UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

Volume 31, Number 6 May 9, 2019

In this issue:

Farmers scout their brassica transplants for cabbage root maggot eggs before planting them out in the field, where they were immediately covered with row cover. Photo: K. Campbell-Nelson

Crop conditions

Farming in Massachusetts with a large urban population has many advantages, one of which is great access to consumers. Seasonal roadside stands are opening up this weekend, right in time for mother's day. Other benefits include access to public infrastructure and water supplies (making it easy to comply with FSMA water testing requirements). However, sometimes farming in an urban state includes challenges. Earlier this week, the town shut off the water supply on a street where the farmer had 5 greenhouses full of starts and was suddenly scrambling to find water elsewhere plumbing it in from a portable tank to keep his transplants alive!

Otherwise, the major challenge this spring has been dealing with constant rain and clouds, waiting for soils to become dry enough to get equipment on to prepare fields for planting. With soil temperatures largely in the 50's around the state, farmers are eager to get their crops in the ground, but many areas still have standing water and soggy fields. Those able to get seeds and transplants in this week included brassicas, beets, lettuce, Swiss chard, potatoes, and onions.

Pest alerts

Ammonium Toxicity: During this cool, wet spring, we have received several reports of yellow, stunted transplants, with irregular growth and some marginal leaf burn particularly among the lower leaves. Saturated media tests submitted to the UMass Soil Lab confirmed that ammonium levels in these potting mixes were very high (500-700ppm) while the optimum range is considered to be 0-10ppm. Thanks UMass Soil Lab! Nitrogen from organic matter or fertilizers in potting mixes will rapidly convert to ammonium (NH_4^+) but when the weather is cool and soils are saturated, the aerobic bacteria needed to convert ammonium to nitrate (NO_3^-) are not active. Sterilized soils or some soilless media may lack this nitrogen converting bacteria, so fertilizer sources with nitrate such as calcium nitrate should be included. When ammonium is excessive, plants can easily take up too much, causing cell damage. Unfinished compost that is high in nitrogen sources, such as poultry litter or vegetable waste, can be high in ammonium. To reduce ammonium toxicity, increase greenhouse temperatures, allow soils to dry out between watering, pot transplants up into a new mix with more carbon sources, such as peat, and get them out in the field when conditions are favorable! P.S. ammonium toxicity can be considered a form of salt injury, which is often influenced by irrigation, so read the article in this issue about managing irrigation in high tunnels for more information.

Interveinal chlorosis can be a symptom of ammonium toxicity. Photo: G. Higgins

Cabbage root maggot has reached peak flight around the state. Track progress of this pest using the NEWA Cabbage Maggot forecast here: http://newa.cornell.edu/index.php?page=cabbage-magot. See article in the previous issue of *Vegetable Notes* for control recommendations.

Flea beetles: We have not observed flea beetles yet but we expect that they are starting to emerge right around now, and will soon be seen wherever tender young brassicas are planted. Looking for some new ideas to try this year? Check out this webinar on flea beetle biology and management from the Brassica Pest Collaborative.

TRANSPLANT HEIGHT & HARDENING OFF

--Reprinted from Plant & Pest Advisory, a Rutgers Cooperative Extension Publication

At this time of year growers are anticipating planting vegetable transplants in the field. Greenhouse and outside weather factors can contribute to transplant growth and quality, and when plants can get out into the field. Transplants may be at the perfect growth stage

to plant into the field, but if reoccurring rains prevent field preparation or the ability to get into a prepared field to plant then transplants need to be held. Holding back plants and preventing them from getting too tall can be a challenge. In some crops, plant growth regulators can be used. However, in vegetable crops there are few growth regulators labeled or that work well. One growth regulator that is registered for Solanaceous crops (tomato, pepper, eggplant, pepino and tomatillo) is Sumagic (Uniconazole-P) from Valent. However, just because a product is registered, growers should investigate if it is worth using.

Another way to control plant height that is less risky is using the DIF method (the difference between day and night temperatures in the greenhouse). In most greenhouse heating programs the greenhouse will be much hotter in the day than in the night. The greater this difference the more the plants will stretch and grow tall. By reducing this temperature difference or even by reversing it to have higher night temperatures you can greatly reduce stem elongation. The critical time period is the first 2-3 hours after sunrise. By lowering temperatures to 50-55°F for 2-3 hours starting just before dawn and then going back to 60-70°F during the day can keep plants shorter and stockier. This method does not work well for all transplants and is mainly for controlling height in tomato transplants.

