. MDAR's authority to enforce the federal food safety standards was codified in 2018 at [ALM GL ch. 128, § 124](#). The agency recently released [draft regulations](#) that describe how it will enforce the statute in Massachusetts. When promulgating new rules, an agency is required to hold a public hearing – the meeting tonight is that public hearing. If you attended a produce safety training with UMass and MDAR in the last couple of years or are otherwise familiar with the FSMA produce safety standards, you will likely be familiar with most of the content of these state regulations. Again, they have to conform to the federal rule, but may include additional elements. For instance, the draft state rules include that a Commonwealth Quality Program audit, which is specific to Massachusetts, “may be deemed to be in compliance” with the federal rules. Public comments may be presented at the hearing tonight or can be submitted in writing. **Written comments will be accepted until 5:00 P.M. on Friday, August 21, 2020.** Written testimony must be submitted by e-mail to michael.botelho@mass.gov or by mail to Michael Botelho, 30 Riverside Drive, Suite 202, Lakeville, MA 02342. Info on how to join tonight's hearing via Zoom can be found in the Events section of this issue.

PEST ALERTS

Basil

[Downy mildew](#) was reported on basil this week in Franklin County. This is the second report of the disease in MA. Downy mildew can quickly cause plants to become unmarketable due to yellowing, sporulation on leaves, and then complete plant collapse. [Fungicides](#) can be effective if used preventively. Resistant varieties (Obsession, Passion, Devotion, and Thunderstruck) will be protected from disease for several weeks after susceptible varieties succumb before they too likely will become infected.

Brassicas

Reports of [flea beetles](#), [caterpillars](#), and diseases like [black rot](#) and [Alternaria leaf spot](#) continue to come in as these pests spread through brassica fields.

[Brassica downy mildew](#) was reported in transplants in a greenhouse this week. We see this disease most often in the greenhouse where humidity is high, and also in the field in fall when conditions are cool and wet. Often, symptoms that are present on seedlings recede when plants are moved out to the field and conditions are less humid, but the pathogen can remain infective in the plants and symptoms may recur in the fall when conditions are wetter and cooler. For a list of labeled fungicides, consult the brassica disease section of the [New England Vegetable Management Guide](#).



Brassica downy mildew sporulation.
Photo: S.B. Scheufele

Cucurbits

[Cucurbit downy mildew](#) is spreading across the region on susceptible cucumbers, and the disease was confirmed on cantaloupe in Franklin County this week. If cantaloupe still has some time before it will be harvested, this crop should be protected now too. Still no reports on squash in the region.

[Yellow vine decline](#) was confirmed in pumpkin in CT. This disease is not common in the Northeast and this is the first confirmed report since 2003. YVD is caused by the bacterium *Serratia marcescens* and is vectored by squash bugs. The bacteria clog phloem vessels and cause rapid yellowing, wilt, and plant collapse. Report suspected infections to your local extension agent!



Yellow vine decline in pumpkin.
Photo: J. Jasinski, OSU Extension, Bugwood.org

Solanaceous

[Pepper maggot](#) is causing damage now, with the earliest maggots tunneling into fruit while egg-laying continues. This pest is not a problem in every field on every farm, so some farms may never see it. Pepper maggot flies spend most of their time in tree canopies and are hard to monitor for, but you can look for signs of this pest by scouting for sunken, pinpoint egg-laying scars on the skin of fruit. Remove culled fruit from the field and destroy (trash, feed to pigs, etc.) to prevent maggots from pupating in the soil. For more info on pepper maggot management, see the article in the [July 16, 2020 issue](#) of Veg Notes.

Potato foliage is going down and harvest is beginning in the earliest plantings and early-maturing varieties, or where leafhoppers were not controlled and hopperburn is widespread. **Early blight** is also present and causing defoliation. For harvest and curing information see the [August 15, 2019 issue](#) of Veg Notes.

[Stemphylium leaf spot](#) was confirmed on field tomatoes this week where it was causing small dark specks that expand into blotchy, brown or gray patch-



Stemphylium leaf spot. Photo: G. Higgins

es with cracks sometimes forming in the center. Spots sometimes have yellow haloes and cause yellowing. This disease is less common than other fungal leaf diseases on tomato but can be confused for other leaf spots, and management recommendations are the same as for [early blight](#) or [Septoria](#) leaf spots.

[Stink bug](#) injury is being reported now on tomatoes in the field. The damage could be caused by native stink bugs, e.g., brown stink bug, or the introduced brown marmorated stink bug. For more information and management recommendations see the article in this issue.

Sweet corn

The second flight of European corn borer (ECB) is reaching its peak now, with higher numbers this week than last. Corn earworm (CEW) numbers were moderate before the storm but numbers have dramatically increased since Tuesday, with some traps over 60, and most locations at a 4-5 day spray schedule (see table). Same story with fall armyworm ((FAW) which has also dramatically increased in range and number after the storm. Growers should watch for FAW feeding injury in all stages of corn—knee high to tassel—since this pest prefers to feed on tender foliage.



