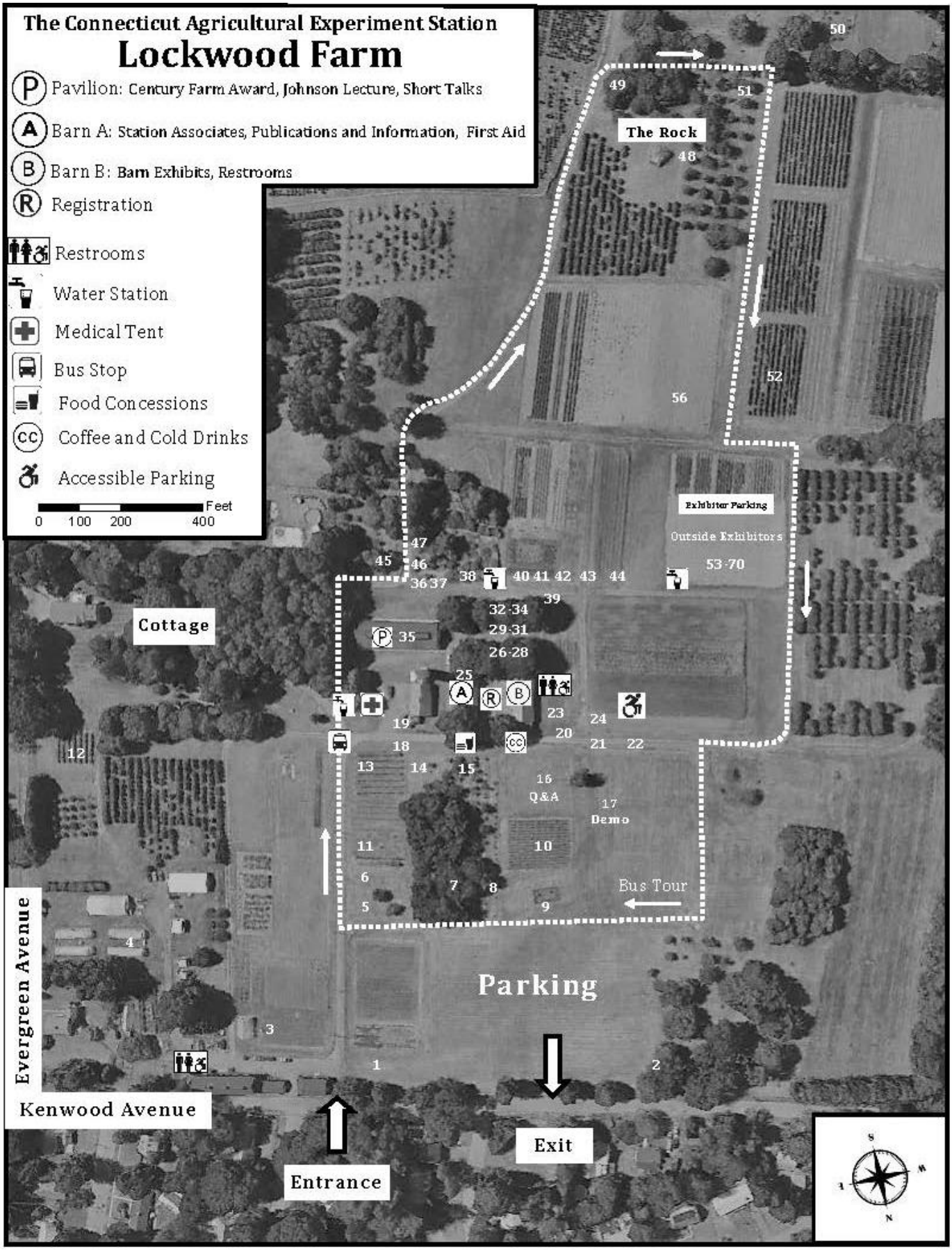
# The Connecticut Agricultural Experiment Station
# 112th Plant Science Day

## Lockwood Farm
## 890 Evergreen Avenue, Hamden, CT 06518
## Wednesday, August 3, 2022


CAES
The Connecticut Agricultural Experiment Station
*Putting Science to Work for Society since 1875*


