UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

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In this issue:

They're finally pulling in bucket loads of tomatoes on this farm in Middlesex Co, MA. Photo, K. Campbell-Nelson

Crop conditions

Now is the time for bulk harvests; more and more are going to wholesale markets in MA. We are seeing bulk winter squash, potato, onion, tomato, cabbage, pepper, and the beginnings of sweet potato. Our cool late summer temperatures have been helpful for bringing field crops down to storage temperature with minimal energy usage. Growers note that in the era of the Food Safety Modernization Act (FSMA), wholesale buyers have gotten fussier. Some buyers are requiring produce to be delivered at 40°F, which means that growers will need refrigerated trucks in order to deliver. For tomatoes, this is problematic since they are sensitive to chilling injury at temperatures below 50°F if held for longer than 2 weeks or 41°F for longer than 6-8 days. If you have a good relationship with your buyers, consider educating them on postharvest quality of produce. Here is an excellent resource from the University of California Davis Postharvest Technology program: http://postharvest.ucdavis.edu/Commodity_Resources/Fact_Sheets/. Another tip on wholesaling comes from a cabbage grower: Rather than selling cabbages 'naked', buyers want the cabbage with a few extra leaves still on so that they can clean it up for the produce section in the grocery store later. A box of cabbage should contain 14-18 cabbages and weigh about 50 lbs. By the way, 50 lb cartons of red and green cabbage are selling at the Boston Terminal Market for $18, which is $4-6 more than the same product coming from NY or Canada. Perhaps buyers are recognizing the higher quality of local produce? Meanwhile, Massachusetts tomatoes are selling for similar prices compared to international tomatoes. Loose, light-red, vine-ripened tomatoes are selling for $1.60/lb; organic greenhouse tomatoes from Canada are also selling for $1.60/lb. However, MA heirlooms are selling for about $3.00/lb. There seems to be a glut of tomatoes in the market and if you can keep diseases out of your heirlooms, they seem to be lucrative. Fascinated by this pricing information? Follow trends on the USDA Agricultural Marketing Service website for terminal market prices of specialty crops in many cities including Boston.

Don't miss the two UMass educational programs coming up in September! See the results of this year's vegetable research trials next Tuesday at the UMass Research Farm (3 pesticide credits available). At the end of the month, join us to talk about wash and pack area design and maintenance. See the Events section at the end of this issue for details.

Pest alerts

Bean

Bean anthracnose is widespread in a bean crop in Worcester Co., MA. Favored by temperatures ranging from 60-75°F and 92% relative humidity, it is no surprise that this disease has proliferated this late summer with cool temperatures and dewy nights. Rotate with non-legume crops for 2-3 years. Promptly incorporate crop debris after harvest to hasten decomposition.

Bean Anthracnose. Photo, S. Scheufele

Mexican bean beetle: Second generation adults are being found in a field scouted in Worcester Co., MA. Despite one release of a biological control, the parasitic wasp *Pediobius foveolatus,* only one larva was found parasitized. There are still larvae in the field and the grower is considering a second release of wasps in an attempt to reduce the over-wintering population.

Beets, Chard, Spinach:

Leafminer eggs were found in chard in Washington Co., RI. We haven't seen this pest since early summer, but be on the lookout in fall spinach and chard. This pest has 3-4 generations per season before overwintering as pupae. Treat when eggs are first seen. Once the larvae tunnel into the leaf, contact insecticides are not effective.

Brassica:

Brassica downy mildew continues to infect a crop of cabbage in a research trial in Franklin Co., MA despite treatment with conventional materials targeting oomycetes (Ranman). See article this issue on brassica diseases for management tips.

Cabbage root maggot: Despite cool weather favorable to root maggot, according to the NEWA pest model we are past the 4th generation flight and maggots should be pupating now to re-emerge next year: http://newa.cornell.edu/index.php?page=cabbage-magot

Cucurbits:

Cucurbit downy mildew is now confirmed on pumpkin in RI and likely in Worcester Co., MA. Symptoms between different cucurbits can vary widely, but the end result—premature death of foliage—is similar among cucurbits. See this table from Cornell for materials if you are interested in keeping pumpkin foliage hanging on a little longer.

Anthracnose on cucumber. Photo, S. Scheufele

Anthracnose was confirmed on cucumber in Franklin and Middlesex Cos., MA. It can be spread by cucumber beetle feeding, as well as by splashing water, workers, and equipment. In the future, consider growing cultivars with resistance to the common races of anthracnose. Rotate away from cucurbits for 2 years. Fruit can be immersed in clean and fresh water containing a labeled sanitizer product, such as Sanidate or Tsunami, to avoid lesions developing after harvest. See product labels for use rates.

