CROP TALK

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UCONN
COLLEGE OF AGRICULTURE, HEALTH AND NATURAL RESOURCES
EXTENSION & PLANT SCIENCE AND LANDSCAPE ARCHITECTURE

IN THIS ISSUE

MEET NICOLE, UCONN EXTENSION'S NEW VEGETABLE IPM OUTREACH ASSISTANT

I am excited to introduce myself as the new Outreach Assistant for UConn Extension's Vegetable IPM Program. I received a bachelor's degree in International Studies from Fairfield University, focusing on humanitarian disasters, social justice issues, and human rights advocacy. I spent over five years in the nonprofit sector before pursuing an interest in local and regional food production. For the past six years I've worked on small scale vegetable farms in MA and CT. Having grown up in central CT, I'm excited to be back and supporting farmers in my home state. As an Outreach Assistant, I will be working with various Extension Specialists and partners to continue to encourage and facilitate communication and collaboration with growers.

My goal is to support farmer innovation, resilience, and success by connecting growers with tools, resources, and data-driven methodologies that are ready for implementation. I look forward to meeting you, visiting your farms, and working alongside you in a collective effort to secure a promising future for all farmers across the state.

CT IPM

FARMER FEATURE

PAUL BUCCIAGLIA
FORT HILL FARM
NEW MILFORD, CT

SOIL STEAMING FOR HIGH TUNNELS AT THREE CERTIFIED ORGANIC CONNECTICUT FARMS

By Paul Bucciaglia

Over the last three decades farmers have seen dramatic shifts in the growing climate in Connecticut. Long dry spells are now common, and when rains do occur they are long duration, intense events that often cause crop damage, soil nutrient leaching, and soil erosion. This has led many small-scale horticultural farms to increasingly rely on high tunnel and greenhouse production to lessen the impact of extreme precipitation and wind events while increasing harvest windows. To preserve soil health, many producers have also switched to low till systems in high tunnels. However, crop production in high tunnels brings about a new set of challenges, including very high winter annual weed seeds in the soil, root knot nematodes, and other pathogens such as *Pythium, Sclerotinia,* and *Fusarium*.

In 2024, Fort Hill Farm received a Climate Smart Agriculture Grant administered through Connecticut Resource Conservation and Development to purchase a Sioux SF-20 soil steamer with steam socks and tarps to steam treat high tunnel growing beds. We used this equipment on high tunnels on our farm, as well as trained two neighboring farms (Riverbank Farm, Roxbury CT, and Massaro Farm, Woodbridge CT) in the use of the steaming equipment. Each farm chose a 4 x 90-foot bed top and took soil samples pre- and post-steaming. These beds were sampled before steaming (0d), 7 days post steaming (7d), and 15 days post steaming (15d) and tested for viable weed seed, soil nutrients, soil microbial activity, and soil chemistry. Additionally, due to the known presence of Southern Root Knot nematodes at Fort Hill Farm, a bioassay for nematodes was also conducted at Fort Hill Farm.

Acknowledgement:
This work was supported by a Climate Smart Agriculture Grant (CSAG) administered by the Connecticut Resource Conservation and Development Area, Inc. (CT RC&D) Funding for this project was paid for by the Climate Smart Farming: Agriculture and Forestry Grant. Funding was awarded and administered by the Connecticut Department of Agriculture (CT DOAG).

Materials and Methods

Bed prep: Crop debris was removed, fertilizer was added, and beds were prepared for seeding or planting prior to steaming. Soils were irrigated pre steaming, with 1/4 inch to 3/4 water inch applied. No tillage passes were performed after steaming.

Steaming: The SF-20 steamer was set up according to the user manual. Briefly, a steam sock was laid down the center of each of two growing beds and covered with a tarp. The tarp was sealed with a 3/8 inch chain laid down the pathway defining each bed, and steam was pumped into the beds until they reached a temperature of 140°F approximately 1.5 to 2 inches down. Steam was applied to keep the beds at this temperature for 20 minutes, after which the steam valve automatically closed and beds were allowed to cool down. The Fort Hill Farm bed was steamed on April 22, 2024, the Massaro Farm bed was steamed August 13, 2024, and the Riverbank Farm bed was steamed September 5, 2024.

Sample collection: for each chosen bed, a 4-ounce plastic container was placed inverted at 4-foot intervals for 40 feet and scooped up with a spatula resulting in 10 samples for each collection time. Sample depth was approximately 1 ¾ inches. Samples were mixed in a bucket and held at approximately 38°F until assay. Subsequent samples were taken at the same interval but in a fresh spot on the bed.

Weed bioassay: for each time date, one cup of soil was spread out over a standard greenhouse 1020 tray containing one inch of weedless potting soil (New England Compost, Danbury CT). Each time point had three replicates. Trays were placed in a greenhouse and watered as needed. The Fort Hill Farm samples were assayed in May and the Massaro Farm and Riverbank Farm samples were assayed in October.

Nematode bioassay: we have previously determined that one of the Fort Hill Farm high tunnels has a very high population of Southern Root Knot Nematodes (Dr. Rochelle Rocha, Connecticut Agricultural Experiment Station). Dr. Rocha recommended we use a bioassay to determine effect of steaming on nematode populations. This gave us a "live nematode" estimate that would be more accurate than the DNA amplification. Soil from a steam treated bed was used to pot up tomato seedlings cv "Sunsugar". Nine seedlings from steamed or unsteamed soil were potted on 5/15/24. Growth was terminated 6 weeks later, roots were washed, and nematode infection lesions were counted.

Soil microbial activity: samples were assayed by the University of Maine Soil Testing Service. The test measures soil microbial activity by detecting CO2 evolution in a given mass of dry soil upon rewetting.

Soil nutrients: soils were assayed using the "Long term Tunnel" test of the University of Maine Soil Testing Service. Data are reported for the Saturated Media Test, which estimates water soluble nutrients.

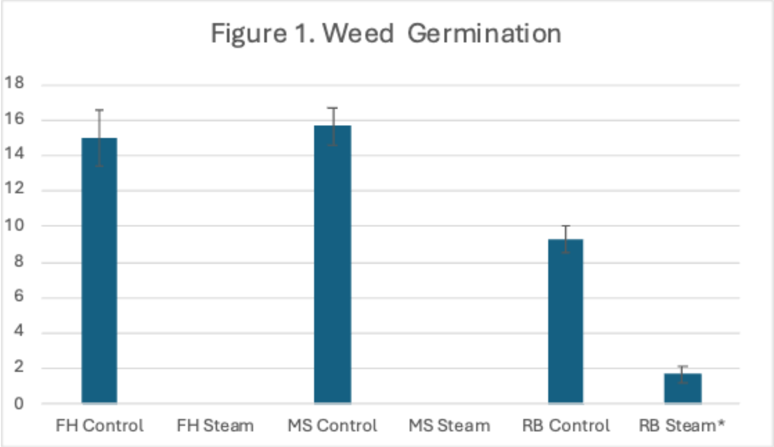
"For us, the tipping point for adopting steaming technology was crop loss due to nematodes. In 2023, we experienced severe losses in carrots, tomatoes, and cucumbers, while in 2024, steamed tunnels showed no such issues. Improved crop health, combined with labor savings and reduced weed pressure, makes soil steaming a compelling option for high-tunnel growers, despite its upfront costs."

- Paul Bucciaglia, Fort Hill Farm

Results and Discussion

Weeds

Steaming resulted in a dramatic reduction of weeds. Numbers of germinated weeds from steamed and unsteamed soil samples are shown in Figure 1. For Fort Hill Farm and Massaro farm, steamed soil resulted in no weed seed germination. Riverbank farm results showed a large reduction in weeds, from an average of 9.3 weeds/tray in unsteamed to 1.7 weeds/tray in steamed soils. (*Interestingly, the "weeds" present in the Riverbank Farm unsteamed trays were all volunteer tomato seedlings.) These assay results are supported by the dramatic drop in weed populations observed in steamed beds across all three farms. Growers estimated that fall weeding hours were reduced by 95% compared with previous years. Riverbank Farm noted a dramatic reduction in chickweed compared with previous years, especially in the second cutting of greens. Any weeds that did emerge in the tunnels mostly came up in the pathways along lines where the sealing chains were located. For this reason, we found it a good practice to put the chains in a pathway where any escaped weeds can be efficiently eliminated with a hoe.



Soil Microbial Activity

Figure 2 shows soil microbial activity across the three steaming events. Fort Hill Farm shows a modest but steady decline in soil microbial activity. Riverbank farm shows an increase in soil microbial activity after steaming, and Massaro Farm shows a dramatic drop in soil microbial activity after steaming. We were unable to detect a trend across the three farms. One contributing factor may be the water status of the steamed soil. Very dry soils become hydrophobic. Therefore, it is recommended to lightly irrigate before steaming.

