UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

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IN THIS ISSUE:

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Crop conditions

In the words of the MA state Ag Commissioner, John Lebeaux, "There is no one more resilient, no more creative problem solver, and no better steward of the working landscape than the Massachusetts farmer." We agree with Commissioner Lebeaux and have been really impressed with the response of local farms to this current health crisis. Farms are adapting quickly, making changes to their crop plans as well as their business plans—switching to boxed shares, online ordering, home deliveries and other innovative solutions—while also developing new habits around the farm to keep each other safe and healthy while continuing to produce the best, freshest, and healthiest food possible for their communities. We know there is still a lot of uncertainty and a lot of questions with unsatisfying answers, and we will continue to work hard daily to support you all through this difficult time. Please reach out to umassveg@umass.edu (general inquiries) or lmkeag@umass.edu (food safety inquiries) for direct assistance.

Earlier this week a new law was passed to guarantee paid sick time for workers under specific conditions related to COVID19. There are still a lot of questions about the impacts of this law for farmer- employers, but please consult the guidance posted here, and we will update you as we learn more.

For other COVID-19 content see the list of resources below.

Meanwhile, now is a busy time out in the field and in the greenhouse! Folks are busy seeding transplants, grafting, harvesting greens, prepping fields, direct-seeding early carrots and beets, planting out the earliest onions and so much more. While UMass Extension staff are not able to get out into the fields at this time, we are still getting a lot of farming questions by phone and email. Many folks are working on crop fertility plans, so we are including an article today summarizing what we learned from the spring nutrient management workshops to help you through this sometimes overwhelming process! If you still need to have a soil test analyzed, the UMass Soil Lab is currently not accepting samples but other labs around New England are open, including UMaine, UConn, and Penn State. While you continue to keep things going on your farms, take care of yourselves and each other—keeping safe distances, cleaning and sanitizing high-touch surfaces, staying home if you are sick, and washing your hands often!

Covid-19 resources

- MDAR COVID-19 Resources for Agriculture

  Includes:

  - Current guidance for **farmers' markets, farm stands and CSAs**
  - Department of Labor fact sheets on the **Families First Coronavirus Response Act** for Employees and Employers
  - **Financial Resources and Funding Opportunities**, including grants and loans available to farmers
- Massachusetts Department of Public Health COVID-19 Information
- Food & Drug Administration (FDA) Food Safety and the Coronavirus Disease 2019

Contact us:

Contact the UMass Extension Vegetable Program with your farm-related questions, any time of the year. We always do our best to respond to all inquiries.

Office phone: (413) 577-3976 *We are currently working remotely but checking these messages daily, so please leave us a message!

Email: umassveg@umass.edu

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

UMass Extension Services Update:

As you are probably aware, operations at the University of Massachusetts Amherst have been significantly reduced in response to the COVID-19 pandemic. Currently, MA and University policy have the effect of temporarily suspending most of the on-campus services that we provide until further notice, including:

- Soil & Plant Nutrient Testing
- Plant Disease Diagnostics
- Hot Water Seed Treatment*
- Nematode Analysis
- Weed, Insect, Turfgrass, and Invasive Plant Identification
- Public access to all farm properties

Until further notice, please do not send or deliver samples to campus, as we cannot process them.

In addition, all in-person UMass Extension events scheduled at least through May 15 have been canceled or postponed.

A number of resources are available from FDA to address concerns about COVID-19. It is important to note that FDA and CDC continue to emphasize that COVID-19 is not a foodborne illness, but resources continue to be updated to provide guidance to the food industry.

- North Carolina State University Infosheets in English & Spanish
- How to Build a Field Handwashing Station in 10 Easy Steps for Under $20
- H-2A Visas, Embassy Closures, and Travel Restrictions

A GUIDE TO CLEANING, SANITIZING, & DISINFECTING FOR PRODUCE FARMS

Written by Chris Callahan, UVM Extension with review and input from team members of the Produce Safety Alliance (Cornell University), Hans Estrin (UVM Extension), Lisa McKeag (UMass Extension), and Phil Tocco (Michigan State University)

This guide is intended to provide information about the differences between cleaning, sanitizing and disinfecting hard surfaces on produce farms. The motivation for this guide is the current COVID-19 pandemic and questions from growers about what can be used and how much should be used. It is important to note that COVID-19 has not been found to be transmitted via food and that this guide is not supporting the disinfection or sanitization of produce. Also remember that cleaning should be a first step in any of these activities. Follow the EPA label for your product and always wear personal protective equipment as indicated.

Also available as a PDF and on the UVM Extension Ag Engineering blog.

What is the difference between cleaning, sanitizing, and disinfection?