*Stink bug damage on tomato fruit.
Photo: A. Radin, URI*

Table 2. Sweetcorn pest trap captures for July 31-Aug 6, 2020

Location	GDD (base 50°F)	ECB NY	ECB IA	FAW	CEW	CEW Spray Interval
Western MA						
Sheffield	-	4	0	-	5	5 days
Southwick	1870	15	0	0	30	4 days
Whately	1865	6	2	-	4	
Central MA						
Bolton	1765	0	0	4	4	5 days
Leominster	1736	5	0	11	12	4 days
Spencer	1703	14	6	0	29	4 days
Eastern MA						
Ipswich	1603	9	0	0	7	4 days
Concord	1717	2	1	3	3	6 days
Millis	1899	8	1	N/A	11	4 days
Sharon		0	1	N/A	53	4 days
Seekonk	1942	2	0	27	20	4 days
Swansea		8	2	5	18	4 days
- no numbers reported for this trap N/A this site does not trap for this pest						
*GDDs are reported from the nearest weather station to the trapping site						

Table 3. Spray intervals for corn earworm based on Heliothis net trap captures

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

CONTACT US:

Contact the UMass Extension Vegetable Program with your farm-related questions, any time of the year. We always do our best to respond to all inquiries. **Office phone:** (413) 577-3976 *We are currently working remotely but checking these messages daily, so please leave us a message!* **Email:** umassveg@umass.edu

Home Gardeners: Please contact the UMass GreenInfo Help Line with home gardening and homesteading questions, at greeninfo@umext.umass.edu.

The [UMass Plant Diagnostic Lab](#) and the [UMass Soil & Tissue Testing Lab](#) are both now open.

WHAT'S UP WITH BMSB?

In the early 2000s, a new stink bug, brown marmorated stink bug (BMSB) arrived in the US, in Pennsylvania, and quickly started causing a lot of damage to fruit and vegetable crops in the mid-Atlantic region. Since then, Extension staff at UMass and UNH have been monitoring for the pest in orchards across the region, and are keeping an eye on this potential threat. However, over the last 10 years of trapping for this pest, numbers of BMSB have remained low, and we haven't seen much damage either. That's not to say we never see damage, but the damage often occurs in hot spots near urban areas where the pest overwinters inside homes—in MA the highest numbers we have trapped so far are around Worcester County. Furthermore, BMSB feed somewhat indiscriminately on many plants that are not agricultural crops, and the damage is impossible to distinguish from feeding damage caused by other native stink bugs. In a recent [BMSB-focused episode](#) of Anna Wallingford of UNH Extension's excellent podcast, "[Over-Informed on IPM](#)", Anna declares that "the take home here is that you should be aware of the potential for crop injury due to this invasive pest but don't freak out! Not yet!"

The brown stink bug is a native pest that feeds on blossoms, buds, and fruit on a wide range of vegetables, fruits, and weeds. Adults are plain brown or grayish-yellow, 11 to 15 mm long, and the shield-like shape typical of stink bugs is rounded at the 'shoulders'. Adults overwinter among plant debris and in weeds, and persist for 2 or more months in summer. Eggs are yellowish-white and laid in clusters of about 20. Nymphs are light colored, yellowish-brown above and white to yellow underneath. There are 2 generations per year. Both adults and nymphs cause damage to tomato fruit, causing white star-like patches on the fruit skin with shallow injury to the flesh below the skin. Bugs migrate into fields from weedy borders, woods, or brambles.



Brown stink bug nymph (left) and adult (right). Photos: H. Pilcher, USDA ARS, Bugwood.org and M. Quinn, TexasEnto.net

Damage is worse in dry seasons and is often limited to the edge of the field; border treatments are often adequate to manage this pest. High tunnel tomatoes may be affected. High weed pressure, reduced-tillage and increased use of cover crops may increase damage by providing hiding places within fields. Natural enemies in the field usually contain outbreaks if they are not disrupted by broad-spectrum insecticides. It is difficult to monitor by direct observation in tomato as it is reclusive, well-camouflaged and inconspicuous. Shake plants over sheet or tray to check for presence of bugs.

The brown marmorated stink bug was first documented in the US in PA in 2001 and since then has become a serious pest of fruit, vegetables and field crops in the mid-Atlantic region and a sporadic pest in the Hudson Valley region and southern New England. Its range is expanding northward into New England and its pest status is likely to increase.

BMSB Identification: Same as the brown stink bug, adult BMSB have the characteristic shield-shaped body common to most stink bugs. Adults are about 3/4" long, 3/8" wide, and mottled or marbled grey-brown in color. The underside is white, sometimes with grey or black markings, and the legs are brown with faint white banding. One way to distinguish a BMSB from other stink bug species commonly found in New England is by the **alternating dark and light bands on the insect's last 2 antennae segments**. The name "stink bug" refers to the scent glands located on the dorsal surface of the abdomen and the underside of the thorax. BMSB adults are commonly confused with the western conifer seed bug;

both invade homes in the fall to overwinter. BMSB adults can also be confused with the spined soldier bug, a beneficial predatory insect that preys on many vegetable insect pests. Spined soldier bugs have distinctively pointed "shoulders", compared to the rounded shoulders of BMSB and the brown stink bug.



