UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

Volume 30, Number 25 November 15, 2018

In this issue:

UMass now has a high tunnel we can conduct trials in! On October 26th, before construction was complete and expecting a weekend of rain, The Vegetable Team seeded 15 varieties of spinach with downy mildew resistance. The tunnel is now skinned, and the spinach germinated. Stay tuned for results. Photo: K. Campbell-Nelson

Crop conditions

High tunnels have been planted and greens are up, while in the field, roots are being dug. Fields are being put to bed and equipment stored away ahead of today's predicted snow. November is a time when we can look back and reflect upon the growing season, so we chose to share a reflection from one of you. We heard from many of you that this year was the most challenging yet because of the weather. Why? Here is a synopsis from farmer Harrison Bardwell in Hatfield, MA:

"Early spring was cold and we were excited to get planting. Temperatures were below average across much of the state, and soil was slow to warm. In between very cool days and the warmer days, we managed to get the first transplants in the ground. Cabbage and chard settings sat in the soil for almost a month with minimal growth. This led to a lot of damping-off (seedling death), and cabbage root maggot damage was high. We got through the cold spell and were blessed with average rainfall through the early weeks of May, this helped us plant all of the main season crops. By mid-July most of the state was 'abnormally dry' or in a 'moderate drought' ,according to the US Drought Monitor. This made establishing mid-season crops difficult without adequate irrigation. But on June 28th we got a thunderstorm with 3.5" of rain, in the middle of a drought… explain that?" See article this issue for an explanation.

More from Harrison: "Through the rest of July and August we dealt with constant above average temperatures and excessive rain; it really took a toll on both the farm crew and crops. We had average temps in the mid '90s with high humidity, which made it very difficult to keep up with the crops, weeds, and daily life on the farm. Crops grew so fast that sweet corn settings were coming in on top of each other. Vine crops such as winter squash and pumpkins matured in the first weeks of August! (After an early season drought, we ended the season with too much rain!)

There are major downfalls in choosing a career and life like this one, but we cannot let this stop us. We have to push through the difficulties and harvest the crops that grew the best for us. It was a great season to see which varieties held up better than others under these extreme conditions, which ones were resistant to certain diseases and weather conditions, and ones that failed miserably. We look at the 2018 season as an experience, not a loss."

Harrison's experience was similar to many of yours this season, so, we are taking the opportunity to publish an article by climate scientist Toni Lynn Morelli of the Northeast Climate Adaptation Science Center to help shed some light on climate predictions affecting vegetable production in Massachusetts. See the article this issue "Climate Predictions for Vegetable Farmers in Massachusetts".

Language barriers on farms survey

We're still gathering information about language barriers on farms. If you own or work on a farm where more than one language is spoken, please share your experience with us in this survey: https://www.surveymonkey.com/r/22S2ZJX.

Climate predictions for vegetable farmers in Massachusetts

Following is a summary of observed and predicted climate trends from recent publications of the Northeast Climate Adaptation Science Center based right here at UMass, Amherst. The Northeastern U.S. is expected to experience the effects of climate change 20 years before the rest of the globe, so it is necessary for us to begin adapting before others (Karmalkar and Bradley, 2017). The following information may be helpful in determining the types of equipment, infrastructure, or cultural practices you may plan to, or already have invested in, to adapt to climate change. We know many of you have already made changes in your farming practices to adapt to more unpredictable and extreme weather— please share your successful adaptations with us! Send photos, email or call: umassvegetable@umass.edu, 413-577-3976.

Adaptations to temperature fluctuations: Use row cover more frequently. Make sure it is available for easy use early in the season when temperature fluctuations are occurring. Plant later in the spring than you have in the past to make sure the plants will survive the early cold season knowing that you will be producing later in the year.

Changes in Temperature

Observed: According to the U.S. National Climate Assessment published in 2014, the Northeast has seen more than 1.5°F increase in average temperature increase and 10 additional frost free days since 1991. While overall temperatures are getting warmer, we still experience temperature fluctuations, which include killing frosts and cool, wet springs.

