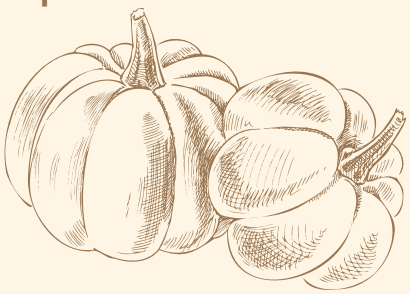
UConn Extension and Department of Plant Science and Landscape Architecture

CT IPM

CROP TALK



Volume 18, Issue III — October 2022

In This Issue:

UCONN
COLLEGE OF AGRICULTURE, HEALTH AND NATURAL RESOURCES

EXTENSION & PLANT SCIENCE AND LANDSCAPE ARCHITECTURE

Application of ultra-fine bubble technology to reduce Listeria monocytogenes contamination of Romaine lettuce

Brindhalakshmi Balasubramanian,[1] *Trushenkumar shah,*[2] *Chen Zhu,*[3] *Kimberly Rankin,*[4] *Shuresh Ghimire,*[5] *Indu Upadhyaya,*[6] *Abhinav Upadhyay.*[7]

(1-4) Graduate Research Assistant, Department of Animal Science, UConn
(5) Vegetable Specialist Assistant Extension Educator, UConn
(6) Food Safety Assistant Extension Educator, UConn
(7) Assistant Professor, Department of Animal Science, UConn

Listeria monocytogenes is a major foodborne pathogen that has been responsible for multiple outbreaks in the US. The ubiquitous distribution of *L. monocytogenes* in the environment results in frequent contamination of food processing facilities, and food products. Although listeriosis outbreaks have been traditionally associated with consumption of ready-to-eat meat and dairy products, an increasing number of reports in the past two decades show increasing contamination and prevalence of *L. monocytogenes* in fresh produce. Produce such as lettuce, and melons have been linked to listeriosis outbreaks in the recent past. Water used for cleaning (e.g., in dump tanks) can act as a source of product contamination with *L. monocytogenes*. Therefore, decontamination of dump tank wash water is critical for maintaining the microbiological safety of fresh produce. Scientific literature suggests that commonly employed disinfectants, including chlorine, peracetic acid and quaternary ammonium compounds, are not completely effective in killing *L. monocytogenes* on food products. Moreover, the presence of chemical residues and the formation of harmful organochlorine compounds is of concern due to associated health risks, including cancer. Therefore, there is a need for developing a novel antimicrobial strategy for reducing Listeria contamination on fresh produce and survival in wash water.

Ultra-fine bubble technology: In recent years, ultra-fine bubble technology has drawn tremendous attention, due to its application in a wide variety of fields, such as water/sewage treatment, pesticide removal, and dental hygiene. Ultra-fine bubbles are defined as small, spherical, gas-filled cavities within liquids, with a diameter between 50 to 200 μm. The electrostatic interactions between nanobubbles (due to their surface negative charge) in liquid prevent coalescence and facilitate their uniform distribution in liquid. When combined with a gas of choice, the technology has the potential to influence several sectors of agriculture. Ozone (triatomic form of oxygen) is a strong oxidizing agent that is widely used in the industry for sterilization, virus inactivation, deodorization, and organic matter decomposition. Aqueous ozone has strong antimicrobial activity against bacteria and does not induce microbial resistance. Moreover, ozone readily decomposes to oxygen without generating harmful residues, making it safe for food washing applications. However, ozone has low water solubility and a half-life of about 20 min before it degrades back to oxygen. The application problem due to short half-life of ozonated water could be overcome by developing ozone nanobubbles in water for washing fresh produce.

Overall goal: With an aim to target the industry's need of a microbiologically safe fresh produce supply chain, the overall goal of this study was to develop novel washing treatments using ultra-fine bubble technology in combination with ozone to reduce the survival of L. monocytogenes on fresh produce and in water used for washing.