Another method is mechanical movement of plants by brushing them over the tops two times a day with a pipe or wand made of a soft or smooth material. Be careful to do this gently, so not to damage softer plants like squash, cucumber and pepper. Reducing watering and fertilizer is also a method in controlling plant growth. However, be sure not to reduce water or fertilizer so much that it causes plant injury. Besides reducing growth, limiting watering and fertilizer just before planting is part of the hardening off process it is good to expose plants to lower daytime temperatures outside and wind to strengthen stems. Just be sure not to put them out in high wind situations and temperatures that are too cold and can cause damage. Placing them in an overhang area or shed may be a good idea if weather is too harsh. If the greenhouse has roll up sides or ends that can be removed to expose plants to wind and outside temperatures, hardening can take place in the greenhouse. To begin hardening transplants, reduce the amount of water used, lower temperatures and stop fertilizing plants. Starter fertilizer can be used a day or two before planting or if using a waterwheel transplanter it is best to add a soluble starter fertilizer to the tank water.

When hardening off vine crops, tomatoes, peppers, or eggplants, do not lower the temperatures for hardening more than 5°F below the recommended minimum growing temperature. Tomato, pepper, broccoli, cabbage and cauliflower are best hardened off at temperatures around 60°F. Cucumber, squash, melon, and eggplant are best hardened off at around 65 degrees Fahrenheit. Cold tolerating transplants like lettuce can be hardened off at temperatures as low as 40°F. Even though cole crops like broccoli and cauliflower survive cold temperatures, they should not be hardened right away to cold temperatures after leaving the greenhouse to prevent bolting and buttoning of the crop later during head formation.

UMASS WINTER SPINACH VARIETY TRIAL

Spinach downy mildew has been present in spinach-producing parts of the world since the 1800s. More recently, with the increasing demand for bagged spinach greens, this disease has become increasingly important. Outbreaks of spinach downy mildew have occurred in New England very year since 2014, primarily in the late-fall, winter, and early-spring. Many New England growers plant spinach in valuable high tunnel space for fall, winter, and spring markets—for those growers, spinach downy mildew can pose a significant threat to winter production and income.

Spinach downy mildew is caused by the oomycete pathogen *Peronospora effusa* (previously called *Peronospora farinosa* f. sp. *spinacea*). Like other oomycete pathogens such as late blight and other downy mildews, spinach downy mildew is an aggressive pathogen and it can quickly render a spinach planting unmarketable. This pathogen produces asexual sporangia that emerge from stomata and are dispersed by wind and splashing rain or irrigation water. These sporangia land on other leaves, germinate, and cause new infections. Sporangia require leaf moisture to germinate, and disease development is favored by cool temperatures and high humidity—late-fall and early-spring high or low tunnel environments are often ideal for downy mildew. Fuzzy gray-purple sporulation forms on the undersides of infected leaves when conditions are conducive to disease development. When infected plants are harvested before they start sporulating, the disease can develop in retail bags.

P. effusa can also undergo sexual reproduction—there are two mating types of this pathogen, and if opposite mating types meet within a spinach plant, oospores will be produced. Oospores are thick-walled, long-lived spores that can survive on seed and in soil. Oospores of spinach downy mildew are routinely found on spinach seeds, but researchers are uncertain if growing conditions in the Northeast are conducive to oospore germination—therefore it's not yet clear what role oospores play in the spinach downy mildew life cycle in the Northeast.

All downy mildew pathogens are highly host-specific. *P. effusa* can only infect spinach and cannot infect other crops, even crops in the same family such as beets or Swiss chard. Similarly, other downy mildews that affect, for example, cucurbits, basil, lettuce, or brassicas, cannot infect spinach. Additionally, *P. effusa* is a complicated organism which exists as a suite of many races or strains, and not all races are able to infect all varieties of spinach. There are currently 17 identified spinach downy mildew races. Spinach varieties have different genes that give them resistance to specific downy mildew races. For example, the variety 'Tasman' is resistant to races 1-12 and 14-16 but is not resistant to races 13 or 17. Spinach breeders are constantly selecting for and breeding new spinach varieties that carry resistance against the most number of strains and the most recently evolved strains. However, the pathogen evolves quickly. It takes time for breeders and seed producers and distributers to get a new spinach variety to market; in the past, the spinach downy mildew pathogen routinely "broke" new resistance genes before the new resistant varieties even made it onto the market. **Resistance to the most recently identified race, race 17, seems to be more robust than resistance to older strains and has held up for several years now.**