Tomato:

Bacterial Speck caused by *Pseudomonas syringae* pv. *tomato* was confirmed in Middlesex Co., MA on Red Bounty tomato foliage. In this case, the disease was only present on plants beneath the tree line in a 3-acre field. In a field like this, harvest the affected areas last and avoid harvesting when foliage is wet to avoid spreading symptoms to fruit. This disease DOES NOT affect peppers, so don't treat peppers. In general, bacterial diseases of field crops are difficult to control with pesticides; copper/mancozeb solutions are most effective.

Bacterial speck on several varieties of tomato. Photo, L. McKeag

Amaranth / Callaloo:

Pigweed flea beetle: This pest has been found damaging the minor crops pigweed (in CT) and amaranth (in RI). It can also be a pest in beets, chard and spinach. It looks similar to the three-lined potato beetle.

Leafminer: This is a different species than beet or spinach leafnminer. Eggs are laid directly under the leaf surface, and larvae are smaller and create thinner tunnels.

Leafminer tunnels on amaranth. Photo, S. Scheufele

Pepper:

Bacterial spot on pepper. Photo, UMass Vegetable Program

Bacterial Leaf Spot caused by *Xanthomonas campestris* pv. *vesicatora* (Xcv) was confirmed on St. Nick peppers in Middlesex Co., MA. This disease causes spots on both foliage and fruit of pepper and tomato. One infested seed in 10,000 may easily result in 100% diseased plants in the field under favorable conditions. Therefore, hot water seed treatment is recommended. Apply appropriate bactericides or combination pesticides. In general, bacterial diseases of field crops are difficult to control with pesticides; copper/mancozeb solutions are most effective.

Potato:

We published the Cornell Extension table, Fungicides Labeled for use in Potato for Early and Late Blight Management, 2017 in the July 13th issue of Veg Notes. They found an error in the potato table (the tomato table was correct). Find the corrected table here: https://ag.umass.edu/sites/ag.umass.edu/files/potato_fungicide_table_for_lb_and_eb_corrected_version_aug_2017.pdf.

Sweetcorn (see Table 1):

Corn earworm: Trap captures are lower this week. Temperatures have dropped below 80°F, which means that caterpillar life cycles have slowed down. Spray intervals have therefore been extended by 1 day. CEW eggs hatch in 2.5-6 days depending on the weather.

Fall armyworm is an increasing problem for late summer sweet corn and many growers are not trapping for this pest so they do not know if they are at risk or not. This week we captured 150 FAW moths in our trap in South Deerfield! The research corn is not treated and nearly 100% of the ears being harvested now are infested with CEW or FAW. Control programs for this pest need to begin at tassel; waiting until silking is too late for both ECB and FAW. With ECB numbers very low, growers may be depending on CEW trap captures to make spray decisions, when, in fact, FAW may be the main culprit! FAW eggs hatch in 2-10 days depending on temperature (taking longer when it is cooler).

European corn borer trap captures are virtually zero in most locations.

Table 1. Sweetcorn pest trap captures for 8.24.17-8.31.17

Location	ECB	FAW	CEW	Spray Interval for CEW*
Western, MA				
South Deerfield	0	150!	3	*7 days*
Sheffield	1	-	-	-
Whately	1	-	8	*5 days*
Central, MA				
Leominster	0	-	12	*5 days*
Lancaster	4	0	9	*5 days*
Northbridge	0	6	32	*5 days*
Eastern, MA				
Ipswich	0	0	22	*5 days*
Dover	2	-	8	*5 days*
Millis	1	-	38	*5 days*
Sharon	0	-	0	*No spray*
Swansea	0	-	40	*5 days*
NH				
Litchfield	0	30	46	*5 days*
Hollis	0	15	8	*5 days*
Mason	0	0	18	*5 days*
Washington County, NY	0	1	-	No spray

European corn borer (ECB), Fall armyworm (FAW), Corn earworm (CEW)
***Spray intervals have been increased by one day because temperatures have been below 80°F and caterpillar development has slowed down.**

FALL DISEASES OF BRASSICAS

Fall, with its cooler temperatures and dewy mornings, is the time when diseases of brassicas can quickly take off and reduce yield and quality. There are a few major diseases of brassicas which share much in common—they all can be seed-borne, they all can survive in crop residues in soil for about two years, they are spread by wind and splashing water and insects like flea beetles, and are favored by moist conditions. This means that the following preventive, cultural practices will go a long way in reducing the impacts of all of the diseases described in this article.

- **Start with disease free seedlings.** All of these diseases are commonly introduced on infested **seed**. Either talk to your supplier to be sure the seed has been tested or, better yet, **hot water treat** your seed to eradicate bacteria, fungi, and oomycetes that may be present (you can do this at home with some simple equipment, or use the UMass Hot

Water Seed Treatment service). Avoid overwatering and encourage air flow through greenhouses. Monitor transplants in the **greenhouse** and remove any symptomatic plants.

