UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

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In this issue:

Margaret Christie of CISA addresses the over 80 people who gathered at Plainville Farm yesterday to discuss this year's climate related disasters and the available state relief. Applications due September 29. More info below.

Crop Conditions

We are heading into fall, and we're now on a biweekly or monthly schedule for publishing full Veg Notes issues. It's been a stormy week, with thunderstorms bringing heavy wind and rain across the state, and a whopping 11 inches of rain within just a few hours to the Leominster area on Monday. Western and Central MA got 5+ inches of rain this week, and some locations got hail, ruining ready-to-be harvested crops. On top of that, the Cape and Islands are bracing for Hurricane Lee (expected to downgrade to a tropical storm before landfall) this weekend and are under a tropical storm watch and 4-foot storm surge alert starting as early as Friday evening.

The latest corn plantings are silking now, with some late plantings missed because of wet fields in July. And fall crop harvests are underway—sweet potatoes, winter squash, potatoes. Tomatoes have had a rough season with the rain and humidity and many fields are done now, ravaged by foliar disease. But there are still good-looking peppers and eggplants out there and fall brassica plantings are looking good in fields where folks are spraying routinely for diseases and caterpillars. Cover crops are coming up nicely in fields that are finished for the year.

We saw many familiar faces at CISA's farmer dinner last night, where there were interesting discussions about how farmers could collaborate on adapting to climate change, respond to future climate crises, and overall become more resilient. Our colleagues at MDAR came to answer questions about and provide support for the MA Natural Disaster Recovery Program, established to provide funds for farmers who experienced losses from the February 3-5 and May 17-18 freezes and the July 9-16 rain and flooding this year. There is concern that the application requires a lot of paperwork but folks who have finished applying have reported it has only taken 10-15 minutes. Applicants are required to submit a map of the affected farmland and fill out an excel template detailing their losses and some historical acreage and profit information. Mixed vegetable farms are able to report these losses across all vegetable crops as a whole (as opposed to reporting losses crop-by-crop). Be sure to submit this excel sheet as an excel file and don't save as a pdf, as MDAR will work further with the data after you submit it. MDAR is not able to respond to questions about farm-specific scenarios at this point, but they have provided an FAQ document that answers many questions—see the NDR FAQ document here. It can be tricky to estimate these losses precisely—generally, simply use your best judgement, do your best to estimate the losses, and be

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 **Email:** umassveg@umass.edu

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

honest! If you need help with your application, reach out to us or your Buy Local group.

At the end of this incredibly difficult season, there is a lot of discussion of banding together and having a unified voice on climate change and agricultural topics so that growers can reach out to state representatives and hopefully impact changes on a state level. An existing platform for this might be the New England Vegetable & Berry Growers' Association, a region-wide association that hosts educational workshops (including the New England Vegetable & Fruit Conference), funds research, and advocates for MA farmers at the state house. The group is a known, trusted collective voice for farmers in the region. If you're interested, check out their website or attend a meeting this winter.

Pest alerts

Alliums

Purple blotch is severe in one leek field in Hampshire Co.—not surprising with the length of time that leeks are in the ground and the wet weather this year. This fungal disease causes boat-shaped (i.e. a bird's-eye view of a canoe) lesions on foliage that are dark-brown to purple colored. Spores are spread by wind and splashing rain. Incorporate infected crop residue promptly after harvest and practice 3-year crop rotations out of alliums. Fungicides can control purple blotch if applied early and often. See the appropriate crop disease control section of the New England Vegetable Management Guide for labeled fungicides. Copper plus a *Bacillus*-based biofungicide (e.g. Double Nickel, Serenade) has shown some efficacy in trials on organic control of purple botch when used preventively and regularly when conditions are favorable.

Purple blotch lesions. Photo: G. Higgins

Basil

Basil downy mildew is widespread at this point in the season. Varieties with no resistance are very heavily affected now, but we have low levels of disease in the resistant variety 'Prospera' in a basil research trial. Resistant varieties generally provide up to several weeks of production after susceptible varieties go down. If you have downy mildew on a resistant variety—Prospera, Devotion, Passion, Obsession, or Thunderstruck—let us know at umassveg@umass.edu so that we can track this important disease.

Brassicas

Cross-striped cabbageworm (CSCW) is skeletonizing unsprayed plants now. This is usually the last brassica caterpillar pest to show up in the Northeast and commonly causes damage in late-summer and fall plantings. Unlike the other brassica caterpillars that lay eggs singly, CSCW moths lay eggs in clusters, resulting in a lot of caterpillars on one plant. See the brassica insect control section of the New England Vegetable Management Guide for labeled materials. The most effective OMRI-listed material for caterpillars is Bt (e.g. Dipel, Xentari), which specifically targets caterpillars and will not harm beneficials.

A Brussels sprouts plant skeletonized by cross-striped cabbageworm.

Chenopods

Hawaiian beet webworm has been identified in southeastern and central MA this fall. It was seen causing damage in Swiss chard but also feeds on beets, spinach,

and amaranth and weedy hosts like pigweeds and lambsquarters. This pest is common in southern and mid-Atlantic states and is not commonly seen in the Northeast. It was likely blown north on the numerous storms this summer. The adult moths are brown with white bands across the wings. Caterpillars are pale green-yellow with a dark stripe running down their back and a light brown head capsule; the body is shiny and smooth and looks somewhat translucent. Caterpillars feed on foliage, causing windowpane damage where the upper layer of the leaf remains intact. Older larvae will fold and bind leaves together with silk threads and feed within this protective structure. They will pupate within a folded leaf or drop to the soil to pupate. Bt products will effectively control beet webworm when the caterpillars are small. Radiant, Proclaim, Avaunt, Intrepid and diamides like Coragen, Exirel and Harvanta are all labeled for the worm complex. Intrepid is a growth regulator and should target small worms. Diamides will cause rapid feeding cessation.

