



UMass  
Extension

# Vegetable Notes

For Vegetable Farmers in Massachusetts since 1975



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*We said goodbye to our summer student employees last week—but not before getting some elbow grease out of them to wash our research trial harvest crates! Thanks to Jordan Smith and Jared Schneider for their great work visiting farms and assisting with research trials this year!*

## CROP CONDITIONS

Tropical Storm Henri brought less rain and wind than expected, although some areas still got up to 2” of rain between Sunday and Monday, and small tornadoes touched down near Bolton, Stow, and Marlborough. We heard from several growers who said they prepared for the worst, harvesting preemptively, sending crews home, closing farmstands, and rescheduling deliveries, only to find that Sunday and Monday had milder weather than an average summer thunderstorm. Growers in the Boston area reported perfectly sunny days on Sunday and Monday! Better to be over-prepared and underwhelmed than vice versa, but it is frustrating to be left with disrupted deliveries, harvest surpluses, and lost valuable work hours.

We are getting to the time of year where Pest Alerts are starting to look sparse—unfortunately, not because there are no pests out there, but just because it’s been the same diseases and insects since July. We have detailed articles about most of the main pests of vegetable crops, which include information on identification and management recommendations. You can search for keywords in Veg Notes article titles in the archive, [here](#).

Our last event of the summer is coming up next Wednesday—a Zoom presentation of three case studies of winter high tunnel spinach production. Join us to learn about the economics of winter spinach growing and the range of possible production systems! [Registration link is available here](#). The Produce Safety Alliance is also holding another remote Spanish-language Grower Training on September 8-9. This is the same training that is required for any growers covered by FSMA or CQP and is a thorough food safety foundation course for exempt farms as well. Registration closes **Monday, August 30**. More information (in Spanish, as well) and registration [can be found here](#). Growers in any of the 12 Northeast states can have their registration fee reimbursed by the Northeast Center to Advance Food Safety. Contact Lisa McKeag, [lmckeag@umass.edu](mailto:lmckeag@umass.edu), for more information.

## PEST ALERTS

**Basil:** [Basil downy mildew](#) has been reported on several resistant varieties this season due to high disease pressure, including ‘Prospera’ and the Rutgers varieties ‘Obsession’ and ‘Devotion’. The resistant varieties are usually tolerant to the disease and offer several additional weeks of production beyond susceptible varieties, but are not totally resistant. Chemical control of basil

DM can be effective if materials are applied preventatively and regularly, before symptoms appear. Chemical control is not effective when the disease is already widespread in a planting. See the article in the [June 17, 2021 issue of Veg Notes](#) for more information.

**Brassicas:** We’re continuing to receive scattered reports of [downy mildew in brassicas](#) from throughout the region, on

## 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](mailto:umassveg@umass.edu)

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

both waxy and non-waxy crops. Downy mildews are highly host-specific; the pathogen that causes brassica downy mildew affects only brassicas and does not infect other crops. The disease prefers cool, wet weather and we most often see it in the spring and fall, both in transplants in greenhouses, in high tunnel crops, and in the field. Taking measures to increase air movement and promote leaf drying can reduce the incidence of downy mildew. Labeled fungicides can be found in the appropriate [crop section](#) of the New England Vegetable Management Guide.

**Cucurbits:** [Cucurbit downy mildew](#) (CDM) is continuing to spread on cucumber and cantaloupe throughout the region. There are resistant cucumber varieties available (e.g. Bristol, DMR401, NY264, Citadel); these varieties will develop CDM to some degree but can offer several additional weeks of harvests compared to fully susceptible varieties. If you can diligently spray a rotation of conventional protectant and targeted downy mildew materials every 5-7 days, you can likely get a high yield out of a susceptible cucumber variety into October. If that spray schedule is unfeasible, we recommend growing a resistant variety for harvesting in August and September. This year, CDM arrived earlier than normal, in July.

**Sweet Corn:** [Corn earworm](#) and [fall armyworms](#) have shot up across the region in the past week, with FAW trap counts as high as 130 and CEW as high as 54. CEW trap counts have put most locations on a 4-day spray schedule, which should also control FAW. CEW and FAW populations can be patchy, so if your CEW trap counts do not warrant a spray, scout blocks from pre-tassel stage onward for FAW and ECB larvae and treat if more than 12% of plants are infested.

**Table 1. Sweetcorn pest trap captures for week ending August 25**

Location	GDD (base 50°F)	ECB NY	ECB IA	FAW	CEW	CEW Spray Interval
<b>Western MA</b>						
Deerfield	2246	1	1	130	14	4 days
Southwick	2178	1	0	18	58	4 days
Whately	2323	2	0	29	13.5	4 days
<b>Central MA</b>						
Lancaster	2161	1	2	3	7	4 days
Leominster		2	0	0	53	4 days
Northbridge	2040	2	0	0	30	4 days
Spencer	2132	6	0	2	15	4 days
<b>Eastern MA</b>						
Ipswich	2109	4	3	5	30	4 days
Concord	2212	4	7	0	7	4 days
Millis	-	2	2	N/A	13	4 days
North Easton	2273	2	0	N/A	1	no spray
Sharon		-	-	-	-	-
Seekonk	2464	1	0	109	54	4 days
Swansea		2	0	0	5	5 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						



*Brassica downy mildew sporulation.  
Photo: G. Higgins*

**Table 2. Squash Vine Borer trap captures, week ending August 25, 2021**

Location	SVB
Deerfield	-
North Easton	0
Westhampton	0
Whately	-
Sharon	-
Leominster	1

# **TWILIGHT MEETING RECAP: COVER CROP STRATEGIES FOR VEGETABLE FARMS**

As the season moves towards fall and fields start to empty out, many growers are starting to think about getting cover crop seeds into the ground. It's now common practice to seed oats or rye at the end of the season, but there are so many additional types of cover crops and a wide variety of goals that using cover crops might help you achieve. Having any species of living roots in the soil will prevent erosion, and incorporating any plant material into the soil will increase soil organic matter, but different types of cover crop species are particularly good at suppressing weeds, increasing soil aggregation, fixing nitrogen, scavenging nitrogen, mitigating soil compaction, and even providing food for pollinators.