Spinach downy mildew races are classified by inoculating a set of spinach varieties. The resulting pattern of which varieties develop downy mildew determines the race of the downy mildew isolate. If a specific isolate is determined to be a significant threat to large-scale spinach production areas like California and Arizona, it is given an official race designation. If an isolate doesn't align with an existing race and doesn't pose a significant threat, it is designated "novel". **Since 2014, there have been outbreaks of races 12, 14, and 15 as well as several novel strains in the Northeast.**

In the winter of 2018-19, the UMass Extension Vegetable Program conducted a trial to evaluate the performance of fifteen spinach varieties in a winter high tunnel growing system. These types of studies are important because almost all spinach varieties are developed for California or Arizona production and when they are released by seed producers, it's often not known how they will perform in different environments. The trial was conducted in an unheated high tunnel at the UMass Crop Research and Education Farm in South Deerfield, MA. Spinach was seeded by hand on October 26, before the tunnel had been skinned—tunnel plastic was installed on October 31. Plots were 4 feet by 4 feet squares with 5 rows of spinach seeded at 2 inch in-row spacing and 2 seeds per hole, and organized in randomized complete blocks with each variety replicated four times. There were 2 feet of unplanted buffer around each plot. It rained the day after seeding, and because the tunnel was not yet skinned, the seed didn't have to be manually watered in. After the tunnel was skinned, the trial was irrigated as needed—twice in December and once in March. There was a hard

Table 1. Downy mildew race resistance of varieties trialed

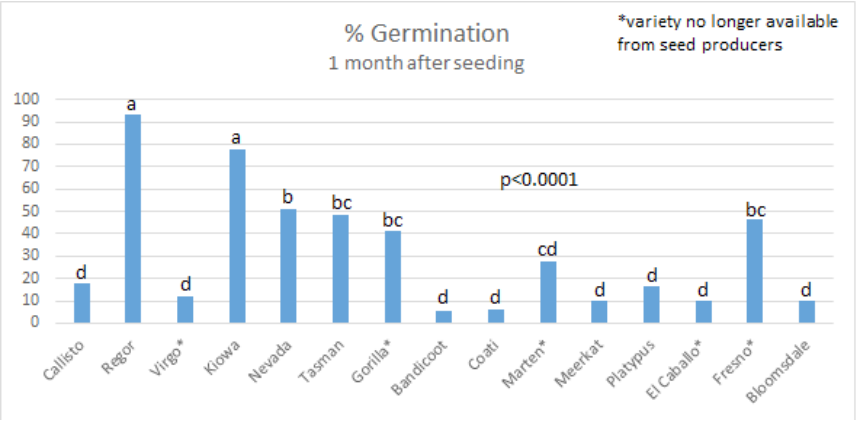
Variety	Resistance
Callisto	1-14, 16, 17
Regor	1-17
Virgo*	1-15
Kiowa	1-17
Nevada	1-17
Tasman	1-12, 14-16
Gorilla*	1-8, 10-15
Bandicoot	High: 1-16; Intermediate: 17
Coati	1-15, 17
Marten*	
Meerkat	1-15, 17
Platypus	1-15, 17
El Caballo*	
Fresno*	
Bloomsdale	none

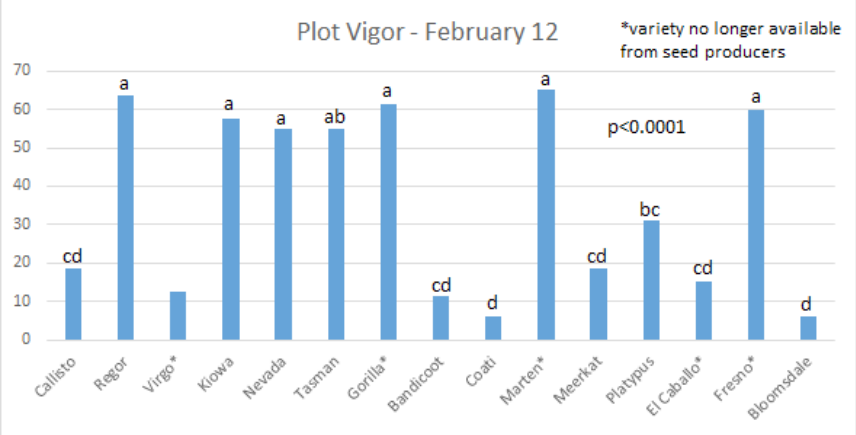
*no longer available from producer

frost immediately after seeding into the uncovered tunnel, which may have affected germination. If anything, the results from this trial show how these varieties perform despite less-than-ideal conditions!