Beet webworm caterpillar and adults.
Photos: A. N. Sparks, Jr. Univ. of GA, Bugwood.org and Rutgers University

Cucurbits

Pickleworm was reported in cucumber on Cape Cod this week. Similarly to beet webworm (see Chenopod section above), this pest is common in southern and mid-Atlantic states but we don't usually see it in New England. Caterpillars are yellow-green to white with many small black spots. Older larvae lose their spots and often become a dark copper color. Eggs are laid in the growing points or flower buds of cucurbit species and the larvae bore into the fruit, causing small round entry holds with lots of frass. Summer squash is the most preferred cucurbit crop. This pest does not overwinter in the Northeast. Pickleworm is not included in the New England Vegetable Management Guide but labeled materials can be found in the Mid-Atlantic Vegetable Production Guide—scroll down to "Specific Commodity Recommendations" and choose the appropriate crop, then search for "pickleworm" in the pdf.


Pickleworm larva and damage on zucchini. Photos: J. L. Capinera

Nightshades

Late blight has still not moved significantly closer to us. There has been one additional report in northern NY this week. Most tomato crops are nearing their end after a wet, disease-y season, and potatoes are being harvested now, so the risk of impactful late blight infection is small at this point.

Sweet Corn

This is our last week reporting sweet corn pheromone trap counts for the year. Next issue we will include graphs of the yearlong trap counts to show the trends from this season.

European corn borer numbers have returned to 0 in almost all locations. The overwintering generation is now or will soon be pupating in crop residues. Till under late corn residues promptly and thoroughly to reduce the number of overwintering pupae.

Corn earworm numbers remain relatively high, similar to last week. Growers will be getting on their last few sprays to the latest silking corn now. CEW will not overwinter in most Northeast locations, although there are a few hot spots

where it is overwintering.

Fall armyworm numbers are also similar to last week, very low, with a high of 8 caught at one location in Hampden Co. Fall armyworm will not overwinter in the Northeast.

Table 1. Corn earworm spray intervals based on Heliothis trap moth captures

Moths per night	Moths per 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

Table 2. Sweetcorn pest trap captures for week ending September 13

Location	GDD* (base 50°F)	ECB NY	ECB IA	FAW	CEW	CEW Spray Interval
Western MA						
Feeding Hills	2545	0	0	0	60	4 days
Southwick		0	0	8	45	4 days
Granby	2446	5	0	3	15	4 days
Whately	2568	0	0	0	83.5	4 days
Central MA						
Leominster	2621	2	0	3	68	4 days
Lancaster		0	0	0	4	4 days
North Grafton	2273	0	0	0	7	4 days
Spencer	2398	0	0	0	20	4 days
Eastern MA						
Bolton	2432	0	0	0	15	4 days
Concord	2408	1	0	2	14	4 days
Haverhill*	2469	1	0	4	40	4 days
Ipswich*	2382	0	0	3	38	4 days
Millis	-	-	-	n/a	17	4 days
North Easton	2542	0	0	0	26	4 days
Sharon		0	0	0	40	4 days
Sherborn	2559	0	0	0	19	4 days
Seekonk	2483	0	0	0	121	3 days
Swansea		-	-	-	72	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

PUMPKIN & WINTER SQUASH HARVEST, CURING & STORAGE

Pumpkins and winter squash—at least those that didn't succumb to Phytophthora or other diseases—are being harvested now. Correct harvest timing, curing and storage conditions can significantly affect eating quality, storage length and post-harvest disease.

Harvest Timing for Winter Squash and Pie Pumpkins: For winter squash and pie pumpkins, harvest timing determines the flavor and texture of the fruit. As squash fruits grow, they accumulate starch, which is then converted into sugar in the field and during storage. The balance of starch (texture) and sugar (sweetness) in a squash determines the eating quality. Squash is mature when seeds are completely filled. If squash is harvested before it is mature, the fruit will use starch reserves from the flesh to fill the seeds, resulting in poor flesh quality. Immature squash will also not have enough starch to convert into sugar later on.

Most squash varieties are mature and ready to harvest 50-55 days after fruit set, or days after pollination (DAP). In many varieties, this is many weeks after the fruit turns a marketable color, which can be misleading. Dr. Brent Loy, late researcher emeritus at the NH Ag Experiment Station, said that days to maturity listed in seed catalogs are often incorrect, especially for acorn squash; catalogs often state 70-76 days to maturity (from time of seeding) when in reality it's more

like 90-100 days to maturity. It's not necessarily easy to keep track of fruit set, so there are some other indicators that squash is ready for harvest—see the end of this article for more information about specific types of squash.

Delicata squash

Harvest Timing for Pumpkins: Since the pumpkin market lasts from Labor Day to Halloween, pumpkins may need to be held for several weeks before they can be sold. One factor in deciding when to harvest is the condition of the vines. Intact foliage protects fruit from the sun, and when vines and foliage die down from powdery or downy mildew, fruit can get sunscald. Foliar diseases, especially powdery mildew, can also reduce the quality of pumpkin handles, leading to reduced marketability for jack-o-lantern pumpkins. As cooler fall weather approaches, the other major factor in deciding when to harvest is avoiding chilling injury. Chilling hours accumulate when squash or pumpkins are exposed to temperatures below 50°F in the field or in storage. Injury increases as temperature decreases and/or length of chilling time increases. This is particularly important for squash headed into long-term storage.