Two weeks ago, we held a twilight meeting at Appleton Farms, in Ipswich, MA, focused on cover cropping. We had great presentations from Andrew Lawson, farm manager at Appleton, Jason Lilley of UMaine Extension, and Hannah Whitehead of the UMass Extension Vegetable Program. For those of you who couldn't make it but are interested in learning more about the logistics of cover cropping, we've written up a summary of the talks and discussion here.

Jason presented four actions to take and things to consider when making cover crop decisions:

- 1. Make a written crop plan for the year** to identify windows where you'll have bare ground that you can get a cover crop into. Cover crop seed suppliers can run out of inventory mid-season, so buy at least a season's-worth of seed well ahead of time.
- 2. Make a *multi-year* crop plan** to plan ahead for high residue or multi-year cover crops. Fibrous cover crops like ryes, sudangrass, or sunnhemp can take a long time to break down after incorporation. Other crops such as clovers can provide the most benefits if allowed to grow for more than one full season.
- 3. Identify and prioritize the goals you want to achieve with cover crops.** All cover crops will add some organic matter to your soil, scavenge leftover nitrogen from the soil in the fall, and prevent erosion, but there are many other goals that can be moved towards by using specific cover crop species. Legumes will fix nitrogen from the air and release it into the soil in a form that can be used by your cash crop when the cover crop is tilled in. Broad-leaf cover crops will shade out summer annual weeds quickly. Species with deep or extensive root systems can penetrate plow pans. The Northeast Cover Crop Council has developed a [Cover Crop Species Selector Tool](#) to help narrow down cover crop species based on your location and your goals. Cover crop species are rated based on how well they achieve different goals, and the tool provides extensive information about whichever location you enter (e.g., soil type and average rainfall) and about each crop species.

Jason has also developed an Excel spreadsheet with recommended seeding dates and windows for different cover crop species, examples of cover crops to include in cash crop rotations, and a template for creating crop rotation plans. [Click here to download this resource.](#)

- 4. Choose your cover crop species based on what equipment you have available.** The equipment you have on-hand for seeding, terminating and incorporating a cover crop may dictate what species you choose and how much seed to use. For instance, some crops such as red clover and annual ryegrass won't be well controlled with a roller-crimper, and you may be able to use less seed if you plan to use a grain drill rather than broadcasting the seed.

## **Cover Cropping at Appleton Farms**

Andrew Lawson of Appleton Farms spoke specifically about the cover crops used at Appleton, as well as the equipment they use for cover crop seeding and termination. Appleton Farms crops about 35 acres every year, to feed a 650-member summer CSA and 200-member winter CSA. They grow on relatively sandy soil that dries out quickly, so their goal is to keep the soil covered as frequently as possible to prevent erosion. They also have a well-populated seed bank in the soil, so suppressing weeds using cover crops is another important goal. With those goals in mind, here are some of the cover crops used at Appleton Farms:

- **Oats + peas:** *For seeding in the spring into fields that didn't receive a cover crop in the fall. For seeding into a field after tilling in fall-seeded rye, to prevent the rye from becoming too fibrous. For seeding in the fall for fields that will be planted into a cash crop in early-spring.* They have had good success with both field and Austrian peas at Appleton Farms
- **Buckwheat:** *For filling in mid-season cropping gaps.* They seed at a high rate to get the most weed suppression pos-



sible. Buckwheat grows quickly and goes to seed quickly—till it in 5-6 days after it begins flowering to avoid self-seeding.

- **Winter rye:** *For the latest fields only—seeded after September 20, when other species might not germinate or grow fast enough to establish.* Increase the seeding rate as you seed later and later after September 20, to ensure that you get a good stand.
- Other cover crops that are part of the mix at Appleton are **sudangrass** (most often seeded in July), and a **triticale + vetch mix**.

At Appleton, they primarily use a high-speed disc, made by the Czech company Farnet and distributed out of NY, for cover crop prep and seed incorporation. The high-speed disc is comprised of two rows of toothed discs with a rolling basket in the back. Each disc rides separately, instead of as a group with the other discs in the row, so an individual disc can bounce up if it hits a rock and the other discs will continue on. It's a heavy implement that requires ~90-100 horsepower to pull, and it works better the faster you go. With the high-speed disc, they can incorporate cash crop residues to prep for cover crop seeding and then adjust the height of the implement to very shallowly incorporate cover crop seed (just ~2-4" deep).

To incorporate cover crops, Andrew uses a spader (a gang of rotating spades, similar to but less intensive than a rototiller), sometimes mowing the cover crop before incorporation. They set beds with a bed shaper. If a new field is going to be put into production, which is rare, it is turned under using a moldboard plow.