The varieties in this trial were all relatively new spinach varieties with the newest resistance packages at the time. By the time the trial had started, the varieties Virgo, Marten, El Caballo, and Fresno were no longer being produced. See Table 1 for the resistance of the varieties in this trial.

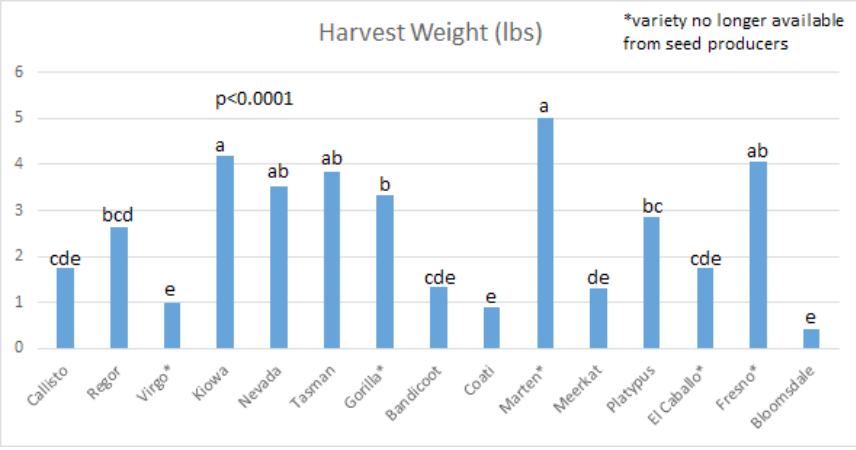
There was low downy mildew disease pressure during the winter of 2018-19—there was only one reported local outbreak of spinach downy mildew this winter—so we never observed the disease in the trial. We therefore were not able to collect any data on differences in resistance between the varieties to local spinach downy mildew strains. We rated germination one month after seeding, on November 19. Plot vigor was then rated regularly, on December 18, January 8, 15, and 29, February 5 and 12, and March 1, taking into consideration, stand, plant size, and yellowing. In Figure 2, plot vigor from February 12 only is presented because most varieties were of harvestable size on that date. The spinach was harvested on March 4 (reps A, B, and D) and March 8 (rep C), and plot yields were recorded along with notes about flavor, texture, and ease of harvest.





Plot vigor ratings took into consideration stand, plant size, and yellowing of cotyledons and/or older leaves.

Of the varieties trialed, five varieties performed equally well in terms plot vigor at harvestable size and harvest weight: Regor, Kiowa, Nevada, Gorilla, and Fresno. Regor and Kiowa had significantly higher germination rates than the other varieties. The plot vigor and harvest weight of Tasman were also equally high, but Tasman had a slightly lower germination rate. Marten had very poor germination but then grew quickly; this variety could have been harvested much earlier than other varieties and the leaves were quite large by the time the other varieties were ready to be harvested. This explains how the variety with the lowest germination rate ended up with the highest harvest weight. Of the highest performing varieties, Gorilla, Marten, and Fresno are no longer produced by seed producers, leaving Regor, Kiowa, Nevada, and Tasman as the best-performing available varieties. **Regor, Kiowa, and Nevada all have the most complete and current resistance packages**—all are resistant to races 1-17. Tasman is not resistant to race 13.



Several winter spinach growers told us that the demand for local spinach in the winter is so high that they can sell as much as they can produce, regardless of leaf shape, minor flavor or texture differences, or other parameters. We noted some slight differences in flavor and texture between the varieties in this trial, but nothing drastic that would make a variety unmarketable.

The growth habits of the varieties in the trial varied from very upright to very prostrate. Flatter varieties, including Regor, were more difficult to harvest compared to more upright

Photos taken February 5, three months after seeding. Clockwise from top left: Kiowa, Nevada, Tasman, and Regor. Photos: G. Higgins

varieties, including Nevada. We seeded the spinach at fairly wide spacing. It's likely that decreasing the spacing would make it easier to harvest the more prostrate varieties, because the leaves would grow upright against each other. Kiowa and Tasman both had fairly upright growth habits and, despite being grown at fairly wide spacing, formed compact plants.