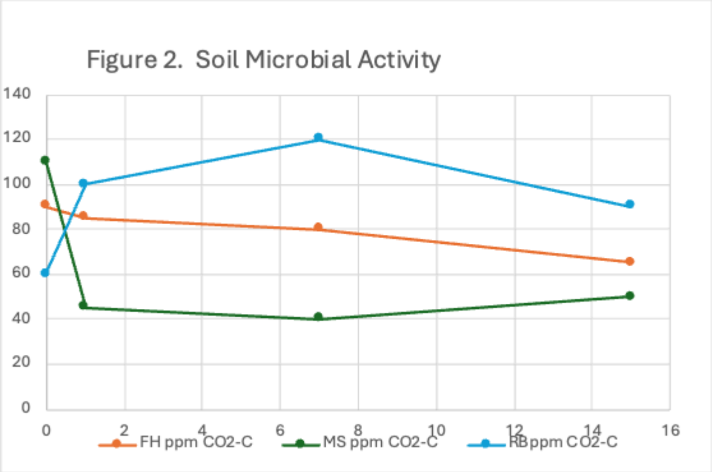


Figure 2. Soil Microbial Activity

Massaro farm has heavier soils than the other two farms and had longer steam times to bring the beds up to 140°F target temperature. Riverbank Farm and Fort Hill Farm have lighter, sandy loam soils. We did not track the amount of water added before steaming but did note that Massaro Farm soils seemed to have more moisture at steaming. It's also important to note that Fort Hill Farm bed was steamed in April when starting soil temperatures were quite cool and required long steam times to bring the beds up to temperature.

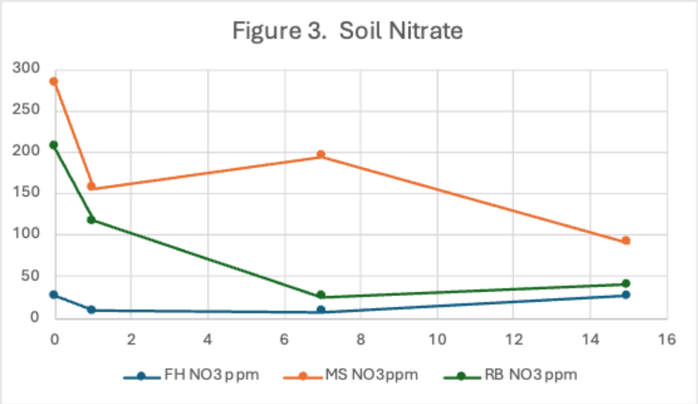


Figure 3. Soil Nitrate

Soil Nitrate Levels

Soil nitrate levels are shown in Figure 3. Massaro Farm and Riverbank Farm showed decreases in soil nitrate levels from pre steam levels, while Fort Hill Farm showed a slight increase.

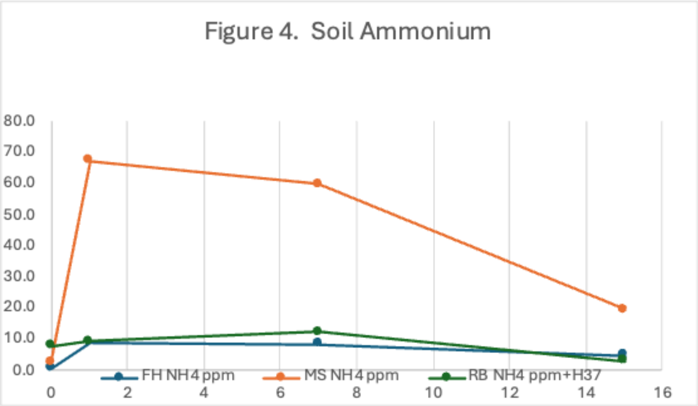
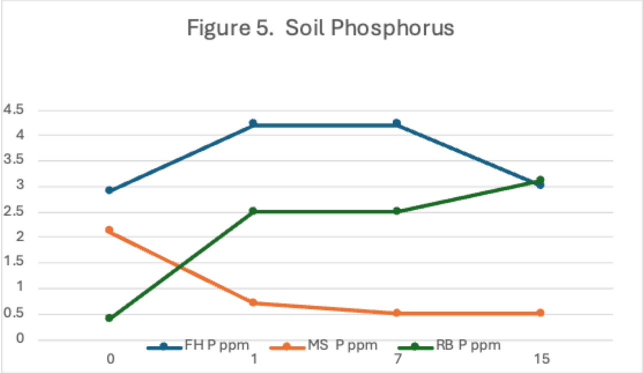


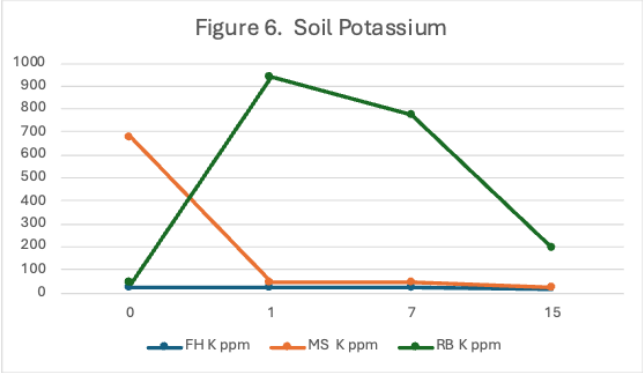
Figure 4. Soil Ammonium

Soil Ammonium Levels

Soil ammonium levels are shown in Figure 4. Massaro farm shows a spike in ammonium levels post steaming, with a gradual decline. Fort Hill Farm and Riverbank farm show more steady levels of ammonium.

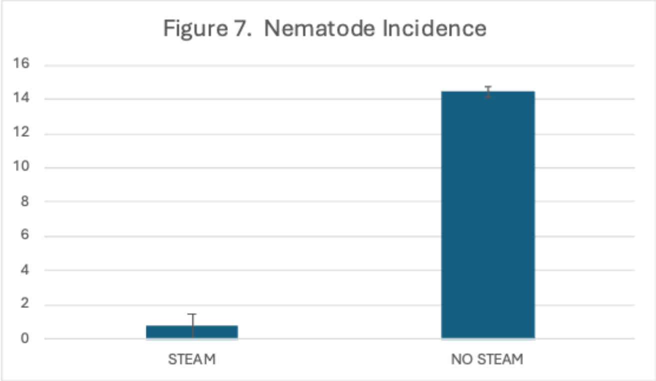
We had hypothesized steaming might cause an increase in free nitrate and ammonium due to the death of soil microbes and subsequent mineralization of nitrogen, but only the ammonium data from Massaro farm supports this model. Soil phosphorus levels are show in Figure 5. Massaro Farm shows a decrease in available phosphorus, while both Riverbank Farm and Fort Hill Farm show an increase post steaming. Potassium levels are shown in Figure 6, with Riverbank Farm showing a large increase with a gradual decline, Massaro farm showing a sharp drop post steaming, and Fort Hill Farm uniformly low throughout the experiment.





Plant Pathogenic Nematodes

The effect of steaming on nematode populations was determined on Fort Hill Farm soils. Steaming dramatically dropped the incidence of nematode infection from 14.44 +/- 0.32 to 0.77+/-0.69 (Figure 7). The tomato variety "Sunsugar" was selected for this experiment because in the previous year we had experienced a crop failure of this variety with ungrafted plants grown in the same bed.



Anecdotally, in 2024 we did not experience any noticeable crop damage to nematodes grown in steamed beds in our 0.3 acre three season high tunnel, when in the previous year we had dramatic or complete reduction in yield in tomatoes, carrots, cucumbers, and lettuce due to nematode predation. We did lose a bed of carrots to nematode damage in the high tunnel which had been seeded before we were able to steam the planting bed for that crop.

Economic Consideration of Soil Steaming Technology

Soil steaming can be a significant investment, but its potential benefits make it an option for certain farming operations. The Sioux SF-20 steamer we acquired cost $52,000, including the necessary accessories such as hoses, socks, and tarps. Simpler versions of the SF-20, which lack automated valves and shut-off features, are available for approximately $45,000. Additionally, a smaller unit can be purchased for around $20,000. [We worked with Andre Cantelmo andre@heronpondfarm.com from Heron Pond Farm, South Hampton, NH, to acquire our equipment.]

Diesel fuel usage is a notable operating expense and can range between 20 and 60 gallons per 30 x 96 ft high tunnel, depending on the initial moisture and temperature of the soil. Labor costs for handling the socks and tarps typically amount to about four hours per tunnel during an 8-9 hour workday. Our decision to invest in automated valves proved to be a valuable upgrade. These valves allow the operator to monitor the steamer intermittently while tending to other tasks, significantly reducing labor demands. The additional valve on our unit also enables seamless switching between areas being steamed, minimizing downtime and improving efficiency.

From a broader perspective, the costs of steaming can be shared across multiple farms. A single steamer could effectively service 3-5 farms with six 30 x 96 ft tunnels each, assuming tunnels are steamed every 2-4 years. However, peak usage times in early spring and late summer could present logistical challenges if shared among too many farms.

While we have not used the steamer long enough to fully evaluate long-term benefits, we anticipate steaming will be required approximately once every three years. This assumes the grower employs shallow, non-inversion tillage, maintains good organic matter, and supports soil biodiversity in their tunnels.

The benefits of steaming extend beyond weed and pathogen control. Though our soil respiration data showed no clear trends, farmers in our trial reported good to excellent crop growth in steamed tunnels. For organic growers, labor savings in weed control are particularly noteworthy. In our steamed tunnels, weeding was minimal and limited to a quick hoe along pathways where steam penetration is less effective.