There can be extra work involved in bringing fruit in early and finding good storage locations, especially for growers who normally have pick-your-own harvest. Ideally, pumpkins would be harvested as soon as crops are mature and stored under proper conditions. Proper curing and storage conditions are key for pumpkins in particular, because improper conditions can result in handles shrinking and shriveling, making the pumpkins unmarketable. If you need to hold fruit in the field for pick-your-own or any other reason, using a protectant fungicide (e.g. sulfur, oil, or chlorothalonil) along with one of the targeted powdery mildew products can help protect from black rot, powdery mildew, and other fungal fruit rots. For information on identifying and controlling fungal fruit rots of winter squash, see the September 3, 2020 issue of Veg Notes. Scout for insects feeding on the fruit and handles, which may include squash bug nymphs and adults and striped cucumber beetles, and control them if damage is evident. See the Pumpkin, Squash, & Gourds insect control section of the New England Vegetable Management Guide for treatment recommendations.

Harvest: Despite their tough appearance, squash and pumpkin fruit are easily damaged. It is important to avoid bruising or cutting the skin during harvest. Once the rind is bruised or punctured, decay organisms will invade the fruit and quickly break it down. Place fruit gently in containers and move bins on pallets. Use gloves to protect both the fruit and the workers. For some squash, especially butternut, stems can be removed to prevent them from puncturing adjacent fruit during harvest and storage. If stems are removed, allow the stem scars to heal before putting into storage (see Curing below).

Curing: For some squash types (e.g. acorn and delicata), the mature fruit can be eaten immediately after harvest. Other squash types (e.g. butternut, hubbard, kabocha), need time to convert starches to sugars and must be cured or stored for a specific amount of time before they are eaten.

Curing speeds up the conversion of starches to sugars so that squashes reach optimum eating quality sooner. It also causes fruit skin to harden and accelerates wound healing to prevent disease development. *Cucurbita maxima* and *moschata* squash varieties can be cured to hasten market readiness. However, curing is not always necessary: if you are planning to store squash for a few months before selling, and the fruit is free of wounds, it should have sufficient time to convert starches to sugars and can go directly into storage conditions without the extra boost. *Cucurbita pepo* squash types are ready to eat at harvest (if harvested when mature!) and curing can actually reduce their storage lifespan.

To cure squash, store it for a short period of time (5-10 days) at a high temperature (80-85°F) and 80-85% relative humidity immediately after harvest. This can take place in the field if weather allows (night temperatures should not drop below 60°F), or in a well-ventilated barn, greenhouse, or high tunnel.

Storage: Pumpkins and winter squash should be stored in a cool, dry, well-ventilated area. Store fruit at 50-60°F with 50-70% relative humidity. Chilling injury is possible at temperatures below 50°F, and long-term storage at temperatures above 60°F will result in weight loss due to increased respiration rates. Large fluctuations in temperature favor condensation on fruit within the bin, which encourages disease. Therefore, fruit temperature should be kept as close to the tempera-

ture of the air as possible to avoid condensation and fruit rot. Relative humidity above 70% provides a favorable environment for fungal and bacterial decay organisms, and relative humidity below 50% can cause dehydration and weight loss. In a greenhouse, temperature can be managed with ventilation on sunny days; heaters will be needed for storage into November and beyond. An inner curtain can reduce heat loss and cost.

Storage life depends on the condition of the crop when it comes in and your ability to provide careful handling and a proper storage environment. All fruit placed in storage should be free of disease, decay, insects, and unhealed wounds. See the end of this article for maximum storage times for different types of squash. Fruit that has been exposed to chilling temperatures (below 50°F) will not store well and should be marketed first.

Few farms have the infrastructure to provide ideal postharvest conditions for all of their fall crops. Fortunately, finding a method that is 'good enough' often does the job. Even if it is difficult to provide the ideal conditions, storage in a shady, dry location, with fruit off the ground or the floor, is preferable to leaving fruit out in the field.

Harvest timing and storage needs for different squash types:

- ***Cucurbita pepo* (acorn, delicata, sweet dumpling, some pie pumpkins):** Acorn squash turns dark green 2-3 weeks after fruit set, which is 40-50 days *before* it should be harvested. Because acorn squash *can* be marketed as soon as it turns dark green, regardless of eating quality, many acorn varieties will never accumulate enough starch and will therefore never be sweet. The variety 'Honey Bear' was developed by UNH and has high sugar content at harvest. Harvest *C. pepo* squashes when the 'ground spot' (the part of the squash that lays on the ground) is dark orange. Pie pumpkins should be harvested when the skin is fully orange. These varieties can be eaten at harvest and will store for 2-3 months. They should not be cured, because it can reduce their lifespan in storage.
- ***Cucurbita maxima* (kabocha, hubbard, buttercup):** Stems become dry and corky when the fruit is ready to be harvested. These are more susceptible than other squash to sunburn and so if vines go down from disease, they should be harvested early (40 DAP), cured, then stored at 70-75ºF for 10-20 days to achieve acceptable eating quality. These have high starch content at harvest and so need to be stored for 1-2 months before being eaten, with the exception of all mini-kabochas and all red-skinned kabochas, which can be eaten at harvest. They will store for 4-6 months.
- ***Cucurbita moschata* (butternut, some edible pumpkins):** Butternut will turn tan 45 DAP but should not be harvested for another 2 weeks. Mini-butternut can be eaten at harvest and will store for 3 months. All others should be stored 1-2 months before eating to allow for starches to be converted into sugars and will store for 4-6 months. Carotenoid, the pigment that gives squash its yellow/orange color, also increases in storage for these squash, giving them more color and making them more nutritious.

Additional information:

- Eating Quality in Winter Squash and Edible Pumpkins
- Maximizing Yield and Eating Quality in Winter Squash - A Grower's Paradox
- Managing Winter Squash for Fruit Quality and Storage

--Written by G. Higgins and R. Hazzard, compiled 2018 from resources by Brent Loy, late researcher emeritus, New Hampshire Agricultural Experiment Station, and professor emeritus of genetics, UNH.