Two other concepts that came up during our discussions were the **intricacies of using small-seeded cover crop species like clover** and **the importance of seed-soil contact for germination**. All cover crop seeds need to be incorporated, because the seeds need to have 360° contact with the soil in order to imbibe water and germinate. You may even want to compact the soil gently after spreading and incorporating cover crop seed—some growers use a cultipacker after incorporating cover crop seed to achieve this. The Northeast Cover Crop Council Tool offers recommendations for how deep to incorporate different cover crop species.

Clovers are tricky because clover seed is significantly smaller than most other cover crops and it grows slowly. Clover needs to be *just barely* incorporated in order to germinate—bury it too deeply and you'll get poor stand. A grain drill can be the easiest way to seed clovers because they come with a separate seed box for small-seeded crops. A lower-tech option is to drag a section of chain-link fence behind the tractor to lightly incorporate the clover seed, then cultipack to get good seed-soil contact. Because clover grows slowly, it is often quickly overtaken by weeds. One way around this is to seed clover along with a faster-growing nurse crop (e.g. oats and peas). The nurse crop will outcompete weeds while the clover slowly becomes established. The nurse crop can then be mowed when mature to allow the clover in the understory to become dominant. Because clover is so slow-growing, it's a good option for fields that will not be planted into a cash crop for a full season or longer.

### Cover Crops for Pollinators

One of the potential goals for using cover crops is to benefit pollinators and beneficial insects. Hannah Whitehead, who recently joined our team as a Vegetable Educator at UMass Extension, presented on how to maximize cover crop benefits to pollinators. Pollinators and other beneficial insects use flowering cover crops as a food source (pollen and nectar). Therefore, cover



*Andrew Lawson of Appleton Farms (center) and Jason Lilley of UMaine Extension (right), with Appleton Farms' Farnet high-speed disc.  
Photo: G. Higgins*



*Sunflowers are highly attractive to pollinators and can be used as a cover crop.  
Photo: H. Whitehead*

crop species that produce a lot of flowers tend to attract more pollinators. A review of scientific literature found that buckwheat, phacelia, and sunflowers attract the most pollinators. Native wildflower mixes don't establish as well as cover crops, so reserve them for perennial flowering strips or marginal areas as opposed to including in rotations with cash crops. You can also seed cover crops in the fall to provide early spring floral resources for beneficial insects. In one study in the Northeast, researchers compared canola, Austrian peas, and clover, and found that peas and clover did not have a chance to bloom before they were killed to establish the cash crop. Canola did bloom early enough, and attracted pollinators.



*Phacelia (left) and buckwheat (right, with a syrphid fly visitor) are also highly attractive to beneficial insects.*

Cover crops commonly have to be mowed or tilled in when they begin flowering—buckwheat, for example, will happily re-seed itself and needs to be tilled in about 5-6 days after it begins flowering. So growing cover crops for the benefit of your cash crop and for the benefit of beneficial insects can be counteractive goals.

Combining flowering cover crops with permanent hedgerows or perennial strips of flowering plants is a good way to provide pollen and nectar for beneficial insects year-round. One study found that 4-year-old flowering strips attracted wild bees and hover flies to nearby blueberry fields, resulting in increased pollination services and increased yield, which offset the cost of establishing and maintaining the strip. They also found more parasitoid wasps, lady beetles, and spiders in blueberry fields near flowering strips, and measured increased predation on corn earworm eggs. In tomatoes, researchers found more beneficial insects like lady beetles and parasitoid wasps in tomato fields up to 200m away from flowering hedgerows. Those fields also had fewer aphids, leading to less insecticide use. It is important to note that it takes several years to establish wildflower strips and hedgerows.

Developing a cover crop plan for your farm takes lots of trial and error, in addition to learning the concepts behind cover cropping practices. If you are just getting started learning about cover cropping on your farm, learning from your fellow farmers is a great way to gain practical knowledge about the logistics of cover crop management. Then you can take the information home and experiment with different cover crop species, planting dates, and equipment.

*--UMass Vegetable Program*

## **IDENTIFYING BENEFICIAL INSECTS**

While scouting in the field for insect pests, also keep an eye out for the insects that are working in your favor. Your pest management decisions should be based in part on the natural controls that are already at work—for example, a targeted Bt product used to control caterpillar pests will not affect the wasps and spined soldier bugs that parasitize and eat caterpillars. It is important to be able to identify the beneficial insects that are helping you by killing pests. Many different insects either prey upon or parasitize vegetable crop pests. Some beneficials are generalists and will feed on a variety of insect species, while others are more discriminating—this is generally true of parasitoids, which lay their eggs within the eggs or body of a specific host. The most effective natural enemies on farms tend to be those that either consume voraciously (e.g., green lacewing larvae, which feed on aphids and many other small insects) or those that are host-specific (e.g., *Diaeretiella* wasps, which parasitize exclusively aphids). They should have high reproductive rates and life cycles that coincide with those of their hosts or prey.

The principals of integrated pest management (IPM) include capitalizing on natural controls of vegetable pests, along with using cultural practices and making strategic applications of appropriate chemical controls that protect beneficials as



much as possible. The goal of IPM is not to eliminate all of the pests from a crop, but to reduce the populations of pests so that they are not causing economic losses while maintaining enough of the pest population to sustain their natural enemies.