In untreated tunnels, labor for weeding greens crops like spinach, salad mix, or baby kale can range from 2 to 6 person-hours per bed. With six beds per tunnel at Fort Hill Farm, and labor costs (wage plus fringe) at a minimum of $22 per hour, steaming can save $264 to $792 in weeding labor per tunnel. Furthermore, with proper management, these weed suppression benefits can extend into future seasons, significantly enhancing the return on investment.

Conclusion

Surface soil steaming using portable boilers, socks, and tarps is an effective way to eliminate plant pathogens and weeds from high tunnel soils at shallow depths. When done at modest temperatures (140°F to 1.5 inches) on prepared beds, there can be minimal effects on beneficial soil microbes and soil nutrients. Our experiments did indicate that soil moisture and ambient soil temperatures may amplify negative effects on beneficial soil microbes. Our recommendation is to only pre irrigate the beds enough to reduce any soil hydrophobicity. If soils are watered to saturation, it's best to let the soil dry down before steaming. Similarly, we found that pre-heating the beds with a material such as row covers, clear plastic, or simply shutting down the greenhouse vents can reduce the time and fuel needed to steam a high tunnel, and we will incorporate that into our protocol for future steaming.

We are also curious what effect cultured soil microorganisms might have on soils post steaming or feeding with soluble microbe solutions such as fish emulsion and molasses and will likely include those materials into future post steaming soil care.

Special thanks to Paul for his contribution to this newsletter! If you have a research idea in mind that you're looking to test on your farm, see the opportunity below. We'd love to collaborate!

UConn Extension's Vegetable IPM Program Seeking 4-5 Additional Farmers For On Farm Participatory Research Trials

UConn Extension Specialists have the unique opportunity to observe and interact with farmers who are testing out new crop varieties, fertilizers, techniques, small-scale tools, etc. With some planning and preparation, we are hoping to establish data-seeking collaborations with farmers who are conducting independent experiments this season, making them more statistically meaningful. Our goal is to gather on-farm data that can be shared with growers across the state, providing insights on the parameters, scalability, and outcomes of these farmer-led trials.

If interested in working together, our collaboration will include one-on-one farm consultations, support for trial implementation, and data collection that can be analyzed and shared with farmers across the state. For more detailed information about this research opportunity, please click here for Shuresh Ghimire's original call for collaboration.

Current projects underway include testing the viability of growing peanuts in CT, exploring the economics of growing saffron on CT farms, and trialing non-conventional garlic fertigation set ups.

HAVE AN IDEA YOU WANT TO TEST ON YOUR FARM?

Contact us via email: shuresh.ghimire@uconn.edu or nicole.davidow@uconn.edu
Or fill out our survey linked here: Participatory Research Survey

THEY DO NOT STINK ALL THE TIME: RECOGNIZING THE SPINED SOLDIER BUG

By: Dr. Ana Legrand, Extension Assistant Professor
Department of Plant Science and Landscape Architecture, UConn

Stink bugs are familiar insects that get their common name for the defensive scent they release when disturbed. There are several stink bugs that can show up in vegetable plantings. Not all of them are recurrent pest problems and some are beneficial because they prey on insect pests. This is the case of the spined soldier bug *Podisus maculiventris,* a common predator that attacks over 100 species of prey, particularly immature insects. Prey include the larvae of corn earworm, European corn borer, diamondback moth, beet armyworm, fall armyworm, cabbage looper, imported cabbageworm, Mexican bean beetle, Colorado potato beetle, and many others.

Figure 1. Spined soldier bug eggs can have different colors. Pale eggs (left) are laid on leaf undersides while dark eggs (center) are laid on leaf tops. Some have a golden color (right).

This generalist predator undergoes gradual metamorphosis so you can encounter eggs, nymphs, and adults as part of the life cycle stages. Tight clusters of barrel-shaped eggs are typical of stink bugs. Predatory spined soldier bug eggs have spine-like projections around the top rim and are attached to vegetation. Eggs can be cream, dark gray, or golden in color (Fig.1). Nymphs go through five instars before molting into the adult stage. First instars gather by the eggs after hatching but soon they are off to hunt for prey (Fig. 2). Spined soldier bugs overwinter as adults, and they seek refuge in bark crevices, vegetation, and plant debris near fields and other protected places.

The sight of a stink bug may cause alarm. However, it is important to check if you have a spined soldier bug or a pest like the brown marmorated stink bug (*Halyomorpha halys*), the brown stink bug (*Euschistus servus*) or the green stink bug (*Acrosternum hilare*). You can use color and general shape differences to help you with identification. Most importantly, checking the mouthparts is key to determine if it is a pest or predatory stink bug. Spined soldier bugs have pierce-sucking mouthparts precisely forged to stab another insect for feeding (Fig.3). On the other hand, the plant-feeding ones have a longer, thinner, more flexible straw-like structure to suck nutrients from the plant (Fig. 4). It helps to have a 15-30x magnifying lens or other magnifying tool to see the mouthparts well. The cellphone camera can come in handy for this. The spined soldier bug also has spine tips projecting outward on each side of the body region next to the head (Fig. 5). This is an important feature to note but keep in mind that there are other brownish color stink bugs with similar spines.

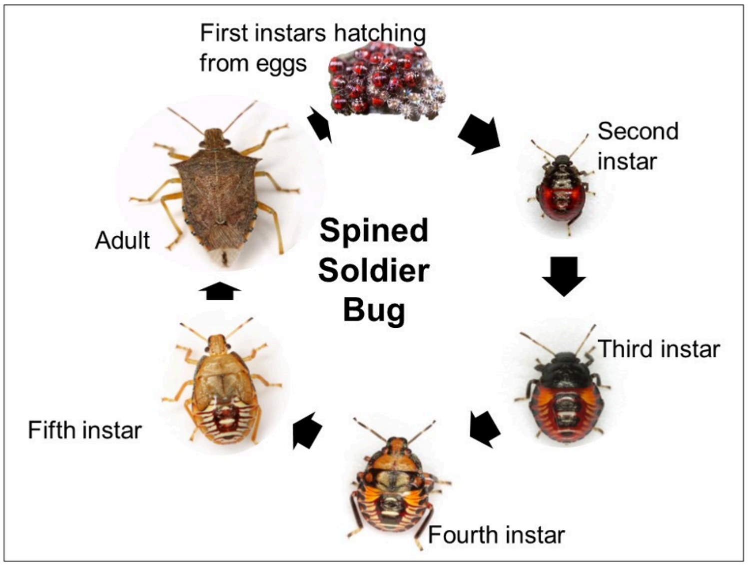


Figure 2. Spined soldier life cycle.

Figure 3. Spined soldier bug feeding on Mexican bean beetle larvae.

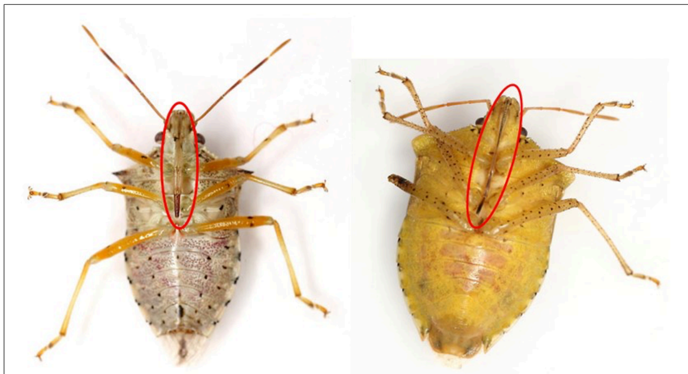


Figure 4. Mouthparts comparison of spined soldier bug and brown stink bug. Mouthparts in red ovals – note the thickness of the predator mouthparts.

References

Hoffmann, M.P. and A. C. Frodsham. 1993. Natural Enemies of Vegetable Insect Pests. Cornell University, Ithaca, NY. 63 pp.

Photo Credits

Fig. 1 left and center: Leslie Abram
Fig. 1 right: D. Mueller, ISU
Fig. 2 Eggs and first instars: A. Sisson, ISU
Fig. 2 Adult and nymphs: Mike Quinn, TexasEnto.net
Fig. 3 Scott Bauer, USDA ARS
Fig. 4 Mike Quinn, TexasEnto.net
Fig. 5 Spined soldier bug, brown and green stink bugs: Mike Quinn, TexasEnto.net
Fig. 5 Brown marmorated stink bug: W. Hershberger

Figure 5. Stink bug adults. Note red arrows marking spined soldier bug's spine tips and dark stripe on wing tips. The other plant feeding stink bugs lack these. The green stink bug and brown marmorated stink bug also white or light color bands on their antennae.

Read more about Dr. Legrand's research here, or contact her via email at ana.legrand@uconn.edu.

GETTING READY TO MANAGE EARLY SEASON VEGETABLE PESTS

By: Dr. Shuresh Ghimire, Associate Extension Educator, Extension Vegetable Specialist

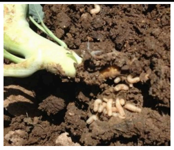
Integrated Pest Management (IPM) offers a holistic approach to managing pests, combining monitoring, cultural practices, biological controls, and targeted chemical use to minimize damage and protect the environment. The UConn Extension Vegetable team is ready to collaborate and provide advice tailored to your farm.