In March 2019, Jim Correll, a spinach researcher from the University of Arkansas who works with large-scale spinach growers in California and Arizona, visited Massachusetts to teach us about spinach downy mildew and to learn about winter spinach production in New England. Together, we toured several farms growing high tunnel spinach. Some take-home messages on how to improve winter spinach production from Jim's visit are:

- **Plant varieties with the most comprehensive resistance.** The downy mildew race that pops up in a given area is often determined by the varieties that are being grown. For example, if several nearby growers all plant Tasman year after year in their tunnels, it's likely that eventually, race 13 or 17 will pop up in the area because Tasman does not have resistance to either of those races. The fact that we've seen races 12, 14, and 15 in the Northeast is probably not because those are the only races present but because growers are planting varieties that happen to be susceptible to those races. *Therefore, planting races that have full 1-17 resistance is the best way to prevent a downy mildew outbreak on your farm.*
- **Plant several varieties.** Regardless of whether you are planting 1-17 varieties or not, plant more than one variety. Novel strains of spinach downy mildew that don't match any of the 17 races are common, and we can't predict which varieties a novel strain will be able to infect. With more than one variety planted, it's less likely that you will lose all of your spinach to a novel strain.
- **Take the time to prepare uniform beds.** Many winter spinach growers struggle with patchy germination and leaf yellowing in spinach beds. This may be due to inconsistent moisture in the beds—on our farm tours, we observed that wet (and often lower) spots tended to show yellowing, potentially because of nutrient leaching, among other factors. Taking the time to prepare beds that are slightly raised and well-tilled may help reduce inconsisten-

Photos taken May 1, 4 months after seeding. Clockwise from top left: Kiowa, Nevada, Tasman, and Regor. Photos: G. Higgins

cies in germination, soil moisture content, and fertility.

- **Decrease plant spacing.** Spinach varieties vary a lot in their growth habits—some are very upright, while others grow very close to the ground. For varieties that grow close to the ground, decreasing plant spacing will make harvesting easier because the plants will prop each other up into more upright positions. Some growers choose to harvest spinach leaf-by-leaf, harvesting older leaves and leaving younger leaves to grow; decreasing plant spacing would likely make harvesting more difficult with this harvest technique.
- **It's possible to grow winter spinach without heat or row covers.** It can feel scary to leave a crop in the ground, even in a high tunnel, when temperatures drop to the single digits, but we've found that cold-tolerant spinach varieties can survive the cold just fine without supplemental heat or row cover. Twice during the trial, air temperatures dropped below 16°F for three nights in a row—January 21-23 and January 31-February 2. The lowest air temperatures during the trial was 13°F on January 21. Soil temperature at 3" below the soil surface dropped to 32°F during that period. Frost developed on the spinach in our trial several times over the winter but we observed only minimal frost damage in the tunnel. Eliminating the labor costs of dealing with row cover and the cost of heating a tunnel can increase net income from winter spinach production.

Many New England growers direct-seed spinach in high tunnels in the fall, just before main-season field crews are done for the year and harvest just enough spinach to keep a bit on farm stand or farmers market shelves through the winter. For many growers, winter is a time for much-needed rest and planning and it's nice to not have crops in the ground begging to be harvested. For growers who want to maximize winter profit or just get the most out of valuable high tunnel space, it seems possible to increase winter spinach yields and make production more efficient with fairly minimal effort, including trying some new varieties.

We are continuing to learn about spinach downy mildew in the Northeast! If you suspect spinach downy mildew on your farm, let us know: umassvegetable@umext.umass.edu or (413) 577-3976.

--Written by Genevieve Higgins, UMass Extension Vegetable Program

IMPROVING IRRIGATION TO MANAGE SALT BUILD UP IN HIGH TUNNELS

Did you notice white crusting on the surface of your high tunnel soils this winter? This may be salt! Salts in the soil come from fertilizers and manure, and they are not your typical table salt, sodium chloride. Salts are dissolved ions from fertilizer and organic compounds that can precipitate to the soil surface with evapotranspiration, and little to no overhead irrigation to flush them back down into the soil. Adding organic amendments like compost yearly, fertilizing with high salt index materials, and leaving the plastic on tunnels year-round, can cause salt to build up to problematic levels in a high tunnel. Germinating seeds and young seedlings are most susceptible to salt damage. In established crops, high salt concentrations make it difficult for crops to take up water from the soil, therefore reducing yields.