WARM ROOMS FOR STORAGE CROPS & FREEZE PROTECTION FOR COOLERS

--Written by Chris Callahan, Extension Associate Professor of Agricultural Engineering at the University of Vermont. Originally published November 29, 2021 on the UVM Extension Ag Engineering blog, https://go.uvm.edu/warmrooms

Some crops like winter squash and sweet potatoes are ideally kept in "warm" rooms for long-term storage. It is also helpful to have some freeze protection even in cold storage rooms during the winter months when outside temperatures drop below the storage temperature. The information below should help accomplish both of these needs simply and inexpensively.

Knowing Your Heat Load

The first step in figuring out how to keep a space warm or prevent freezing is knowing how much heat will be needed.

This depends on the size of the space, the insulation, air infiltration and the inside and outside temperatures. Our online calculator will help you determine how much heating you need to keep a specific space at the right temperature. A heat load is typically given in units of BTU/hr (British thermal units per hour) or Watts. Sometimes heater specifications simply state "BTUs" which can be read as BTU/hr. Electric heaters are typically rated in Watts and combustion appliances such as wood, propane, or fuel oil heaters or stoves are rated in BTU/hr. The calculator provides the heat load in both units, and you can always convert between units knowing that there are 0.239 Watts per BTU/hr (or 3.41 BTU/hr per Watt).

It may be helpful to remember that storage crops are living organisms and they respire. Respiration gives off heat and moisture. Some growers are able to store warm storage crops without any additional heating when using a well-insulated and well-sealed room due to the heat given off from the crops. Winter squash, for example, has a high rate of respiration and can "self-heat." For an estimate of respiration heat, you can use our crop storage planner.

Choosing a Heater

Select an appliance that is actually designed for heating. It may be tempting to use a lightbulb or heat lamp, but these can present other problems such as sprouting (due to light) or fire hazards (due to exposed hot surfaces). Some pointers:

- Choose a heater with a UL listing.
- Make sure there are fire protections included in the heater such as grates, stand-offs, tip sensors, and overheat switches.
- Heaters with lower maximum surface temperatures are generally going to be safer.
- Choose a heater that will turn on when power is applied or one that has an integrated thermostat (see next section). Some heaters have a second step required after power is applied to activate it. These won't work well with an external thermostat used for freeze protection.

UL listing label

Below are some panel heaters with on/off control that would work with an external thermostat for freeze protection. [*Ed. Note – prices and availability updated for 2023*]

- Cozy Chicken Coop Flat Panel Heater – ~$50, 200 Watts. Available at Tractor Supply and Home Depot.
- Cozy Legs Flat Panel Heater – $36, 150 Watts. Available from Cozy Products
- AirChoice Electric Heater – $90, 400 Watts. Available from Amazon

You can also use an oil-filled heater with an integrated thermostat for warm room applications, though it won't work well with an external thermostat.

Controlling the Heat

Heaters are typically controlled by thermostats or timers. Timers simply turn the heater on for a period of time and don't offer precise control of temperature. Thermostats measure temperature and turn a heater on or off based on that measurement. Read more at our post about thermostats.

Some heaters come with a thermostat integrated into the heater. This may be the easiest option for heating a warm room. Unfortunately, these integrated thermostats are most often designed for human comfort (>50 °F) and don't go low enough to offer freeze protection for cold rooms.

An external thermostat with a wider range can be used to turn heaters on and off at lower setpoints such as 32 °F. These can be purchased with plugs attached to make installation easier. Check the amperage rating of the thermostat compared to the heater(s) you plan to control. Some examples are provided in this post.

This Honeywell TurboForce HT-900 is an inexpensive option for air circulation. It provides up to 185 CFM with 3 selectable speeds and has slots on the base for wall or ceiling mounting. $20.

Distributing the Heat

It may be helpful to add a small circulation fan in the room to distribute the heat throughout the space (see picture on previous page). Aim for 2-4 cubic feet per minute of air flow per square foot (CFM/ft2) of storage space. For example a 10 foot x 10 foot warm room should have 200-400 CFM of circulation air flow which is generally one or two small fans. Consider a wall or ceiling mount fan to keep it out of the way and to prevent it being knocked over or falling over.

Air circulation is important even if trying to make the most of respiration heat from the crops. It is also helpful to leave some space between storage bins and between bins and the wall. This allows air to pass more freely so that all storage crops see the same conditions. Remember that stored produce is alive and respiring, so air circulation can help prevent hot spots and areas of high humidity and condensation.

IMPROVING GERMINATION AND STAND IN WINTER HIGH TUNNEL SPINACH

One of the most common difficulties that winter spinach growers in the Northeast have is achieving good germination and stand in high tunnels. Germination is often patchy, and pre- and post-emergence damping off, caused by several fungal and fungal-like pathogens, is hard to avoid. These diseases are caused by fungi in the genera *Rhizoctonia* and *Fusarium* and fungal-like organisms in the genus *Pythium*, which are weak pathogens that only attack young, weakened, or slow-growing plants. They build up in the soil when crops are grown continuously, with no fallow period for the soil and its microbial community to recover. Incorporating fresh organic matter, especially in the form of cover crop residue is one well-documented way to support growth of healthy microbes in soil and reduce incidence of damping off.