On the following page is a quick table highlighting common early-season pests in Connecticut. For in-depth details and recommendations, check out the New England Vegetable Management Guide.

Click Here To Purchase a Copy of the New England Vegetable Guide and the NE Vegetable & Strawberry Pest Identification Guide

Let's work together for a successful growing season!

Common Early Season Vegeteable Pests in Connecticut

Pest Name	Target Crops	Activity	Damage	Management	Photo (click image for source details)
Cabbage Maggot	Cabbage, broccoli, cauliflower, kale, radishes	April, lay eggs at plant base	Larvae feed on roots, causing wilting and death	Use row covers, rotate crops, use insecticide	
Seedcorn Maggot	Beans, corn, peas, direct-seeded crops	March-April, eggs in moist soil	Larvae feed on seeds and seedlings, reduce germination	Use insecticides-soil application, seed treatment, plant in drier soil	
Flea Beetles	Brassicas, tomatoes, eggplants, radishes, leafy greens	April	Shot-hole damage on leaves, stunting seedlings	Rotate crops, use row covers, pesticides,	
Spinach Leafminer	Spinach, beets, Swiss chard	April, lay eggs on leaves	Larvae tunnel through leaves, reducing marketability	Remove weeds, rotate crops, use row covers	
Allium Leafminer	Onions, garlic, leeks	April-May. Eggs are laid on leaf edges.	Larvae mine leaves, moving toward bulbs, causing stunted growth and rot.	Use row covers, rotate crops, and destroy infested plant debris	
Onion Thrips	Onions, garlic, leeks	April-May	Feed by puncturing plant cells, causing silvering and reduced photosynthesis.	Use insecticides, rotate with non-host crops	
Slugs	Lettuce, cabbage, leafy greens	April, in cool, moist conditions	Chewing on leaves, irregular holes, slime trails	Use slug baits, remove debris	
Cutworms	Tomatoes, peppers, brassicas, other transplants	March-May, feed at night	Sever young plants at soil line, kill seedlings	Rotate crops, trap, use insecticides	
Aphids	Lettuce, spinach, brassicas, other leafy greens	March-April, sap-sucking pests	Weakens plants, transmits viruses, sooty mold	Use insecticidal soaps, insecticides, promote natural predators	
Colorado Potato Beetle	Potatoes, eggplants, tomatoes, peppers	Adults emerge April, feed on foliage	Defoliation by larvae and adults, plant health impact	Use row covers, rotate crops, encourage predators, use insecticides	
Tarnished Plant Bug	Lettuce, strawberries, beans, other vegetables	March-April, feed on young plants	Distorted growth, stunting, cat-facing on fruits	Use row covers, apply insecticides	

RECOMMENDATIONS FOR QUALITY VEGETABLE TRANSPLANTS AND HERBS

By: Charles Krasnow, Associate Extension Educator for Controlled Environment Agriculture, UConn Greenhouse and Nursery Extension

Young vegetable transplants and potted herbs are popular for many retail operations. Vegetables such as tomato, lettuce, cabbage, cucumber, kale, and a variety of herbs such as basil, rosemary, and tarragon add color, variety, and are popular with gardeners. The plants can be sold in single pots, 6-pack trays, or flats. With adequate fertility, light, and temperature management, transplants and herbs have a quick turnaround and are relatively easy to grow. However, there are pathogens that can affect plants at this young stage, causing root rots, leaf spots, and blights. An integrated management approach that includes clean starting material, irrigation management, and judicious use of fungicides can be beneficial to produce healthy young plants

There are a few root rot pathogens that commonly affect young plants and include *Rhizoctonia, Fusarium,* and *Pythium*. These are soil-dwelling pathogens that can spread in sand and soil, infested water, or in used pots and flats. *Pythium* is a root nibbler, and will cause stunting symptoms that can be difficult to notice. Seedlings are very susceptible to Pythium but develop some level of resistance once they are potted and actively growing. *Fusarium* root rot of basil and tomato will cause leaf yellowing and wilting, and result in unsaleable plants. The conidia produced by *Fusarium* can spread in irrigation water. Lavender, rosemary, and squash transplants with Phytophthora root and crown rot display brown rotted roots and eventually wilt and collapse (photo).

Photos:
Rosemary with Phytophthora root rot, single branch showing symptoms on left. Darkened roots of infected plantlet shown on right.

Mildews and blights including downy mildew and *Botrytis* are also common on young plants. These pathogens spread via air currents and produce numerous spores on diseased plants when conditions are warm and humidity is high. Downy mildews are crop-specific and are commonly observed on basil, sage, squash, and cucumber. Botrytis blight is seen on many herbs, and especially sensitive crops include basil and pepper transplants. Reducing leaf wetness and improving airflow are important tools for managing these foliar pathogens. Temperature management in the greenhouse or high tunnel is also important as temperature swings can lead to condensation without adequate ventilation.

Disease management strategies for vegetable transplants and herbs include sanitation, humidity control, and preventive fungicides. Bacteria and fungal spores can be present on seeds at low levels and spread among seedlings during routine watering. Make sure that seed has been treated or tested prior to planting. Similarly, ensure that new cuttings root rapidly and have optimal conditions during this growth period.

Photos:
Basil seedlings displaying chlorosis from downy mildew infection on left. Tomato transplants with early spot (*Alternaria solani*) and powdery mildew shown on right. Photo credit L. Pundt.

Once seedlings and cuttings have been potted, controlling irrigation quantity and timing can help to reduce disease. In general, herbs can be grown with less frequent watering than vegetable transplants. Keeping the foliage dry by improving airflow and reducing condensation in the greenhouse or high tunnel can go a long way to reducing the risk of infection. Sanitation is important for reducing the introduction of these pathogens into the growing area.

Fungicides and biocontrols should be applied preventively starting at the seedling stage. There are many products labeled for use on these plants, and can be found here: herbfungicides.pdf. Biocontrols that can be used on vegetable starts can be found in the New England Vegetable Guide: https://nevegetable.org/vegetable-transplant-production. Be sure to check the label to ensure the crop you are treating is included on the list of registered crops. Fungicides that are labeled for use on vegetables in the field are not necessarily labeled for use on transplants in the greenhouse. Fungicides application should be initiated before symptoms are observed.

CULTIVATE THE SOIL HEALTH PROGRAM

SHARE YOUR EXPERIENCES, NEEDS AND INTERESTS TO DIRECT UPCOMING AND FUTURE PROGRAMMING

>>> COMPLETE THIS BRIEF SURVEY

Soil Health as a focused program area is still new to UConn Extension and your input and participation in this survey is highly valuable to help plan and design training, events, resources and guidance.
By completing the survey you will also have the opportunity to enter a prize draw to receive either a $30 Johnnys Seeds or $30 Premier 1 gift card!

LET'S DIG IN TOGETHER!

QUESTIONS?

Contact Amelia Magistrali,
Soil Health Extension Educator
amelia.magistrali@uconn.edu

HOW CAN ARTIFICIAL INTELLIGENCE HELP YOUR FARM? WE WANT YOUR THOUGHTS!

Artificial Intelligence (AI) is creating a lot of buzz across industries, including farming. Depending on the size and focus of your farm, AI can open up some exciting opportunities, but it can also leave us with more questions than answers. From business planning and market analysis to tools such as cameras, sensors, and the Internet of Things (IoT), AI seems to touch just about everything. But how useful is it, really?

For some farms, AI is already helping with practical, everyday tasks. Tools like ChatGPT can save time by drafting newsletters, social media posts, or even grant proposals. Canva makes it easy to design professional-looking flyers and posters for CSA programs or farm events. And if you're looking to stay connected with your customers, AI-powered tools like HubSpot can help automate follow-ups, organize contacts, and make communication easier.

There are also some high-tech options on the horizon -- like drones, robotic weeders, and other farmbots -- that sound promising. But before jumping into something like that, we need to know if they're effective and affordable for small farms.

Here at UConn Extension, we are here to help our farmers explore the possibilities AI has to offer. But what we really want to know is your perspective. Are you excited about AI and ready to try it out? Are you on the fence, waiting to see how it pans out? Or does all this tech just feel like something that won't fit with how you run your farm?

We're here to support Connecticut farmers and want to make sure we're focusing on what you need. That's why we're asking for your input.

Take a moment to fill out our survey:
Assessing Artificial Intelligence on Connecticut Farms

Your input will help us prioritize our research and extension efforts regarding this technological transformation and ensure that the tools and resources we develop truly meet the needs of our farming community.

DIALING IN NUTRIENT MANAGEMENT FOR FRUIT PRODUCTION AND BEYOND

DEFICIENCIES, EXCESSES, AND CURRENT TECHNOLOGIES

By: Evan Lentz, Assistant Extension Educator, Commercial Fruit Production

Introduction

Adequate nutrient management is essential in all fruit production systems. The availability of essential plant macro- and micronutrients largely influences the growth and development of plants, fruit yield and subsequent fruit quality, and the severity of abiotic and biotic stress. Thoughtful nutrient management plans aim to maximize output while avoiding system deficiencies and excesses. Although plant nutrition has been exhaustively studied and its importance thoroughly communicated, the practice of nutrient management is still considered challenging at best, even by experienced growers. In this article, we will explore some of the common complicating factors in nutrient management, the tools available to growers, and available resources.