Salts are measured by electrical conductivity (EC) because the dissolved ions (K^+, NO_3^-, NH_4^+, $H_0PO_4^-$, etc.) have a positive or negative charge, the higher the number, the greater the number of ions and electrical charge in the soil. Using the 1:2 method, an electrical conductivity reading measuring 2 mmhos/cm is high and will cause reduced germination, however, we have found that readings of 4 or 5 mmhos/cm in mature crops don't seem to affect yields in high tunnel tomatoes very much. Perhaps this is because the tomato root structures are larger and go deeper than where the salts have accu-

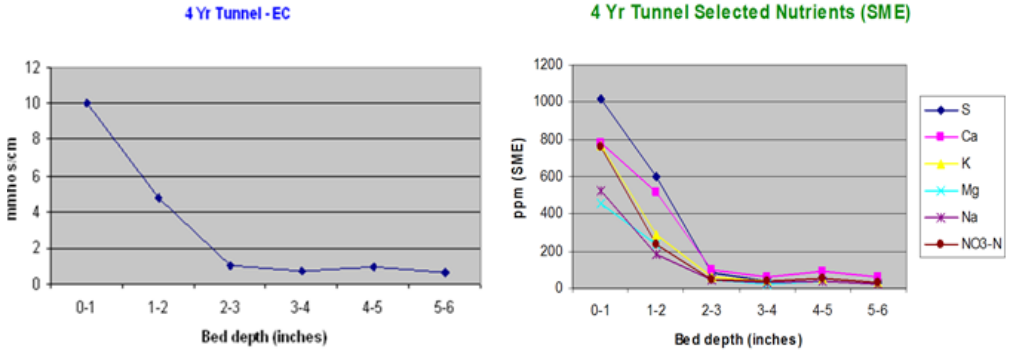


Figure 1a. (left) *Electrical conductivity of a 4 year-old high tunnel at different depths after crop harvest.* ***Figure 1b (right)*** *Saturated Media Extracted nutrients in the same high tunnel at different depths after crop harvest. Images: Bruce Hoskins, UMaine Soil Lab*

Table 1. Salt tolerance of vegetable crops. Electrical conductivity observed at 50% yield reduction using SME method. (Adapted from Ayers and Westcot, 1976)

Crop	EC (mmhos/cm)
Strawberry	2.5
Bean	3.7
Onion	4.3
Carrot	4.6
Pepper	5.1
Radish	5.1
Lettuce	5.2
Corn, sweet	5.9
Potato	5.9
Sweet Potato	6
Cucumber	6.4
Turnip	6.5
Cabbage	7
Tomato	7.5
Broccoli	8.3
Spinach	8.6
Beet	9.6
Celery	9.9
Zucchini	10
Asparagus	13

Table 2. Salt indexes for common fertilizers (Adapted from: Fertilizer Salt Index, 2002)

Fertilizer	Salt Index
Manure Salts	113
Ammonium nitrate	104
Ammonium sulfate	88
Urea	74
Ammonium polyphosphate	20
Monoammonium phosphate	27
Diammonium phosphate	29
Potassium chloride	116
Potassium nitrate	69
Potassium sulfate	43
Ammonium thiosulfate	90

mulated near the surface. For most tunnel crops, the soil should read 2-3.5 mmhos/cm from UMaine and UMass soil tests (SME method), or 0.8-1.3 mmhos/cm from UNH soil tests (1:2 method). Salt tolerance of vegetable crops can vary widely (Table 1). Salt buildup can be prevented by avoiding excessive applications of organic materials like compost, by diligently managing soluble fertilizers, by avoiding fertilizers with a high salt index (Table 2), and those high in ammonium forms of nitrogen, and by maintaining soil at water holding capacity.

Often, amendments are not incorporated deeply enough into high tunnel soils and even incorporated salts (which mainly consist of valuable plant nutrients!) are easily wicked to the soil surface by irrigation water. Bruce Hoskins, University of Maine Soil Analytical Lab Director analyzed soil from a high tunnel in production for 4 years and found that salts were heavily concentrated in the top 0-2 inches (Fig. 1a and b). High salt accumulation in the top inches of tunnel soils could be the reason why even highly salt tolerant crops like spinach can get salt injury in a tunnel, because they are shallow rooted. In this case, soil tests taken to a depth of 6" would not indicate unusually high soluble salt levels.

So what can you do during this summer season to keep salt levels from building up? Monitoring EC and soil moisture on your own is easy to do with relatively inexpensive equipment. Maintaining soil moisture at field capacity (50% of air pore space filled) is important in high tunnel production because of potential for salt injury or other nutrient related disorders such as blossom end rot or yellow shoulder in tomatoes which can occur with large fluctuations in soil moisture content. Use 8mil plastic drip tape with emitters every 6" and a flow rate of at least 0.5 gpm/100ft to ensure more uniform moisture in beds and include 2 lines per row of summer season crops for better root zone coverage.