The CDC provides more detail on their cleaning website, but the take-homes are:

- "Cleaning removes germs, dirt, and impurities from surfaces and objects…using soap (or detergent) and water to physically remove [them]."
- "Sanitizing lowers the number of germs on surfaces or objects to a safe level, as judged by public health standards or requirements."
- "Disinfecting kills germs on surfaces or objects. Disinfecting works by using chemicals to kill germs on surfaces or objects. This process does not necessarily clean dirty surfaces or remove germs, but by killing germs on a surface after cleaning, it can further lower the risk of spreading infection."

When should I sanitize and when should I disinfect?

If you have a **possible** hazard (e.g., pathogenic *E. coli* in growing environment) cleaning and **sanitizing** is appropriate for food contact surfaces such as harvest bins, wash line food contact surfaces, and sorting and packing tables. This is doing what you would normally do within a farm food safety plan or cleaning and sanitizing SOP. Each farm and situation is unique, but some examples of when you might choose to sanitize include:

- Sorting table in an open wash/pack shed
- CSA bins returning from community distribution with no known illnesses
- Farm stand counters
- Credit/debit card machine key pads

If you have a **known or probable (likely)** hazard (e.g., visible feces, bodily fluids, or blood or an employee is found to be ill with communicable disease) cleaning and **disinfecting** is appropriate. This is generally an activity focused on specific surfaces that uses a higher concentration of disinfecting chemical and/or longer contact times, when compared to sanitizing. These surfaces may be high-touch areas that many people touch regularly or they may be surfaces with visible contamination. Each farm and situation is unique, but some examples of when you might choose to disinfect:

- Visible feces, blood, or other bodily fluid on food contact surfaces
- CSA bin returned from a household with a known transmittable illness

- CSA bins returned from a high volume distribution in a location with high probability of known illness
- Tractor / truck cab after operator has been diagnosed with a known transmittable illness

Can I use a sanitizer or disinfectant not labeled for coronavirus for protecting against coronavirus?

Unfortunately, nothing is currently labeled for killing SARS-CoV-2, the novel coronavirus we're dealing with now. The virus is too new to have had anything be tested for efficacy. Even though many commonly-used sanitizers are labeled for sanitizing and disinfecting food contact surfaces, the labels will not list SARS-CoV-2 as a target organism. Use of the product may be appropriate to the label when the target is more generally pathogenic microorganisms such as in routine sanitation. Routine sanitation practices are expected to also control SARS-CoV-2 levels.

Some products are labeled for other coronavirus or viruses that are more difficult to kill, however. The EPA does provide "List N" which are disinfectants that they approve for use against SARS-CoV-2. For example, both Ultra Clorox Brand Regular Bleach (EPA#5813-103) and CloroxPro Clorox Germicidal Bleach are included in this list (EPA#67619-32). This list includes products with the same active ingredients as some sanitizer products used on the farm. For example, there are PAA/Hydrogen Peroxide solutions on this list which use the same active ingredients as the SaniDate, Tsunami, and Vigorox branded products which are common on many fruit and vegetable farms. It stands to reason that these other products would also be effective when used accordingly (at the right dose, in the right application, with the right amount of time, etc.) These are not normal times, and sourcing products that are on List N may not be possible. If you have a sanitizer with common active ingredients, it may be your best choice.

How do I adjust my use of a sanitizer for disinfection? (see Table 1 for summary)

1. **Clorox Bleach Example:** Reviewing the label for Ultra Clorox(R) Brand Regular Bleach (alternate name, "Clorox Germicidal Bleach"), a 6.0% sodium hypochlorite product, we note that this product is labeled as effective against human coronavirus (p.35 revised). We also note that the concentration used for disinfection of hard, nonporous surfaces (p. 14 and 22 of PDF) is 2700 ppm (¾ cup per gallon of water) available chlorine and that a contact time of 5 minutes is required. This is a higher concentration and longer contact time compared to the lower rate used for sanitizing (p. 14 of PDF) of 200 ppm (1 tbsp per 1 gallon of water) with 2 minutes of contact time. For treatment of water use for fruit and vegetable washing (p.37, "For Fruit and Vegetable Washing") the concentration is 25 ppm with a submersion time of 2 minutes. The effectiveness of chlorine depends on the pH of water.