In the fall of 2021, we investigated a few different strategies to improve spinach stands in winter tunnels by reducing damping off and/or improving spinach germination. We tested three factors:

1. **Incorporating cover crop residues into the soil pre-plant.** Soil microbes, including both beneficial and pathogenic fungi and fungal-like organisms, feed on organic matter in the soil. Soil microbes compete for resources and space, and pathogenic soil fungi are relatively poor competitors. By adding fresh organic matter to the soil, we hoped to provide more resources for the whole soil microbial community and give a boost to beneficial soil fungi that could out-compete pathogenic fungi. We chose buckwheat as our cover crop because it could potentially be grown quickly between summer and fall high tunnel crops and has been shown to reduce damping off when incorporated 3-weeks before planting.
2. **Priming the seed** to speed up germination. Priming is a process of soaking seed before planting in order to jumpstart the germination process, resulting in faster germination after seeding. Damping off pathogens only infect young or weakened seedlings, so we hypothesized that the faster seeds germinate in the soil, the less time damping off pathogens have to infect the germinating seeds, resulting in lower incidence of damping off and better stands. Solutions used for priming seed vary from just water, to water + hydrogen peroxide, to solutions with chemicals added to control the osmotic potential in order to limit how much liquid the seeds take up. We did not find a common, scientifically-verified procedure for priming spinach seed, so we spoke to an expert on seed science, Dr. Alan Taylor of Cornell University, and developed the method described below. We wanted to test a protocol that would be simple for farmers to replicate on farms using materials they could easily source.
3. **Spinach varieties** vary widely in their germination speed and uniformity, and the effects of seed priming are known to vary by variety, so we also included two varieties in our trial. For this trial, we compared the effects of cover cropping and seed priming on Kolibri, which is commonly grown in Northeast tunnels, and Crosstrek, a newer variety that has performed well in our recent variety trials.

Trial Setup

Cover Crop

To evaluate the effects of incorporating cover crops on spinach germination, the high tunnel was split in half. Over the summer prior to planting the spinach trial, one half was planted into cucumbers for an unrelated trial, and one half was planted into a cover crop in preparation for the spinach trial.

For the cover crop treatment, buckwheat was broadcast-seeded into half of the tunnel on July 23 at a rate of 1.39 lbs/1000 ft^2 (60.5 lbs/A). Due to poor germination, the buckwheat was reseeded at a rate of 2.08 lbs/ft^2 (90.75 lbs/A)

on July 30. The seeding on July 30 was raked by hand to incorporate and then irrigated for 4 hours. The buckwheat was irrigated regularly throughout July and August, then mowed on September 9 and rototilled to incorporate on September 10, three weeks before planting spinach.

The non-cover cropped half of the tunnel was planted with cucumbers grown on white plastic beds over the summer of 2021. This side of the tunnel was amended with 50 lbs/A of nitrogen in the form of 5-4-8 chicken manure prior to the cucumbers being planted. The cucumbers and the plastic mulch were removed in late-September.

Priming

The spinach seed was primed overnight the day before seeding. The seeds were soaked in a 0.3% hydrogen peroxide solution for 3 hours, then were drained and put into a container where they remained damp for 16 hours at 65°F, allowing the seeds to slowly imbibe water overnight. The next morning, the container lids were removed and the seeds were spread out to dry at room temperature before planting.

Spinach was seeded into the tunnel on September 31, at a rate of 3 million seeds/A (70 seeds/ft^2). Plots were 2 ft x 6 ft, with 1 ft between plots in-bed. Within each cover crop treatment, plots were arranged in a randomized complete block design with each factor replicated 4 times within the cover cropped side and the non-cover cropped side. The tunnel was overhead irrigated as needed throughout the winter. From September 31 to November 2, the tunnel sides, end wall doors, and end wall vents were open. On November 2, the end wall doors were closed and the sides were programmed to close at 40°F and open at 50°F; end wall vents remained open. There were no exhaust or circulating fans running throughout the course of the trial.

Over the course of the trial, air temperature ranged from 28.9 to 77.7ºF, and soil temperature 3 inches below the soil surface ranged from 40.0 to 72.1ºF. Both air and soil temperatures were highest at the beginning of the trial, in mid-October, and both were coldest in early to mid-November, just before the end of the trial.

Germination was rated by counting the number of plants in 2 row feet 1 week after seeding. Post-emergence damping off was rated on October 12, 15, and 19 by counting the number of wilting or dead plants in 2 row feet. Plot vigor, rated as a percentage, was also rated on all of those dates and twice a week from October 22 through November 16. All plots were harvested on November 18 and yield data was collected.

Results

Statistical analysis was conducted using a general linear mixed model including all main effects and interactions. While priming was significant ($p = 0.0477$), using the priming protocol we developed had no positive effect on germination speed—plots with primed seed actually had *lower* germination rates than plots with unprimed seed. Thus, we used the unprimed data for the rest of the analysis, leaving cover crop and variety as our two main effects. The incorporation of cover crop residue had the largest effect ($p = 0.0001$) on germination, vigor, and yield, though variety was also significant ($p = 0.0392$), with Crosstrek outperforming Kolibri in all measures. All treatments reached their maximum vigor (all above 80%) and yields (all 0.58 lbs/ft^2) in the cover crop plots (see Figures 1 and 2). The interaction of variety and covercrop was not significant ($p=0.4550$), meaning the effect of cover cropping was the same across the two variet-