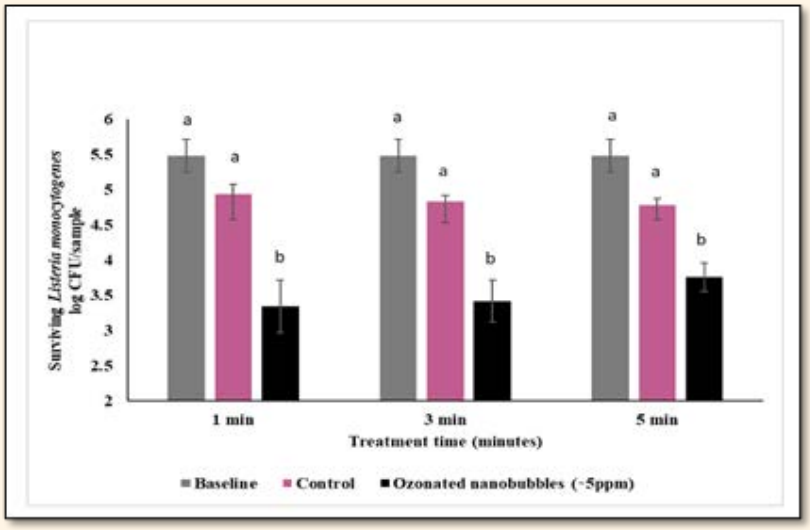
Objective 1: Development and characterization of Ultra-fine bubble generation system in the laboratory.

Ultra-fine ozone (UFO) bubbles were generated and characterized as described below (Figure 1). Oxygen was supplied to generate ozone in an ozone generator. Ozone was passed through an ultra-fine bubble generation machine into water to produce ultra-fine bubbles. The bubble number, and size was characterized using a zetasizer. Bubble characterization results indicated that the bubble number in water was approximately 10^8/ml with size ranging from 90-150 nm. The dissolved ozone concentration in UFO bubble water was ~ 5 ppm at 25 degrees C.

Objective 2: Investigate the efficacy of UFO bubble water in killing Listeria monocytogenes on romaine lettuce.

Romaine lettuce was inoculated with L. monocytogenes (~ 6 log CFU/sample) followed by washing at room temperature for 1, 3 or 5 min with normal water or water containing UFO bubbles.

After the wash, the number of surviving L. monocytogenes population on the produce was enumerated by standard food microbiology procedure of dilution and plating on Oxford agar. **Washing of Romaine lettuce with ultra-fine ozone bubble water significantly reduced L. monocytogenes load by ~ 1.5 log CFU/sample, as early as 1 min of treatment time (Figure 2; P<0.05).** No significant increase in efficacy against L. monocytogenes on lettuce was observed by increasing the wash time to 5 min (P>0.05). The wash treatment did not affect the color parameters (L, a, b values) of lettuce (P>0.05). No L. monocytogenes was detected in wash water (> 5 log CFU/ml reduction).



Experiments investigating the efficacy of UFO bubble water in reducing the survival of S. Enteritidis on Romaine lettuce are currently underway.

Two Spotted Spider Mites Clean-Up

Leanne Pundt, Extension Educator, UConn

With the hot, dry summer and continued warm fall temperatures, two-spotted spider mites were especially troublesome this year. They may be still found on a wide range of plants including greenhouse tomatoes, many vegetable transplants, weeds, and any leftover unsold plants under protected cover.

Now is a good time to clean up any empty greenhouses, so you do not allow spider mite-infested weeds, and unsold plants to remain in the greenhouse. Remove plant debris and spilled growing media on the floor, too. As you remove plant material, be sure cull piles are far away as possible from the greenhouse.

Remove mite- infested plants at the end of the day (so you do not inadvertently spread the spider mites as you are working within the greenhouse) as they may crawl up your arms!