Predicted: With increases in temperature of even 2 degrees, we will eventually see winters in Massachusetts without snow. We expect to see 90% fewer freezing days in Massachusetts by the middle of the century, compared to what was observed at the end of the 20th century (Rawlins, Bradley et al., 2016) (Fig 1). Winters will be about 3°F warmer, while the rest of the year are likely to warm by at least 2°F. Imagine the difference between 32°F with snow and 34°F with rain!

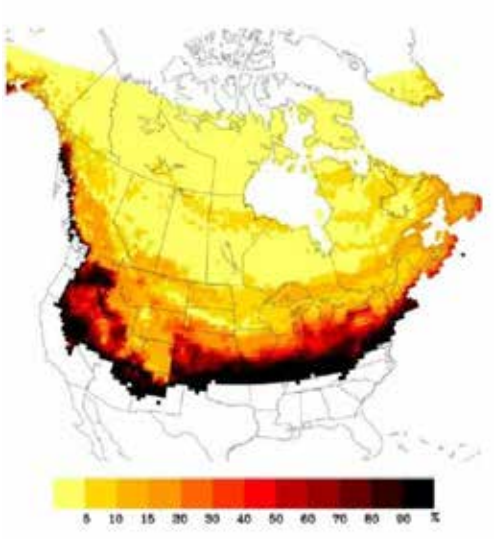

Fig 1. Projected percentage change in number of freezing days in 2041-2070 compared to 1971-2000.

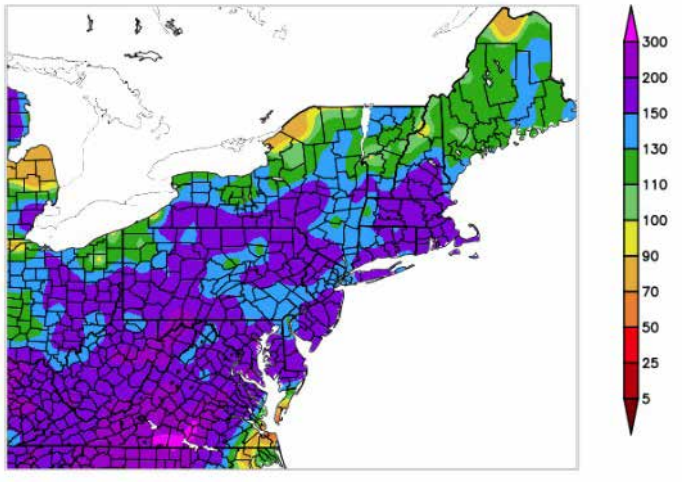

Fig 2. Percent of normal precipitation Sep. 15, 2018 - Nov. 13, 2018. Source: NOAA Regional Climate Centers

Changes in Precipitation

Observed: We have recorded a 71% increase in heavy precipitation events (> 2 inches) since 1991. Just this fall, we have seen 200 - 300% above normal precipitation in MA (Fig 2). Yet, during the same time period in 2016 we were experiencing extreme drought, according to the US. Drought Monitor. The drought of 2016 prompted the National

Oceanic and Atmospheric Association to work with specialists in the Northeast to develop an early drought warning system for the region to help us predict the increase in 'flash droughts' we are experiencing. The Northeast was the only region in the U.S. that did not have an early drought warning system already in place. During the winter, we have seen less snow/lower snowpack overall, but it comes in more intense storms. Moreover, with warmer temperatures and more rain-on-snow events, snow doesn't stick around as long.

Predicted: We are predicted to experience more droughts and more floods in the Northeast, as a result of climate change. Winters will be wetter, while summers will be drier, with areas of the Cape being drier than other parts of the region. As temperatures continue to rise, snow and ice will melt earlier, and peak spring flow will occur up to 2 weeks earlier. By the years 2081-2100, expect no snow in November or March and only a 10-20% chance of snow during the months of December-February in Massachusetts. That's in some of our lifetimes!