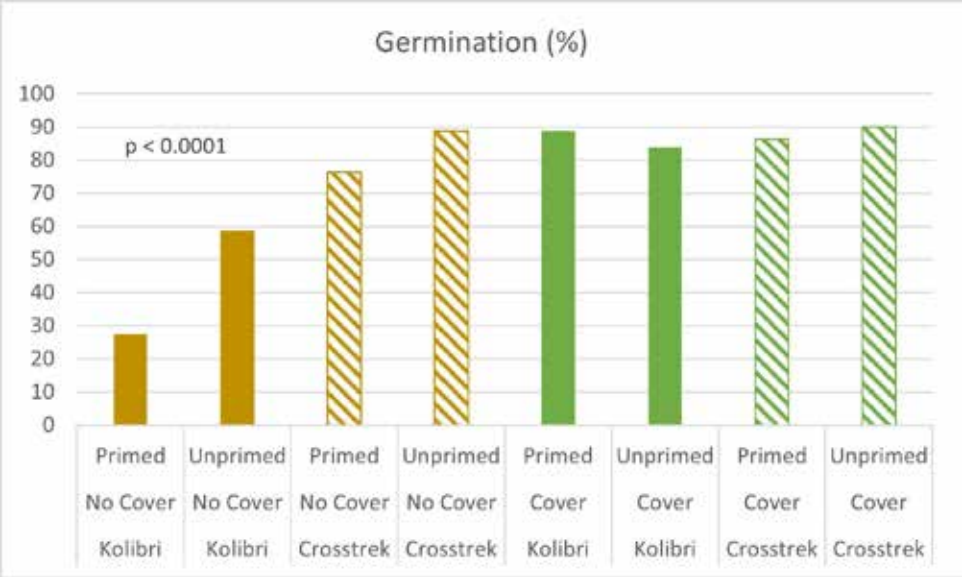
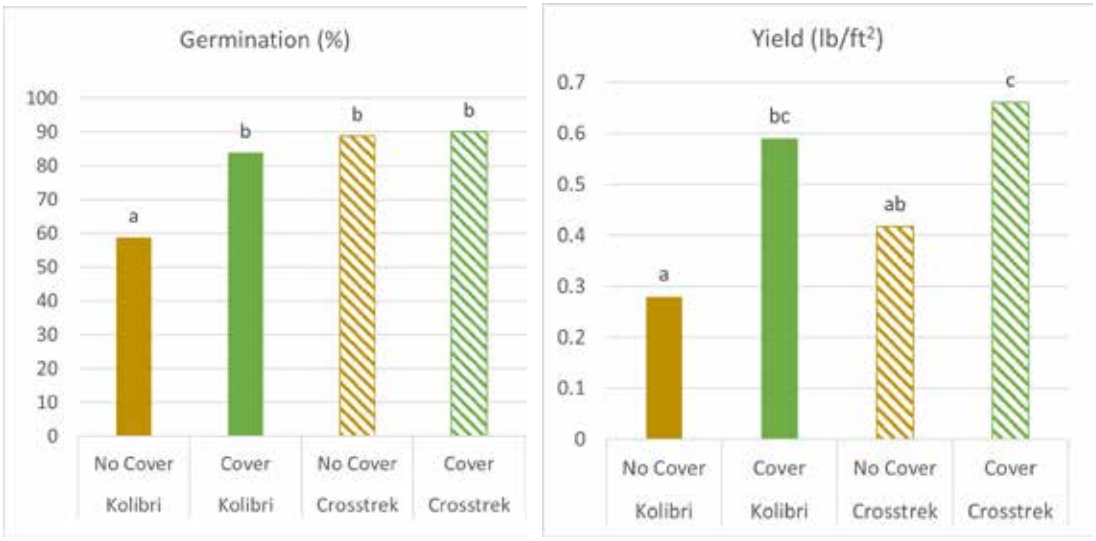


Figure 1. Percent germination. In all cases, the primed seed had worse germination than unprimed seed, so priming was eliminated as a factor for the rest of the data analysis.

ies—cover crop residues led to increased germination, vigor, and yield no matter the variety.

Discussion

While we had hypothesized that turning in fresh cover crop residues would stimulate activity of beneficial soil microbes and reduce damping off, we were surprised by the scale of the difference we saw in germination and growth on the two sides of the tunnel by mid-October. So, we tried to determine what else might have contributed to these differences in growth.



Figures 2-3. Germination rates and yield, excluding the priming factor. In all three metrics, Crosstrek outperformed Kolibri in both cover cropped and bare ground plots. Both varieties performed better in plots that had been cover cropped compared to in bare ground plots.

The bare ground half of the tunnel had been planted to cucumbers the previous summer, while the cover-cropped half was in buckwheat all summer. No fertilizer was added to either side before the spinach trial was planted. On October 29, pre-sidedress nitrate tests showed that the soil nitrate in the cover-cropped beds was double that of the bare ground beds—32 compared to 15 ppm. Since we did not control for soil nitrate content between the cover-cropped side of the tunnel and the bare ground side, the effects we saw from cover crop incorporation may have simply been the effect of higher soil nitrate. We hope to conduct further experiments to tease apart these two variables in the future.

Figure 4. Timeline of nitrogen contributions to both sides of the high tunnel. The left side received fertilizer prior to growing cucumbers that were trellised and harvested all summer, and had nitrate content of 15 ppm in October 2021. The right side had no fertilizer applied before buckwheat was planted and grown all summer, and had nitrate content of 32 ppm in October 2021, more than double that of the cucumber side.

Conclusions

The significant trends that we saw from this study were:

1. Incorporation of a buckwheat cover crop three weeks before seeding (and/or higher available nitrate at seeding) resulted in maximized germination, vigor, and yield of winter high tunnel spinach. This difference could also be attributed to nitrogen fertility in the plots, further study is needed to tease this apart.
2. The variety Crosstrek consistently out-performed Kolibri.
3. Priming seed using the protocol we developed reduced germination and yield of both varieties.

*Figure 5. Comparing effects of **spinach variety**. Crosstrek (left) and Kolibri (right), both unprimed, both with no incorporated cover crop on November 18, the day of harvest. Crosstrek had much better germination and vigorous growth than Kolibri*

Taking a step back, it's clear that variety selection can have a big impact on germination, and therefore on yields. It can be difficult to access the newest spinach varieties through New England distributors, as most spinach is marketed to large-scale, West Coast producers. Distributors are often able to special order unlisted varieties, especially if the order meets a minimum size, so work with neighboring farms to meet minimum orders! One of the most important recommendations for managing spinach downy mildew, an important disease of winter spinach, is to grow several varieties with varying gaps in DM resistance. If you follow this recommendation and grow several varieties, pay attention to differences in germination, and adjust your variety choices based on your observations.