When plants are heavily infested, spider mites may fall to the ground and walk to other plants or move from one leaf to another if plants are touching. They also produce silken threads or webbing, which they can use to "rope-down" to the ground or to other plants. Adult females also tend to migrate to the top of plants where air currents can help them disperse to other plants. They can crawl along the wires for vining crops moving from plant to plant. Workers also readily move the spider mites during routine pruning and harvesting tasks.

Figure 1: Spider mite webbing on greenhouse tomatoes. Photo by L. Pundt

Two-spotted spider mites enter a hibernation phase known as "diapause" during decreasing day lengths, decreasing temperatures and a decline in their food supply. Females change color, turning orange to orange red in color. (Although they are bright red, these diapausing mites, should not be confused with the beneficial long legged fast moving beneficial predatory mite, Phytoseiulus persimilis.)

Figure 2: Look on underside of leaves, especially along the mid vein, for small, 1/50-inch-long, greenish to orange mite with characteristic two dark spots on either side of abdomen and their round eggs. Photo by L. Pundt

After mating, the overwintering females tend to walk off the plants to hide in cracks and crevices in the greenhouse, away from the light. During this hibernation phase, they do not eat, or lay eggs, and are less susceptible to chemical pesticides. Diapausing spider mites are also more difficult for predatory mites to find because they are hiding in concealed places.

Figure 3: Two-spotted spider mites, round eggs, and bright orange red diapausing or overwintering female spider mite (within circle). Photo by L. Pundt

You may have a spider mite problem in the same location from year to year, for the two spotted spider mites become active when temperatures increase to about 50° F and move to the plants nearest the edge of the greenhouses. So, one way to help prevent this is by a thorough clean-up at the end of the growing season.

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Drone Imagery for Early Detection of Fruit Crop Nutritional Deficiencies

Mary Concklin, Extension Educator Emeritus, Fruit Production & IPM, Dept of Plant Science & LA, UConn
Evan Lentz, Graduate Student and Research Assistant, Dept of Plant Science & LA, UConn
Dr. Chandi Witherana, Assistant Professor, Dept of Natural Resources & the Environment, UConn

In 2020, a study, funded by the USDA Specialty Crop Block Grant through the CT Dept of Agriculture, was begun to develop models for detecting plant nutrient deficiencies in fruit crops using drone images (NDVI, NDRE indices) and Pearson's Correlation Coefficient. Researchers conducted 15 drone flights at 3 CT orchards during 2020 through 2022 growing seasons and tested 165 tissue samples for nutrient deficiency correlations in grapes, blueberries, apples and peaches. At the project's conclusion, it was possible for researchers to correlate the drone imagery with tissue results to develop 62 models. A storymap was developed by members of UConn's Center for Land Use Education and Research (CLEAR) to show what was done on this project and can be seen at https://s.uconn.edu/IPMdrones. Our team has applied for a grant to begin in 2023 to validate these models and determine economic feasibility with seven orchards of various sizes.

Multispectral Drone Data

Drone flights occurred concurrently with tissue sampling. Using multispectral drone imagery, the vegetation indices, such as normalized difference vegetation index (NDVI), and normalized difference red-edge index (NDRE) were derived for each of the 11 crop/location combinations. Average values for NDVI and NDRE were calculated for the areas of interest that were sampled from (either a single row or block of rows).

Correlation and Regression Analysis

The two sets of data (nutrient analysis and vegetative indices) were analyzed in SAS (statistical analysis program). Correlation coefficients were obtained to determine the relationship between the captured data (NDVI, NDRE) and the plant nutrient levels for each specific crop/location and nutrient. For example, correlation coefficients were obtained from the drone captured NDVI and NDRE values of Apples and each individual nutrient analyzed by SNAL. The relationship between each nutrient and each vegetative index was analyzed and scored as either a weak (0.0 – 0.3), medium (0.3 – 0.6), or strong (0.6 – 1.0) correlation. Medium and strong correlations suggest there may be a relationship between the vegetative indices and plant nutrient levels. After this, medium and strong correlations were run through simple linear regression analysis. This yielded predictive equations (models) that can be used to determine plant nutrient levels based solely on drone images.