Monitoring EC: If your soluble salts were tested by a soil lab with a saturated media extract test (SME), then, the EC will be in the ranges reported in Table 3. If you are measuring soluble salts on your own, or using the UNH test, the 1:2 dilution method has been used for many years and has good interpretative data to back it up (Table 3). In the 1:2 method, an air-dried sample of soil and water are mixed together in the volume ratio of 1 part soil to 2 parts water (e.g., using a measuring cup, 3 fl. oz. of soil + 6 fl. oz. of water). The liquid extract is then separated from the solids using laboratory grade filter paper or 2 common coffee filters doubled up. The extract is then ready for analysis. This is a very easy test to master and quite suitable for on-site testing of pH and soluble salts using the so-called pH and EC "pens" available from greenhouse suppliers. See this video from Tina Smith and Doug Cox of the UMass Greenhouse and Floriculture Program, showing how to do this test. **Portable EC meters:** KBW Supply, Hannah Instruments

Table 3. Soluble salts levels determined by different methods of media analysis.

1:2	SME	Indication
0-0.03	0-0.8	Very low
0.3-0.8	0.8-2.0	Low
0.8-1.3	2.0-3.5	Normal
1.3-1.8	3.5-5.0	High
1.8-2.3	5.0-6.0	Very high
>2.3	>6.0	Extreme

Monitoring Soil Moisture: To maintain soil moisture at field capacity, two tensiometers or soil moisture sensors may be installed—one at 6" and at the rooting depth of the crop (12" for pepper, 18-24" for tomato, cucumber and eggplant). Depending on the soil texture in your tunnel, irrigate when your tensiometer or moisture sensor is at 25% depletion and bring the soil moisture level up to field capacity for your soil type. Tunnels heavily amended with compost or with high organic matter will have a higher water holding capacity than field soils. Follow the instructions on page 46 of the "Iowa

High Tunnel Fruit and Vegetable Production Guide" to calculate gallons of water needed to bring your volume of soil to the rooting depth of your crop back up to field capacity. **Soil Moisture sensors:** Hansen, Spectrum Technologies, Irrometer

Recommendations: Till the soil to 8" or more between plantings to make sure that salts get reincorporated deeply into the soil profile. Using moisture meters or a tensiometer, maintain soil moisture at field capacity, but not saturation (100% of soil pore spaced filled), and uncover tunnels during the off-season so that the soils may be well flushed. An EC meter is a helpful tool for periodic measurements during the season since mineralization may occur quickly in warm, moist tunnels causing salt loads to be released from organic matter and be wicked to the surface.

Compost and other organic amendments are typically slow to mineralize, although they may mineralize more quickly in hotter temperatures found in tunnels, releasing salts more rapidly. For this reason, it is desirable to find liquid fertilizers that can provide nutrients immediately. For organic growers, Chilean nitrate (12-1-1) and Potassium sulfate (0-0-50) can be dissolved in warm water and used to fertigate. Nature Source (8-1-1) is another good option which is low in P and does not clog up fertigation systems like fish emulsion does (It doesn't smell as bad either!).

Resources:

"Soil Moisture Monitoring and Sensor Installation" University of Minnesota Extension

"Iowa High Tunnel Fruit and Vegetable Production Guide" PM 2098 January 2010. Leopold Center

"Current Methods of Greenhouse Media Testing and How they Differ" -Cox, D. University of Massachusetts.

"How to Use pH and EC "Pens" to Monitor Greenhouse Crop Nutrition" Cox, D. University of Massachusetts.

--Written by Katie Campbell-Nelson, UMass Extension, with thanks to Andy Radin, URI Extension and Bruce Hoskins, UMaine Soil Lab for review.

News

Invitation to Participate: Local Food Distribution Survey

The University of New Hampshire Department of Natural Resources is conducting a survey on local food distribution and is inviting commercial fruit and vegetable growers in New England to respond. Your responses to this survey will help distributors, producer cooperatives, food hubs, and other organizations understand your distribution needs, and better evaluate potential approaches for addressing the regional needs of growers throughout Northern New England.

This survey should take fifteen to twenty-five minutes to complete. If you are 18 years or older, please click on the link below to begin the survey.

Survey link: https://unh.az1.qualtrics.com/jfe/form/SV_6QoNagKPXFQCs0B

Your participation in this survey is entirely voluntary and all of your responses will be kept confidential. The link is used to estimate a response rate. No personally identifiable information will be associated with your responses in any reports of this data. Should you have any further questions or comments, please feel free to contact Julia Jones at jws47@wildcats.unh.edu or Dr. Alberto Manalo at alberto.manalo@unh.edu or 603-862-3917.