2. **SaniDate Example:** Reviewing the label for Sanidate 5.0 (p.12, "General Disinfection"), a 5.3% peroxyacetic acid and 23.0% hydrogen peroxide product, we note that the concentration used for disinfection is 0.5-2.2 fl. oz. per gallon of water (230-1000 ppm of peroxyacetic acid in water) with a contact time of 10 minutes compared to the lower rate used for sanitizing (p.10, "Sanitization of Food Contact Surfaces") of 1.6-5.4 fl. oz. to 5 gallons water (147-500 ppm) with a 1 minute contact time. Later in the label, we find the postharvest water application to control cross contamination that we're most familiar with (p. 20, "Treatment of Fruit and Vegetable Processing Waters") where the rate of use is 59.1-209.5 fl. oz. per 1000 gallons of water (27-96 ppm).

3. **Tsunami Example:** Reviewing the label for Tsunami 100, a 15.2% peroxyacetic acid and 11.2% hydrogen peroxide product, we note that there is no labeled use as a disinfectant. The label guidance for sanitization (p.4, "Sanitizing Food Contact Surfaces") is 1.0 to 1.8 fl. oz. per 8 gallons water (1000-1800 ppm of product, 150-270 ppm of PAA) with a contact time of 1 minute. We also note that the postharvest water application to control cross contamination that we're most familiar with (p. 2, "For Pathogen Reduction and Control in Fruit and Vegetable Processing Waters in Food Facilities") has a rate of use of 2.5 to 6.7 fl. oz. per 100 gallons of water (30-80 ppm PAA).

4. **Vigorox Example:** Reviewing the label for Vigorox SP-15 (p.5 "Surface Disinfection"), a 15.0% peroxyacetic acid and 10.0% hydrogen peroxide product, we note that the concentration used for disinfection is 0.5-2.2 fl. oz. per gallon of water (230-1000 ppm of peroxyacetic acid in water) with a contact time of 5 minutes compared to the lower rate used for sanitizing (p.4, "Sanitization of Non-Porous Food Contact Surfaces") of 3.1 fl. oz. to 50 gallons water (85 ppm PAA) with a contact time of 1 minute. The postharvest water application to control cross

Product	Active Ingredients as Received	Labeled Concentration for Wash Water Treatment	Labeled Concentration for Sanitizing Hard Surfaces	Labeled Concentration for Disinfecting Hard Surfaces
Ultra Clorox Brand Regular Bleach	6.0% sodium hypochlorite	**25 ppm** free chlorine 1/2 cup per 75 gallons 2 minute submersion time	**200 ppm** 1 tbsp per 1 gallon of water. 2 minutes contact time.	**2700 ppm** ¾ cup per gallon of water. 5 minutes contact time.
Sanidate 5.0	5.3% peroxyacetic acid (PAA) and 23.0% hydrogen peroxide	**27-96 ppm PAA** 59.1-209.5 fl. oz. per 1000 gallons of water	**147-500 ppm PAA** 1.6-5.4 fl. oz. per 5 gallons water. 2 minutes contact time.	**230-1000 ppm** PAA 0.5-2.2 fl. oz. per gallon of water. 10 minutes contact time.
Tsunami 100	15.2% peroxyacetic acid (PAA) and 11.2% hydrogen peroxide	**30-80 ppm PAA** 2.5-6.7 fl. oz. per 100 gallons of water	**150-270 ppm PAA** 1.0-1.8 ounces (product) per 8 gallons of water 1 minute contact time.	**Not Labeled**
Vigorox SP-15	15.0% peroxyacetic acid (PAA) and 10.0% hydrogen peroxide	**45 ppm PAA** 0.54 fl. oz. per 16 gallons of water	**85 ppm PAA** and 57 ppm hydrogen peroxide 3.1 fluid ounces per 50 gallons of water. 1 minute contact time.	**800 ppm PAA** and 530 ppm hydrogen peroxide. 3.0 fluid ounces of the product per 5 gallons of potable water. 5 minutes contact time.

Table 1. Summary of sanitizing chemicals commonly used on many farms showing the differences in concentrations and contact time for the different intended applications of produce wash water treatment, sanitizing, and disinfecting. Based on review of EPA labels. Reference the label for your specific product to confirm applications, concentrations, and contact times. Always wear appropriate personal protective equipment (PPE).

contamination that we're most familiar with (p.6, "For Reducing Pathogenic Foodborne Bacteria in Processing Waters for Fruits and Vegetables") where the rate of use is 0.54 fl. oz. per 16 gallons of water (45 ppm PAA).

For help determining appropriate mixing rates for volumes other than those above, see the sanitizer dose calculator available online.

TAKE-HOMES FROM MARCH 2020 NUTRIENT MANAGEMENT WORKSHOPS

In early March, we had the pleasure of holding two workshops on nutrient management for vegetable crops, presented by Becky Maden and Laura Johnson of University of Vermont Extension. In addition to getting into the details behind soil pH, organic matter, and nitrogen availability, Becky and Laura addressed the fact that managing soil fertility can often be very overwhelming and expensive for farmers and they gave some overarching take-home messages to prevent farmers from getting bogged-down by stacks of soil tests and in-depth fertility recommendations.