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For NDRE, moderate correlations were found in peaches for phosphorus, calcium, magnesium, copper, and zinc. For apples, there are six nutrients moderately correlated with NDVI (phosphorus, copper, iron, sodium, lead, and zinc) and five nutrients that are moderately correlated with NDRE. For grape, many more correlations are found between plant tissue nutrient levels and the two vegetative indices. Fourteen strong correlations were found for grape. NDVI is strongly correlated with nitrogen, potassium, magnesium, aluminum, copper iron, and lead. NDRE is strongly correlated with potassium, calcium, magnesium, boron, copper, iron, and sodium (Figure 1).

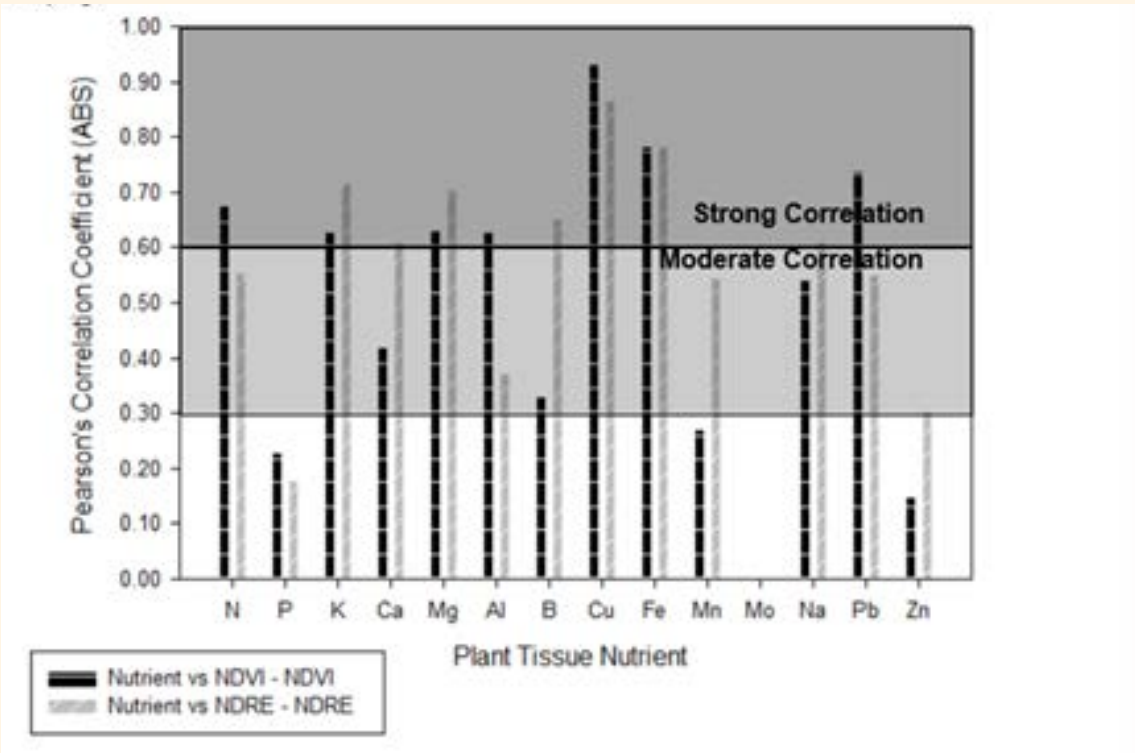

Figure 1. Relationship between two drone-captured plant-health-indicators (NDVI, NDRE) and internal plant tissue nutrient levels for grapes. The scale is 0-1.0 with 0-0.3 being a weak correlation, 0.3-0.6 being a moderate correlation, and 0.6-1.0 being a strong correlation. Moderate and strong correlations signal the ability of the drone technology to accurately detect deficiencies in those specific plant nutrients without traditional tissue sampling.