The Connecticut Agricultural Experiment Station
Lockwood Farm
P Pavilion: Century Farm Award, Johnson Lecture, Short Talks
A Barn A: Station Associates, Publications and Information, First Aid
B Barn B: Barn Exhibits, Restrooms
R Registration
Restrooms
Water Station
Medical Tent
Bus Stop
Food Concessions
CC Coffee and Cold Drinks
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Exhibitor Parking
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The Connecticut Agricultural Experiment Station's **Plant Science Day** is held at Lockwood Farm on the first Wednesday of August every year, beginning in 1910. This one-day event features reports on research, field plots, barn exhibits, tours, and other opportunities for Connecticut residents and attendees to discuss many topics of plant science on an informal basis and interact with CAES scientists and staff. While the event only lasts one day, planning for Plant Science Day is a year-round activity spearheaded by the *Plant Science Day Planning Committee*. This committee, chaired by Ms. Vickie M. Bomba-Lewandoski, is comprised of CAES staff members who strive to make this event as meaningful and organized as possible. We acknowledge their hard work and thank them for allowing this historic event to happen each year.

## Plant Science Day Planning Committee

Mr. Michael Ammirata
Ms. Terri Arsenault
Mr. Joseph Barsky
Mr. Gregory Bugbee
Ms. Vickie Bomba-Lewandoski
Ms. Calanthe Cavadini
Mr. Richard Cecarelli
Ms. Kelly Fairbrother
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Ms. Summer Stebbins
Dr. Blaire Steven
Dr. Lindsay Triplett
Dr. Jason White
Dr. Quan Zeng
Dr. Nubia Zuverza-Mena

Program booklet created, compiled, and edited by
Ms. Vickie Bomba-Lewandoski, Ms. Kelly Fairbrother, and Ms. Summer Stebbins

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# HISTORY OF LOCKWOOD FARM, HAMDEN

Lockwood Farm is a research facility of The Connecticut Agricultural Experiment Station. The farm was purchased in 1910 with monies provided by the Lockwood Trust Fund, a private endowment. The original farm was 19.6 acres with a barn and a house. Since then, several adjacent tracts of land have been purchased, enlarging the property to 75.0 acres.

The farm is located in the extreme southern portion of the Central Lowland Physiographic Province. This lowland region is underlain by red stratified sandstone and shale of Triassic age from which resistant lava flows project as sharp ridges. One prominent ridge, observed from the farm, is Mount Carmel (the “Sleeping Giant”), which lies to the north. The mountain is composed of diabase, a dense igneous rock which has a fine crystalline texture, having been pushed up as magma close to the surface where it cooled quickly. The "trap rock" of this region is either diabase, or its compositional equivalent basalt which was extruded onto the surface in lava flows that form topographic "trappa" or "trappe" (steps or stairs) and it is commonly used as a building material and ballast for railroad tracks.

The topography of the farm is gently rolling to hilly and was sculpted by the Wisconsin glacier that overrode the area some 10,000 years ago and came to rest in the vicinity of Long Island. A prominent feature of the farm is a large diabase boulder that was moved by flowing ice from its place of origin, and is therefore also known as a Glacial Erratic. The boulder probably fell onto the top of the glacier oozing its way down past the Sleeping Giant's head during the waning stage of the last continental glaciation. It was deposited here, near the toe of the waning glacier, onto "till," an unsorted mass of sandy or silty material mixed with rounded pebbles and boulders that had been pushed in front of, or under, the glacier, and deposited as the ice melted. Most of the boulders around the area, such as those in the nearby stone walls, are rounded and their surfaces have been ground smooth by abrasion beneath the glacier. The boulder came to rest on the crest of a hillock to the south of the upper barns. From this hillock, Sleeping Giant State Park comes into full view and is a favorite spot for photographers and other artists.

The soils of the farm developed on glacial drift are composed primarily of the underlying reddish-brown sedimentary rocks. The soils, characterized by reddish-brown profiles, are the well-drained Cheshire fine sandy loam (67%), the moderately well-drained Watchaug loam (10%) and the shallow-to-bedrock Sunderland fine sandy loam (16%). Along the western edge of the farm, adjacent to the Farmington Canal Greenway, lies a level terrace of stratified glacial drift. There, the well-drained Branford loam and the moderately well-drained Ellington loam (7%) dominate. Elevations on the farm range from 140 to 220 feet above mean sea level.

The farm lies in the Coastal Plain Climatological District. The local climate is influenced by its proximity to Long Island Sound, which lies 9 miles to the south. The average frost-free season is 190 days, compared to 180 days at the inland Valley Laboratory in Windsor.