Address the low-hanging fruit first: pH and macronutrients.

pH. Optimal pH for most vegetable crops is 6.5-6.8. Nutrients are most available at a neutral pH (7) and start to become unavailable as soil becomes more acidic. At a pH of 5.5, only 77% of N, 48% of P, and 77% of K in the soil is available to plants. Lime your fields to get your pH closer to 7 before you spend lots of money on fertilizers.

Macronutrients. Focus on reaching optimal levels of N, P, and K before addressing micronutrient concerns. Micronutrients are present in such small quantities in soils that they are hard to detect precisely with soil testing methods. Instead of trying to increase your soil zinc from 0.8 to 1.0 ppm, keep an eye out for nutrient deficiencies throughout the season and submit a tissue sample if you suspect a specific micronutrient deficiencies.

Base cation saturation ratios: The model of soil fertility that all state university soil labs use is based on the proven concept that nutrient levels can be defined for all crop nutrients and below those levels, you will see a yield response in your crop if you add more of that nutrient. This is known as the "sufficiency level of available nutrients" model. There are some private soil labs that use the "base cation saturation" (BCSR) model. The BCSR model focuses on fertilizing soils based on the ratios of calcium, magnesium, and potassium in the soil, with the goal of achieving "ideal" ratios that will result in a "balanced" soil and maximum crop quality and quantity. This idea of ideal ratios was first proposed in the late 1800s but became popular in the 1970s after it was publicized by the soil scientist William Albrecht. However, the BCSR concept has since been disproved and it has been shown that maximum yields of many crops can be achieved across wide ranges of Ca:Mg and K:Mg ratios, if pH is maintained in an optimum range and sufficient macronutrients are supplied. While Mg and K deficiencies can certainly occur, it is much easier to address those deficiencies once the low-hanging

fruit (pH and macronutrients) have been addressed. See the "Resources" list at the end of this article for more information about BCSR.

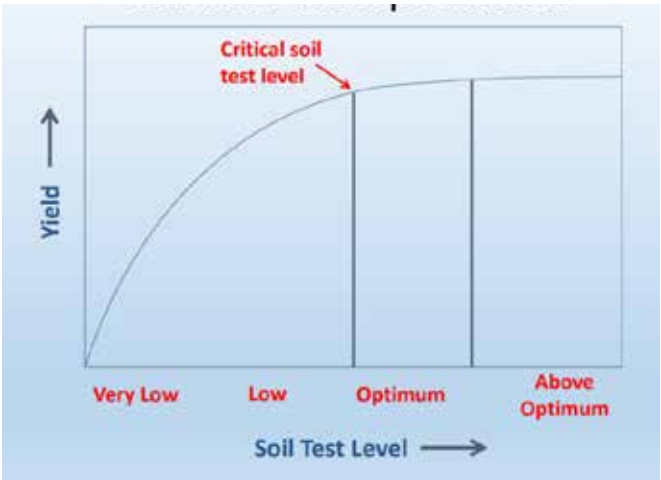

Figure 1. Crop yield response to soil nutrient levels. If a soil contains no nutrients, adding some nutrients will result in a large increase in yield. As soil nutrient levels approach optimum, each incremental addition of nutrients has less and less of an effect on crop yield. Figure: UVM Extension

Prioritize problem fields and/or high-value crops. While we should strive to achieve the recommended fertility for every crop every year, it is not always realistic or even necessary. Crops respond to added nutrients logarithmically (see Figure 1), meaning the initial response to added fertility is huge but there is a point of diminishing return, where adding more fertilizer leads to only small gains in growth or yield. Fertilizer is expensive! So spend your time and money wisely and get "close enough." Work on dialing in nutrients for fields where you see nutrient problems regularly and for high-value crops where you can't afford to get less-than-optimum yields. For other crops, you may be happy enough getting less-than-optimum yields and saving money on the fertilizer needed to get that last 5% yield.

Don't obsess over soil organic matter—work within the range of your soil type. Soil organic matter (SOM) includes living (e.g. insects, bacteria, fungi), dead (e.g. dead plants, insects, bacteria, fungi), and very dead (aka humus) material in soil. Organic matter is generally increased by incorporating cover crops or applying organic amendments like manure and compost, most of which have high phosphorous levels relative to crop need. Generally, 2-3% SOM is considered low, and 4-6% is considered good. *But* it's nearly impossible to maintain SOM above 3% in a sandy soil, and if you're adding enough compost that your SOM is increasing above 3%, your phosphorous levels are very likely skyrocketing. If you have sandy soils, aim to maintain your SOM instead of increasing it. Across all soil types, look at the trend of your SOM and don't obsess over the value alone. If you're increasing your SOM without applying excessive phosphorous, great! If you're maintaining your SOM, great! If your SOM is decreasing, consider making a change.