BMSB nymphal instars (left 5) and adult (right). Photo: W. Hershberger

BMSB eggs are elliptical (1.6 x 1.3 mm), light-yellow to yellow-red with minute spines forming fine lines. They are attached, side-by-side, to the underside of leaves in masses of 20 to 30 eggs. There are 5 nymphal instars (immature stages). Nymphs have deep red eyes and a yellowish-red abdomen in the first instar progressing to off-white with reddish spots in the fifth instar. The legs, head, and thorax of nymphs are black.

BMSB Life Cycle: Adults overwinter and emerge in late-April to mid-May to mate and deposit eggs on host plants from May through August. There is likely one generation per year in New England, but research is indicating that two generations are occurring in mid-Atlantic states. BMSB will begin searching for overwintering sites again during late-August through mid-September. This period, while BMSB are on the move, is when we typically see BMSB damage on fruiting crops including apples, sweet corn, tomatoes, and peppers. In nature, overwintering sites could be cracks and crevices but, in populated areas, BMSB commonly find their way onto or into homes and can become a nuisance.

Damage: Fruits, including apples, peaches, figs, mulberries, citrus fruits, and persimmons, have been the most severely attacked by BMSB in the US so far. Other hosts include many ornamental plants, weeds, and soybeans. Vegetable crops damaged by BMSB include sweet corn, tomatoes, lima beans, and green peppers, and this list is likely to grow as the pest spreads into new areas. Feeding damage to fruits and vegetables includes scarring, cat-facing in tomatoes, spotting, and internal damage which reduce marketability. In sweet corn, feeding damage is often not visible until the damaged ear is cooked, with damaged kernels turning brown.

Management: Research on monitoring, thresholds and control methods is ongoing. Look for adults, eggs and nymphs and for damage. The UMass Extension Fruit Team has an active trapping program; sign up for their newsletter [Healthy Fruit](#) to get updates on BMSB during the season, or contact them for help setting up your own on-farm trapping. For more on trapping and monitoring see their factsheet [here](#). Insecticides labeled for stink bugs (without species indicated) may be used for BMSB; a few products have expanded labels to include BMSB specifically.

The moral of the BMSB story so far is: keep this pest on your radar and keep an eye out for the bugs and the damage, but don't worry too much for now. Look for additional information from state and regional Extension programs as more becomes known about this pest.

-- adapted for 2020 from the New England Vegetable Management Guide

USING COPPER FUNGICIDES

Copper products play an important role in disease management in both conventional and organic systems. They are the most effective controls for most bacterial diseases. In organic production, copper products are the main protectant fungicide used in the control of diseases caused by destructive oomycete pathogens, such as those that cause late blight and downy mildews, as well as fungal and bacterial diseases. As more copper products become available, and it is helpful to understand the differences and benefits of different active ingredients and formulations. Solubility, phytotoxicity, human health risks, impact on soil ecology, labeled crops and diseases, and efficacy are important considerations in using particular copper products.

How copper works. When copper (Cu) is mixed with water, copper ions (Cu²⁺) are released into solution. Modern copper products typically use insoluble or "fixed" forms of copper, creating a suspension of copper molecules in the spray solution. These un-dissolved copper particles persist on plant surfaces after the spray dries and copper ions are released from these deposits each time the plant surface becomes wet. The gradual release of copper ions from the copper deposits provides residual protection against plant pathogens present on the leaf surface. Copper ions kill pathogens primarily by destroying cell membranes and proteins and by disrupting protein synthesis. Since the mode of action of copper targets



Western conifer seed bug is commonly mistaken for BMSB when they invade homes. Photo: D. Owen, CA Dept of Forestry and Fire Protection, Bugwood.org



Spined soldier bug. Photo: M. Spellman

such fundamental components of living tissues, it affects a wide range of plant pathogens including bacteria, fungi, and oomycetes, but can also damage plant cells and be toxic to humans and other non-target organisms. Achieving the best control without injuring plant foliage and fruit depends on the concentration and rate of release of copper ions on the leaf surface, which is determined largely by the solubility of the copper formulation.

Solubility.

Less soluble (fixed) formulations release copper ions more slowly. This slow-release lowers the risk of phytotoxicity and provides longer residual activity. The following are **low-solubility active ingredients**: copper oxide (e.g., Nordox), copper hydroxide (e.g., Kocide, Champ), copper oxychloride (e.g., COCS and BadgeX2), and copper octanoate, which is copper ions linked to fatty acids to form a soap, (e.g., TennCop, Cueva).