For blueberries, a total of nine moderate correlations were found between the two vegetative indices and plant tissue nutrient levels. NDVI is moderately correlated with phosphorus, magnesium, boron, and sodium. NDRE is moderately correlated with potassium, calcium, copper, manganese, and zinc.

As our team continues to investigate the use of drone imagery to detect nutrient deficiencies in fruit crops, the inclusion of additional data points will always yield a more accurate, sustainable, and well-buffered predictive model.

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Insects in winter: out of sight but not out of mind for IPM

Dr. Ana Legrand, Extension Asst. Professor,
Department of Plant Science and Landscape Architecture, UConn

While we transition to colder weather and prepare for a different pace, many insects get ready and seek shelter to survive the winter. Insects like the potato leafhopper and cabbage looper do not overwinter in our area and return every summer from southern locations. Many others do stick around and enter a period of dormancy seeking shelter underground or in plant debris. Integrated pest management (IPM) tactics like crop rotation and crop residue removal can help in dealing with some of the overwintering pest insects. Crop location planning relative to previous and future surrounding crops is also important. For the next season, timely pest monitoring will help with early pest detection.

See Table 1 for examples of common insect pests and of how they pass the winter.

European corn borer larva
Photo: Clemson University - USDA Cooperative Extension

References:

Campbell-Nelson, K. Editor. 2020-2021 New England Vegetable Management Guide https://nevegetable.org/

Capinera, J. 2001. Handbook of vegetable pests. Academic Press, 800 pg.

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Table 1. Overwintering Common Insect Pests

Insect Pest	Crop Host Plants	Overwintering Life Cycle Stage
Asiatic garden beetle	Beets, carrots, turnip, basil	Larvae or grubs descend deep into soil for overwintering.
Brown marmorated stink bug	Sweet corn, tomatoes, lima beans and green peppers	Adults overwinter in wooded areas, hedgerows and emerge late April to mid-May.
Cabbage maggot	Cole crops	Pupae buried about 4 inches deep in soil.
Colorado potato beetle	Potato, eggplant	Adults overwinter in soil.
Crucifer and striped flea beetles	Cole crops	Adults overwinter in crop and nn-brassica leaf litter and in soil.
European corn borer	Sweet corn, bean, pepper, potato and others in a list of over 200 host plants.	Larvae survive winter in stalks of corn and other host plants and pupate in the spring. Adults emerge in late May – early June.
Imported cabbageworm	Cole crops	Pupae hidden in surrounding vegetation.
Mexican bean beetle	Legume crops	Adults overwinter under plant debris, logs, under stones and hedgerows.
Onion thrips	Onions and other plants including alfalfa, clover, cucurbits or brassica crops	Overwinter as adults in crop residues, alfalfa, wheat and weeds along the border of crop fields.
Spinach leafminer	Swiss chard, beets, spinach	Leafminer overwinters as a pupa in the soil and flies emerge from late-April to mid-May.
Squash bug	Cucurbits, especially yellow summer squash, zucchini, Hubbard squash and pumpkin	Adults find shelter in crop residues and field margin vegetation.
Squash vine borer	Summer squash	The pupae overwinter 1 – 2 inches deep in the soil.
Striped cucumber beetle	Cucurbit crops	Adults overwinter under soil and plant debris near cucurbit fields. They become active in early spring.
Tarnished plant bug	Celery, lettuce, bean, eggplant and others in a list of over 300 host plants.	Overwinter as adults in crop residues and weeds. Active again in early spring.