*Figure 6. Comaring effects of **cover crop incorporation**. Unprimed Kolibri, in plots with incorporated cover crop (left) and no cover crop (right), on November 18, the day of harvest. The plots with incorporated cover crop had much higher germination and more vigorous growth than those with no cover crop.*

The effects of cover crop incorporation in this trial were clear – plots with buckwheat incorporated significantly outperformed those with no buckwheat – but the mechanism behind those effects are unknown. More research is needed to investigate whether the benefits we saw from buckwheat incorporation were from the addition of fresh organic matter to the soil, or whether they were from the higher residual nitrate, or both.

Lastly, while priming as we did it clearly had a negative effect on germination, there are many other priming procedures—different priming solutions and treatment times—that might have different effects. More research in this area could also be useful.

--Written by G. Higgins

News

USDA Transition to Organic Partnership Program

UMass Extension has partnered with NOFA/Mass on the Transition to Organic Partnership Program (TOPP), a new USDA initiative that will invest up to $100 million over 5 years to provide education, technical assistance, and support for producers transitioning to organic. UMass Extension will provide technical assistance and training on topics relevant to those interested in learning more about organic production practices. Keep an eye out here for more information on workshops to come!

UMass Extension continues to support *all* MA growers, organic, conventional, or otherwise. Our educational opportunities as part of this program will be open to all growers interested in learning more about organic production practices.

The TOPP includes a grower mentorship program where certified organic producers can serve as paid mentors and will be paired with a transitioning producer, providing support through the certification process. Transitioning producers receive mentorship at no cost.

For more information on the project, visit https://www.organictransition.org/ and register as a farmer mentor or mentee through the NOFA/Mass website: https://www.nofamass.org/topp/.

Northeast SARE Farmer Grant Program Now Open

The Call for 2024 Northeast SARE Farmer Grants is now available. Approximately $800,000 has been allocated to fund projects for this grant cycle. Awards of up to $30,000 are available, depending on the complexity of a project. The online system for submitting proposals will open on September 15,2023.

Proposals are due no later than 5:00 p.m. EST on November 14, 2023.

Northeast SARE Farmer Grants provide the resources farmers need to explore new concepts in sustainable agriculture conducted through experiments, surveys, prototypes, on-farm demonstrations or other research and education techniques. Projects address issues that affect farming with long-term sustainability in mind.

Farmer Grants are designed to be a strong starting point for farmers interested in pursuing grant funding for projects. Before starting their proposals, potential candidates identify a Technical Advisor who can provide non-farming expertise in areas such as research design, troubleshooting, and promotion. The Technical Advisor acts as a go-to support person throughout the grant project, making it easier on first time grantees and forging new relationships in agricultural communities across the Northeast.

Northeast SARE funds projects in a wide variety of topics, including marketing and business, crop production, raising livestock, aquaculture, social sustainability, climate-smart agriculture practices, urban and Indigenous agriculture and more. Click here to see examples of funded Farmer Grant projects.

Northeast SARE covers the Northeast and Mid-Atlantic states of Connecticut, Delaware, Maine, Massachusetts, Maryland, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, West Virginia, Vermont, and Washington, D.C

FY2024 Agricultural Food Safety Improvement Program (AFSIP) – Round II

A second round of MDAR's AFSIP Grant has been posted with a due date of **Friday, October 6, 2023**

MDAR is now accepting applications from produce and aquaculture operations who wish to participate in the Department's Agricultural Food Safety Improvement Program (AFSIP). Interested operations are encouraged to review the Request for Response (RFR) on the AFSIP website. If interested in applying, applications must be submitted with any additional documentation by the deadline of Friday, October 6, 2023.

The purpose of the AFSIP grant is to support produce and aquaculture operations in implementing enhanced on-farm food safety measures that help reduce food safety risks and help to minimize microbial contamination and food-borne illnesses. In addition, by implementing eligible upgrades that help reduce a food safety risk, the program helps operations maintain or increase market access. AFSIP is a competitive, re-imbursement grant program that funds projects up to $50,000 or 80% of total project costs.

This round of funding has an application deadline of **Friday, October 6, 2023** and projects must be completed by **June 30, 2024.**

NOTE: For those applicants who have already submitted their applications under the first round RFR-AGR-AFSIP-FY24 you do not need to resubmit. These applications are still under review and applicants will receive notification of their status once awards are finalized.

Applications can be found here: Agricultural Food Safety Improvement Program

Events

In-Person Preventive Controls Qualified Individual Blended Training

When: Monday, September 25, 2023

Where: UMass Amherst

Registration: Register for Part 1 here ($108). Register for Part 2 here ($125).

Need to gear up for Food Safety Modernization Act regulations?

In September 2017, all manufacturers with more than $1 million in annual sales will be required to comply with the Preventive Controls for Human Food regulation of the Food Safety Modernization Act. That means you need a "qualified individual" responsible for writing your Food Safety Plan.

The Food Safety Preventive Controls Alliance has developed a *blended course* that can help reduce the amount of real-time classroom instruction. Instead of taking the 3-day face-to-face course, you can take *Part 1 of the course online*, then attend *Part 2, as a one-day training session*, to complete the Qualified Individual course requirements.