- **Plant into a clean field.** That means **rotate** out of brassicas (including **weeds** like shepherd's purse, wild radish, field pennycress, etc.) for 2-4 years. Any amount of rotation you can do will help and the further the better, as these diseases can be dispersed by wind and insect feeding. Chopping and burying infested **residue** quickly after harvest will shorten the period of time the organisms persist in the soil. For example, avoid leaving diseased Brussels sprouts stalks standing in the field through the winter; mowing them is better than nothing if you can't disk them in. Manage **cull piles** well so that they do not become sources of inoculum.

Brussels sprouts stripped of lower leaves to improve airflow around plants and reduce leaf wetness.

- **Reduce leaf wetness.** All of these diseases require moisture to grow and spread. Increase **plant spacing** so plants will dry off more quickly and so the pathogens can't as easily spread from plant to plant. If overhead irrigation is necessary, or when **watering** in the greenhouse, water on a sunny day when leaves will dry quickly.
- **Control insects and remove weeds.** Flea beetles can move fungal spores and bacteria from plant to plant and field to field. A study showed that spores of *Alternaria brassicicola* occur on their bodies, in their mouths, and in their feces, and that **flea beetles** actually concentrate Alternaria spores in their mouthparts when they clean their antennae. The insects move from plant to plant, basically injecting spores and bacteria into wounds they create through their feeding. Therefore, reducing flea beetle pressure will also reduce the spread of diseases through the field. Similarly, cruciferous **weeds** can harbor diseases and act as bridges between fields and between seasons. Weeds also crowd the crop, increasing moisture and leaf wetness in the row making the environment around the plant more conducive to disease.

Chemical control. There are many effective pesticides to control these diseases; please see the New England Vegetable Management Guide for chemical recommendations. Copper products and plant defense activators like Actigard or Regalia are the best choices for managing black rot. Avoid using excessive pressure when spraying for black rot as this can very efficiently spread the bacteria throughout the planting and can cause abrasions and wounds through which the bacteria can enter the plant—use only enough pressure to get good coverage. OMRI approved fungicides have not shown good efficacy for other diseases but many copper products, plant defense activators like Regalia, and other biopesticides are labeled for downy mildew, black rot, and alternaria—check labels.

Black rot on cabbage.

Black Rot is one of the most devastating diseases of brassica crops, and can result in high losses of yield and quality. The bacterium, *Xanthomonas campestris* pv. *campestris*, plugs the water-conducting tissue of the plant with xanthan, a mucilaginous sugar causing chlorosis (yellowing) and wilt. Seedlings are commonly affected but symptoms can appear at any growth stage or an infected plant may appear symptomless. The most common and characteristic symptom is a yellow, V-shaped lesion that extends from the leaf margin toward the base of the leaf, caused by bacteria entering through guttation droplets that form at the hydathodes. Lesions can also occur mid-leaf, as darkened dead patches of tissue between the veins, where wounding from insect feeding, hail, or mechanical injury has occurred. The pathogen may move into the plant vasculature; infected veins turn black as they are plugged with xanthan, and the normal flow of water and nutrients is impeded. Blackened veins may also appear in root crops like rutabagas even though foliar symptoms may not be present. On heading crops, infection may spread into the leaves of the head and is often followed by invasion by soft-rotting organisms.

Black rot is commonly transmitted by seed, and a seed lot with as little as 0.03% infected seed can cause an epidemic. The bacteria can persist in infected plant debris for up to two years, but can only survive for 40-60 days in the soil in the absence of host tissue. Disease development is favored by warm, wet weather and is spread within the field by splashing

water, wind, equipment, workers, and by insects such as through flea beetle feeding. *X. campestris* pv. *campestris* can be spread long distances or introduced into new areas by infested seeds and transplants.

Alternaria leaf spot is a fungal disease that affects all cultivated brassicas, causing small black spots that grow into large lesions with characteristic concentric rings on leaves, stems and heads. The disease can be caused by several fungi in the genus *Alternaria*, but the most damaging species in the production of vegetable brassicas are *A. brassicae* and *A. brassicicola*. Disease development is favored by cool temperatures and long periods of leaf wetness or high relative humidity, and Alternaria leaf spot can be a limiting factor in the production of vegetable and seed crops in regions where these conditions are common. Infection can cause reduction in crop quality and yield through damage to seeds, seedlings, leaves, and heads, and can also spread during storage of vegetable crops like cabbage. Brussels sprouts can be rendered unmarketable by numerous small spots on the buds. Brown, sunken spots on heads of broccoli and cauliflower can make those crops unmarketable. The disease can spread in storage so management is especially important for cabbage and other storage crops and crops should be inspected for early symptoms before storing. In New England, as cultivation of a wide range of brassica crops and a longer growing season through season extension has increased in recent years, this disease has become more severe and is causing more losses, especially in fall crops.