Pest and natural enemy dynamics on reduced-till systems in Connecticut

Shuresh Ghimire, Extension Vegetable Specialist, UConn

Soil disruption can alter the habitats for many pests and their natural enemies. Conventional methods of soil preparation for crop cultivation that involve intensive and frequent tillage can negatively impact soil structure, pest and natural enemies' populations, and crop yield and quality. Excessive tillage can contribute to soil degradation through loss of soil aggregates, increased soil erosion, compaction, decreased water-holding capacity of soil, and loss of soil carbon, besides disturbing habitats of soil-dwelling organisms.

On the other hand, no-till or reduced till cultivation practices can improve soil quality and provide habitat for soil-dwelling organisms and improve crop yields and quality in long run.

Figure 1. Ground nesting bird population is increasing over time in a no-till farm in CT.

UConn Extension worked with three certified organic farms in Connecticut that were practicing no-till or reduced till vegetable production to complete qualitative observations on insect-pest, diseases, natural enemies, crop yield and quality. A semi-structured interview was conducted with the farmers in 2021.

Farm A was started 5 years ago and has been on no-till since then. Observed benefits from no-till farming:

- Disease and insect-pest pressure has been reduced over years
- Increased population of natural enemies: ground beetles, predatory wasps, ladybugs, frogs, toads, snakes, spiders, and ground nesting birds, and increased predation and parasitizing
- Soil compaction is not an issue at any location in the farm
- Infiltration capacity of the soil has been greatly improved; no standing water shortly after 4 inches of rain
- Soil aggregate/structure is improving
- Even though soils are cooler in early spring due to crop residue on the surface, no incidence of Rhizoctonia or Pythium root rot or damping off problems likely because of the presence of beneficial microbes in the soil
- Much more compact/robust plants, for example pepper plants were shorter but much more robust and bearing good amount of fruit
- Overall good yield and quality of crops

Potential concerns due to continuous no-till system:

- Cooler soils in the spring due to presence of cover crop residue on the soil surface delays spring crop production
- Incresed damage from slugs (all crops) and ants (brassica seedlings)
- Wireworms caused significant damage to onions in one of the 3 years of observations.

Farm B has been on reduced till for the last 12 years. This farm uses cover crops (peas, vetch, oats, buckwheat, clover, rye, sun hemp, barley, Sudan grass) and tarping extensively, also uses living mulch or landscape fabric between beds.

Figure 2. Exclusion netting is effective in keeping flea beetles away from brassica seedlings.

Observed benefits from reduced tillage:

- Soil structure has been improving
- No significant change in insect-pest, disease, weed pressures, or natural enemies
- Minimal pesticide sprays have been adequate to keep the pest pressure under control
- Crop yield and quality have been decent for most crops in most years

Potential concerns due to reduced tillage:

- Slugs are really problematic where there is a great amount of cover crop residue

Farm C grew no-till squash and tomatoes in 2019-2021.
Observed benefits from no till system:

- The second and third year of no-till winter squash and tomato were successful
- Weed pressures was manageable
- No difference in pest-pressures or natural enemies likely because the no-till plots were moved every year
- Tomato yield and quality (clean fruit) was better in no-till plot compared to conventionally tilled plots

Figure 3. Companion plants, cover crops, and hedgerows grown for other purposes can also serve as insectary plants.

Potential concerns on the reduced till system:

- The first year of no-till experiment was a failure because of too much weed pressure
- Soil was compacted in no-till plot (because of use of heavy equipment in the previous years and no opening of the soil when no-till was started)
    - No change in soil structure noticed (too early to notice that)

UConn Urban Farmer Training Program Revived in 2022

Jacqueline Kowalski, Urban Agriculture Educator, UConn

The Urban Farming Training Program was initiated by former Sustainable Communities Extension Educator German Cutz in the mid-2010s and was held in several Connecticut cities. After his departure and the arrival of the COVID-19 pandemic, the program was put on hiatus for two seasons. New Urban Agriculture Extension Educator, Jacqueline Kowalski felt her priority was to revamp the program and get aspiring farmers working in the soil again.

Late summer, the class headed back into the classroom and focused on the business aspects of starting a farm and selling produce.