More soluble formulations act rapidly but have higher risk of phytotoxicity and shorter residual activity. Basic copper sulfate and copper sulfate pentahydrate are highly soluble.

Metallic Copper Equivalent (MCE). Product labels list percent active ingredient (eg., 23.8% copper oxychloride or 98% basic copper sulfate), but this doesn't tell you the actual metallic copper by weight, as the formulation also impacts the total copper present. Look for the "metallic copper equivalent" listed below the active ingredients to determine the amount of actual copper by weight. A product with 40% metallic copper has 0.4 lbs metallic copper per lb of product. The range in MCE among products is vast, ranging from under 1.8% to over 50% copper by weight, so it is important to consider the MCE because the effectiveness of a copper spray is highly correlated to the amount of copper applied.

Effects of pH, Spray Additives, and Weather

- Under acidic conditions, copper solubility and the potential for phytotoxicity increases. Spray solutions should be kept above pH 6-7, depending on the formulation, to prevent excessive amounts of copper ions from being released and possibly damaging fruit and foliage.
- Adding maneb or mancozeb to copper products as a tank mix increases the release of copper ions in solution. There are pre-mixed products available (e.g., ManKocide), or growers can make their own mixtures. This may be especially helpful for controlling bacterial diseases such as bacterial speck, spot and canker of tomato.
- Using an approved adjuvant or 'sticker' may help the product to be more rainfast. However, when stickers are used with highly soluble copper sulfate formulations, they can cause phytotoxicity.
- Finely ground compounds will be more active than coarser ground materials because the smaller particles result in better coverage of the leaf and are less likely to be removed from the leaf by wind and rain.
- Copper can accumulate on plant tissue when sprayed repeatedly to cover new growth and there is no rain. In this situation, after a rain event, a large amount of copper ions will be released and may cause phytotoxicity.
- The risk of plant injury increases when the spray solution dries slowly due to cool wet weather, as the duration of active release of copper ions on the leaf is increased.
- Always read the label instructions. When mixing, follow the tank mix partner instructions.
- For each product, application rates vary with crop and disease. The recommended rate for a given crop may have a 2-fold difference between the high and low rates. Higher rates are recommended when disease pressure is high or conditions are especially favorable. Most products are labeled for a wide range of vegetable crops.

SAFETY

Human Health Hazards. Eye exposure is the most serious risk associated with using copper hydroxide. Eye damage can be irreversible. There is moderate risk from skin contact, ingestion, and inhalation. Products vary in EPA hazard rating most are "Warning" or "Danger," but Badge SC has a lower risk "Caution" label. The greatest health risk is to the person who mixes and sprays the material. Proper protective equipment must be worn when handling or applying copper products as with any pesticide or fertilizer. The required protective equipment is specified on the label and usually includes: long-sleeved shirt and long pants, chemical resistant gloves, shoes plus socks, **and protective eyewear.** Though not usually required, you may also want to consider wearing a respirator or dust mask, especially for mixing dry formulations. Dry product sometimes comes in a paper bag that has a tendency to leak out of the seams and needs additional containment such as a plastic bin.

Restricted Entry Interval (REI). Most copper products have an REI ranging from 24-48 hours, which means that

workers are not allowed to go into treated fields to pick fruit or do any other field work for that duration of time. Plan your spray and harvest schedule to accommodate your marketing needs as well as the REI. Fruit may need to be polished before marketing, to remove the blue residue left on fruit.

Environmental Hazards. Some farmers have expressed concern about copper toxicity in the soil or with respect to soil microbes and earthworms. Additionally, copper can be very toxic to fish and aquatic organisms if drift and run-off occur. This should be a concern in sandy, acidic soils or near surface water. Copper is actually an essential plant micronutrient and, in New England, it is more often deficient than excessive in soils. The amount found naturally in soils in MA ranges from 0.1 to 8 ppm while nationally soils range up to 200 ppm. Crops remove less than 0.1 lb/A copper per year. Copper usually accumulates on the soil surface where it becomes chemically bound to organic matter and clay minerals. In acidic soils, the solubility of copper increases and toxicity or run-off may occur. An application of 1 lb of active ingredient per acre is estimated to raise the copper levels about 0.5 ppm. A single application of Nu Cop at 2 lb per acre with 77% active ingredient adds about 1.5 lb copper per acre to the soil, or could raise the concentration in the soil by 0.5 to 0.75 ppm. Therefore, the level of copper in soil would increase slowly over time, except in perennial planting systems such as apple orchards. In annual rotational systems, where copper applications might only be made on a small portion of crops, copper accumulation may be less of a concern. Nonetheless, copper use is regulated and certified organic farmers in the US are required to restrict their use of copper products. Regular soil tests should be taken and copper levels in the soil should be monitored.