In 1936, a fully instrumented weather station was established on the farm. The weather data are reported to and published by the U.S. Weather Service in their cooperative observer program. The mean annual temperature for the farm is 49.0 F. A record high temperature, 104.0 F, was observed on July 4, 1949. A record low temperature, -24.0 F was recorded on February 16, 1943. The mean annual precipitation for the farm is 52.6 inches. The greatest total precipitation, 74.36 inches, was recorded in 2011. The least precipitation, 30.4 inches, was recorded in 1965. The mean annual snowfall for the farm is 32.3 inches. The greatest total snowfall, 78.5 inches, was recorded during the winter of 1995-1996. The least total snowfall, 10.0 inches, was recorded in 2011-2012.

The farm provides a field laboratory for Experiment Station scientists who learn how to control the pathogens and insects that attack trees, fruit, and vegetables. In some experiments, scientists learn how crops grow and develop strategies for efficient crop production. All field research can be observed at Plant Science Day, held each year on the first Wednesday in August.

# 2022 CONNECTICUT CENTURY FARM AWARD

The Century Farm Award is selected by the Connecticut Agricultural Information Council and goes to a deserving farm that has been in operation for more than 100 years. The award is presented at the CAES Plant Science Day in August and recognized at Ag Day at the Capitol.

The 2022 winner of the Century Farm Award is:

## Fairholm Farm
## Woodstock, CT

*Proclamation from Governor Ned Lamont:*

In 1920, Ethal and Estella Barrett purchased Fairholm Farm in Woodstock. Fairholm means sunny hillsides surrounded by streams. Ethal worked the farm after having served in the army during World War I. Ethal, Estella, and their three children, Barbara, George, and Doris worked together to make and sell dairy products that they marketed locally and in surrounding towns. In this way, the family survived the hardships of the Great Depression. Ethal passed away when George was sixteen. George completed high school and returned to working and growing the farm. Barbara and Doris went on to other careers but always found time to help out on the farm whenever they were needed. Although none of the original barns remain, the original 1812 farmhouse still stands and is where the fifth generation now lives.

Fairholm Farm currently raises and milks 400 Holstein cows using a modern robotic system and recently added a small retail store as well as an online store where they sell their own pork, beef, and cow's milk soap, in addition to honey and maple syrup. A Community-Supported Agriculture (CSA) program was started in 2021 and the farm is opened for visitors and educational opportunities such as four different Farm Camp programs for children and Hay Wagon Farm Tours to educate the public about how their food is produced.

## THE SAMUEL W. JOHNSON MEMORIAL LECTURE (Pavilion)

The Experiment Station Board of Control established the lectureship to further discuss issues of concern to Connecticut residents and the Station. Professor Johnson was director of the Experiment Station from 1877 to 1900 and a leader in the establishment of American agricultural experiment stations.

## ANSWERS TO YOUR QUESTIONS (Plot 16)

Staff members in the "questions and answers" tent are prepared to give information on identification of insects, plant disorders, soils and their management, and other problems of growers and gardeners.

## KIDS' CORNER (Plot 21)

Come to the Kids' Corner to pick up your child's passport and a gift. The passport is a special activity for young children to help them enjoy and explore Plant Science Day. There are six different stations located throughout Lockwood Farm that they can visit, where they can ask questions, learn about the topic featured at the station, and then receive a special stamp for their passport. Once the passport is complete, they can go to the Self-Guided Activity Plot (plot 22) to collect a CAES patch.

## SELF-GUIDED ACTIVITY FOR ALL CHILDREN, INCLUDING GIRL SCOUTS (Plot 22)

Girl Scouts and older children should be directed to this plot. A self-guided worksheet is available for all children, and it is better suited for older children than the passport. The activity will guide them to interact with some of the many people here today helping to put science to work for society. In addition, Girl Scouts may use the activity to complete steps towards their Naturalist Legacy badge. Once the activity is completed, all children can return to this plot to collect either a Girl Scout or CAES patch. Children with completed passports should return here to collect their badges as well.

## CONNECTICUT PESTICIDE CREDITS (Registration, R)

Connecticut pesticide credits will be offered for attending Plant Science Day. If you are interested in obtaining pesticide credits, you must sign in at the registration desk (R) at the start of the day between 9:30 a.m.-10:00 a.m., to obtain your Pesticide Credit Passport, which you must have validated after you have attended or visited each of the required talks, demonstrations, and barn exhibits. Sign out begins at 3:35 p.m. at the Registration Desk (R), where you will redeem your Passport for your Pesticide Credit Form.