It is often the larval stages of predators that do the bulk of the feeding; the adult stages of many beneficial species may only feed on pollen or nectar, so maintaining flowering plants—whether wildflowers at the edges of fields, or cultivated flowers interspersed within the crop—can help to provide both food and shelter for beneficial insects. To learn more about planting flowers to attract beneficial insects to your fields, please see the following:

- [\*Insectary Plants: Flower Power for Natural Enemies of Vegetable Pests\*](#) by Dr. Ana Legrand, IPM Program, University of Connecticut, December 2018.
- [\*Attracting Beneficial Insects to Reduce Cabbage Aphid Population Size, 2018\*](#) by Michele Meder, Genevieve Higgins, and Susan B. Scheufele, December 2018.

Below are descriptions of a few beneficial insects that are commonly found in farm fields in New England.

## Predators

**Predatory midge (*Aphidoletes aphidimyza*)** larvae feed on small insects like aphids and mites. They are small (about 2 mm long), orange or yellow, legless maggots. In its lifetime, one larva can kill from 10 to 30 aphids. Adults are very small (2-3mm), delicate, mosquito-like flies with long legs and long antennae. Adults feed on honeydew (aphid excrement) and fly at night, so they're rarely seen during the day. Adults lay minute (less than 0.3 mm), orange eggs in clusters or singly around aphid colonies. Predatory midges are an important part of biological control programs in greenhouse crops and are widely sold in the U.S.



*Predatory midge. Photo: A. Eaton.*

**Syrphid flies (Diptera: Syrphidae)** (also known as hover or flower flies): The larvae of several common syrphid flies also feed on aphids. Larvae are ½-inch long and semi-transparent, with green, pink, or brown coloring. Each larva can consume up to 400 aphids during development. When syrphids are abundant, aphid populations can be reduced by 70-100%. Adults of many syrphid species resemble bees to ward off predators but have characteristic helmet-like fly eyes. Adults are prominent pollinators, and visit flowering plants for pollen and nectar. See the article *Attracting Beneficial Insects to Reduce Cabbage Aphid Population Size*, linked to above, for more information about syrphid flies.



*A syrphid fly larva feeding on aphids (left) and a syrphid fly adult (right). The bronze-colored aphids are likely parasitized by the braconid wasp, *Diaretiella rapae*. Photos: G. Higgins*

**Spined soldier bug (*Podisus maculiventris*)** adults feed on larger soft-bodied insects, including the larvae of European corn borer, diamond-back moth, corn earworm, beet armyworm, fall armyworm, cabbage looper, imported cabbage-worm, Colorado potato beetle, and Mexican bean beetle. With good timing, you can catch a spined soldier bug that has impaled its prey with its piercing-sucking mouthparts. One study found that a single adult consumed over 100 fall armyworm larvae in its lifetime. Adults are pale-brown to tan and about 8.5 to 13 mm long. They are shield-shaped with characteristic spurs on their “shoulders”, immediately behind the head. These shoulder spurs distinguish them from brown marmorated stink bugs, a pest of fruiting vegetable crops. Nymphs are round instead of



*Spined soldier bug adult (left) and nymph (right). Photos: M. Spellman, P. Sloderbeck, Kansas State Univ., Bugwood.org*

shield-shaped; young nymphs are red and black while older nymphs have red, black, yellow-orange and cream-colored bands and patches (see photo). Females lay hundreds of gray to gold, barrel-shaped eggs in clusters of 20-30, on leaves or twigs. Eggs hatch in 5-9 days. Growth from egg to adult lasts about 30-35 days and adults live from 1-4 months.



**Lady beetles:** There are both native (including the twelve-spotted lady beetle, *Coleomegilla maculata*) and non-native (including the multicolored Asian lady beetle, *Harmonia axyridis*) species of lady beetles, both of which prey on insect pests of vegetables. Eggs are yellow-orange, oval, and laid on-end in clusters on leaves. Larvae look, strangely enough, reptilian; they are flat, dark-colored, with long alligator-like tails, and spines covering their bodies. Lady beetles are excellent predators of aphids but also feed on other insects including mites and scale. Adults overwinter in field edges and other sheltered locations (including in your house, in the case of the multicolored Asian ladybeetle).



Clockwise from top left: Lady beetle pupa - sometimes mistaken for CPB larva! (Photo: J. Boucher). Twelve-spotted lady beetle (Photo: M. Spellman). Convergent lady beetle eating an aphid (Photo: UMass Vegetable Program). Convergent ladybeetle larva (Photo: L. F. Aristizabal)

**Green lacewing (*Chrysopa* and *Chrysoperla* spp.)** adults are pale green, with a slender, soft body, about ½-inch long, and four delicately veined wings. Eggs are laid on filamentous stalks attached to plant tissues, often with several laid in a row. Larvae are ⅛- to ½-inch long and alligator-like, but skinnier than lady beetle larvae, with a flattened body that tapers at one end. Larvae have long, curved mandibles that they grab their prey with. The adults of most species are not predaceous, feeding mostly on nectar and pollen. The larvae, however, are voracious predators, and will consume large numbers of a wide range of soft-bodied insects, including other lacewing larvae. Lacewings are found naturally in New England, and are also available commercially, as they are very effective at cleaning up outbreaks of aphids and other pests in greenhouses.



Clockwise from top left: Green lacewing adult (J. Berger, Bugwood.org); Lacewing eggs (L. McKeag); Lacewing larva (G. Higgins)

### Parasitoids

The beneficial parasitoids that are important in vegetable crops aren't often seen, as most of them are tiny wasps. Parasitic wasps lay their eggs in either the eggs or larvae of their hosts, where the wasp larvae feed on the insides of the host, and pupate in or on the host before emerging as adult wasps. Often what will be visible in crops to indicate parasitoid activity will be either the parasitized host or the wasp pupa. There are thousands of species of parasitic wasps, most of which are highly specialized to use a particular species or family as a host. Several parasitoid wasp species naturally occur in New England, or have been successfully introduced, and others are commercially available for release in greenhouses.