Sources of Deficiency

True System Deficiency This is the most straightforward type of deficiency: there is not enough of a given nutrient available to the plant. To solve this problem, supplemental nutrition needs to be added to the system.

Effect of pH on Availability and Uptake

This issue is 2-fold: availability and uptake. The image on the right shows some of the changes in availability of essential nutrients across pH ranges (Figure 1). This means that absent any crop, nutrients vary in availability depending on the soil's pH. In addition, each crop has its own preferred pH range at which it performs best. This includes the ability of a plant to uptake nutrients from the soil environment. Plants that are grown out of their preferred pH range will have difficulty acquiring essential nutrients, even if the specific nutrient is available in the system. To solve this problem, the soil pH needs to be raised (with lime) or lowered (with sulfur) to match the preference of the crop.

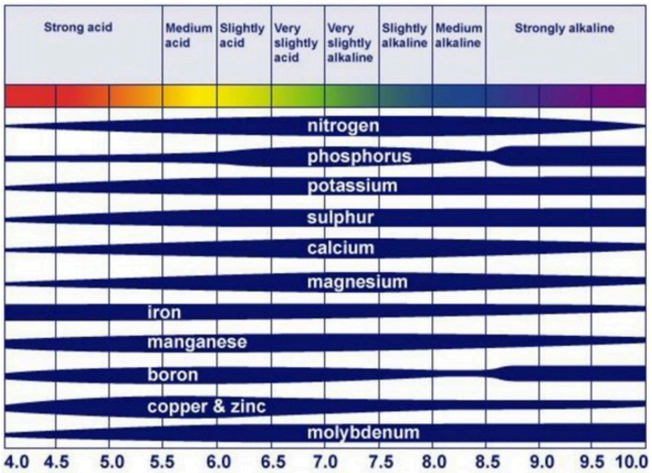


Figure 1. The effect of soil pH on nutrient availability (Roques et al., 2013)

Water Status

Essential nutrients are taken up from the soil environment in different ways: mass flow, diffusion, and root interception (Figure 2). Nutrients that move by mass flow rely on being dissolved in water and moved to plant roots to be absorbed. Nutrients that are taken up via diffusion are moved to the surface of roots across a concentration gradient (from an area of higher concentration to an area of lower concentration). These nutrients are first taken up from directly around the root surface; then these nutrients will move from the surrounding area into the range of the root surface where they will be taken up again. This is a continuous process. Finally, uptake via root interception occurs as a result of roots growing through the soil environment until they reach the nutrient. The water status in any system will influence the uptake of nutrients via these various mechanisms.

Questions about commercial fruit production, integrated pest management, or agricultural technology? Contact Evan Lentz at evan.lentz@uconn.edu.

In drought conditions, the lack of water will inhibit the movement of nutrients in the soil environment. Likewise, oversaturated soils will inhibit the roots' ability to uptake nutrients. To solve this problem, supplemental irrigation or drainage is recommended to maintain adequate water status throughout the entire growing season.

Nutrient	Mass Flow	Diffusion	Root Interception
Nitrogen	x		
Phosphorus		x	
Potassium	x	x	
Calcium	x		x
Magnesium	x		x
Sulfur	x	x	
Boron	x		
Copper	x		
Iron	x	x	x
Manganese	x		x
Zinc	x	x	x
Molybdenum	x		

Figure 2. Transport processes for various plant nutrients (Cornell University, 2010)

Induced Deficiency

Induced deficiencies are a result of an overapplication of another nutrient, in excess of what is required for growth. On the right is a table showing which nutrients (when in excess) serve as the cause for various induced deficiencies (Figure 3). The mechanism for induced deficiencies can vary. The first mechanism for an induced deficiency results from the relative required amounts of plant nutrients and system limitations.

Nutrient in Excess	Induced Deficiency
Nitrogen	Potassium
Potassium	Nitrogen, Calcium, Magnesium
Phosphorus	Potassium, Copper
Sodium	Potassium, Calcium, Magnesium
Calcium	Magnesium, Boron
Magnesium	Calcium, Potassium
Iron	Manganese
Manganese	Iron
Copper	Iron

Figure 3. Nutrient excesses and associated induced deficiencies (Concklin, 2021)

For example, nitrogen is the most limiting nutrient in any system as it is needed in largest quantities. A plant will grow optimally until it uses up all the available nitrogen. If there is no shortage of nitrogen, optimal growth will continue until there is no more available phosphorus, which is the nutrient required in the second largest quantity. In this way, overapplication of nitrogen causes excessive growth, utilization of all available phosphorus, and subsequently a phosphorus deficiency. The second mechanism for induced deficiency is nutrient antagonism. This is largely due to similarities in the properties of some nutrients. For example, potassium, magnesium, and calcium have a well-documented antagonistic relationship. This is due to the similarity in size and charge of their ions, which affects nutrient uptake and the like.

Challenges with Excesses

There are many challenges associated with excessive nutrition beyond inducing a deficiency of another plant nutrient. Below is a summary of some challenges associated with overfertilization in fruit production systems

1. Environmental Pollution: Excessive use of nitrogen fertilizers can lead to high levels of nitrate in the soil, which can leach into groundwater and find its way into rivers and streams. Nitrates tend to persist for extended periods of time. The same can be said for phosphorus. Once these nutrients find their way into bodies of water, they can trigger algal blooms, proliferation of potentially toxic algae, habitat degradation, and even fish kills due to hypoxic conditions.
2. Reduced Crop Productivity and Quality: In particular, nitrogen can increase excessive vegetative growth which can cause shading, negatively impacting flower bud development, fruit set, and fruit quality including color. Excessive vegetative growth can also lead to delayed fruit development, small fruit size, and even soft fruit (FIGURE 4).
3. Increased Susceptibility to Pests and Diseases: Overfertilization and subsequent excessive growth poses a problem for pest management by decreasing air flow and sunlight penetration, creating the perfect environment for both insects and pathogens. Excessive vegetative growth leads to the development of soft, succulent tissues which serve as an entry point for disease such as Fireblight and feeding sites for insects like aphids (FIGURE 5).
4. Economic Inefficiency: Lastly, but certainly not least, is the economic impact of overfertilization. As the name suggests, these are applications more than what is needed which means: waste. Producing fruit is an already high-input endeavor. Overfertilization not only wastes money on the front end for fertilizer you do not need, it can also require corrective action including additional pesticide applications to control encouraged pests and diseases.

Figure 4. Excessive vegetative growth in raspberries due to nitrogen overfertilization (Concklin, 2021)

Figure 5. Green Apple Aphids feeding on succulent new growth of an apple tree (Schoof, 2015)

Managing overfertilized soils can be challenging, certainly more so than deficient soils.

The University of Massachusetts' Soil and Plant Nutrient Testing Laboratory has a great resource available entitled, "Corrective Measures and Management of Over-Fertilized Soils" outlining some considerations and practices to manage overfertilized soils. Below is a summary. The full factsheet can be found here: https://ag.umass.edu/soil-plant-nutrient-testing-laboratory/fact-sheets/corrective-measures-management-of-over-fertilized

1. Re-check your sampling method to ensure the results that you received are accurate before proceeding.
2. Assess plant health to determine the impact of excessive nutrient levels on growth and development. If tolerant of high nutrient levels, further corrective action might not be warranted.
3. Leach out salts. Leaching out of soluble nutrients requires the use of irrigation water to remove applied nutrients.
4. Utilize cover crops. Cover crops can help to absorb and remove excess nutrients from the soil.
5. Monitor plant health by testing your soil and plant tissues annually. Do not apply additional nutrients until needed.