Know your phosphorous levels and your environmental risk level before adding organic amendments. Phosphorous is an essential plant nutrient but can become an environmental pollutant if large quantities enter water sources. This is mainly an issue with large-scale growers who use manure or compost or who are growing on fields that historically had lots of manure put down. When P levels are high, there are no corrective actions except avoiding adding more phosphorous. Most organic amendments—composts and manures—are high in P. Cover crops are great ways to add organic matter without adding P. In high tunnels, where cover cropping is difficult, peat moss and coconut coir are two options for adding organic matter without adding extra P.

Optimal phosphorous ranges from a Modified Morgan soil test is 4-7ppm; above that, your phosphorous levels will be reported as "excessive". That means a P at 8ppm will look the same on the soil test report as one at 300ppm, even though 300 ppm is much worse than 8ppm. Generally speaking, P levels above 50 ppm are alarming. We've heard some farmers say that excess P is not a big deal as long as your field is not next to a waterway—not so! There is a growing awareness that long-term over-application of manure and chemical fertilizer contributes to phosphorus movement into the groundwater system, resulting in a significant groundwater source of phosphorus to streams and lakes, as well as potential

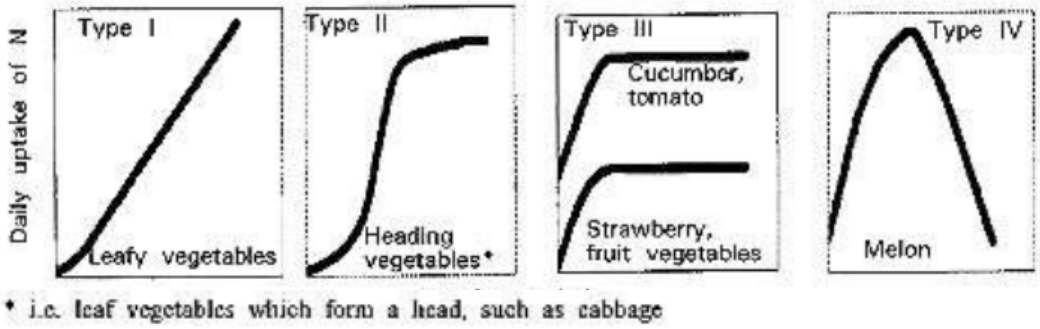

Figure 2. Uptake of nitrogen over the growing period of various crops. Figure: Redrawn from Kato 2000.

contamination of the groundwater resources. Further, excessive P can tie up zinc leading to deficiencies.

Nitrogen is very dynamic in soil. Pre-sidedress nitrate tests (PSNTs) can be very useful for assessing nitrogen status of a field or crop. For example, if you incorporated a leguminous cover crop and want to track when the nitrogen is being released, you could take PSNTs over time and watch the level of nitrate change. Or, you could take a PSNT at the end of the season to see how much nitrogen you have leftover (then plant a cover crop to soak it up!). Most organic sources of N are slow to release, and if you are using these exclusively, you should plan to put down the pre-plant and side-dress amounts all at the beginning of the season as it won't be available to your crop in time if it's put down as a side-dress. Nitrogen from cover crops is typically available 4-6 weeks after incorporation—this might mean you need to change when you are planting in order to line up nitrogen availability with crop need better.