Braconid wasp pupae within cocoons in cabbage. Photo W. Cranshaw, Colorado State Univ., Bugwood.org



Caterpillars are commonly parasitized by braconid and ichneumonid wasps. The braconid wasp, *Cotesia rubecula*, was introduced to New England from China in 1988, and is now established in Massachusetts. This wasp parasitizes imported cabbageworm larvae. You may see their small white cocoons on brassica leaves. Diamondback moth eggs are parasitized by the ichneumonid wasp, *Diadegma insulare*, which is native to eastern North America. *D. insulare* females require sources of nectar to effectively parasitize diamondback moth larvae, so maintaining wildflower stands near brassica fields will encourage their activity. You may be more familiar with the pupae of another parasitic wasp, *Cotesia congregatus*, which lays its eggs under the skin of the tomato and tobacco hornworms. The larvae feed within the hornworms, then emerge to pupate on the surface, eventually killing the host. If you see a hornworm in your tomato crop with many white cocoons on its back, don't kill it—either leave it be, or move it to another area where it can't continue feeding, to allow the wasps to develop.



*Aphid mummies.* Photo: T. Smith



*Aphidoletes aphidimyza* is a parasitic wasp often released in greenhouses to control aphids. Photo: J. Gross.

Aphids also play host to several parasitic wasps that rely on the aphids' bodies to produce and feed their young. If you see puffy, tan or golden aphids among an aphid colony, these are aphids with one of these wasps pupating within, and are called aphid "mummies". Sometimes you will see a small hole in the mummy, indicating that the adult wasp has already emerged. The braconid wasp *Diaeretiella rapae* parasitizes many species of aphid, but is particularly fond of cabbage aphids. Keep an eye out for these mummies when scouting for aphid colonies to get an idea of the level of the biological control you're getting.

--Adapted by Lisa McKeag and Genevieve Higgins, from original article by Kristina Fahey and Ayana LaSalle, Stockbridge School of Agriculture.

## **H**ARVESTING & CURING POTATOES

Potatoes harvest is beginning across the state now. As our colleagues at University of Vermont Extension like to say, "storage is a hotel, not a hospital," meaning that storage cannot improve the quality of tubers, it can only maintain quality at best. So, harvest when environmental conditions are as ideal as possible and pay careful attention to pre-harvest preparation to ensure that the highest quality potatoes come out of the field.

### **Optimum Environmental Conditions for Harvest**

It's still hot out there but as cooler weather approaches, conditions become favorable for harvest and curing potatoes for long-term storage. Optimum environmental conditions for harvest are soil temperatures of 45-65°F, tuber temperatures of 50-50°F, and soil moisture at 60% and 80% of field capacity for loam and sandy soils, respectively. This level of soil moisture ensures that soil clods are not so hard that they damage skins during harvest and not so moist that they remain stuck to potatoes as they are brought into storage. Temperatures below 45°F will increase tuber bruising and temperatures above 60°F can increase transpiration and drying of potatoes or development of disease in storage. **Vine-kill should take place about 2-3 weeks before these environmental conditions are expected.**



*Potatoes being harvested*

### **Pre-Harvest Preparation**

**Vine killing** stops tuber growth at the desired size after bulking, stabilizes the tuber solids, controls hollow heart disorder, promotes skin set, and allows for easier digging and harvesting. Vines may have died down naturally but if they are still green, mow or use a vine desiccant to kill the plants once tubers are mature. Killing vines also reduces the risk



of late blight causing tuber infections, as the pathogen requires a living host to grow and produce spores.

**Skin set** is achieved by allowing 2-3 weeks for tuber skins to mature in the field after vine kill. During bulking, the outermost layer of potato skin is only loosely attached to underlying tissues, to allow for rapid growth of the tuber without the skin cracking. The cells in this layer are soft and easily damaged. Vine kill on mature potatoes will initiate “skin set”—the outermost layer of skin cells will begin to bind tightly to the underlying tissues and produce suberin, creating a tough, durable skin that is resistant to infection and dehydration. Good skin set greatly reduces the amount of wounding at harvest and increases the storability of tubers.

**Maturity** is achieved when the tuber skins are fully developed and are difficult to remove. Periodically dig a few plants to see how easily the skins peel. Sugar content is another index of maturity for processing potatoes, with both immaturity and over-maturity resulting in higher sugar levels. Mature potatoes resist bruising and have lower respiration rates than immature potatoes.

### **Harvest practices to prevent wounding and bruising**

Check harvesting and transporting equipment before harvest begins to make sure it is working properly and does not bruise or wound tubers, and continue to inspect during harvest to determine injury points. Potatoes should not drop more than 4-6” and all equipment surfaces should be padded. Replace bare chains with rubberized links where possible, except for the primary chain. Adjust chain and ground speed so that chains are loaded to full capacity during harvest, and potatoes will “flow” rather than drop from one chain to another. In many cases, increasing ground speed helps to achieve this. Adjust the digger blade so that potatoes flow onto the upper surface of the chain rather than bumping into the front. Ensure that digger blades will cut cleanly through the soil – control weeds prior to harvest to avoid tangling, and sharpen blades before harvesting.