Soil Testing & Limitations

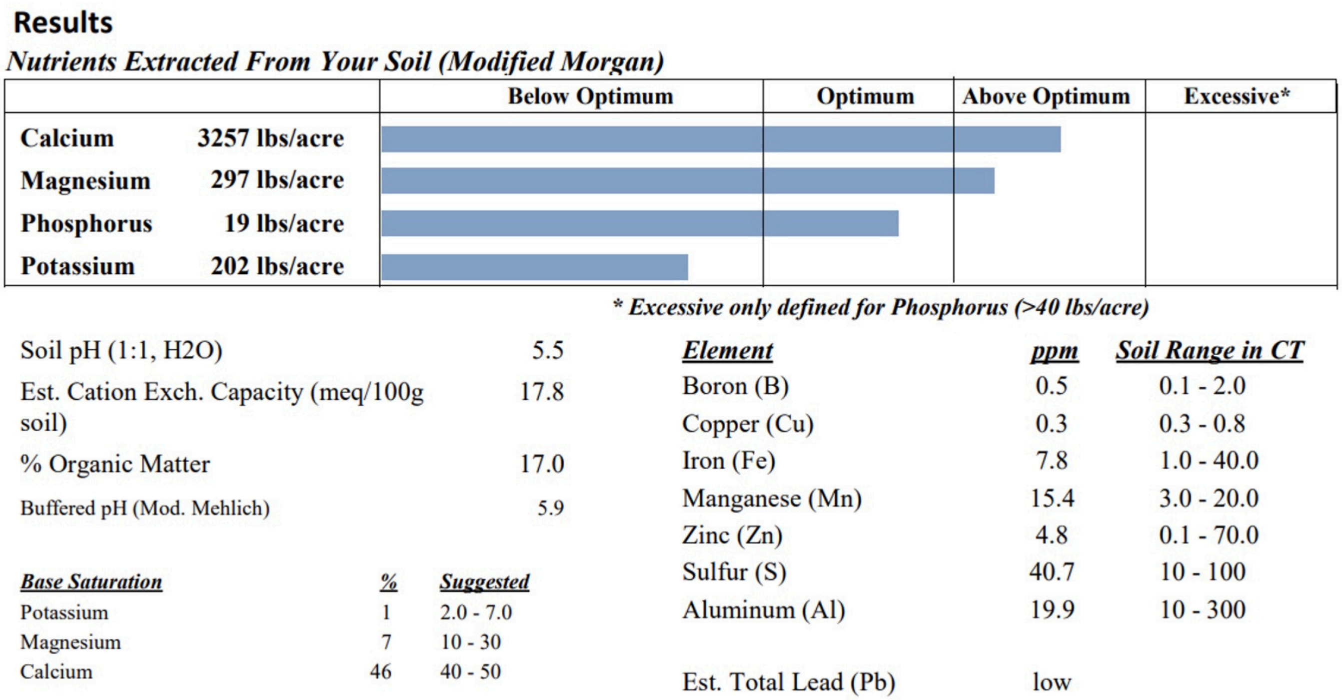
Soil tests should be conducted prior to planting and regularly every 2-3 years after planting. If you are putting down a large amount of any material, say limestone to correct a large discrepancy, soil tests can be performed more frequently. Otherwise, things don't change that quickly in the soil environment and sampling more than every 3 years is wasteful. Below is a breakdown of the soil testing process, including sampling instructions, what is included in the report, and the limitations.

How to Collect and Submit a Soil Sample (copied from UConn Soil Nutrient Analysis Laboratory)

- Late October or early November is usually the best time to sample, but samples may be taken at any time during the year unless the soil is frozen
- Areas differing in topography, drainage, soil texture, manure additions, soil organic matter content (light versus dark colored) or intended crop usage should be sampled and tested separately.
- Under no circumstances should samples represent areas larger than 15 acres.
- Avoid sampling unusual spots such as former sites of manure, compost, or mulch piles and areas where limestone or fertilizer has been spilled in previous years.
- It is imperative that the soil sample represents accurately the entire sampling area. To obtain a representative sample, take a uniform core or thin slice from at least 12 evenly distributed places within a given area. Sample the plow layer, usually the top 6 to 8 inches. Put the slices or cores in a clean container and thoroughly mix them. One cup of this soil mixture constitutes the soil sample. Transfer this one cup into a zipper lock bag and seal.
- Fill out and print the appropriate questionnaire and place it along with your sample(s) and a check payable to UConn ($15.00/sample for standard nutrient analysis) in a sturdy mailing envelope or box. If multiple samples are being sent at one time, be sure to label the outside of each bag with a sample name and/or number. If 10 or more samples are submitted at one time, see information on our multi-sample discount policy for commercial growers.
- Send samples to: UConn Soil Nutrient Analysis Laboratory, 6 Sherman Place, Unit-5102, Storrs, CT, 06269-5102.

What is Provided in Your Results:

The results you receive from the UConn Soil Nutrient Analysis Laboratory contain a wealth of targeted information. Below is a summary of the information provided (Figure 6).


Results

Nutrients Extracted From Your Soil (Modified Morgan)

		Below Optimum	Optimum	Above Optimum	Excessive*
Calcium	**3257 lbs/acre**				
Magnesium	**297 lbs/acre**				
Phosphorus	**19 lbs/acre**				
Potassium	**202 lbs/acre**				

**** Excessive only defined for Phosphorus (>40 lbs/acre)***

Soil pH (1:1, H2O)	5.5
Est. Cation Exch. Capacity (meq/100g soil)	17.8
% Organic Matter	17.0
Buffered pH (Mod. Mehlich)	5.9

Base Saturation	*%*	*Suggested*
Potassium	1	2.0 - 7.0
Magnesium	7	10 - 30
Calcium	46	40 - 50

Element	*ppm*	*Soil Range in CT*
Boron (B)	0.5	0.1 - 2.0
Copper (Cu)	0.3	0.3 - 0.8
Iron (Fe)	7.8	1.0 - 40.0
Manganese (Mn)	15.4	3.0 - 20.0
Zinc (Zn)	4.8	0.1 - 70.0
Sulfur (S)	40.7	10 - 100
Aluminum (Al)	19.9	10 - 300
Est. Total Lead (Pb)	low	

Figure 6. Example of a soil test result (UConn SNAL, 2025)

- Macronutrients: Modified Morgan extractable amounts (lbs/acre) of calcium, magnesium, phosphorus, and potassium are provided in an easy-to-read format, with important designations noting if your soil falls below optimum, within optimum, above optimum, or into excessive range.
- Micronutrients: Modified Morgan extractable amounts (ppm) of boron, copper, iron, manganese, zinc, sulfur, and aluminum are provided, along with the typical ranges of each found in Connecticut soils. NOTE: These are typical ranges and are not standards. Therefore, they are not useful in making management decisions.
- Soil pH: The soil pH is a direct measure of the acidity or alkalinity of your soils. The soil pH influences the growth and development of your crop because it determines the availability of all nutrient elements. It is a true measure of the concentration of hydrogen ions in the soil environment.
- Buffered pH: Buffered pH is essentially a measure of how easily the pH of your soil will respond to additions of limestone or sulfur. This buffered pH is also called the residual or reserve acidity of the soil. The lower the buffered pH, the higher the buffering capacity, meaning the soil has a greater ability to resist increases in soil pH from the addition of limestone. The opposite is true for lowering the soil's pH with sulfur. This allows for targeted recommendations of limestone and sulfur.
- Organic Matter: Organic matter (%) is provided when requested for an extra fee at the UConn Soil Nutrient Analysis Laboratory. Soil organic matter plays an important role in supplying nutrients (mainly nitrogen), contributes to cation exchange capacity, and improves soil structure. Although some crops do have a preference for organic matter (%), this is a direct measure of overall soil health.
- Estimated Cation Exchange Capacity: Estimated Cation Exchange Capacity (CEC) is a measure of plant nutrient availability and retention in the soil. It is not an absolute value, but rather the overall potential of the nutrient supply. This is influenced by nutrient exchange that occurs on the surfaces of clay particles, organic matter and plant roots.

Soil Texture	Typical CEC (meg/100 g soil)
Sands	3-5
Loams	10-15
Silt Loams	15-25
Clay and Clay Loams	20-50
Organic Soils	50-100

Figure 7. The relationship between soil texture and CEC (Culman et al., 2019)

- Base Saturation: Base Saturation is the percentage of the CEC occupied by base cations (Ca, Mg, K, Na). This is closely related to pH: as base saturation increases, pH increases. This measure also provides insight into why some soils with high levels of base cations, such as calcium, may never be lowered past a certain pH. The lab also provides a suggested base saturation range for each measured cation.
- Estimated Total Lead: Finally, the lab provides an estimated level of lead to determine if there are any potential health concerns.
- Recommendations: At the bottom of the results page, your customized recommendations begin. The recommendations will be based on the type of crop you noted on your soil sample submission sheet. Recommendations for limestone, nitrogen, phosphorus, and potassium are provided in pounds per acre. In the following "Comments" section, details on the recommendations are provided, including directions for making split applications and applying sulfur. This section also provides general recommendations for nutrient management, including tissue testing. References and resources for further information are provided at the end.

The goal of these results and accompanying recommendations is to take the guess work out of nutrient management decisions. Simply following the exact recommendations provided and getting your soils re-tested about every 3 years will ensure thoughtful soil and crop management. However, there are limitations to the insights provided in the soil test results. These tests only tell us what is available in the soil. As discussed above, there are other factors affecting the nutrient status of your crop including water status and potential induced deficiencies. To gain a better understanding of the nutrient status of your plants, annual tissue testing is recommended in tandem with regular soil tests.

Plant Tissue Testing

Tissue testing is currently the best tool available to producers in providing an accurate depiction of the nutrient status of crops. Tissue tests tell you exactly what amounts of each nutrient are within your plants. This speaks not only to nutrient availability, but also nutrient uptake and distribution in the plant. Results from tissue tests can reveal limitations beyond simple system deficiencies and pH-restricted nutrient uptake.

How to Collect and Submit a Tissue Sample (copied from UConn Soil Nutrient Analysis Laboratory)
Sampling instructions vary between crop types, however, there are some general sampling guidelines to follow:

1. Sample an average of 10-30 plants of one variety from a representative area
2. If there is a plant growth problem, submit a sample from the problem area along with a sample where normal growth is occurring.
3. Collect the appropriate number of leaves/petioles/clippings per sample. Contact the UConn Soil Nutrient Analysis Laboratory for specific collection information for various plant species.
4. If plant samples have soil, fertilizer, dust, or spray residues, they will need to be cleaned. Try brushing with a soft brush. For persistent residues, wash leaves/petioles with a dilute (phosphate-free) dishwashing detergent in tap or distilled (preferred) water quickly (less than one minute). Rinse well, shake excess water from, and air dry at room temperature on paper towels or other clean, absorbent surface. Do not let plant samples sit in water as nutrients will leach out.
5. Place dried leaves in a clean paper bag and submit to the UConn Soil Nutrient Analysis Laboratory along with the questionnaire and payment. Fresh, rinsed samples may also be brought directly to the lab or shipped overnight to: UConn Soil Nutrient Analysis Laboratory, 6 Sherman Place, Unit-5102, Storrs, CT, 06269-5102.