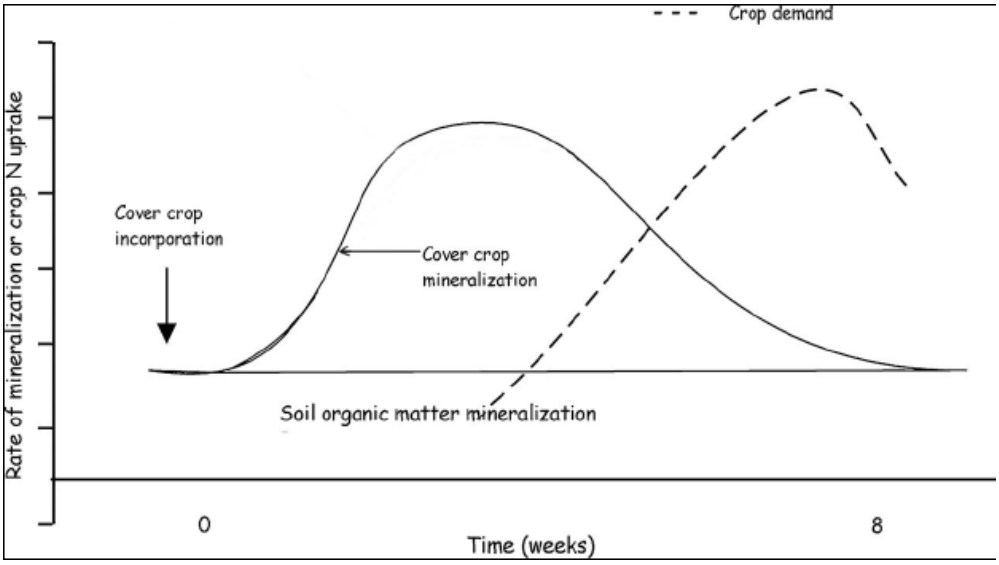

Figure 3. Timing of nitrogen (N) mineralization from soil organic matter, cover crop residues, and organic fertilizer in relation to crop N uptake (from Gaskell et al., 2006).

Updated high tunnel fertility and production recommendations. There is lots of research going on in New England right now looking at high tunnel fertility, for both summer and winter crops. In 2018, several New England state Extensions surveyed 20 tomato high tunnels to analyze growing practices and yields. That project has resulted in updated high tunnel tomato fertility and production recommendations in the New England Vegetable Management Guide, as well as in this survey report: 2018 High Tunnel Survey Report. An important part of these new recommendations is that high tunnel tomatoes should be fertilized based on the potential yield of the production system: a heated tunnel of indeterminate, hybrid, disease-resistant, grafted tomatoes that are closely spaced and heavily pruned has the *potential* to produce much higher yields than an unheated tunnel of determinate heirloom tomatoes that will be harvested 3 times before they go down to leaf mold. The first scenario requires much more nutrients than the second. The Guide and fact sheet list nutrient recommendations for low, medium, good, and high yields, all of which refer to the *potential* yield of your high tunnel tomato production system.

Salts can build up in the top two inches of high tunnel soil. Salts are wicked to the soil surface through evaporation and are not flushed back down because there's no rain. These salts are nutrients, so you don't want to remove them, but they can cause plant damage in high concentrations so take measures to mix or flush them deeper into the soil. Mix the soil by rototilling or plowing to a >6" depth and/or leave the tunnel plastic off for the winter every time you change it, to flush the salts back down.

In conclusion, when you get all 35 of your soil tests back and don't know where to start remember that you just need to get close enough, start with the low-hanging fruit, and feel free to contact any of us for help making a plan or going through some of the calculations.

Additional Resources:

- Becky Maden created a fertilizer calculator where you can enter nutrient levels, soil pH, and organic matter levels from a soil test, as well as cover crop information, and the spreadsheet will walk you through how much of a given amendment you should be applying to your field.
- Base Cation Saturation Ratio System, *Building Soils for Better Crops*. Magdoff, F., and van Es, H.
- A Review of the Use of the Basic Cation Saturation Ratio and the "Ideal" Soil. Kopittke, P., M., and Menzies, N. W.
- Phosphorous and Groundwater: Establishing Links Between Agricultural Use and Transport to Streams. Domagalski,

J. L., and Johnson, H.

- The New England Vegetable Management Guide covers many of these topics:
  - See the Plant Nutrients section for more information on both macro- and micronutrients
  - See the Fundamentals of Soil Health and Fertility section for more information on soil organic matter and pH
  - See the Fertilizer and Soil Amendments section for information on fertilizers as well as manure and compost.

--Written by G. Higgins and S. Scheufele, March 2020

Holding plants in the greenhouse

Note from the UMass Extension Vegetable Program: This article is geared towards greenhouse producers of ornamental crops. Some of the techniques described here don't apply to vegetable production, but are included because many of our readers grow ornamentals as well as vegetable transplants. See added paragraphs at the end of this article for additional information on holding vegetable transplants in the greenhouse.

Due to the current COVID-19 outbreak and the restrictions imposed by state governments to minimize spread of the virus, growers may struggle to get plants to market in an environment with reduced demand. This may force wholesale growers to keep their crops in greenhouses beyond their scheduled shipping dates, and retail growers to hold plants in the greenhouse for significantly longer than planned.

When holding crops in the greenhouse, the primary goals are to slow down plant growth and maintain the quality of the plants. Both cultural practices and chemical methods can be useful for controlling plant growth and preserving plant quality.