UMass is offering a registration discount to attend the Part 2 program to all small processors by using the promo code **"2023PCQIP2"** for the **Monday, Sept 25, 2023 program.**

BEFORE YOU REGISTER, please ensure you understand the requirements of a blended course participant. For more information, go to: https://www.ifsh.iit.edu/sites/ifsh/files/departments/fspca/pdfs/FSPCA-Preventive-Controls-for-Human-Food-Blended-Course-Information-01-12-2017.pdf

ADDITIONAL NOTES: To attend this one-day training session, you must complete Part 1 of the course online **AHEAD OF TIME** (and bring the Part 1 Enrollment ticket to class). Visit the FSPCA site to learn how to take Part 1 of the blended course (Part 1 fee is $108): https://www.ifsh.iit.edu/fspca/fspca-preventive-controls-human-food#FPCHFBC

Instructor: This course is being taught by FSPCA Lead Instructors trained to teach the FDA-recognized standardized curriculum: Amanda Kinchla, Extension Professor/Food Safety Specialist, University of Massachusetts, Amherst, 413-545-1017, kinchla@umass.edu, http://www.umass.edu/foodsci/faculty/amanda-kinchla.

Cost: Registration for Part 2 is $125.00 per person before Aug 31 for small processors using promo code "2023PCQIP2". The course tuition is traditionally $275. Registration includes course instruction, program exercises, a light continental breakfast, 2 coffee breaks, and lunch. For more information, go to Registration Details for UMass Part 2 Blended Preventive Controls Program, Sept 25, 2023

Twilight Meeting at Heart Beets Farm: Sweet potato production and fall pest management

When: Thursday, September 21, 4-6pm

Where: Heart Beets Farm, 181 Bayview Ave, Berkley, MA 02779

Join UMass Extension to hear about sweet potato production at Heart Beets Farm, and to learn timely info about fall pest management.

1.5 pesticide credits available.

Eastern MA CRAFT Meeting: Geothermal Water Use and Good Agricultural Practices at Farmer Dave's

When: Saturday, October 21, 4-6pm

Where: Farmer Dave's, Dracut, MA

We will take a tour of their solar and geothermal systems and the reuse of the geothermal water for hoop house irrigation. Lisa McKeag from UMass Extension will share about a project the farm is involved in to assess pre- and post-harvest agricultural water quality for food safety. She'll talk about the results of water samples taken at the farm in 2022-23 and give an update on current food safety regulations related to agricultural water.

MDAR Growing Your Farm Business Planning Course

When: Tuesdays, January 9 – March 5, 2024, 6-8:30pm

Where: MDAR office in West Springfield, or alternate western MA location dependent upon interest

Registration: Applications are accepted on a rolling basis. $150 per farm. If interested, please complete the brief Growing Your Farm application and email it to Diego.Irizarry-Gerould@mass.gov, or mail a hard copy to: MDAR, Attn: Diego Irizarry-Gerould, 138 Memorial Ave, Suite 42, West Springfield, MA 01089.

A hands-on course to help established farmers develop a business plan and financial projections for their farm business. This course covers topics including resource assessment, marketing strategy, financial management, risk management, quality of life, and goal setting. The course is taught by a professional business planner with years of experience working with Massachusetts farms and guest speakers on topics such as succession planning and online marketing. Enrollment is open to farmers who have been operating a farm business in Massachusetts for at least the three prior years, but participating farmers could also have 20-30 years of experience and utilize the course to plan for growth or adding a new enterprise. Eight weekly classes will be held in person in West Springfield on Tuesday evenings from January 9th through March 5th, (no class February 20th). The Growing Your Farm course has been approved as a certified USDA Farm Service Agency (FSA) borrower training for financial management.

For more information, see ABTP program webpage or contact Diego at 857-248-1671. It is important to us that course fees do not create a barrier to participation. If the fee would prevent you from participating, please contact Diego at the number or email above and we can discuss waiving the fee.

MDAR Exploring the Small Farm Dream Course

When & Where: Tentative plans are to offer a fall session and/or a winter session. Final determinations for each course session are dependent on sufficient numbers of interested participants.

Fall Session: Wednesdays, November 1 – December 6, 2023, 6-9pm, tentative Western Mass location.

Winter Session: Wednesdays, January 17 – February 14, 2024, 6-9pm, location tbd based on interest.

Registration: $100 for up to two participants per enterprise, as space allows, not due until course location has been confirmed. If interested, please complete the brief application found here: Exploring the Small Farm Dream and email it to Jessica.Camp@mass.gov, or mail a hard copy to: MDAR, Attn: Jessica Camp, 138 Memorial Ave, Suite 42, West Springfield, MA 01089.

This 5-session course provides guidance to aspiring farmers through the decision-making process of whether to start a farm business. Participants will learn about the many aspects of starting a farm business, assess their own skills and knowledge, and get help finding resources for support, including marketing, financing, and regulations. The course utilizes the Exploring the Small Farm Dream curriculum and workbook developed by the New England Small Farm Institute. Through four guided group sessions and a farmer panel session, participants will analyze the feasibility of their small farm dream and clarify their vision together with other class participants.

For more information, see ABTP program webpage or contact Jess at 617-823-0871. If the course fee would prevent you from participating, please contact Jess at the number or email above and we can discuss waiving the fee.

Land for Good's Succession School

Are you thinking about the next steps for the future of your farm? **MDAR** and Land for Good are planning the next Farm Succession School and want to hear from you!

This three-session course provides farmers and partners with structured support to make decisions, engage their families, and organize the next steps for transitioning the farm business to the next owner. It is an opportunity for senior generation farm owners, with OR without identified successors, to talk with peers, learn from advisors, and get support on the process of farm succession and transfer planning.

If interested, fill out Succession School Interest form to help us understand your needs and determine the next course location. Questions, contact Laura Barley at 857-507-5548, Laura.Barley@mass.gov

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

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