Adaptations to drought: Make sure irrigation infrastructure is set up ahead of time and ready for use. Invest in micro-irrigation or drip irrigation with a maximum flow rate of 30 gal/hr.

Adaptations to fluctuations in precipitation: Use more mulches to reduce water loss. Plant more cover crops to increase soil water holding capacity and reduce erosion. Reduce tillage to maintain soil structure.

Overall Changes in Growing Season

Observed: First bloom dates have increased by 2-3 days in Massachusetts over the past decade. Our hardiness zones in MA have increased from being mostly a 5 (-10°F to -20°F) in 1990 to mostly a 6 (0°F to -10°F). More pests are overwintering and Lyme disease is increasing, as one consequence.

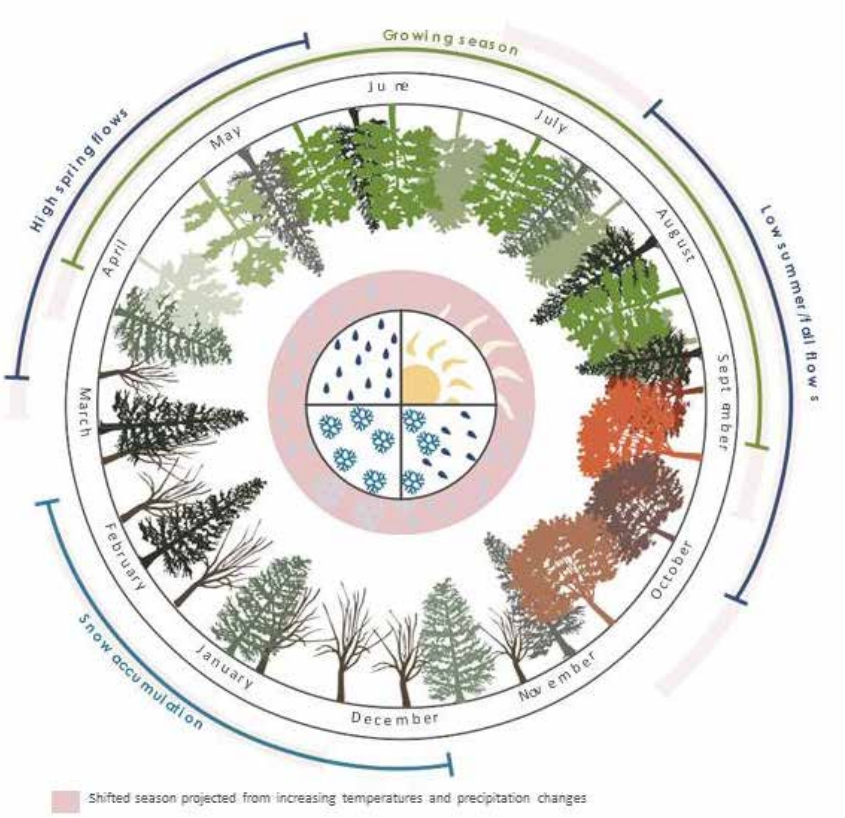

Fig 3. Projected shifts in the Northeast and Midwest seasonal cycle. Source: http://necsc.umass.edu/

Predicted: By 2039, our hardiness zone is predicted to be 7a in much of Massachusetts with our coldest temperatures reaching 0°F-10°F. With more rain but higher temperatures, expect more evapotranspiration to occur. When it rains, expect very wet soils to start, but expect soils to dry off quicker than usual. "Dry years" will be drier, "wet years" will not be as wet. With changes in temperature and precipitation comes an increased risk for invasive plants, and Massachusetts is considered to be at risk for invasion of about 900 new plant species (Allen and Bradley, 2016). A summary of all the predicted changes can be seen in Fig. 3, highlighting that the growing season for natural ecosystems will likely extend from mid-March through October by the end of this century. The vegetable growing season may shift a little differently and run from mid-April through November, since we will still struggle to get into wet fields early in the season, but once crops are established, frost protection may be employed to keep harvests going later in the season.