Cultural practices to reduce plant growth may include the following:

- **Reduced watering:** Mild water stress can stimulate reductions in plant growth rates. This can be implemented by consistently allowing the root zone to dry down, by withholding irrigation until early symptoms of wilting are observed.
- **Reduced fertilizer application:** Reducing nitrogen fertilization will slow overall plant growth. However, proceed with caution because if nitrogen becomes deficient plants can end up stunted and yellow. Regarding phosphorus, a mild or moderate phosphorus reduction can result in a more measured growth rate and enhance green color of foliage. Unfortunately, a phosphorus deficiency is more difficult to create than a nitrogen deficiency.
- **Temperature manipulation:**
  - **Decreasing greenhouse temperature** is among the best best strategies to slow plant growth, if outside temperatures allow. For cold tolerant plants such as petunia, snapdragon, nemesia, dianthus and marigold, greenhouse temperature can be reduced to 40-45 degrees F. For cold sensitive plants such as celosia, portulaca, torenia, angelonia and vinca, greenhouse temperature can be reduced to 50-55 degrees F. With reduced greenhouse temperature, be sure to keep relative humidity low because high humidity reduces water uptake and increases incidence of diseases such as botrytis.
  - **The difference between day and night temperature (DIF)** can also be used to control plant growth. DIF affects stem elongation and plant height. Negative DIF (day time temperature less than night temperature) reduces stem elongation and plant growth and is an effective way of reducing growth rates.
- **Pinching:** Pinching involves removal of the terminal growing point and young leaves. Pinching eliminates apical dominance and allows the dormant buds below the pinch to grow. Pinching is used to increase branching and improve plant shape, and also helps to reduce height and to slow plant growth.

Pinching off the terminal growing point of plants, as these workers are doing to petnuia pots, can help reduce plant height and slow plant growth. Photo: G. Njue

- **Spacing:** The distance between containers affects the amount of light, water and nutrients available to individual plants. Closely spaced plants grow taller with smaller diameter stems. Widely spaced plants grow shorter with larger diameter stems. If possible space plants strategically to reduce stem length.

Chemical methods to reduce plant growth:

- **Applying plant growth regulators (PGRs)** is another tool for slowing down plant growth. There are several PGRs available in a variety of formulations, and it is very important to take special care in selecting the right PGRs for this objective. Performance of PGRs can also vary depending on application method. When the goal is holding plants temporarily sprench applications are preferable to sprays or drenches, as a sprench lasts longer than a spray. Drench application is not advised soon before shipping or selling plants because the effect of the PGR may last longer than desired.

Additional information on holding vegetable transplants in the greenhouse: from the New England Vegetable Management Guide.

- **Plant Growth Regulators:** A review of pesticide labels indicates that Sumagic (uniconazole) is the only growth regulator labeled for use on a limited group of vegetable transplants (tomato, pepper, eggplant, tomatillo, ground cherry, and pepino). Sumagic is a gibberllin biosynthesis inhibitor suppressing plant height by inhibiting internode elongation. It is a particularly active plant growth regulator, so very small concentrations are needed. Apply Sumagic only as a foliar spray at a rate of 2-10 ppm. As with any plant growth regulator, it is recommended to test growth regulator treatments on a small number of plants with a low rate before full-scale implementation. The maximum cumulative amount of Sumagic applied must not exceed 10 ppm with coverage of 2 quarts per 100 sq. feet. This means that total amount used in sequential applications can only add up to 10 ppm spray (example, two applications at 5 ppm or 4 applications at 2.5 ppm). The last spray must be no later than two weeks after the two to four leaf stage of development. Experiments have shown that sequential applications produce the best results and that the earlier that the plants receive the Sumagic spray, the greater effect it will have on the final height of the transplants. As only a limited number of tomato varieties have been tested, growers are encouraged to do their own in-house trials on a small number of plants with a low rate before full-scale implementation.
- **Mechanical Brushing:** Mechanical stress reduces stem elongation. Wind, shaking or brushing are all types of mechanical stress. Research has shown that mechanical stress reduces stem elongation and maintains plant height. For example, brushing transplants twice daily for 18 days using about 40 strokes back and forth with a cardboard tube suspended from an irrigation boom can result in as much as a 30% reduction in stem elongation. Growers have also successfully used a wand made of plastic plumbing pipe or a flat piece of polystyrene foam. Vegetable plants such as tomatoes, eggplants, cucumbers and some varieties of broccoli and cabbage have responded to this method of height control. Note that this technique has damaged some tender plant species such as peppers and could also enhance the spread of disease. Brush plants when the foliage is dry and if you see plant damage, reduce the number of times you are brushing the plants. Brushing can improve establishment of transplants in the field. They resume their normal growth about 3 days after the brushing stops. There is also little or no reported effect on yield.