Alternaria leaf spots on Brussels sprout leaf (left) and sprout (right)

The initial symptoms of Alternaria leaf spot are small black dots surrounded by chlorotic haloes. As the disease progresses lesions expand into characteristic, dark brown to black circular leaf spots with target-like concentric rings. The centers of lesions often turn brown and crack or fall out, giving the leaf spots a shot-hole appearance. Individual spots coalesce into large necrotic areas and leaf drop can occur. Lesions can occur on petioles, stems, flowers, flower pedicels, and seed pods. Pod infection causes distortion, premature shattering, and shriveled, diseased seed that germinate poorly.

Alternaria species overwinter primarily in diseased crop debris. Lignin-rich stalk tissues can persist in the soil for over two years, and the fungi can remain active on that tissue as long as it is present. Disease development is favored by temperatures of 60-78° F and 12 hours of relative humidity of 90% or more. The main means of introduction into new areas is on infested seed. However, spread from one infected crop into nearby crops occurs easily once the disease is established on a farm. The fungi sporulate profusely and are spread throughout fields by wind, splashing water, equipment, and workers.

In 2009, a Brussels sprout variety trial was conducted by the UMass Vegetable IPM Program. Seven varieties were evaluated—Vancouver, Franklin, Nautica, Diablo, Dimitri, Roodnerf and Oliver. Among these varieties, Oliver and Franklin showed significantly more disease damage from Alternaria leaf spot than the other cultivars. There are many fungicides with efficacy against Alternaria leaf spot including Quadris, Endura, and Bravo among others—please see the New England Vegetable Management Guide for recommendations. Research on the efficacy of biological fungicides (eg. Serenade, Sonata, and Actinovate, etc.) to control Alternaria in cabbage is ongoing at the UMass Research Farm, look for those results over the winter.

Brassica downy mildew on broccoli leaf.

Downy mildew caused by the fungus *Hyaloperonospora parasitca*, is an important disease of broccoli, collards, kale, cabbage, cauliflower and Brussels sprouts, as well as root crops such as rutabaga, turnip and radish. There are many downy mildews, seemingly every crop has one, but they are all unique and very host specific—if you have cucurbit downy mildew you don't need to worry about it infecting your brassicas, or the other way around. Disease development is favored by cool, moist conditions caused by rain, heavy dew, or fog. Infection can occur at any stage of growth. On seedlings, slighty yellow patches appear before whole leaves and cotyledons turn yellow and drop. Early

infections can also be symptomless until seedlings are transplanted to the field and conditions become favorable. Irregular, angular yellow to brown spots develop on both the top and bottom of the leaf and a characteristic grayish-white, fluffy growth on the undersides of leaves appears. In the floral parts of broccoli or cauliflower, dark brown areas develop internally in curds or floral buds of the head. Stems and stalks of the flower head may be darkened or have black streaks, and this may be the first sign of infection in broccoli. In cabbage, internal darkening and purplish spots appear in the inner layers of the head or move upward in the head from stem infections. The disease can spread in storage and infected plants are susceptible to secondary infection with soft rot bacteria, resulting in a stinky puddle of rotten cabbage.

Unlike other downy mildews that blow in from afar each year, *Hyaloperonospora parasitica* can survive from season to season as thick-walled resting spores, called oospores, in the soil or crop debris. These sexual spores can survive in the soil for extended periods and produce infectious sporangia when conditions are moist and cool, especially at night. Other sources of initial inoculum are infested seeds, or cruciferous weed hosts. Disease development is favored by abundant moisture on leaves provided by dew, drizzling rain, or heavy fog, and by temperatures of 50-60°F. Sporulation, germination, and reinfection can occur in four to five days. Sporangia (secondary, asexual spores) are spread throughout the field by wind, splashing rain, and by feeding insects. This disease commonly infects plants early on but shows no symptoms until environmental conditions become favorable and suddenly all the plants begin to show symptoms later in the season. Resistant or tolerant varieties of broccoli have been developed; our sources list Marathon and Arcadia among these.

Blackleg (*Phoma lingam*) causes a leaf spot and a stem canker on many cruciferous crops, especially cauliflower, broccoli, and turnip. Rutabaga, radish, and mustard cultivars are only slightly susceptible. This disease can spread rapidly within a field. Initial symptoms are small lesions on stems at cotyledon stage which elongate, turn brown with a black to purplish border, and become sunken. The lesion extends up and down the stem, the stem becomes girdled and blackened, with many fruiting bodies (pycnidia) embedded in the tissue. Lesions may extend below the soil and attack roots. Diseased plants often wilt, lodge, and die. On root crops, symptoms occur in the form of cankers on the fleshy roots and a dry rot may appear in storage.

Phoma on cabbage leaf.
Photo, C. Ocamb from pnwhandbook.org

Phoma lingam is a fungus which can survive for up to four years in seed and three years in infected crop debris. Plants can become infected at the seedling stage or at any stage in the field. The initial source is probably infected seed. The disease spreads by spores which are exuded from pycnidia in long coils and are splashed to nearby plants to initiate new infections. The disease is favored by wet conditions, though it may get an early start on seedlings in the greenhouse and cause problems even in dry, sandy fields. The disease has become less important in brassica crops because of successful disease management strategies in seed production. Once present on the farm, management should focus on avoiding spread of the disease by rogueing out affect plants and reducing soil moisture.