We appreciate your time and consideration in completing the survey! It is only through the help of growers like you that we can provide information to help businesses and organizations strengthen New England's local food distribution system in a way that truly works for growers!

Open Application Period for MDAR Grant Programs

The Massachusetts Department of Agricultural Resources (MDAR) is now accepting applications from agricultural operations who wish to participate in the Department's grant programs. Grants are available to help agricultural opera-

tions make farm improvements that enhance their economic viability, help prevent negative impacts to environmental resource, adapt to and mitigate climate change, improve energy efficiency, adopt renewable energy, and improve on-farm produce safety. Interested farm operators are encouraged to review the information and applications on each program's webpage. If interested in applying, applications must be submitted with any supporting documentation by the program's deadline.

Below is a list of programs, with more information (including applications) available at each program's website.

Applications for the following programs are due Friday, May 31, 2019:

- Agricultural Climate Resiliency & Efficiencies (ACRE) Program
- Agricultural Energy Program (ENER)
- Agricultural Food Safety Improvement Program (AFSIP)
- Agricultural Environmental Enhancement Program (AEEP)

Applications will be opening soon for the following programs:

- APR Improvement Program (AIP)
- Farm Viability Enhancement Program (FVEP)
- Matching Enterprise Grants Program (MEGA)

Events

Creating Pollinator Forage in the Landscape

Tom Sullivan of Pollinators Welcome will present strategies for improving bee forage. He will cover bee-friendly flowers, bloom phenology, and how to choose plants that meet site conditions and increase pollinator diversity and abundance. Along the way, he will identify threats to pollinator health and explain how we can help bees by creating pollinator havens on farms, in gardens, and within conservation areas. He will also cover native bee biology and nesting needs, and explore the basics of meadow making for beekeepers and other pollinator-positive stewards. We will go outside if weather permits, and ample resources will be provided via email after the workshop. Coffee and light refreshments will be provided.

When: Sunday, June 2, 8:30am-12:30pm

Where: Agricultural Learning Center, UMass Amherst

Registration: $25. Pay with cash or check at the door. Click here to register for this event.

This workshop is partially supported by a grant from the USDA.

Vermont Vegetable & Berry Growers Association On-Farm 2019 Workshop Series

The Vermont Vegetable & Berry Growers Association is holding a series of nine on-farm workshops from June through November this year. For more information on all workshops in this series, please click the linked event title above.

The first on-farm workshop will be held at Sam Mazza's Farm Market & Greenhouses.

When: Monday, June 10, 4:00-7:00pm

Where: Sam Mazza's Farm Market and Greenhouses, 277 Lavigne Rd., Colchester, VT 05446

This farm has one of the largest vegetable and ornamental greenhouse operations in the state. Join farm managers Gary and Laurie Bombard and greenhouse manager Neil Comstock for a tour of multiple greenhouses growing tomatoes, bedding plants and other ornamentals. Margaret Skinner and Cheryl Frank Sullivan of the UVM Entomology Lab will be on hand to describe monitoring, use of biocontrols and other IPM strategies for greenhouse pest control. Ann Hazelrigg will cover greenhouse diseases, Vern Grubinger will lead discussion of tunnel tomato production.

Attendance at these events is free for members of the Vermont Vegetable & Berry Growers Association. The cost is $10 per-person for non-members, payable on-site. Refreshments will be served. Membership in the

VVBGA costs $55 per farm, per calendar year. The VVBGA works with University of Vermont Extension to deliver education and applied research for its growers.

Questions? Contact Vern Grubinger, 802-257-7967 x303. To request a disability-related accommodation, contact Dana Rupert, 802-257-7967, three weeks prior to an event so we may assist you.

UMass Fruit and Vegetable Program Twilight Meeting at Indian Head Farm

When: Tuesday, June 25, 2019 – Late afternoon. SAVE THE DATE

Where: Indian Head Farm, 232 Pleasant St., Berlin, MA 01503

Indian Head Farm has worked with UMass Extension Fruit and Vegetable Programs for many years. Come hear from Extension Educators about research and management updates for Brown Marmorated Stink Bug, Spotted Wing Drosophila, and High Tunnel Production issues which we have worked on with this farm over the last few years. Indian Head Farm has also recently updated their irrigation system are in the process of farm transfer to next generation. Come learn how they do it all, socialize, and stay for a light supper.

**1 pesticide recertification credit is available for this workshop.*

This event is free and is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture.

THANK YOU TO OUR SPONSORS:

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