Managing blights in organic tomato and potato using copper

Many copper-based fungicides are labeled for use in organic systems and have demonstrated effectiveness in preventing late blight. Copper fungicides do not kill infections that are already present; they must be used preventatively in order to effectively protect plants from initial infections. Most pathogens have latent periods, when the plant is infected but does not show any symptoms. Thus, when symptoms appear, it is too late to protect the crop effectively—especially with late blight. Some strains of late blight are more aggressive than others and this will also influence the efficacy of copper spray programs. Regular applications of copper **will also help protect tomatoes from bacterial spot and speck, early blight, and Septoria leaf spot**, which can progress rapidly and cause plantings to produce far less than their full yield potential. Once disease is present and/or conditions are favorable for disease to occur, weekly sprays may be warranted to keep diseases at bay.

Several copper products are OMRI-listed for use in certified organic production and are registered for use in Massachusetts. Check the OMRI website for updates or consult your certifier. As with insecticides, dry formulations are more commonly approved for use in organic systems. Note that OMRI approval is for specific formulations, and there are often multiple formulations with the same trade name (eg. Badge X2 and Badge SC, of which only Badge X2 is OMRI-approved).

High Tunnel and Greenhouse Considerations

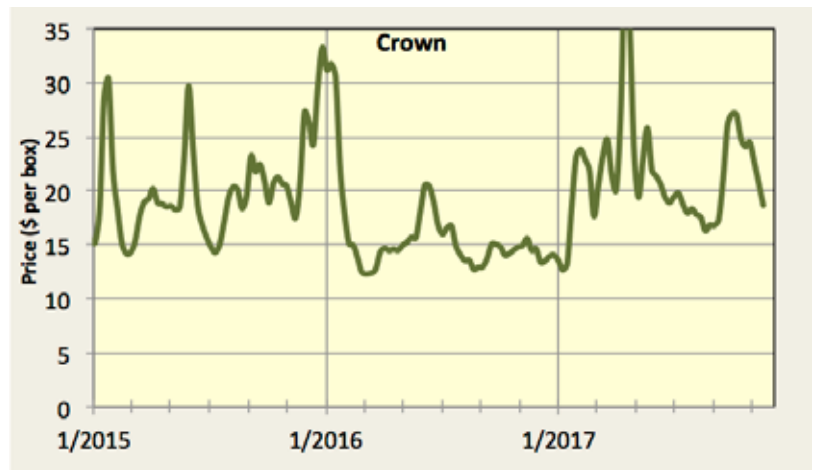
- Read the label to be sure that a product is not restricted from use in the greenhouse, many copper products are.
- The same protective gear and restricted entry interval apply in high tunnels and greenhouses as do in the field.
- Apply with sides open for ventilation.
- Most labels require that in addition to the standard REI, an eyewash station and notice of eye risk should be available for 7 days after application.
- If you suspect late blight, have the disease identified. Leaf mold, powdery mildew, and Botrytis gray mold or ghost spot are common diseases in high tunnel tomatoes and can look very much like late blight under certain conditions.
- If tomatoes (or other crops on which copper is used) are grown in the same area year after year, and copper is used, build-up in the soil is more likely. Include copper levels in your annual soil testing. Rotate to other crops!

--S.B. Scheufele and R.Hazzard. *Adpated from T. Zitter & D. Rosenberg, Cornell Plant Pathology, E. NY Commercial Horticulture Weekly Vegetable Update. June 26, 2013.*

MANAGING HEAT-RELATED DISORDERS IN BRASSICAS

Achieving 500-600 boxes per acre of broccoli through the hottest part of the summer is a tricky proposition, and while

there isn't a silver bullet that will ensure a perfect crop, there are ways that you can mitigate your risk and ensure the best possible broccoli crop all summer long. Plant too early, and your broccoli or cauliflower may suffer from buttoning due to cold temperatures; have head formation occur during a heatwave, and you may suffer from heat related disorders. However, there is a benefit to having a crop like broccoli year round if selling to a wholesale market. There are many spikes in the price, and having fields to harvest year-round will give you the opportunity to capture a good price (see figure).



Terminal market prices of broccoli crowns in the East. Mean value for all Eastern terminal markets for crown-cut broccoli. Source: USDA AMS Market News

To avoid the risks of heat related disorders, many growers focus their brassica production on the cooler ends of the season. They have been harvesting early spring brassicas since May, are now cutting spring cabbage and broccoli, and are starting to plant their fall brassica crops. Some growers are managing to produce summer brassicas successfully, with head formation beginning now, but this can be challenging. As our first heat wave of the summer hit New England this past week, we thought now would be a good time to discuss management of heat related disorders in brassicas. Heat and moisture stress reduce the crops' ability to take up and translocate nutrients within the plant, ultimately leading to a majority of the disorders discussed below. Head rot, brown beading, and tip burn are all caused by calcium (Ca) deficiencies in the plant, while hollow stem is caused by a boron (B) deficiency.

Head Rot and Brown Beading: Problems with Ca uptake combined with rapid growth can result in head rot or brown beading in broccoli, even when soil Ca levels are high. Head rot results from bacteria breaking down the tissues under wet conditions, and brown beading results from individual flower buds aborting under dry conditions. Excess nitrogen and extended periods of wet or dry conditions during warm temperatures give rise to rapid plant growth while Ca uptake is diminished due to poor transpiration rates in the plants.