--by Susan Scheufele, UMass Vegetable Program

FALL COVER CROPS

A well-established late season cover crop increases organic matter, improves soil structure, scavenges remaining nutrients, chokes out weeds, and prevents soil erosion. Each cover crop species has strengths and weaknesses. Previously titled “Late Summer Cover Crops”, we have noticed that fall temperatures remain warmer longer allowing cover crops to establish, so we re-named this article “Fall Cover Crops”. Play with seeding dates on your farm this year; hopefully you will succeed in getting some ground cover. Below is a list of several good choices for this time of year, depending on your specific goals and field conditions.

Grasses can reduce erosion and return a significant portion of organic matter and other nutrients to the soil if planted after removal of a seasonal crop and given enough time to mature. Kill grasses before maturity in the spring to ensure efficient decomposition. Mix grass species with a legume to reduce the C:N ratio and supply more nitrogen for the following year’s crop.

Annual or Italian Ryegrass (*Lolium multiflorum*) and Perennial Ryegrass (*Lolium perenne*) are gaining popularity by some growers as commercial varieties such as Fria Annual Rye are becoming more available. Annual and perennial ryegrass have dense root systems that outcompete weeds and protect against erosion, and they are easy to incorporate in the spring.Annual ryegrass can tolerate some flooding. Perennial ryegrass is more cold-hardy but also harder to kill if it goes to seed. Both are shade tolerant though they may not germinate very well under droughty conditions. These cover crops should be planted 6-8 weeks before the fall frost date. The seed is small and light, so specialized equipment such as a Brillion seeder will be needed if seeding a large area. **Seeding rate:** 20-30 lbs/A broadcast; 10-20 lbs/A drilled; 8-15 lbs/A mixed with a legume.

Winter or Cereal Rye (*Secale cereale*) is the most common cover crop used by growers in Massachusetts. It is inexpensive, easy to get and to establish, and can be seeded until 2 weeks before a killing frost. However, it is best planted before September 15th in order to recover the available N from soil and to produce enough canopy to protect soil from erosion and outcompete weeds. It consistently overwinters here and will continue to grow in the spring, producing up to 7,000 lbs/A of biomass contributing to soil organic matter. It should be seeded with a legume to keep the C:N ratio low, making more N available in the spring. Some growers are hesitant to use this cover crop because of the longer decomposition rate and allelopathic effects on direct seeded spring crops. **Seeding rate:** 90-120 lbs/A broadcast; 60-120 lbs/A drilled; 50-60 lbs/A mixed with a legume.

Winter Wheat (*Triticum aestivum*) is increasingly being used as a cereal grain and as a cover crop. It is winter hardy, but does not grow as tall or mature as quickly as rye so there is no rush to kill it in early spring and risk compacting wet soils. Wheat is excellent for erosion control, scavenging N, P and K, building soil organic matter and improving tilth. For best results, plant it in late summer to early fall, before September 15th. Best growth will be in well-drained soils with moderate fertility. Rye is a better choice on wet soils. Wheat works well as a nurse crop for legumes such as hairy vetch, clover, or peas. **Seeding rate:** 90-160 lbs/A broadcast; 60-120 lbs/A drilled; 60-90 lbs/A mixed with a legume.

Triticale *(x Triticosecale)* is a hybrid between wheat and rye. It can be seeded as early as August and can produce more fall growth than winter wheat, providing more weed suppression and erosion control. **Seeding rate:** 90-100 lbs/A broadcast; 75-80 lbs/A drilled; 60-90 lbs/A mixed with a legume.

Oats (*Avena sativa*) can be seeded in the late summer; it is best planted before September 15th, similar to winter rye. This cover crop comes up very quickly. Unlike winter rye, oats will winterkill in Massachusetts, making for simpler field preparation in the spring, however, with less organic matter contribution and weed control. To maximize nitrogen carry-over to the following crop, mix with a legume that will overwinter such as hairy vetch. **Seeding rate:** 110 – 140 lbs/A broadcast; 80-110 lbs/A drilled; 60-90 lbs/A mixed with a legume.

Legumes are a good choice if you are interested in adding nitrogen to the soil, however, it is important to inoculate seed before planting with the appropriate root-nodulating bacteria that will fix nitrogen from the air. Some growers use Coca-Cola or sugar water to help the inoculum stick to the seed and plant while still wet to keep the bacteria alive. Bacterial inoculants are specific to certain legumes and therefore must be used with the correct plant groups in order to establish. If well managed, legume cover crops can provide as much as 100 to 150 lbs nitrogen per acre to the following crop. Imagine the fertilizer cost savings!