**Curing:** During the first 2-3 weeks of storage, wounds and bruises from harvest are suberized to prevent invasion of pathogens. This process is called curing, and it is essential for completing skin set.

**Maintain temperatures at 50-60°F.** Harvesting when pulp temperatures are already in this range is ideal. The ability to move from field to curing temperatures will depend on storage ventilation systems, varieties, availability of cooling air, and humidity controls. If potatoes are harvested during hot weather and cool off slowly, the likelihood of storage rot is increased. If active refrigeration is available, potatoes can be harvested at 62-65°F pulp temperature and cooled effectively. Storage areas with no refrigeration should not be loaded with potatoes with a pulp temperature above 60°F.

**Maintain relative humidity at 85-95%.** Low relative humidity will result in poor suberization. During the curing phase, tubers will lose moisture through cuts and bruises and incompletely suberized skin. As much as 2-4% of the tuber weight can be lost in the form of water during the first month in storage. If managed properly, this water loss can be minimized and, if captured, this lost moisture can be used to maintain the high relative humidity needed during curing for 3-6 hours per day. A humidifier can also be used to maintain proper humidity.

**Uniform air movement** is necessary during curing to remove heat from the field and from respiring tubers, to supply oxygen, and to prevent condensation within the pile. Monitor temperatures within the tuber bins or pile to avoid heat buildup, which increases tuber rot. In a through-the-pile forced air ventilation system, fans should be operated minimally—usually 1-2 hours per day provides sufficient oxygen but minimizes moisture loss.

**Curing and storage must take place in the dark** since even low light levels can cause development of chlorophyll (greening) and solanine, a toxic, bitter compound, in tuber skins, rendering tubers unmarketable. 1-2 weeks in low light can result in greening, and higher light levels cause faster greening.

**Curing infrastructure:** Curing may be accomplished within the space that will be used for storage, or in a different location. Diversified farms and those who are in the process of building up their fall/winter storage infrastructure may find it more challenging to provide the appropriate conditions for curing. On a small scale (up to about 1100 cubic feet), curing can be accomplished using a Cool-bot and humidifier in an insulated space. A combination of vents and fans to exhaust warm air and bring in cool air, controlled with relative humidity and temperature sensors, can make best use of outdoor conditions to manage the indoor environment. Good environmental control is very difficult in an open barn situation.

**When tuber quality is poor:** Potatoes affected by freezing injury, *Pythium* leak, late blight, or soft rot will break down at normal curing temperatures. If this is the case, eliminate the curing period—grade out the rot and sell immediately, or cool rapidly to 45°F with low to medium relative humidity. Questionable potato lots should be harvested closer to

55° F if they must be stored. Chilling injury is cumulative and is worse the longer the tubers are in chilling temperatures. Freezing occurs at 30°F, but chilling injury can occur after a few weeks at 32°F.

## **Disease Management**

We still haven't seen late blight in Massachusetts this year, so it should not be an issue on tubers this fall. When late blight is around, spores can be carried by rainwater onto tubers and cause problems in storage. The pathogen can only survive on living tissue, so vine kill is key in disease management if late blight is present on the foliage. If black scurf (*Rhizoctonia* spp.) or silver scurf (*Helminthosporium solani*) are present, they will increase in severity as long as tubers remain in the soil. Wireworms can also cause tuber damage. If markets are ready or suitable storage space is available, minimize the effects of these diseases and pests by starting harvest as soon as skins are set.

If the soil is wet during harvest, soil may adhere to the tubers and promote infection by soft rot organisms. Potato fields that have been saturated with water will be especially prone to post-harvest diseases. Bacterial soft rot (*Erwinia* spp.), Fusarium dry rot, pink rot (*Phytophthora erythroseptica*), and Pythium leak are four serious tuber rotting pathogens that cause the most significant losses in storage (see "Potato Tuber Diseases" in [August 5, 2021 Vegetable Notes](#)). A good online resource on tuber diseases can be found at [http://vegetablemdonline.ppath.cornell.edu/factsheets/Potato\\_Detection.htm](http://vegetablemdonline.ppath.cornell.edu/factsheets/Potato_Detection.htm). However, finding a photo online that looks like your problem is not the same as having a plant pathologist confirm what is on YOUR tubers! Send samples to the [UMass Plant Diagnostic Lab](#) to get an accurate diagnosis. Proper identification is key as different tuber blights require different management techniques. Grade out diseased tubers before storage as much as possible, as some diseases can spread in storage.

## **Cooling and Storage**

After the curing period, cool tubers as soon as possible but gradually and steadily to the holding temperature. Ideal holding conditions are as follows: 80-90% relative humidity and 38-40°F for tablestock and seed potatoes, 45-50°F for chipping, and 50-55°F for French fry stock.

## **Sterilizing Storage**

An important aspect of potato disease control in storage is providing a pathogen-free environment. All storage and potato handling surfaces should be thoroughly cleaned and disinfected prior to putting the crop in storage. Surfaces should be well-moistened with disinfectant spray. Spray bin walls until there is slight runoff. Recommended disinfectants are quaternary ammonium compounds such as Hyamine 2389. Bins or equipment treated with quaternary compounds must be rinsed with clean water before coming into contact with potatoes to be used for human consumption. Read disinfectant labels carefully regarding use on walls or floors versus use on food-contact surfaces and to determine suitability for your needs. Organic produce may not come in contact with surfaces that have been treated with quaternary ammonium compounds. Chlorine, ozone, and peroxyacetic acid are approved disinfectants for organic produce. See the fact sheet [Introduction to Selecting an EPA-Labeled Sanitizer](#) by the Produce Safety Alliance for more information on choosing an appropriate sanitizing agent.