Brown beading (left) and head rot (right) in broccoli.

Research done by Thomas Bjorkman at Cornell University, using the cultivar 'Galaxy', showed that the critical period for heat sensitivity in broccoli only lasts for roughly ten days. This 'window' of sensitivity corresponds to the time when the growing tip shifts from vegetative growth to flower bud initiation. This period of about 10 days begins just before a tiny crown is visible in the center of the plant. Temperatures above 35°C (95°F) for more than four days during that period causes uneven bud development, resulting in heads that are uneven and poorly shaped, leading to head rot and brown beading. Other references suggest that temperatures above 85°F can cause heat injury.

Management: Uneven or inadequate soil moisture also exacerbates heat stress. Drip irrigation is helpful for supplying water on a steady basis without increasing the risk of water sitting on the head. When individual buds or areas of the head are killed by heat stress, this allows entry of pathogens. Uneven heads also allow water to remain longer on the surface of the head, which increases the likelihood of disease development. Mixing varieties based on rate of maturity offers growers another practical defense against either head rot or brown beading, because it distributes the critical period for heat sensitivity across a range of weather conditions. Select a later-maturing cultivar to be harvested along with your regular cultivar for the part of the growing season when problems have typically occurred. Check with your seed supplier regarding heat tolerant varieties. 'Emerald Crown' (Seedway), 'Green Magic' (Johnny's Selected Seeds, Harris), and 'Belstar' (JSS, High Mowing Seeds) are standard varieties reported to have good heat stress tolerance in New England. The Eastern Broccoli

Project, led by Thomas Bjorkman found that “in the most stressful environments, four varieties stood out from the rest with respect to head uniformity and dome structure: DuraPak 19, Lieutenant, DuraPak 16, and Tradition.”

Tip burn has been generally recognized as a calcium (Ca) disorder, though it usually results from high temperatures and uneven rainfall/irrigation preventing the plant from taking up adequate Ca, rather than from a deficiency in the soil. Tip-burn and internal browning affect many brassicas and both head and leaf lettuce. Calcium (Ca) deficiencies show up on young, growing tissues. In cabbage, margins of inner leaves turn brown, beginning at the hydathodes (structures in the leaf tip or margin that excrete excess water), and later desiccate to become thin and papery at the margin or over large portions of the leaf. The affected tissue may turn dark brown to black, occasionally being invaded by secondary bacteria that cause a watery soft rot. In cauliflower, internal leaves turn brown and fold over the developing curds. When secondary microorganisms attack these leaves, they become a mushy smear over the curd and make the head unmarketable. On a daily basis, Ca moves with the transpiration stream to the outside leafy parts of the plant, which are actively transpiring on sunny days. At night, especially when dew forms, transpiration is reduced and water movement generated by the roots is directed to the inner part of the head. However, on warm, dry nights the outer leaves continue to transpire, and Ca is diverted away from the head. Once Ca is fixed by the outer leaves, it cannot be translocated to the interior of the head.



*Internal tip burn in cabbage.
Photo: J. Howell*

Environmental conditions that favor rapid plant growth favor tipburn. Abundant soil moisture promotes rapid growth, while excess moisture reduces soil oxygen levels, which in turn reduces Ca uptake and movement. A warm dry spell after a period of abundant moisture may aggravate the disorder. Drought or root damage such as early season cabbage maggot feeding also stress the root system and can impair the plant’s ability to take up Ca and translocate it. Excess nitrogen (N) encourages rapid growth, and also results in large outer leaves that accumulate Ca at the expense of young inner leaves. Wide spacing also encourages large outer leaves and rapid growth.

Use of urea, ammonium nitrate, or calcium ammonium nitrate fertilizer can aggravate Ca problems, because ammonium cations out-compete Ca for uptake in the plant. Calcium nitrate is more expensive, but the N is all in the nitrate anion form which will give brassicas the needed N fertility but will not compete with Ca for uptake. Note that when applying Ca nitrate through a drip system it is important to use greenhouse grade material rather than field grade to avoid clogging the system. Excess potassium cations also inhibit uptake of Ca, while excess phosphorus binds with Ca in the soil, reducing uptake of both nutrients. Some of our soils have excessively high phosphorus relative to potassium.

Management: Factors that promote rapid plant growth should be avoided, because rapid growth puts a high demand for Ca on the tissues. Maintenance of optimum but not excessive fertility (including N) is important. Maintaining a phosphorus to potassium ratio of 1:1 should help to minimize the incidence of tipburn. Irrigation may be necessary to maintain steady and optimum levels of soil moisture. Addition of high levels of Ca to the soil and foliar applications do not seem to alleviate the problem. Close plant spacing and prompt harvesting of crops when mature are beneficial practices. Internal symptoms grow worse as heads become larger and more mature. Avoid aggressive cultivation which can damage roots.