Hairy Vetch (*Vicia villosa*) usually benefits from being grown with a nurse crop such as rye, oats or wheat to help reduce matting during spring and to keep weeds down. Both the vetch and the grain can be mixed together in the seed drill or broadcast. Adding vetch to a cover retains more soil moisture than a grass planted alone. In the spring, vetch is incorporated at early bloom, typically in late May. If the vetch is planted in late July or early August, it is less likely to survive the winter, which can be a good thing if you've ever struggled with self-seeded vetch. With a good flail mower, vetch can be used in a reduced tillage system without matting and tangling in the equipment. **Seeding rate:** 25-40 lbs/A broadcast; 15-40 lbs/A drilled, 15-20 lbs/A mixed with a grass.

Red Clover (***Trifolium pratense***) is a short-lived perennial that is somewhat tolerant of soil acidity and poor drainage. Mammoth red clover produces more biomass for plow-down than medium red clover, but does not regrow as well after mowing. Mammoth will often establish better than medium red clover in dry or acid soils. Sow in early spring or late summer. Red clover can be undersown in mid-summer into corn or winter squash before it vines, and into other crops such as fall brassicas if soil moisture is plentiful. **Seeding rate:** 10-15 lbs/A broadcast; 6-15 lbs/A drilled; 6-10 lbs/A mixed with a grass.

Crimson Clover *(Trifolium incarnatum)* grown as a winter annual should be seeded early August to early September in New England; seed it too early and it will make seeds in the fall and be unable to re-grow until spring soils warm up. While it grows well in dry conditions if already established, it may have trouble germinating. This clover is a better fall weed suppressor than hairy vetch. This crop is easily killed by incorporation or even rolling or mowing at late bloom stage for no-till situations in the spring. **Seeding rate:** 22-30 lbs/A (15-20 lbs/A in a mixture) broadcast; 15-18 lb/A (10-12 lbs/A in a mixture) drilled.

Field Pea (*Pisum sativum* subsp. *arvense),* also known as Austrian winter peas (black peas) or Canadian field peas (spring peas), should be planted mid-August to mid-September in much of New England. These peas fix nitrogen more quickly in dry conditions than white clover, crimson clover, or hairy vetch. Field peas are susceptible to *Sclerotinia* so don't plant them in a field with a history of white mold. Drill or incorporate seed 1-3 inches to ensure good soil moisture contact. **Seeding rate:** 80-120 lbs/A broadcast; 75-100 lbs/A drilled; 60-80 lbs/A in a mix.

Brassicas may be used as cover crops for pest management or in the case of the forage radish, for improving water drainage and soil structure. Mustards should not be planted successionally with any brassica crops since they are in the same family, and are susceptible to the same pests.

Radish (*Raphanus sativus*), specifically daikon/tillage radish/forage radish/oilseed, is an appropriate biological subsoiler, often producing 8-14 inch tap roots. With its deep roots, this cover crop can recover N, P, S, Ca and B for the following season, but a cash crop must be planted early in the spring or else these nutrients are lost through fast decomposition and the deep root holes. Best planted in late August, this cover crop typically winterkills in November or December. A unique no-till strategy with forage radish includes seeding it in the late summer along with cover crop mixtures on 6 ft. centered beds, then in the spring, place transplant plugs directly in the holes where the radishes grew. Read more about this method of planting in this SARE funded grant titled: Evaluating no-till and biological strip-till methods for commercial seedless watermelon production. This cover crop releases most of its harvested N by May, unless seeded with a grass such as oats. Higher seeding rates are effective for weed management, while lower seeding rates are better for breaking compaction. See photo at right. **Seeding rate:** 10-13 lbs/A broadcast; 7-10lbs/A drilled; 5-8 lbs/A in a mixture.

In one trial, a grower planted a mixture of 6lbs/A Fria rye, 4lbs/A crimson clover and 10lbs/A radish (2). The radish is a highly effective weed killer when seeded at this rate and smothered out the other 2 cover crops including weeds entirely! Adjacent Fria rye and crimson clover seeded alone survived the winter just fine (4). Compare this treatment to 70lbs/A winter rye and 25lbs/A vetch (1) and no cover crop (3)(see the weeds!?). Photo taken on 4/21/2017.

Brown Mustard (*Brassica juncea*) found in many of the 'Caliente' seed mixes is a biofumigant planted to combat root knot nematode and a variety of soil-borne fungal pathogens including Fusarium, Verticillium, Rhizoctonia, Pythium and *Phytophthora capsici*. It is also allelopathic against weeds. If allowed to flower, this crop is highly attractive to honey bees. Successful biofumigation with this cover crop is achieved by following these steps: 1) Apply adequate fertility (50 lbs N/A and 20 lbs S/A); 2) Allow it to flower before incorporation; 3) Mow, disc or rototill under, and roll or pack the soil immediately; 4) Add irrigation to enhance fumigation or incorporate before rain. Plant this in late August through September. Other brassica cover crops include rapeseed or canola and turnips, which are often used as livestock forage. **Seeding rate:** 10-15lbs/A broadcast; 8-12 lbs/A drilled.