Hot off the press! Read more about adaptations to climate change being implemented by fellow famers in New England in this publication from a 2017-2018 SARE project by Alyssa White and others at the University of Vermont: "New England Adaptation Survey for Vegetable and Fruit Growers".

--Written by K. Campbell-Nelson UMass Vegetable Program and Toni Lyn Morelli, Northeast Climate Adaptation Science Center, USGS

References:

Allen JM, Bradley BA (2016) *Out of the weeds? Reduced plant invasion risk with climate change in the continental United States.* Biological Conservation, 203, pp. 306-312. https://doi.org/10.1016/j.biocon.2016.09.015

Karmalkar AV, Bradley RS (2017) *Consequences of Global Warming of 1.5 °C and 2 °C for Regional Temperature and Precipitation Changes in the Contiguous United States.* PLoS ONE 12(1): e0168697. https://doi.org/10.1371/journal.pone.0168697

Rawlins MA, Bradley RS, Diaz H, Kimball J, Robinson D. (2016) *Future Decreases in Freezing Days across North America. Journal of Climate.* 29, 6923-6935. https://doi.org/10.1175/JCLI-D-15-0802.1

Hot water seed treatment

Benefits of hot water seed treatment: Starting with disease-free seed is an important step towards growing disease-free crops. Some plant pathogens are able to penetrate and survive within the seed, out of reach of surface seed treatments. They include many bacterial pathogens as well as some fungi, oomycetes, and viruses. Tomato, pepper, and brassicas are good candidates for hot water seed treatment because there are common bacterial and fungal diseases of these small-seeded crops that can be easily killed through treatment. Hot water seed treatment is a valuable tool for preventing establishment of seed-borne diseases on the farm, or their reintroduction year after year. Hot water seed treatment also has the beneficial effect of priming seeds, resulting in faster germination than untreated seed.

However, it's important to note that while hot water seed treatment will kill pathogens on your seeds, it does not protect seeds or crops from disease and does not guarantee disease-free crops. Crop rotation and field sanitation are key for preventing diseases that overwinter on crop debris, and crops need to be scouted regularly for wind-, water-, and insect-borne diseases.

Hot water seed treatment with a precision hot water bath. Photo: UMass Extension

Deciding which seeds to treat: To decide whether to use hot water treatment, first determine the likelihood that seed-borne pathogens could be present based on the crop (see Table 1 for reference). Next, ask your seed supplier if the seed was produced in a way to minimize exposure to seed-borne pathogens and if the seed was tested for their presence. Find out if the seed has already been treated with hot water or if it has been primed (pre-soaked to promote earlier and more uniform germination), as treating again could adversely affect the seed. You should also not treat seed that has a fungicide or insecticide treatment coating, as it will wash off during treatment. Only a few companies routinely hot-water treat seeds - many are reluctant because there is a risk that germination rate will drop if the water is too hot or if the seeds were already exposed to stressful environmental conditions.

Treatment procedure and seed requirements: The temperature of water for treating seed varies from 115 to 125°F, depending on the crop, and the treatment period varies from 10 to 60 minutes. Large-seeded crops (beans, cucurbits, peas, corn etc.) are usually not effectively disinfested with hot water treatment because the temperature required to heat the whole seed would kill the outer seed tissue and the seed will not germinate. In some cases, hot water has been used to disinfect just the surface of larger seeds, for example, treating anthracnose on beans. Hot water treatment will also negate other seed treatments, and so chemically-treated, pelleted, or primed seed should not be hot-water treated. Hot water seed treatment can decrease germination rates, especially for older seed (more than 1 year old) or seeds that were grown under stressful environmental conditions. You may want to test the germination of a small sample of your seed both before and after hot water treating to evaluate the potential effects of treatment on germination. Treat no more seed than you think you will use in the course of a season, as hot water treated seed may not remain viable for as long as untreated seed. It is important to use the appropriate protocol for each crop to control pathogens without damaging the seed. While hot water seed treatment can be done effectively on a stovetop in a large pot with an accurate thermometer and careful temperature control, it is much better to use precision water baths which provide an even, stable, and accurate temperature.

