UMass Extension

Vegetable Notes

For Vegetable Farmers in Massachusetts since 1975

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Crop Conditions

This month, crop conditions come to you from Long Island. Last week, I drove to New London, CT, onto a ferry and over to Riverhead, NY to give a talk for Cornell's Suffolk Co. Extension on using weather forecasting models for decision making on diversified vegetable farms. While there, I met: an 11th generation farmer who has been using no-till practices on his pumpkins for the last 10 years to combat *Phytophthora* and build soil organic matter, an organic farmer who owns farmland in Iowa, Arizona and Long Island advising that crop diversity and rotation is a major key to adapting to climate change, a farmer and trainer for a land trust farm with some great tips for managing deer, and Legislator Al Krupski who is also a diversified fruit and vegetable farmer. Farmers seem to be as diversified as what they grow. Al says he is able to keep his farm stand open now until Christmas while even 10 years ago, it was too cold in November to attract customers. We are seeing similar trends in farm stores across Massachusetts. More news from the home front: with the ground finally frozen and some snow on the ground, greenhouse, fencing, and irrigation construction projects are coming to a halt. Last week, before the snow, strawberries were being mulched around the state and one grower who tried growing ever-bearing varieties under low tunnel perforated plastic was very pleased with his harvest up until Thanksgiving! High tunnel and greenhouse crops are being harvested, but not without their problems. This past month spinach downy mildew (an oomycete) was diagnosed in several New England states, though not MA and powdery mildew (a fungus) on lettuce from Norfolk, Co. MA was diagnosed by UMass Diagnostician Angie Madeiras. These mildews are caused by entirely different organisms and therefore different classes of pesticides are used to manage them. Also, the downy mildew on spinach is different from the downy mildew found on cucurbits or basil, while the powdery mildew found on lettuce may also infect cucurbits but is different from the powdery mildew found on tomato. A lettuce/cucumber rotation in high tunnels should be avoided if powdery mildew is common, though other wild and ornamental hosts are likely the most important source of inoculum. See **Pest Alerts** below for more information.

Snow on lettuce? Nope! Powdery mildew. photo: G. Higgins, UMass Extension

Oh, and are you interested in that tip on deer management from the farmer in Long Island? His approach is mostly focused on animal behavior. Deer fencing works great only if the deer can be trained to go around the fencing. Therefore, use apple scent to bait the herd to an electric fence, and do not chase the deer if you see them near the fencing since spooking them may cause them to jump through the fence and into the field. Once in the field, deer will now know that the fence is not really a barrier. Occasionally, fencing must be set up in a way to give corridors to the deer to encourage them to pass through a farm rather than staying. In the meantime, enjoy hunting season!

PHOSPHORUS MANAGEMENT FOR VEGETABLE FARMERS

Over the last few years, some growers have been wondering: How did my soil phosphorus levels get to be so high and what can I do about it to keep from being a source of phosphorus pollution? UMass Extension hosted a symposium last month on 'Managing Phosphorus in Organic Residuals Applied to Soils' with experts and professionals from all over the region and we now have a better understanding about how to tackle that question. We learned that phosphorus demand and supply are unevenly distributed in the US and within our region with New England being a net importer of P in the form of fertilizer and feed (human and animal), therefore we can improve P management by using local sources. Highlights from the symposium about soil phosphorus dynamics, soil testing and interpretation, and P mitigation strategies are included here to help growers take some practical steps toward improved P management.

Soil phosphorus dynamics: Fertilizer phosphorous comes mostly from fossilized bones and is rapidly fixed once applied to soil. Organic forms of phosphorus applied—including manure, compost, biosolids, or cover crops—become available more slowly through the growing season, depending on microbial activity which is regulated by temperature, moisture, and soil fertility. For example, in cold soils below 50°F, the mineralization of P from organic sources by microbes is slowed down, and there is often a crop response to additions of P containing more rapidly available starter P fertilizer. From either source, phosphorus is highly soluble and erodible if not incorporated into the soil where it will quickly—within a few hours—bind with iron, aluminum, calcium or magnesium (depending on soil pH) and consequently become very slowly soluble for plant uptake (Fig 1). Incorporated P can still contribute to pollution when soil particles containing P erode with wind or water. In most soils, there is plenty of Fe, Al, Ca and Mn to bind P so surface runoff from unincorporated fertilizer or organic matter is the largest source of P pollution. An actively growing root system is one of the best ways to cycle P, utilize it for crop growth, and reduce potential for erosion. The concentration of soluble P needed for growth of agronomic crops is about 0.2 ppm, while a phosphorus concentration ten times lower of 0.02 ppm is all it takes for aquatic plants to grow and cause eutrophication in aquatic systems. This is why phosphorus can so quickly cause water pollution.