For more information refer to the links below:

Runkle, E. and H. Lindberg, 2020. Holding greenhouse crops. Michigan State University Extension Fact Sheet. https://www.canr.msu.edu/news/holding-greenhouse-crops

Currey, C. J. and R.G. Lopez, 2010. Applying plant growth retardants for height control. Purdue University Extension Fact sheet. https://www.extension.purdue.edu/extmedia/ho/ho-248-w.pdf

Cox D., 2007. Controlling plant height without chemicals. UMass Extension Fact Sheet. https://ag.umass.edu/greenhouse-floriculture/fact-sheets/controlling-plant-height-without-chemicals

--Written by Geoffrey Njue, UMass Extension Greenhouse Crops and Floriculture Program

News

Upcoming Pesticide Exams Cancelled

The Massachusetts Department of Agricultural Resources has made the difficult decision to cancel all pesticide exams within the next 30-days. The following exams are cancelled:

April 3rd: Lantana

April 10th: Lantana

April 14th: Springfield Technical Community College

April 17th: Lantana

April 22nd: Cape Cod Technical High School

April 24th: Lantana

The Department will develop a plan on how individuals that have had their exams cancelled will be able to take the exam. Until such a time that the administration's orders are lifted, individuals will not be able to retake or sign up to take exams.

While this is a very challenging time, please know that the Department is committed to serving it's constituents and stakeholders and will continue to work in the most helpful and supportive manner possible. We appreciate your patience and understanding, as together, we navigate this rapidly evolving situation.

For more information about this decision, please see the full MDAR Bulletin here: https://www.mass.gov/doc/pesticide-exams-bulletin/download

If you have any questions about this Bulletin, please contact Taryn LaScola-Miner, Director of Crop and Pest Services, MDAR, at taryn.lascola@mass.gov.

MDAR Grants Announced

MDAR's Urban Agriculture Program is seeking to award grants statewide to promote strategies addressing food insecurity, to expand and create new economic opportunities and to increase access to fresh, local produce in urban neighborhoods.

- Application deadline is 4:00 PM on May 28, 2020
- For questions regarding the RFR, applicants can email Rose.Arruda@state.ma.us .
- Applicants are responsible to refer to the COMMBUYS link for any changes or updates to the RFR.

MDAR's Food Ventures Program seeks proposals for funding projects that will increase access to fresh, local produce in urban and rural communities and provide economic opportunities that promote job creation enterprises or new businesses. MDAR is seeking to award grants statewide, primarily in communities of low or moderate income, to individuals or entities with experience developing and supporting food businesses.

- Application deadline is 4:00 PM on May 28, 2020

Additional MDAR grants that are currently open for applications can be found in the Financial Resources and Funding Opportunities section of the the MDAR COVID-19 Resources for Agriculture site.

Events

Webinar: Best Practices for Small Farm Marketers During the COVID-19 Pandemic

Join North Carolina State University educators, Lynette Johnston, Chip Simmons, Elena Rogers, and Chris Gunter as they discuss cleaning and sanitization for small direct farm marketers.

When: April 3, 2020, 8:30-9:30am

Click here to join the webinar: Webinar Link

Cornell: COVID-19 and Your Produce Farm Webinar

This webinar will cover steps that produce farm managers and individuals working with fruit and vegetable farms should consider to protect their workforce, their business, and their markets.

When: April 3, 2020, 10:00-11:30am

How to Watch: Click here to register for this webinar.

This webinar will be led by Richard Stup, PhD, Cornell Agricultural Workforce Development, Elizabeth Bihn, PhD, Director of Produce Safety Alliance at Cornell, and Anu Rangarajan, PhD, Director of the Cornell Small Farms Program. The webinar will cover why prevention of the coronavirus/COVID-19 is important, steps that employers should take to protect employees, how to manage cleaning and disinfection in the workplace and employee housing, state and federal sick leave and workforce reduction policies, and disaster contingency planning to manage and prevent the spread of COVID-19 on-farm. The webinar will be recorded and posted on the website. Attendance is limited to 500 individuals on a first come, first serve basis.

Farm Commons COVID-19 Podcast

The Farm Commons team has created 5 podcast episodes answering questions on a variety of farm-related COVID-19 topics. Check in weekly for new episodes covering the emerging challenges facing farm businesses during this time. Coming soon will be episodes on the Families First Act, food safety liability and insurance, farming through shelter-in-place executive orders, and more.

Part 1: Sick Leave on the Farm
Part 2: Health Screening and Unemployment on the Farm
Part 3: Diversifying Farm Sales in Response to COVID-19
Part 4: Farm Sales through Online Platforms and CSA
Part 5: Managing Workers on the Farm during COVID-19

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