Keep in mind it is always best to plant a cover crop, as leaving a field bare over winter is very damaging to soil structure, increasing erosion and reducing long term fertility. Though it may take several growing seasons or a lifetime to perfect the art of cover cropping, your soil will thank you.

Cover Crop Resources:

- ***A Comprehensive Guide to Cover Crop Species used in the Northeast United States.*** Prepared by: Shawna Clark. http://www.plant-materials.nrcs.usda.gov/pubs/nypmcpu10645.pdf
- ***Managing Cover Crops Profitably:* 3rd ed.** Published by the Sustainable Agriculture Network, Beltsville, MD. http://www.soilandhealth.org/03sov/0302hsted/covercropsbook.pdf
- ***Cover Crop Plant Guides*** prepared for the USDA by: NRCS, RMA and FSA. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/plantsanimals/plants/projects/?cid=stelprdb1077238
- ***Cover Crop Chart*** prepared by USDA-ARS. http://www.ars.usda.gov/Main/docs.htm?docid=20323

- Katie Campbell-Nelson adapted from work by R. Hazzard & F. Mangan, UMass; Vern Grubinger , UVM and Thomas Bjorkman, CU. Resources: Managing Cover Crops Profitably, 3rd edition, published by Sustainable Agriculture Network; New England Vegetable Management Guide (www.nevegetable.org). Thanks to Julie Fine Stockbridge School of Agriculture for review, 2016.

Sweet Potato Harvest & Storage

While it's still only August (for another few hours), all these nights in the 40s over the past two weeks have got us thinking about sweet potatoes, among other fall crops. Research done by our Extension colleague, Becky Sideman at UNH, has shown that sweet potatoes should be dug as late as possible in the fall to maximize yields, though harvests may be starting now for early markets. The sweet potato's harvest and storage needs differ from other common New England root crops. Once harvest is completed—generally by early to mid-October—curing and storage issues continue to be important.

Sweet potato roots continue to grow until the leaves are killed by frost or until soil temperatures fall consistently below 65°F, whichever comes first. Time of harvest is often determined by digging up a few representative plants and determining the percentage of roots in different size classes. The crop can be harvested whenever the majority of the roots are the desired size. When tops of the plants turn black after the first frost, it is imperative to harvest as quickly as possible regardless of root size. Chilling injury can occur in the soil, if soil temperatures drop to 55°F or below. It is also important to avoid holding sweet potatoes in saturated, low-oxygen soil conditions prior to harvest, because this promotes rapid decay in storage.

Sweet potatoes are very susceptible to damage at harvest. Sweet potato roots do not have a thick protective outer layer of cells such as that on white potato tubers. Abrasions and wounds can lead to rots in storage.

Curing immediately after harvest is recommended when sweet potatoes will be held in storage for retail or wholesale sales. Curing minimizes damage and loss during storage by healing harvest wounds. To cure, maintain roots in temperatures between 80°F to 86°F and a high relative humidity (85-95% RH) for 4 to 7 days. Respiration rate is high during curing, so ventilation is important to remove CO_2 and replenish O_2. This forms a corky periderm layer below the damaged areas which limits microbial invasion and water loss. A greenhouse can provide good curing conditions.

A freshly harvested sweet potato is more starchy than it is sweet. During curing and storage, starches in the sweet potato are converted to sugars, improving flavor. The change in sugars is measurable within one week, but it is recommended to wait at least three weeks after harvest before consuming sweet potatoes to permit the starches to convert to sugars for maximum eating quality.

Sweet potatoes can maintain excellent quality for up to a year in proper storage conditions. The ideal storage conditions for sweet potato are the same as for winter squash; moderately warm (55-60°F) at 60-75% relative humidity. Like winter squash, sweet potato suffers chilling injury at temperatures below 55°F and grows more severe at lower temperatures or longer periods of exposure. Signs of chilling injury include shriveling, sunken, dark areas on the tuber surface, and blackening of tubers when cut open. 'Hardcore' is a physiological disorder cause by chilling, in which areas of the tuber

become hard – but this condition only appears after cooking. Because chilling injury is irreversible and makes tubers unmarketable, growers should take particular care to avoid field, curing, or storage conditions that dip below 55°F.

Yield studies were conducted for several years by Becky Sideman at University of New Hampshire. Best yields were found in Beauregard, Covington and O'Henry (a white-fleshed variety). A good yield was 2.5 lbs per plant; equivalent to >65 lbs per 20 row-feet, assuming 9 inch spacing between plants in a single row.