Connecticut Pesticide Credits Offered: **ALL CATEGORIES and PRIVATE APPLICATOR (PA) CATEGORY / 3.25 TOTAL CREDIT HOURS.**

# SOCIAL MEDIA LINKS

Keep current with The Connecticut Agricultural Experiment Station by using our **Social media** and **email alert** resources.

The CAES is encouraging our constituents to share their photos about **The CAES** and **Plant Science Day** on social media using the hashtag **#CT_CAES**. Selected photos may be used in future publications.

**Facebook** (www.facebook.com/CT.CAES)

**Twitter** (www.twitter.com/CT_CAES)

**YouTube** (www.youtube.com/user/CTAGEXPSTATION)

**Instagram** (www.instagram.com/ct.caes/)

**Wikipedia** (http://en.wikipedia.org/wiki/Connecticut_Agricultural_Experiment_Station)

**Pinterest** (www.pinterest.com/caes123)

**Spotify** (https://open.spotify.com/show/3ZDVEkmebY1rubzb9Gc936)

To visit our webpage, go to https://portal.ct.gov/caes,
or scan our QR code below with your smartphone.

## E-mail mailing list

**Mail Chimp** sign up for our CAES e-mail list
https://mailchi.mp/d0807919f3d2/caes-email-notifications

# NO PETS, PLEASE. SERVICE DOGS ONLY.

Under the Americans with Disabilities Act (ADA), "a service animal is defined as a dog that has been individually trained to do work or perform tasks for an individual with a disability."


Also, under the ADA, "emotional support animals, comfort animals, and therapy dogs are not service animals under Title II and Title III of the ADA."

## JUST A REMINDER THAT LOCKWOOD FARM IS A WORKING FARM WITH ACTIVE RESEARCH BEING CONDUCTED, SO PLEASE RESPECT THE SCIENTISTS' WORK.

After the lecture, visitors may remain in the pavilion to eat lunch. Coffee and cold drinks are free.

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# 112th PLANT SCIENCE DAY

Gates open at 9:30 a.m.
Program begins at 10:00 a.m.
Event 10:00 a.m. – 4:00 p.m.

# AGENDA

**Moderator – Ms. Vickie M. Bomba-Lewandoski, Information Officer**

**10:00 a.m. – 10:15 a.m.** **PAVILION**
***MORNING GREETING AND OPENING REMARKS***
**Dr. Jason C. White, Director**
**The Connecticut Agricultural Experiment Station**

**10:15 a.m. - 10:45 a.m.** **PAVILION**
**Dr. Leigh Whittinghill, Assistant Agricultural Scientist II, Department of Environmental Science and Forestry**
***Urban Agriculture for Food Security in Challenging Spaces***
Production to combat food insecurity is one of the primary goals of urban agriculture. Food security is still a challenge in many communities in the United States. The current severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2, also called COVID-19) pandemic exacerbated food insecurity and food access issues and increased interest in urban agriculture. Food production in urban areas has great potential to provide safe, nutritious food to communities, but there are many barriers that must be overcome. These include high costs, contaminated soils, pollution, and limited growing space. There are many creative production systems in use in urban agriculture that help to overcome such barriers. Some of these systems are backed by resources and research that enable growers to maximize yields and nutritional quality. Others have not been thoroughly researched as they are unique to urban agriculture and not suited to large scale production. These include novel systems, such as green roof production and production using small plastic pools or other found containers, and systems backed by traditional knowledge and practice, such as cut-and-come-again harvesting of greens. Dr. Whittinghill's research focuses on some of these production systems in the hopes to better enable urban growers to meet their food security goals.

**10:15 a.m. – 10:35 a.m.** **TECHNICAL DEMONSTRATION TENT**
*(20-minute demonstration, repeated twice during the day, 10:15 a.m. & 2:30 p.m.)*
**Mr. Mark Creighton, Agricultural Research Technician I, Department of Entomology**
***Beekeeping Systems Used in Connecticut***
Interested in joining Connecticut's beekeeping community? Many have found that working with honey bees is a very rewarding experience. The honey tastes good too! Did you know that honey bees have been on this planet for over 100 million years? Come and explore the art of beekeeping, learn about the different styles of hives used in Connecticut, and consider becoming a beekeeper today! One major challenge for bees today is habitat loss. Learn a simple technique using straw bales to plant food for the bees and yourself.