Specific Guidelines for Fruit Producers

Sampling times will vary between crop types. This is due to differences between specific crop types as well as the stability of nutrients at different times across the growing season (Figure 8).

- Apples, apricots, and cherries should be sampled during the summer. Collect 50 of the most recently matured leaves from new growth.
- Pears and plums should be sampled during the summer. For pears, collect 50 midshoot leaves from new growth. For plums, collect 25 midshoot leaves from new growth.

- Peaches and nectarines should be sampled during fruit set in the spring. For both, collect 25 midshoot leaves from new growth.
- Strawberries should be sampled during bloom. Collect 25 leaves from new growth.
- Blueberries should be sampled during the summer. Collect 75 of the most recelty matured leaves.
- Raspberries should be sampled 2-3 weeks after harvest. Collect 50 leaves from the midshoot section of primocanes. Primocanes are one-year-old canes.
- Table grapes and wine grapes should be sampled during bloom. Collect 50 petioles from leaves opposite flower clusters. Wine grapes can also be sampled during veraison. Collect 50 petioles from leaves opposite fruit clusters. Petioles are leaf stems. Veraison is when the fruit begins to turn color.

Decreases (higher concentrations early)	Mostly Stable	Increases (higher concentrations later)
Nitrogen	Magnesium	Calcium
Phosphorus (slight)	Iron	Manganese
Potassium	Copper	
Boron		

Figure 8. Nutrient concentration as affected by time throughout the growing season (Stile and Reid, Cornell)

Sampling instructions for other crops including vegetables, turfgrass, Christmas trees, and greenhouse crops can be found at: https://soiltesting.cahnr.uconn.edu/analysis/

What is Provided in Your Results

The results from tissue analysis will look somewhat different than those from your soil test. The results will look similar to the chart below (Figure 9). Actual amounts of all macro- and micronutrients will be provided along with the sufficiency ranges for each. This will allow you to easily identify any issues. However, there are no recommendations provided for tissue analysis. It will be up to you to contact your Extension professional to come up with an action plan. The reason that recommendations are not provided is that there are many factors that affect the internal nutrient content of plants, as have been outlined above. You will work with your Extension professional to analyze results of both the tissues analysis as well as your soil tests. Together, with an evaluation of your cultural management, recommendations can be made.

Plant Nutrient	Sample Results	Sufficiency Range
Nitrogen (N) % Dry Weight	1.94	1.7 - 2.1
Phosphorus (P) % Dry Weight	0.13	0.10-0.40
Potassium (K) % Dry Weight	0.52	0.40-0.65
Calcium (Ca) % Dry Weight	0.56	0.30-0.80
Magnesium (Mg) % Dry Weight	0.18	0.15-0.30
Boron (B) PPM Dry Weight	78.00	30-70
Copper (Cu) PPM Dry Weight	2.20	5-20
Iron (Fe) PPM Dry Weight	90.30	60-200
Manganese (Mn) PPM Dry Weight	211.60	50-350
Molybdenum (Mo) PPM Dry Weight	0.0	No data
Zinc (Zn) PPM Dry Weight	11.20	8-30
Non-Essential Elements		
Sodium (Na) % Dry Weight	0.01	No data
Aluminum (Al) PPM Dry Weight	95.60	120-160
Lead (Pb) PPM Dry Weight	0	No data , Ideal value would be 0

Figure 9. Example tissue analysis results table for blueberries (UConn SNAL)

Limitations

Even though tissue analysis is the best tool we currently have to evaluate the nutrient status of plants, it is not without its limitations. The primary limitations with tissue sampling are time and money. First, results can take up to and beyond 2 weeks to receive, depending on how busy the lab is. Second, is the cost. The per sample cost for tissue analysis is $30.00 per sample. Since it is suggested that variety- and site-specific samples be taken, the cost of analyzing an entire operation can get expensive.

The Future of Nutrient Management

To address the limitations of our current nutrient management technologies, the University of Connecticut has been developing novel tools for whole-farm nutrient analysis. This 6-year grant funded project utilizes unmanned aerial vehicles (UAV's) or drones equipped with high powered multi-spectral sensors (Figure 10). These sensors capture a wide range of spectral data, far beyond what is observable with the human eye (Figure 11). This includes wavelengths in the infrared and ultra-violet ranges to name a few. This spectral data can be used to determine if nutrient deficiencies or excess exist within a given system. Currently, predictive models are being developed to provide real-time feedback on plant nutrient status on a whole-farm scale.

Figure 10. Drone equipped with hyper-spectral sensors (Vision Aerial, 2023)

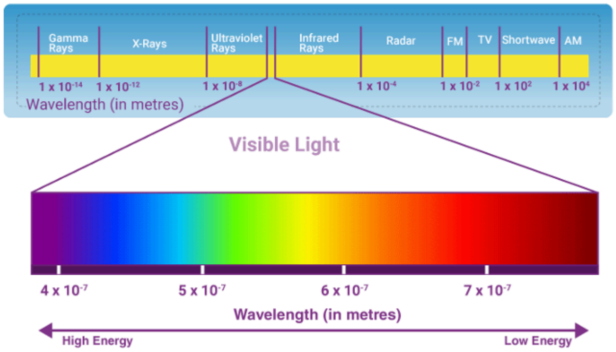


Figure 11. Electro-magnetic spectrum and visible wavelengths (BYJUS, 2025)

This technology has the potential to vastly improve the current nutrient management practices in use. First, the real-time feedback would eliminate the lag-time between collecting a sample and getting results or recommendations to then act upon. One of the biggest limitations of traditional testing methods is that any corrective action taken is only going to impact next year's crop. There is currently no protocol for addressing nutrient challenges in-season, in hopes of impacting the current year's crop. Next, this technology has the potential to address the challenge of cost. Since the technology address nutrition on a whole farm scale, hundreds of acres can be covered in just a few hours. This real-time feedback, combined with foliar nutrient spray applications, could work to correct nutrient deficiencies and improve the current year's crop.

Although this technology is still a few years away from implementation, its efficacy is currently being evaluated. For more information of this technology, please visit the interactive storyboard.

ADDITIONAL RESOURCES

UConn Soil Nutrient Analysis Laboratory

New England Tree Fruit Management Guide

New England Small Fruit Management Guide

References:

Cornell University. 2010. Competency Area 2: Basic Concepts of Soil Fertility. Northeast Region Certified Crop Adviser Study Resources. https://nrcca.cals.cornell.edu/nutrient/CA2/CA0209.php

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LETTUCE DISEASES COMMONLY FOUND IN CT

Identifying disease symptoms, commonly used prevention methods, and best practices for growing healthy lettuce

The original fact sheet is published on the UConn Extension Vegetable IPM Website. It is summarized here by: Nicole Davidow

A Healthy Fall Lettuce Crop

FUNGAL DISEASES IN LETTUCE

Sclerotinia Drop

Also known as lettuce drop or white mold, sclerotinia drop is often first observed when the outermost leaves of lettuce plants begin to wilt. Upon closer inspection, you may also notice a water-soaked ring around the stem where it meets the soil, as well as snowy white web-like fungal growth. Black structures called sclerotia, which can be as small as a mustard seed or as large as a bean, may form in the web of the fungal growth, usually on the underside of the leaves touching the soil.

Bottom Rot

Often observed in warm and wet conditions, plants usually start showing symptoms when they're just about ready to be harvested. Before you are able to notice the wilting leaves from above, the fungus enters the plant through the bottom leaves in direct contact with the soil. Slightly sunken spots, rust-colored to chocolate brown, appear on the leaf petioles and dribs Theses spots may ooze a light brownish or amber colored liquid. If conditions are made unfavorable for the fungus, the rust-colored spots on the petioles will dry and turn chocolate brown. If conditions remain favorable for the fungus, it will continue to grow upward through the leaves until the entire head becomes a slimy brown mass. The bottom rot fungus (*Rhizoctonia solani*) also provides a path for the entry of secondary rot bacteria.

Gray Mold

Generally speaking, gray mold is not strong enough to infect healthy, robust plant tissue. It ofen infects plants as a secondary pathogen. Gray mold is caused by the fungus Botrytis cinerea, which can grow up the stem and rot out the inside of a head causing the plant to collapse before any symptoms are visible on the outside. As the fungus grows, inner leaves become water soaked, grayish green or brown, and finally turn into a brownish-gray, slimy mass. If lettuce is allowed to flower, the flowers can also be infected during or after flowering.

DISEASE RESISTANT LETTUCE VARIETIES

Browse a long list of disease resistant lettuce varieties compiled by Cornell University from seed catalogues published between 2017-2022.