Tuber damage from wireworms can occur during the growing season and reduce marketability. More work needs to be done to understand which species is causing the damage, but likely candidates are corn wireworm (*Malanotus communis*) or wheat wireworm (*Agriotis mancus*). Both feed on roots, stems, stolons and tubers and are pests of potato, sweet potato, other non-root vegetables crops, and grains such as wheat and oat as well as sod and grassy cover crops such as Sudangrass. Adults are most active in spring (April-June). Eggs are laid in soil and larvae feed and develop for 2, 3 or 4 years. They can survive periods without food—essentially waiting for new crops to come along. Corn wireworm adults may be especially attracted to grassy cover crops such as Sudan thus keeping fields free of those during peak egg laying is advisable. It is difficult to trace the history and cause of wireworm damage, because it is often 2-4 years after eggs are laid before the damage becomes noticeable or serious. Damage is likely to be worst when larvae are nearly full grown. There are baiting methods to sample for larvae before planting. Corn wireworm larvae are also favored by wet soil conditions thus damage may be heavier in wet areas.

Voles love sweet potatoes and can take up residence in the sweet potato field, causing significant damage. Voles may be deterred by a clean cultivated border around the planting, and keeping nearby areas weed-free or well mowed to minimize good hiding areas. Timely harvest may reduce the level of damage. Watch storage for vole activity after harvest.

Reports on Becky Sideman's sweet potato work can be found at: http://www.mofga.org/Publications/MaineOrganicFarmerGardener/Spring2009/SweetPotatoes/tabid/1081/Default.aspx and in the related fact sheet, *Growing Sweet Potatoes in New Hampshire*.

- adapted by R. Hazzard from the Sweet Potato section of the New England Vegetable Management Guide, nevegetable.org; articles by Becky Sideman, UNH Cooperative Extension; wireworm information from J. Capinera Handbook of Vegetable Pests.

Events

Twilight Meeting: UMass Vegetable Program's Research Tour and Pest Roundtable

When: Tuesday September 5th, 2017, from 4 pm to 7 pm

Where: UMass Crop Research and Education Center, 91 River Rd. Deerfield, MA 01373

Join UMass Extension educators and specialists at the UMass Crop Research and Education Center to tour our ongoing research and participate in a roundtable discussion. Research trials include: cucurbit disease management, cabbage aphid control, and nitrogen contributions from cover crops for vegetable fertility. After a field tour, we will have a roundtable discussion with UMass Extension Specialists where you can get crop or pest management questions answered over dinner! Registration is free, but please pre-register so we can order food accordingly.

3 Pesticide credits will be available.

Co-sponsored by Sustainable Agriculture Research and Education program (SARE) and USDA - National Institute for Food and Agriculture (USDA-NIFA)

Click here to register: https://www.surveymonkey.com/r/8PY65KC

Contact: Sue Scheufele at 413-577-3976 or sscheufele@umass.edu

Twilight Meeting: Produce Wash Station Design, Use and Maintenance: Improving Efficiency & Complying with Food Safety Requirements

When: Tuesday, September 26, 2017 - 4:00pm to 6:30pm

Where: Atlas Farm, 635 River Road, Deerfield, MA 01342
(*note:* this meeting is at the main farm on River Rd, and NOT at the Atlas Farm store on Routes 5 & 10 in S. Deerfield)

A functional wash and pack area can improve both workflow and produce safety. FSMA's Produce Rule states that equipment, tools, and buildings must be of adequate design and able to be cleaned and properly maintained. We will discuss the range of options available for growers of different scales to meet these requirements. We'll tour the wash house with a recirculating washer-conveyer at Atlas Farm with owner, Gideon Porth, and hear about the design of a mobile wash station by Amanda Brown from the UMass Student Farm. We will also cover how to develop Standard Operating Procedures (SOPs) and keep sanitation records. Extension Educators will be on-hand to give input and answer questions on the following topics:

- Infrastructure upgrade decision-making – Chris Callahan, University of Vermont Extension Agricultural Engineer
- Developing useful SOPs – Amanda Kinchla, UMass Food Science Extension
- Produce safety regulations -- Lisa McKeag, UMass Extension

A light dinner will be provided.

Co-sponsored by UMass Extension and Community Involved in Sustaining Agriculture (CISA)

Click here to register: https://www.surveymonkey.com/r/8QWR52Q

Contact: Lisa McKeag at 413-577-3976 or lmckeag@umass.edu

Massachusetts No-Till Conference 2017: Dairy and Vegetables

When: Monday, October 30, 2017 - 9:00am to 3:00pm

Where: Carter and Stevens Farm, 500 West Street, Barre, MA 01005

Topics will include:

- Why no-till works! (Kate Parsons, NRCS Resource Conservationist)
- Nutrient management in No-till systems(Tom Morris, UConn Plant Science Professor)
- Pest and Disease Management for No-Till (Katie Campbell-Nelson, UMass Extension Vegetable Program)
- No-Till Planter Demo

- Cover crops
- Farmer Presentations

Sponsored by the USDA Natural Resources Conservation Service (NRCS), Massachusetts Association of Conservation Districts, and Worcester County Conservation District, UMass Extension, and Sustainable Agriculture Research and Education (SARE)

To register contact: Lisa.trotto@ma.usda.gov

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

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