Cultivars that grow less vigorously are less prone to this disorder. Resistant cultivars are available for some crops - check your seed suppliers for their recommendations. Growers reported that the cabbage cultivars Green Cup and Bronco had worse symptoms than other cultivars when the problem occurred in 2004 and 2005.

Hollow Stem: Heat and rapid growing conditions exacerbate the effects of boron deficiency leading to hollow stem in heading crops, which is often not noticeable until harvest. Chlorotic younger leaves or rosette die-back can be a sign of B deficiency and hollow stem. Hollow stem is worsened by pH greater than 7. Excess moisture leaches B out of the soil and low moisture inhibits soluble B uptake and poor root development. Excess Ca, K, or Zn have also been shown to outcompete B in plant uptake. Other causes include excess nitrogen fertilizer, imbalance of nitrogen and boron, or rapid growth after head initiation. High P levels in soil have been shown to increase B uptake. There are cultivar differences in B sensitivity.



*Boron deficiency in cauliflower.
Photo: J. Howell*

Management: Avoid sidedressing brassicas with nitrogen after head development begins. Broccoli, cabbage, cauliflower, turnip, and rutabaga are very sensitive to boron deficiency. The best method to apply a small amount of boron is as an additive to the fertilizer or diluted in a water spray applied to soil before final field preparation. For example, if the level of boron in the soil is low (below 3ppm), apply 3 lb of boron (15 lb Solubor, or 30 lb Borax)/A before planting broccoli and cauliflower, and 2 lb/A for cabbage. Conventional fertilizers can be purchased with added boron. Other boron products include granular Boron 15% and soluble Borosol 10%.

-- UMass Vegetable Program, updated 2018

NEWS

OPEN APPLICATION PERIOD FOR FOOD SECURITY INFRASTRUCTURE GRANT PROGRAM

The Executive Office of Energy & Environmental Affairs (EOEEA) is accepting online applications for The Food Security Infrastructure Grant Program (FSIG) on a rolling basis now through **September 15th, 2020**.

The goal of the Food Security Infrastructure Grant Program is to ensure that individuals and families throughout the Commonwealth have access to food, with a special focus on food that is produced locally, and equitable access to food. The Program also seeks to ensure that farmers, fisherman, and other local food producers are better connected to a strong, resilient food system to help mitigate future food supply and distribution disruption. Participants selected to participate in the Program will be provided with reimbursement grants broken into three funding categories: \$0 to \$10,000; \$10,000 to \$75,000; or \$75,000 to \$500,000.

Eligible projects include: (i) information technology needs; (ii) facility adaptation to new safety guidelines; (iii) storage, processing, and delivery equipment, and (iv) other strategies that connect local food production with food insecure communities and residents. Project categories are broken into three funding sections.

For more information, or to submit an online application go to: www.mass.gov/service-details/food-security-infrastructure-grant-program. Please refer to the Request for Response (RFR) available on this website for full Program details. To apply online please review the RFR and then click on the 'Food Security Application Questions' to submit your application.

NORTHEAST BIPOC FARMER RELIEF FUND NOW ACCEPTING APPLICATIONS

The Northeast BIPOC Farmer Relief Fund is now accepting applications from BIPOC (Black, Indigenous and People of Color) folks living in the Northeast who work in agriculture and have been economically impacted by the COVID crisis. Applications will be accepted through **August 10**.

This Relief Fund is providing support to BIPOC folks because they have received COVID relief funds at disproportionately lower rates than white individuals, while the COVID crisis has impacted BIPOC communities at disproportionately higher rates than white communities. Both of these disparities are the result of structural racism. The amount recipients will get from this initiative is not by any means meant to rectify the racism in how previous (and current funds) have been distributed, but it is one small step to acknowledge and address these disparities.

For more info and application link, [click here](#).

The grant funds are being provided by Farm Aid, and Rural Vermont is excited to be among the farm and food systems organizations in the Northeast that are collaborating on this initiative.

NORTHEAST CENTER FOR OCCUPATIONAL HEALTH & SAFETY FARMWORKER SURVEY

The Northeast Center for Occupational Health and Safety (NEC) is conducting a survey with farmworkers in the Northeast to assess the impact of the pandemic on them and how we can best serve their needs. Farmworkers could complete the survey online, by a mail copy, or by telephone interview. This is voluntary and confidential. Attached is information about the survey which is available in English and Spanish.

English version: <https://redcap.bassett.org/redcap/surveys/?s=NH8CHXX499>

Spanish version: <https://redcap.bassett.org/redcap/surveys/?s=LND3MR9TPD>

To learn more about the Northeast Center, visit our website: <https://www.necenter.org/>

ADDITIONAL COMMODITIES ELIGIBLE FOR CORONAVIRUS FOOD ASSISTANCE PROGRAM (CFAP)

The USDA, Coronavirus Food Assistance Program (CFAP) adds additional commodities, and expands funding for seven previously funded commodities. USDA's Farm Service Agency (FSA) is accepting applications through **Aug. 28, 2020**. Read more about these changes [here](#), or contact your local FSA office.