Seven participants will graduate in late October, and we wish them the best in their future growing endeavors. Details regarding the 2023 program are being finalized. To be added to the interested list contact Jacqueline Kowalski, jacqueline.kowalski@uconn.edu.

In partnership with Green Village Initiative (Bridgeport, CT), the program was offered in 2022. The class started in May with 8 weeks of indoor instruction on basic botany, soil health, vegetable production, etc. The training site was cleared and planted with variety of vegetables. As you can imagine, things didn't go exactly as planned. Over the past couple of seasons, the site became overgrown, it took continual effort to remove noxious plant species, there were several access points in the fence for groundhogs, and the class struggled to keep everything watered during the drought. However, they persisted and were able to sell the produce they grew on nine Saturdays at the Reservoir Farm Farmers' Market (also operated by GVI) throughout the growing season.

Solid Ground and Grown ConNECTed Updates

As the colder weather begins to set in at our farms in CT, it means the start of something else: Workshop season! Kicking off in November, the Grown ConNECTed project has partnered up with Solid Ground to put on 3 Webinars surrounding Marketing for Farms. Each webinar focuses on an aspect of marketing and how to get your farms in front of the eyes, and your products in the hands, of more people. For more information, check out the series and their descriptions below!

Content Creation, Social Media & What it Means for your Farm

Tuesday Nov. 1 | 6:00-7:30 pm | **Register Here**

What is content creation and why is it so important? What should I be posting to attract more attention to my farm? What should I boost and when? What even is boosting?! I'm so busy at the farm, I don't even know where to start... These are just a few of the questions that we'll be addressing!

In this workshop, we will specifically be looking at Instagram & Facebook and how to create effective content to draw more eyes to your farm. Not only can it help you gain customers, it can assist you in retaining the folks that you bring in! We want you to walk away feeling confident.

Accepting SNAP/EBT at Your Farm

Wednesday Nov. 9th | 6:00-7:30 pm | **Register Here**

There are many different ways to bring in income for our farms, and one way that is often overlooked, or seems too complicated, is by accepting EBT/ SNAP (formerly know as Food Stamps) benefits. But it doesn't have to be complicated anymore! Join Whitney Butler from Marketlink as she talks about a grant they have received to assist farmers in accepting EBT/SNAP.

Marketlink provides one on one assistance in helping you apply to accept EBT/SNAP and helps you navigate the process of applying. After you have been accepted, they also provide you with a free SNAP/EBT card reader, a 1 year free subscription to the TotilGo App (required to accept EBT/SNAP) and Equipment setup and questions.

New opportunities to Sell to Wholesale Buyers

Tuesday Nov. 15th | 6:30-8:00 PM | **Register Here**

Farmers' Markets, farmstands, and CSAs are great opportunities to distribute your farm products, but what if you have a bumper crop of items that you need to move off the farm? Or just want another way to move your product? Wholesale opportunities are great ways to move product fast and help feed the community local healthy food.

In this workshop you'll hear from multiple folks about easily accessible wholesale opportunities in our community that you can start selling to right now. These opportunities do not require you to sell in 100s or thousands of pounds of products but try to work with you to purchase what you have available.

Announcements:

SARE Farmer Grants

SARE offers grants of up to $30,000 for farmers to, "explore new concepts in sustainable agriculture conducted through experiments, surveys, prototypes, on-farm demonstrations or other research and education techniques." Applications are due by Nov. 15. More information about applying can be found at: https://northeast.sare.org/grants/get-a-grant/farmer-grant-program/ A recent recorded webinar also provides an overview: https://www.youtube.com/watch?v=92yw4rtzKwM

Save these Dates!