Best Practices: Fungal Disease Prevention

The following is an abbreviated list of general guidelines for reducing the risk of fungal diseases in lettuce crops

- Crop rotations with grains and other vegetable crop non-hosts. Note, some diseases survive in the soil for several years without a susceptible host, so a multi-layered approach to prevention is recommended.
- Plant in well-drained soil and using raised beds can help reduce field moisture.
- Growing on a 4-inch-high and 6-inch-wide ridge may be helpful in disease prevention because there is increased air flow, better drainage, and less contact between the bottom leaves and the soil.
- Soil steaming for one hour at 131°F or for 36 hours at 113°F, or solarization can reduce inoculum levels.
- Improve airflow by increasing spacing between plants and controlling weeds
- Avoid excessive nitrogen fertilization.
- Plant varieties that have shown some tolerance to this disease. See Disease Resistant Lettuce Varieties.
- Irrigate in the morning and avoid overhead irrigation to keep surfaces dry.
- Removing infected plants from small plantings is effective in preventing spread of the disease to other plants.
- Immediately plow debris under after harvest.

VIRAL DISEASES IN LETTUCE

Lettuce Mosaic Virus

The lettuce mosaic virus (LVM) is most commonly transmitted through infected seeds. However, infected plants as well as weed hosts can also serve as virus reservoirs, enabling visiting insects such as aphids to spread the virus to nearby healthy plants. Symptoms will depend on the age of the plant when infection occurs, the variety of lettuce, and the temperature. When infected as seed/seedling, the plants will be very stunted. They may fail to head, produce a small head, or if infected later, may produce a deformed head. Older plants will have irregularly shaped leaves. Mottling is also symptom, most noticeable on leaf lettuce. In sensitive lettuce varieties, there may be browning of the veins or on the edges of the leaves, the leaves may curl downward or die.

For the most up to date recommendations on chemical control measures for disease/pest management, click the link below:
New England Vegetable Management Guide

Aster Yellows

The lettuce mosaic virus is caused by phytoplasma and can occur anywhere lettuce is grown, resulting in bitter, stunted, and disfigured heads. When young plants are infected, their outer leaves become yellow and twisted. Bushy outgrowths (often referred to as Witch's Broom) may be present on the flowering stalks, and the plants may be sterile or abort seeds. Infected heads are often unmarketable. Aster yellow phytoplasma is transmitted from one plant to another by the six-spotted leafhopper and the aster leafhopper. After the leafhopper has acquired the phytoplasma, it is able to transmit it to healthy plants for the rest of its life.

Best Practices: Viral Disease Prevention

The following is an abbreviated list of general guidelines for reducing the risk of viral diseases in lettuce crops

- Use certified disease-free seed.
- Hot water seed treatment is a cheap and effective way to kill pathogens.
- Control hosts. Effective scouting and timing insecticide applications to coincide with peaks in vector populations can help manage outbreaks. Alternatively, consider releasing beneficial insects to mitigate the insect vector population.
- Manage previous crop residue by plowing under debris as soon as possible.
- Remove infected fields before planting lettuce in nearby beds.

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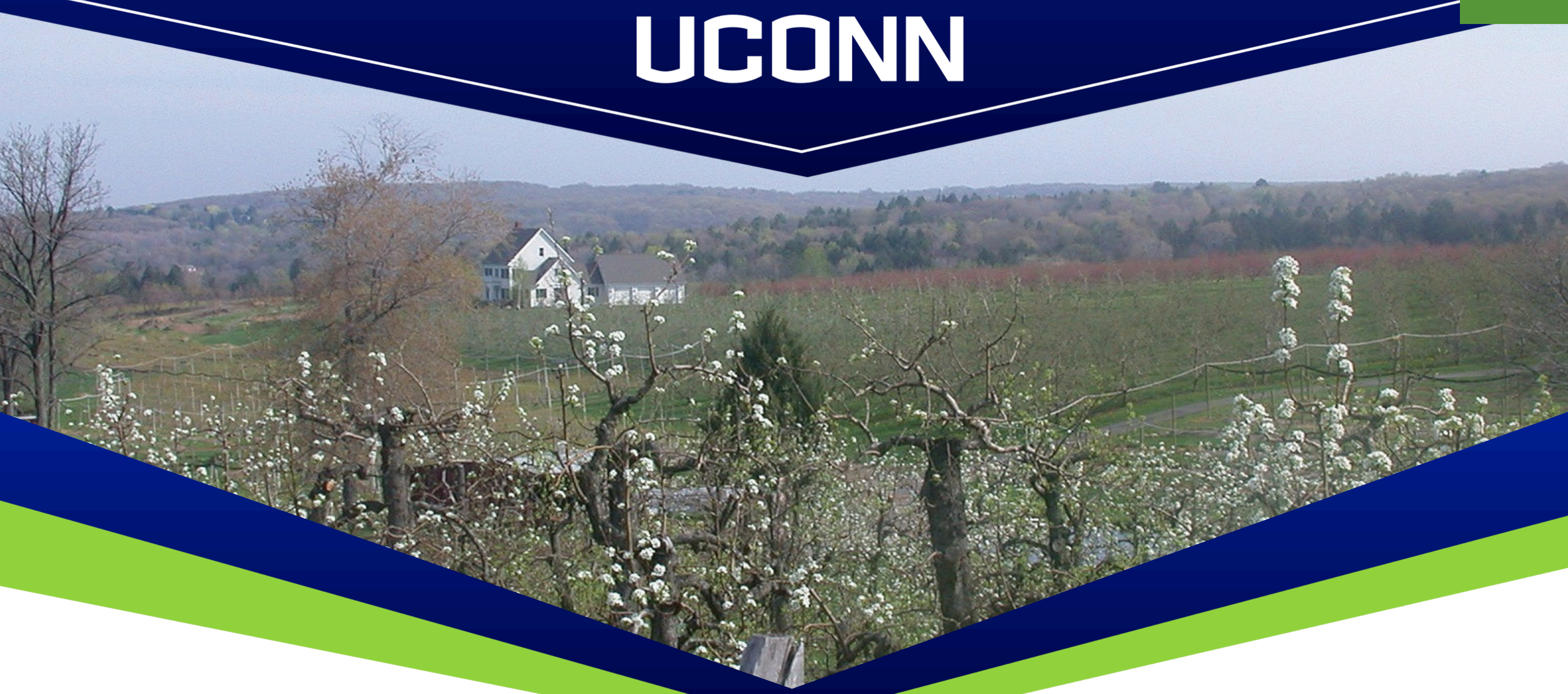

FARM RISK MANAGEMENT

In-Depth Strategies for Effective Farm Risk Management

This unique program from UConn's College of Agriculture, Health and Natural Resources focuses on critical topics for the agriculture industry. Farm risk management involves understanding and mitigating factors that can impact agricultural operations, such as climate change, pest management, and financial uncertainties. Through this grant-funded 12-module course, you will gain knowledge and strategies to enhance the resilience and sustainability of your farm. Pick and choose which modules to complete, or do them all! **To register, click here.**

ONLINE COURSE MODULES

- Farm Risk Management & Mitigation
- Climate Mitigation Strategies - Pest Management Strategies for Vegetable Growers
- Climate Mitigation Strategies - Pest Management strategies for Fruit Growers
- Farm Financial Statements
- Farm Insurance & Retirement Options
- Financing & Benchmarking
- Whole Farm & Micro Farm Crop Insurance
- Food Safety Modernization Act (FSMA)
- Government Agency Programs
- Muti-Peril Crop Insurance
- Farm Business Planning
- Livestock Farm Risk Management

For more information, contact:

Joseph Bonelli - joseph.bonelli@uconn.edu or **Mary Concklin** - mary.concklin@uconn.edu

This program is funded in partnership with USDA, Risk Management Agency, under award numbers RMA23CPT0013448 and RMA24CPT0013928.

USDA United States Department of Agriculture Risk Management Agency

FREE!

Climate Mitigation Field Days

Featuring:

- **Irrigation Management, Systems:** Trevor Hardy, Brookdale Orchards, NH
- **Climate Mitigation Strategies, Water Quality:** Kip Kolesinskas, Consulting Conservation Scientist
- **Climate Mitigation and Fruit:** Evan Lentz, UConn Extension Fruit Specialist
- **Climate Mitigation and Vegetables:** Shuresh Ghimire UConn Extension Vegetable Specialist
- **Agency Programs:** USDA FSA, CT Department of Agriculture
- **Crop Insurance:** USDA RMA

When:	Host Farm:
Tuesday, April 15 @3:00 p.m.	Gresczyk Farms 860 Litchfield Turnpike, New Hartford, CT **Free dinner included, pesticide credits offered**
Wednesday, April 16 @9:30 a.m.	Bishop's Orchards New England Rd, Guilford, CT **Free lunch included, pesticide credits offered**

Each host farm will discuss their current climate mitigation strategies; presentations will be the same on both days.

Registration:

This in-field program will cover climate adaptation strategies and is FREE of charge, but pre-registration is required for planning purposes.

s.uconn.edu/cmfd2025

Questions?
Contact tolland@uconn.edu; 860-875-333

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USDA United States Department of Agriculture
Risk Management Agency

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February 2025 Crop Talk Editors/Contributors

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