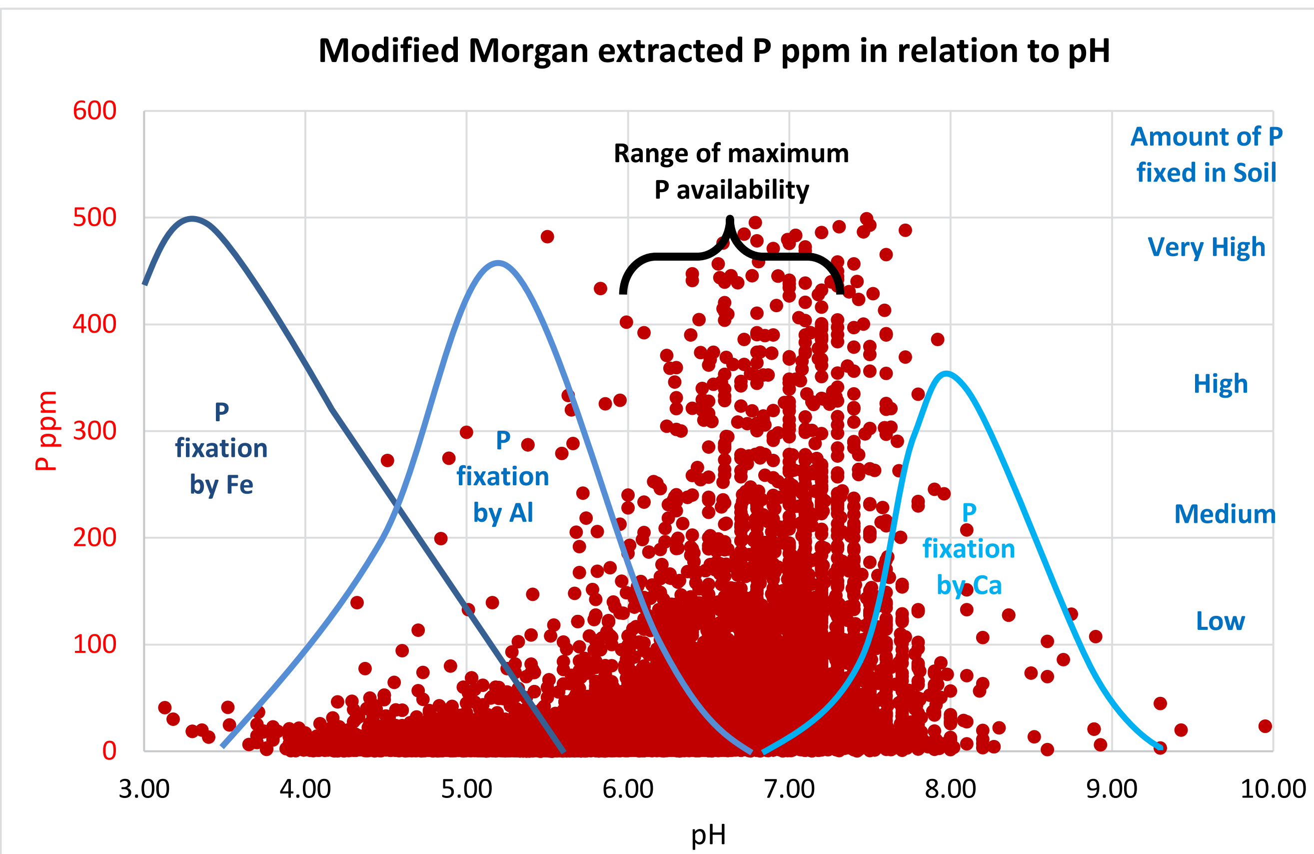

Figure 1 by Katie Campbell-Nelson. The red dots represent Modified Morgan extracted P levels in ppm from over 24,000 soil samples analyzed at the University of Massachusetts and Maine soil labs in 2015. Area underneath the blue lines represent P fixation by iron and aluminum phosphates at low pH and calcium phosphate at high pH.

Phosphorus testing and interpretation: A good practice is to take soil samples at the same time each year (usually fall) to monitor soil test P levels over time and find out if they are increasing, which would indicate that more P is being applied than is being removed by crops. Modified Morgan extractions are still considered the most accurate soil analysis method for New England soils because it has been widely used to conduct nutrient management studies and correlate crop yield to fertility amendments in our region. Different soil test solutions extract different amounts of P from the soil and we don't have as good an understanding of what these values mean for crop yield responses in New England soils. University soil testing labs in VT, MA and CT give P fertilizer recommendations based on extracted P and Al to account for buffering capacity. When testing organic residuals (e.g. compost or biosolids), water extractable P (WEP) is a useful additional analysis to Total P (TP) for determining risk of runoff. Water extractable P represents the P that is available at the time of application, while Total P represents P that will become available during the growing season through mineralization. Please note: Until 2012, the UMass soil lab did not consider soil test P levels to be above optimum until the soils exceeded 40ppm P. However, with recent research showing that P was leachable in certain soil settings at 40 ppm and data showing that crops do not require >14ppm P to achieve maximum yields, soil test interpretations were changed to label soils with >14ppm P to be "above optimum". Therefore, you may have seen an increase in soil P levels due to changes in interpretation of test results that were not due to any change in your farming practice. The UMass soil lab no longer offers compost analysis but here are labs that offer testing services discussed in this article:

UMass Soil and Plant Nutrient Testing Laboratory
Services: Modified Morgan
Web: http://soiltest.umass.edu/
Phone: 413-545-2311
Email: soiltest@umass.edu

UConn Soil Nutrient Analysis Laboratory
Services: Modified Morgan
Web: http://www.soiltest.uconn.edu/
Phone: 860-486-4274
Email: soiltest@uconn.edu

UVM Agricultural and Environmental Testing Lab
Services: Modified Morgan, manure
Web: https://www.uvm.edu/pss/ag_testing/
Phone: 802-656-3030
Email: AgTesting@uvm.edu

UMaine Analytical Lab and Soil Testing Service
Services: Modified Morgan, manure, compost, TP and WEP
Web: https://umaine.edu/soiltestinglab/
Phone: 207.581.2945
Email: hoskins@maine.edu

Penn State Agricultural Analytical Service Lab
Services: manure, compost, TP and WEP
Web: http://agsci.psu.edu/aasl
Phone: 814-863-0841
Email: aaslab@psu.edu

Spectrum Analytic
Services: Modified Morgan, manure
Web: http://www.spectrumanalytic.com/
Phone: 1-800-321-1562
Email: info@spectrumanalytic.com

Dairy One
Services: Modified Morgan, manure
Web: http://dairyone.com/
Phone: 1.800.344.2697 or 607.257.1272
Email: mark.joyce@dairyone.com

If soil test P levels are high or above optimum (>14ppm Modified Morgan extracted P), the risk of P pollution may still be low. Phosphorus becomes a threat to the environment when there is a combination of source AND transfer. Risk of pollution may only be assessed if there is enough information about how the P may be transported to water. For example, there is high risk of pollution from P applications on frozen ground, on slopes greater than 7% or within 25 ft. of a water source. In these scenarios, a field with low or below optimum P levels may actually pose a greater risk of pollution than a high-P field, especially if P was applied right before heavy rains. Another scenario of poor P management would be spreading compost onto a field in the fall without incorporation or a without a cover crop where the P may runoff in the spring with snowmelt into nearby streams. Soils with above optimum P are not a threat to environmental contamination if there is low overland water movement or soil erosion.

Phosphorus mitigation strategies: Symposium attendees came up with quite a few creative P mitigation strategies during round table discussions. Here are some applicable to vegetable growers:

- Identify areas on the farm where there is a large source of P AND high risk of transport. Develop a P mitigation strategy for these fields first.
- When using organic residuals, it is easy to over-apply P when trying to meet a crop's N demands due to the ratio of N:P in the materials. Therefore, calculate P content before making compost or manure applications to meet crop needs, then use an N-based fertilizer such as urea, alfalfa or soybean meal to meet the crop's N needs.
- Do not surface apply organic residuals such as manure or compost before heavy rain.
- If soil test P levels are above optimum, experiment with lower P applications by leaving it off of a few hundred row ft of crop, especially in early spring plantings and then keep track of yields.
- Reduce soil compaction.
- Convert areas of highest risk for P transport to buffer strips.
- Make banded rather than broadcast applications of P-containing materials whenever possible, and incorporate material to 2 inches below seeding depth to allow roots to grow down to meet the P.
- If P-containing residual or fertilizer is applied, consider incorporation to increase mineral binding and applying to planted cover to reduce potential soil erosion caused by tillage.
- Use low-P sources of organic residuals such as leaf mulch compost instead of food waste or manure based compost. Poultry litter and pig manure have the highest P-content of compost based fertilizers because their guts lack an enzyme which stabilizes P; ruminants have this enzyme.
- Consider growing high yielding crops such as corn and removing crop residues after harvest.
- Use 'hyperaccumulator' cover crops like mustard, Johnson grass, corn and sorghum or alfalfa to take up P from the soil, then remove and compost the material or feed it to animals to recycle the P.
- Manage soil pH to a range between 6.5-7.2 first, then get a soil test and amend with P afterwards, only if needed.
- Conduct a whole-farm nutrient balance worksheet, making sure to credit all sources of P including from organic residuals and cover crops.
- Conduct a risk assessment using the Phosphorus Index to determine risk of P pollution from a particular field. Here is a link to conduct the P-Index on your own: https://efotg.sc.egov.usda.gov/references/public/MA/MA-P-Index_Version3__May2014.xltx. Or, contact your local NRCS office for help with interpretation.
- Maintain regular soil testing practices using the Modified Morgan for soils and ask for testing results of organic residuals wherever you source them from.
- Reduce the amount of P that is imported into our region and onto our soils by using local sources of organic residuals rather than purchasing P fertilizer where possible. Organic residuals such as compost have the added benefit of increasing soil organic matter and water holding capacity which will also reduce P runoff.

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Resources:

Presentations from November 2, 2016 Symposium "Managing Phosphorus in Organic Residuals Applied to Soils": https://www.nebiosolids.org/managing-p-in-organic-residuals-applied-to-soils

Massachusetts Phosphorus Runoff Index (Version 3, 2014): https://efotg.sc.egov.usda.gov/references/public/MA/MA-P-Index_Version3__May2014.xltx

-- by K. Campbell-Nelson, UMass Extension Vegetable Program