**Sprout inhibitors** may be needed, depending on storage goals, storage conditions, and cultivar. Potatoes harvested in warm temperatures will be more likely to sprout in storage. Later maturity varieties usually have a longer period of dormancy (2-3 months).

--Written K. Campbell-Nelson, M.B. Dicklow, and R. Hazzard

# **NEWS**

## **IMPORTANT UPDATES TO PANDEMIC ASSISTANCE FOR VEGETABLE & FRUIT PRODUCERS**

USDA made two important announcements on August 24, 2021 for assistance to "sales commodity" producers. "Sales commodities" include fruits, vegetables, maple sap, honey, Christmas trees and tobacco.

Originally under the Coronavirus Food Assistance Program 2 (CFAP 2), payments were based upon 2019 calendar year sales of eligible "sales commodity" crops. USDA announced an amendment to the CFAP 2 payment calculation for "sales commodities" to allow producers to substitute 2018 sales for 2019 sales. Producers are encouraged to take a look at their 2018 sales and to contact their [USDA FSA Office](#) to modify their CFAP 2 application if using the 2018



sales would result in a higher payment. Similarly if a producer hasn't filed a CFAP 2 application for sales commodities, those producers now have the option of using either 2018 or 2019 sales.

USDA also announced the final deadline for filing a new or modified CFAP 2 application with the USDA-FSA as **October 12, 2021**.

Producers are encouraged to contact the FSA Office that serves their farming operation with questions they have along with procedures to file a new or modified application and related paperwork. Producers should call their FSA Office before visiting the FSA Office since FSA may have restrictions in place for in-person office visits. Sales records are not required at the time of signup but producers will have to provide evidence of total sales if the application is selected for a later spot-check.

As of August 22, 2021, 1,260 approved CFAP 2 "Sales Commodities" applicants in Massachusetts have received \$27,698,404 in payments. Don't miss out on this opportunity!

Detailed information also can be found at: <https://www.farmers.gov/coronavirus/pandemic-assistance/cfap2>

## **EPA ISSUES FINAL RULE REVOKING ALL CHLORPYRIFOS TOLERANCES FOR FOOD CROPS**

In response to an April 2021 Ninth Circuit Court decision, the U.S. Environmental Protection Agency (EPA) announced this month that it has revoked all tolerances for chlorpyrifos on food crops. "Tolerances" establish the amount of a pesticide that is allowed on food. With this revocation, chlorpyrifos applications to food will result in the food being considered adulterated under the Federal Food, Drug, and Cosmetic Act and unlawful to distribute. A revised human health risk assessment conducted in 2020 determined that risk of exposure to the chemical in drinking water exceeded safe levels when combined with food and residential exposures from all currently registered users. The chemical was widely used for many years under the trade name Lorsban, though Corteva, the company that produced Lorsban, announced in 2020 that it would stop production this year. Some states, including California and New York had already banned the pesticide. Chlorpyrifos remains available under other trade names and is still allowed for use by the EPA on some non-food crops.

## **USDA TO INVEST \$50 MILLION IN NEW COOPERATIVE AGREEMENTS FOR RACIAL JUSTICE AND EQUITY**

The U.S. Department of Agriculture (USDA) is investing up to \$50 million in cooperative agreements to support historically underserved farmers and ranchers with climate-smart agriculture and forestry. The Racial Justice and Equity Conservation Cooperative Agreements are available to entities for two year projects that expand the delivery of conservation assistance to farmers who are beginning, limited resource, socially disadvantaged and veteran farmers. [Click here to see the full USDA press release.](#)

[For more details and information on how to apply, click here.](#)

## **GUIDANCE FOR FLOOD-AFFECTED FOOD CROPS**

With the excessive amount of rain we've received recently, there are many farms that have experienced flooding, particularly in the western end of the state. If your farm is susceptible to flooding, please read the FDA's **Guidance for Industry: Evaluating the Safety of Flood-affected Food Crops for Human Consumption**, found [here](#).

Per the guidance: "If the edible portion of a crop is exposed to flood waters, it is considered adulterated under section 402(a)(4) (21 U.S.C. 342(a)(4)) of the Federal Food, Drug, and Cosmetic Act and should not enter human food channels. There is no practical method of reconditioning the edible portion of a crop that will provide a reasonable assurance of human food safety. Therefore, the FDA recommends that these crops be disposed of in a manner that ensures they are kept separate from crops that have not been flood damaged to avoid adulterating "clean" crops (Ref. 1, 2, 3)."

The guidance also addresses potential microbial, chemical and fungal contamination, the safety of food crops when flood waters did NOT contact the edible portion of the crop, as well as flooding vs. pooled water.

Please contact MDAR's Produce Safety Division if you have any questions regarding the safety of your crops: Kate Bailey, Produce Safety Inspector, Phone: 857-315-7478, [Kate.Bailey@Mass.Gov](mailto:Kate.Bailey@Mass.Gov)

## SNAP PROCESSING EQUIPMENT AVAILABLE FOR FARMERS AND FARMERS MARKETS: APPLY BY SEPTEMBER 24

Free mobile SNAP processing equipment from Novo Dia Group is now available to direct-marketing farms and farmers' markets through the Department of Transitional Assistance, in collaboration with the Department of Agricultural Resources, and with financial support from the United States Department of Agriculture (USDA). Eligibility is limited to SNAP-authorized farms and markets that do not currently have working equipment received through previous federal grants. Equipment will not process credit/debit. For complete program details and a link to the application, go [here](#).