Procedure: Before you test all of your seed, you may want to conduct a seed germination test, as different varieties and lots may react differently to hot water treatment. Treat a 50 or 100-seed sample using the procedure below, then test the germination of both the treated seeds and an equal number of untreated seeds, either in the same growing media that you

plan to use for transplant production, or in a moist paper towel. If the test gives acceptable germination rates, treat as much seed as you expect to use in the coming season.

Table 1.

Crop	Treatment Temperature and Time		Diseases Controlled
Broccoli	122°F	20 minutes	Alternaria leaf spot, Bacterial leaf spot, Black leg, Black rot
Brussels sprouts	122°F	25 minutes	
Cabbage	122°F	25 minutes	
Collards	122°F	20 minutes	
Kale	122°F	20 minutes	
Carrot	122°F	20 minutes	Alternaria leaf blight, Bacterial leaf blight, Cercospora leaf spot, Crater rot/foliar blight
Celery/Celeriac	118°F	30 minutes	Bacterial leaf spot, Cercospora leaf spot, Septoria leaf spot, Phoma crown and root rot
Eggplant	122°F	25 minutes	Anthracnose, Early blight, Phomopsis, Verticillium wilt
Lettuce	118°F	30 minutes	Anthracnose, Bacterial leaf spot, Lettuce mosaic virus, Septoria leaf spot, Verticillium wilt
Onion	122°F	20 minutes	Purple blotch, Stemphylium leaf blight, Basal rot, Botrytis blight, Smudge, Black mold, Downy mildew
Pepper	125°F	30 minutes	Anthracnose, Bacterial leaf spot, Cucumber mosaic virus, Pepper mild mosaic virus, Tobacco mosaic virus, Tomato mosaic virus
Parsley	122°F	30 minutes	Bacterial leaf blight, Alternaria leaf blight, Black rot, Cercosporoid leaf blight, Septoria blight
Spinach	122°F	25 minutes	Anthracnose, Cladosporium leaf spot, Cucumber mosaic virus, Downy mildew, Fusarium wilt, Stemphylium leaf spot, Verticillium wilt
Tomato	122°F	25 minutes	Alfalfa mosaic virus, Anthracnose, Bacterial canker, Bacterial speck, Bacterial spot, Cucumber mosaic virus, Early blight, Fusarium wilt, Leaf mold, Septoria leaf spot, Tomato mosaic virus, Verticillium wilt, Double virus streak

Source: "Managing Pathogens Inside Seed with Hot Water" – Meg McGrath, Cornell University Long Island Horticultural Research & Extension Center

1. **Preheat water baths.** Heat one bath to 100°F and another to your treatment temperature (see Table 1). The first bath will be used to preheat the seed so that the temperature of the treatment bath doesn't drop when the seeds are added. Heat enough water to allow water to move around seeds freely. We treat about six packets at a time in our six liter water bath. Use an accurate laboratory thermometer. It is important that the water be maintained at a uniform temperature throughout the vessel, that the recommended temperature not be exceeded, and that the seed be treated no longer than the time interval specified. A stirring hot plate helps to provide continuous agitation and uniform water temperature, though it can be done with continuous, consistent manual agitation or an aquarium bubbler. It helps to have a separate container of room temperature water close by to add, if necessary, to prevent overheating.