Connecticut Agricultural Expo 2022

Friday, November 18th, 2022
Aquaturf, Southington, CT

Theme: Ag Innovation & Technology

Event Partners:

- Connecticut Department of Agriculture
- Connecticut Farm Bureau
- Farm Credit East, ACA
- UConn Extension

More information:
https://www.cfba.org/connecticut-agricultural-expo-2022/

New England Vegetable & Fruit Conference and Trade Show

December 13-15, 2022
Manchester, NH

The **New England Vegetable & Fruit Conference and Trade Show** will be back in-person in Manchester, NH on December 13-15, 2022. Registration is now open at https://newenglandvfc.org/. The final educational program has not yet been posted.

UConn Extension's 2023 Vegetable & Small Fruit Growers' Conference

Wednesday, January 4, 2023
Sheraton Hartford South Hotel
100 Capital Blvd, Rocky Hill, CT 06067

Trade Show: 8:00-8:55, 10:00-10:45, 12:00 -1:00
8:00-8:55 Registration, breakfast, socialize, visit trade show
Morning Moderator – Mary Concklin, Fruit Extension Specialist Emeritus, UConn
8:55 Welcome: Indrajeet Chaubey, Dean of CAHNR, UConn
9:00 **Nutrient management in sweet corn** George Hamilton, Emeritus Professor, UNH
9:30 **Vegetable benefits and disease control of nanotechnology** Wade Elmer, CAES
10:00 Announcements
10:15 Break (trade show/coffee &tea)
10:45 **Plug strawberries VS bare root strawberries – pros and cons of both** Tim Nourse, Nourse Farms
11:15 **Small scale bean threshing project with UConn engineering students** Susan Mitchell, Cloverleigh Farm
11:35 **Trap crop- UConn research update** Ana Legrand, UConn
11:50 **New opportunities to sell to K-12 schools and early care providers.** Jiff Martin, UConn
12:00-1:00 Lunch break/trade show
Afternoon Moderator – Shuresh Ghimire, Vegetable Extension Specialist, UConn
1:00 **Winter Growing in low tunnels.** Robert Durgy, CAES
1:30 **Drone imaging to monitor potato leafhopper damage in the field.** Chandi Witharana, UConn
1:45 **Strawberries and irrigation/fertigation** Trevor Hardy and Zoe Stapp, Brookdale Fruit Farm
2:15 **Ozone microbubble for produce safety** Abhinav Upadhyay, UConn
2:30 **No-till and soil health growers' panel** Jamie Jones, Jones Family Farm, Bryan O'Hara, Tobacco Road Farm, others TBD
3:30 Pesticide recertification credits and socialize: 4 CEU to be confirmed

REGISTRATION:

Regular: Early Bird (prior to 12/29) $50.00 (+$1.00 processing fee)
After 12/29 $70.00 same day registration will be available, cash or check only
https://s.uconn.edu/ctvfc2023registration

Student: Early Bird (prior to 12/29) $30.00
After 12/29: $50.00, same day registration will be available, cash or check only. In order to receive the student rate, you MUST present your school or student ID when you check in the day of the event.
https://s.uconn.edu/ctvfc2023studentregistration

Trade Show:

$130.00 per company table; all exhibit attendants (main person and additional helpers) will also need to pre-register for the conference at $50.00 per person.
https://s.uconn.edu/ctvfc2023tradeshow

Contact tolland@uconn.edu 860 875-3331 if you have any questions.

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Putting Science to Work for Society since 1875

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Crop Talk Editors/Contributors

Shuresh Ghimire, Commercial Vegetable Crops, UConn Extension, 860-875-3331, shuresh.ghimire@uconn.edu

Frances Champagne, newsletter compilation and layout, UConn Extension,
frances.pacyna.champagne@uconn.edu

Administrative Officers

Indrajeet Chaubey, Dean, College of Agriculture, Health, and Natural Resources

Michael P. O'Neill, Associate Dean and Associate Director, UConn Extension

Bonnie E. Burr, Assistant Director & Department Head, UConn Extension

Sydney Everhart, Department Head, Department of Plant Science and Landscape Architecture

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