Are you looking for SNAP processing equipment but not eligible for this program? Learn about other options, [here](#).

**Questions?** Contact David Webber, 617-626-1754 or [David.Webber@mass.gov](mailto:David.Webber@mass.gov) or [DTA.HIP@mass.gov](mailto:DTA.HIP@mass.gov).

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## USDA ACCEPTING APPLICATIONS TO HELP COVER COSTS FOR ORGANIC CERTIFICATION

Organic producers and handlers can now apply for U.S. Department of Agriculture (USDA) funds to assist with the cost of receiving or maintaining organic certification. Applications for the [Organic Certification Cost Share Program](#) (OCCSP) are due Nov. 1, 2021.

OCCSP provides cost-share assistance to producers and handlers of agricultural products for the costs of obtaining or maintaining organic certification under the USDA's National Organic Program. Eligible producers include any certified producers or handlers who have paid organic certification fees to a USDA-accredited certifying agent during the 2021 and any subsequent program year. Producers can be reimbursed for expenses made between Oct. 1, 2020 and Sept. 30, 2021 including application fees, inspection costs, fees related to equivalency agreement and arrangement requirements, travel expenses for inspectors, user fees, sales assessments and postage.

Organic farmers and ranchers may apply through an FSA county office or a participating state agency.

## EVENTS

### [ECONOMICS OF WINTER SPINACH PRODUCTION: THREE CASE STUDIES](#)

**When:** Wednesday, September 1, 12-1 pm

**Where:** Zoom

**Registration:** <https://forms.gle/Q89UMus1kWMV2XBq8>

Last winter, the UMass Extension Vegetable Program followed three farms through their winter high tunnel spinach production process, to collect examples of the range of systems of New England winter greens growing. Each farm provided detailed records of spinach inputs, labor, yield, and sales from one high tunnel in order to create an enterprise budget. At this lunchtime Zoom presentation, we will summarize our findings and compare a few key pieces of data from the enterprise budgets. Ryan Karb of Many Hands Farm Corps and Danya Teitelbaum of Queens Greens will join us to answer questions about spinach production on their farms. Join us to hear about these case studies and start thinking about your own winter spinach production goals, techniques, and bottom-lines!

**Questions?** Contact Genevieve Higgins, [ghiggins@umass.edu](mailto:ghiggins@umass.edu)

## WEBINAR: SPOTTED LANTERNFLY TRAPPING UPDATE

**When:** Tuesday, August 31, 2021, 10-11:30AM

**Where:** Online

**Registration:** <https://register.gotowebinar.com/register/310308986140432140>

Join UMass Extension for this free grant-supported webinar for an update on the invasive spotted lanternfly (*Lycorma delicatula*; SLF) as well as trapping research and monitoring efforts from:

- Dr. Joseph Elkington and Dr. Jeremy Anderson, UMass Dept. of Environmental Conservation



- Dr. Miriam Cooperband, Forest Pest Methods Laboratory USDA-APHIS-PPQ-CPHST
- Tawny Sinisky, UMass Extension's Landscape, Nursery and Urban Forestry Program Entomologist
- Dr. Jaime Piñero, UMas Extension's Fruit Program and the Stockbridge School of Agriculture

Landscapers, arborists, grounds managers, foresters, urban foresters, orchardists, fruit growers, and many other land managers and professionals are encouraged to attend this free update that is open to anyone interested in attending! Please note: while participants from anywhere are invited to attend, much of the material presented will be specific to Massachusetts and New England.

*1 pesticide contact hour for categories 25, 27, 29, 35, 36, 48, and Applicator's (Core) Licenses available.*

*This free webinar is made possible by funding support from the UMass Center for Agriculture, Food, and the Environment's Integrated Research and Extension grant program.*

## **SUCCESSFUL VALUE ADDED FOOD PRODUCT DEVELOPMENT: MANAGING FOOD QUALITY AND SAFETY**

Are you an entrepreneur developing new and exciting products? Do you have questions about ensuring the safety of your product? If so, this is the program for you! This course is a program designed specifically to address product development and food safety issues faced by small processors. Throughout the course, we will introduce the food science basics, important considerations when developing a new food product, share key elements required for product labeling, and provide an overview of key regulatory requirements for small and emerging food businesses, such as entrepreneurs and local food processors.

### **Upcoming Sessions:**

- [Successful Food Product Development for New Food Businesses: Managing Food Quality & Safety- NFU and UoA](#): Tuesday, August 31, Wednesday, September 1, and Thursday, September 2, 10am-2pm

## **UVM EXTENSION AG ENGINEERING: VIRTUAL SCRUB TWILIGHT MEETINGS**

The UVM Extension Ag Engineering Program is holding a series of virtual twilight meetings on a range of postharvest efficiencies and best practices. See the series page, [here](#), for details about each session and registration links.

**When:** Wednesdays, September 1 - October 6, 6:30-8pm

**Where:** online

**Registration:** <https://blog.uvm.edu/cwcallah/scrub-events/>

### **Session Dates and Topics:**

- September 1: Bin Blitz
- September 8: Doing more with less (Low cost, high value)
- September 15: Wash/Pack Floors
- September 22: Wash Water Management
- September 29: Tools for Employee Management and Empowerment
- October 6: Bubblers/Aerators for Greens Washing

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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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