We make seed treatments packets out of 4x10" strips of insect netting, folded in half and stapled on either side to make an enclosed packet. The open edge is pinched shut with small binder clips once it is filled with seed.

2. **Prepare the seed.** Make a packet for the seeds out of cheese cloth, screen, or insect netting. Fill each packet no more than halfway with seed, to allow for water movement throughout the packet. Include a metal bolt, coin, or other weight to keep the seed submerged. Label all packets, especially if you're treating more than one variety at once!
3. **Pre-heat the seed.** Submerge the seed in the pre-heat bath for 10 minutes, constantly checking the temperature to ensure that it does not rise above 100°F.
4. **Treat the seed.** Move the seed to the treatment bath and treat for recommended time (see Table 1). Again, check the

temperature constantly to ensure that it does not rise above the recommended temperature. Remove the seeds promptly and run them under room temperature tap water to cool them.

5. **Dry the seed.** Pat dry with towels, then air dry at 70 to 75°F by spreading the seed on dry paper towels.

Equipment: There are many options for water bath equipment; cheaper options likely require you to watch and adjust the temperature constantly where more expensive options may be more precise and hands-off. Stirring hot plates start at about $400. Both analog and digital precision water baths run at about $700 minimum. Laboratory thermometers are about $15.

UMass Hot Water Seed Treatment Service: If the procedure above sounds daunting or you're not sure you want to invest in hot water treatment equipment, we can treat your seed for you! For information about this service, including shipping and pricing information, please see our Hot Water Seed Treatment Submission Form.

--Compiled by G. Higgins, UMass Vegetable Program, 2018

News

Northeast SARE Invites Farmer Grant Applications

The Northeast Sustainable Agriculture Research and Education (SARE) Program has released the call for applications for 2019 Farmer Grants. Proposals are due online by **Tuesday, November 27, 2018 at 11:59 p.m. E.T.** Funded projects will be announced in late February 2019, and projects may begin in the spring.

Northeast SARE Farmer Grants are intended for farm business owners and managers who would like to explore new sustainable production and marketing practices, often through an experiment, trial or on-farm demonstration. Reviewers look for innovation, potential for improved sustainability and results that will be useful to other farmers.

Application materials, including detailed instructions and supporting documents, are posted on the Northeast SARE website at www.northeastsare.org/FarmerGrant. Questions about the grant program should be directed to northeastsare@uvm.edu.

Farmer Grant projects must be conducted in Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, West Virginia or Washington, D.C. Awards are capped at $15,000 and projects may address the wide range of issues that affect farming in the Northeast. To search topics that SARE has previously funded, please access the national database of projects at projects.sare.org/search-projects.

Applicants must work with a technical advisor—typically a Cooperative Extension educator, Natural Resources Conservation Service staff, nonprofit organization employee, private crop consultant, veterinarian or other service provider—who provides support and advice to the farmer applicant.

Northeast SARE will host a **Farmer Grant webinar on Oct. 10 from 12:30 to 1:30 p.m.** Carol Delaney, grant program coordinator, will provide information on program eligibility, how to apply, types of projects SARE funds, allowable expenses and more. The webinar is free. To register, visit http://go.uvm.edu/farmergrant19. To request a disability-related accommodation to participate, contact Debra Heleba at (802) 651-8335, ext. 552, by Oct. 3.

If you have questions about applying for a farmer grant in Massachusetts, contact your state SARE Coordinator: Katie Campbell-Nelson, UMass Extension Vegetable Program, kcampbel@umass.edu or 413-545-1051.

-- Debra Heleba, NESARE Communications Specialist (Debra.Heleba@uvm.edu)

Northeast SARE, which is funded by the U.S. Department of Agriculture's National Institute of Food and Agriculture, offers competitive grants and sustainable agriculture education.