PAYCHECK PROTECTION PROGRAM (PPP) UPDATES

The Paycheck Protection Program (PPP) has reopened the application period until **August 8, 2020**. The PPP original application period closed on June 30, 2020.

As a recap, PPP is a program administered by the U.S. Small Business Administration (SBA) with applications being processed through an SBA-approved lending institution. While PPP is a loan, an important point to note is that the loan will be fully forgiven if the funds are used for payroll costs, interest on mortgages, rent, and utilities (at least 60% of the forgiven amount must have been used for payroll). Forgiveness is based on the employer maintaining or quickly rehiring employees and maintaining salary levels. Forgiveness will be reduced if full-time headcount declines, or if salaries and wages decrease. The period used to cover eligible costs and expenses has also increased from 8 weeks to 24 weeks from loan disbursement, making it easier for PPP recipients to meet the 60% payroll requirement. Special consideration under PPP is provided for seasonal businesses such as farming operations.

More detailed information, including a list of SBA-approved lending institutions that process PPP applications can be found at: <https://www.sba.gov/funding-programs/loans/coronavirus-relief-options/paycheck-protection-program>

PPP is a program you should definitely look into if you employ agricultural workers on your farming operation!

EVENTS

MDAR: PUBLIC HEARING ON PRODUCE SAFETY & MARKET ACCESS REGULATIONS

For an explanation of this hearing, please see Crop Conditions in this issue.

The MA Dept. of Ag (MDAR) will hold a **virtual public hearing** on **Thursday August 6th at 5:30pm** on proposed draft regulations at 330 CMR 34.00. 330 CMR 34.00 establishes **statewide minimum standards relating to the sanitary and safe growing, harvesting, labeling, packing, and storing of fresh fruits and vegetables in the Commonwealth**. The draft regulations are consistent with those established by the Federal Food and Drug Administration pursuant to 21 C.F.R. § 112 and adopted in Massachusetts, in its entirety, through M.G.L. c. 128, § 124.

Testimony may be presented orally at the virtual hearing or in writing. Written comments will be accepted until 5:00 P.M. on Friday, August 21, 2020. Written testimony must be submitted by e-mail to michael.botelho@mass.gov or by mail to Michael Botelho, 30 Riverside Drive, Suite 202, Lakeville, MA 02342.

The proposed regulation is available on the MDAR website at <https://www.mass.gov/service-details/mdar-proposed-amendments-to-regulations>, or may be obtained by calling Michael Botelho at 617-626-1711. For special accommodations for this event or to obtain this information in an alternative format, you may contact ADA coordinator, Donald Gomes, at 617-626-1608.

For background information on the MA Produce Safety Program and a summary of the draft regulation visit the MA Farm Bureau Federation site here: <https://mfbf.net/news/produce-safety-market-access-regulations-summary-and-notice-of-public-hearing/>.

Please note that due to the COVID-19 pandemic, this hearing will be held virtually via Zoom. To join the hearing, please use either the link or the call-in telephone number below:

When: Aug 6, 2020, 5:30 PM

Join Zoom Meeting: <https://us02web.zoom.us/j/85929614155?pwd=WHhXSXdIVWRTMmlWNGpVTVpQa3FNZz09>

SAVE THE DATE! – [UMASS AGRICULTURAL WATER TWILIGHT SERIES](#)

The UMass Extension Vegetable Program is offering a series of online twilight meetings next month all about water! We will welcome extension specialists and farmers from Massachusetts and beyond to cover a range of water-related topics. More details and registration info coming soon!

Wednesday, Sep. 16, 6-7:30 pm: Water use monitoring tools and efficient irrigation, water use regulations

Wednesday, Sep. 23, 6-7:30 pm: Water sources, mapping and inspecting water distribution systems, and water testing for FSMA

Wednesday, Sep. 30, 6-7:30 pm: Post-harvest water quality and sanitizer use

UPCOMING UNH WEBINARS

- Wed, Aug 12. Noon-1pm. [Asparagus: Where the green fern grows. North Country Lunch and Learn.](#)
- Wed, Sept 9. Noon-1pm. [Crop storage: Hold on to what you've got. North Country Lunch and Learn.](#)

For years Lunch and Learns were a staple of Coos County Cooperative Extension's connection with the community. We will be bringing back the Lunch and Learns as a way for people to get together as we continue to practice social distancing. Do your part for society by eating lunch in front of your computer! These occur monthly on various topics and hope everybody can learn something new and interesting. Learn more and register at the link above.

THANK YOU TO OUR SPONSORS!



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Vegetable Notes. Genevieve Higgins, Lisa McKeag, Susan Scheufele, co-editors. All photos in this publication are credited to the UMass Extension Vegetable Program unless otherwise noted.

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