MDAR Grant Announcement: Stewardship Assistance and Restoration on APRs

The Department invites responses from Massachusetts farmers who own or operate farm land under the Agricultural Preservation Restriction ("APR") Program who wish to participate in Round 7 of the Stewardship Assistance and Res-

toration on APRs Program. The purpose of the Program is to address stewardship or restoration issues on farmland resources in order to maximize productive agricultural use of the protected resource.

Funding of up to $25,000, with a 15% match, may be available for identified improvements that will help restore or enhance the protected land resources on an APR farm property.

Eligible uses of funds include contracted labor or equipment rental costs to clear land or reclaim inactive fields back to active cropland use such as: clearing vegetation, removing rocks or stumps, cutting back grown in field edges, or reseeding or applying soil or crop amendments to inactive cropland or pastureland to bring it back into production. Funding may be also be used to restore farm resources that have been negatively impacted by flooding, erosion, storms, tornadoes and other natural disasters.

The deadline for applications is December 7, 2018 by 4 PM, and all projects must be completed by June 30, 2019.

Find the application here: www.mass.gov/media/1733661/download

Events

New England Vegetable & Berry Growers Association Meetings

597th Meeting of the NEVBGA & New England Cooperative Extension

When: Saturday, December 1, 2018

Where: Holiday Inn Portsmouth, 300 Woodbury Ave, Portsmouth, NH

To register, please RSVP to 978-423-6694 or secretary@nevbga.org by November 28, 2018

9:00 Registraion & Welcome – Chris Grant, NEVBGA Secretary-Treasurer

9:30 Swing Arm Trellising for Blackberry Production - Sonia Schloemann, UMass Extension Fruit Team Leader

10:15 Pest Prevention and Food Safety for Farm Processing Areas - Chris Del Rossi, CEO Food & Drug & The Bug

11:00 Know Your Market! Know Your Customers! It's that time of the year to look at trends and opportunities and plan for next season - Nada Haddad, Field Specialist, Food and Agriculture, University of New Hampshire Cooperative Extension, Rockingham County

11:45 What's New with Crop Insurance? – Tom Smiarowski and Paul Russell, UMass Extension Risk Management/ Crop Insurance Education Program

Noon Lunch buffet, $20.

1:00 NEV&BGA Announcements, Vendor Introductions, Extension Updates

1:15 Retooling Your Sprayer for Better Insect & Disease Control - George Hamilton UNH Cooperative Extension Fruit & Vegetable Production Field Specialist

2:15 Farmer Profile - Down with Onions, Up with Malls - Bill Clark, Owner of Clark Farm in Danvers Massachusetts, one of America's Founding Farms, started in 1728 will present on the deep history of "Onion Town" and the Danvers Half-Long Carrot.

3:15 Biological Pest Control Tools in Vegetables - Susan B. Scheufele, UMass Extension Vegetable Team

4:00 Adjourn

Commercial members are welcome to put up table-top displays.

Pesticide recertification credits have been requested for this meeting

Co-sponsored by the UMass Extension Risk Management/Crop Insurance Education Program

Save the date: 598th Meeting of the NEVBGA

Friday, January 4, 2019, Hadley, MA

Save the Date: 599th Meeting of the NEVBGA

Saturday, February 9, 2019, Hudson, MA

High Tunnel Production Conference

Want to fine-tune your high tunnel crop production? This conference is for high tunnel vegetable growers and agricultural service providers of all experience levels. There will be plenty of opportunities to share expertise and learn from one another. 3.5 PAT credits for Dec 3, 5 PAT credits for Dec 4. UMass Extension Educator Katie Campbell-Nelson will be there offering one-on-one support to interpret UMass soil tests for high tunnels.

When: December 3-4, 2018

Where: Manchester Downtown Hotel, 700 Elm St., Manchester, NH 03101

Registration: Click here for attendance or trade show registration.

UConn Extension Cut Flower Workshop

For agenda and registration, please click here.

When: Tuesday, January 8, 2019, 9am-3pm

Where: Scout Hall, 28 Abbe Rd., East Windsor, CT

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

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