**10:40 a.m. – 11:00 a.m.** **TECHNICAL DEMONSTRATION TENT**
*(20-minute demonstration, repeated twice during the day, 10:40 a.m. & 3:15 p.m.)*
**Mr. Gregory J. Bugbee, Associate Agricultural Scientist, Department of Environmental Science and Forestry**
**Assisted by: Ms. Summer Stebbins, Agricultural Research Technician I, Department of Environmental Science and Forestry**
***Managing Weeds in Lakes and Ponds***
What happen to the lake? It was once a beautiful waterbody where I use to swim, boat, and fish. Now it is covered with weeds and a total mess. These statements are commonly brought to the CAES Invasive Aquatic Plant Program. Although native species such as waterlilies and duckweed are sometimes to blame, non-native invasive plants such as watermilfoil, fanwort, hydrilla, and water chestnut are often the problem. These plants not only look unsightly and interfere with recreation, but they also disrupt native ecosystems, reduce property values, and can harbor harmful algae. Researchers in the Department of Environmental Sciences (now the Department of Environmental Science and Forestry) have documented our State's

invasive aquatic plant problem from 2004 to present. Over 350 Connecticut lakes and ponds have been surveyed. We documented over 100 plant species, 14 of which are invasive. Approximately 60 percent of the water bodies contained one or more invasive species. Do you know of a lake or pond that is choked with weeds? Have you wondered how it got that way and what can be done about it? This demonstration talk will answer these questions.

**10:45 a.m. - 11:05 a.m.** **PAVILION**
**CENTURY FARM AWARD**
**Fairholm Farm, Woodstock, CT**

**11:05 a.m. – 11:15 a.m.** **PAVILION**
**EXPERIMENT STATION ASSOCIATES**
**Ms. Cheryl Cappiali, President, Experiment Station Associates**

**11:15 a.m. – 12:00 noon** **PAVILION**
***THE SAMUEL W. JOHNSON MEMORIAL LECTURE***
**Ms. Katie S. Dykes, Commissioner**
**Connecticut Department of Energy and Environmental Protection (CT DEEP)**

**1:15 p.m.-1:45 p.m.** **PAVILION**
**Dr. Itamar Shabtai, Assistant Agricultural Scientist II, Department of Environmental Science and Forestry**
***Soil Organic Carbon: A Key Component of Soil Health in a Changing Climate***
Man-made annual $CO_2$ emissions make up less than 5% of total global carbon fluxes. Yet, because these emissions are unidirectional, they result in the accumulation of atmospheric $CO_2$, the most important greenhouse gas driving global warming. Since soils contain more carbon than the atmosphere and biota combined, small changes in soil carbon content are significant at global scales. Therefore, in addition to decarbonizing the energy sector, sequestering atmospheric $CO_2$ by increasing soil carbon stocks may help mitigate climate change. While the feasibility of offsetting greenhouse gas emissions through soil carbon sequestration is debated in the scientific community, the positive effects of increasing soil carbon on soil health is a consensus, and actions to do so should be taken regardless of its significance in mitigating climate change. This talk will address our evolving understanding of soil organic carbon, its link to soil health and climate change resilience and mitigation, and how to increase it.

**1:45 p.m.-2:15 p.m.** **PAVILION**
**Dr. Carlos Tamez, Assistant Agricultural Scientist II, Department of Analytical Chemistry**
***Laboratory Analyses of Processed Foods, Raw Agricultural Commodities and Animal Feed in Connecticut***
Since the founding of The Connecticut Agricultural Experiment Station in 1875, its Department of Analytical Chemistry (DAC) has been applying science for the benefit of Connecticut residents. Each year, the DAC analyzes over 1000 samples for pesticides, aflatoxins, heavy metals, polychlorinated biphenyls (PCBs), THC, CDB, crude protein, crude fat, and crude fiber. These analyses cover a wide range of consumer products namely, processed food products including baby foods, raw fruits and vegetable produce, pet and animal feeds, fruit juices and beverages, spices, hemp, and environmental samples from potentially contaminated spill sites. Many of these analyses are performed under the DAC's scope of ISO 17025 accreditation, which demonstrates the lab's ability to operate under competent methods and produce valid results. In this presentation, an overview of the DAC's regulatory work, done in conjunction with the CT Department of Consumer Protection, the CT Department of Agriculture, and the US Food and Drug Administration is discussed, and some of the interesting findings are highlighted.

**2:15 p.m.** **PAVILION**
Adjourn Main Talks

**2:30 p.m. – 2:50 p.m.** **TECHNICAL DEMONSTRATION TENT**
(*20-minute demonstration, repeated twice during the day, 10:15 a.m. & 2:30 p.m.*)
**Mr. Mark Creighton, Agricultural Research Technician I, Department of Entomology**
***Beekeeping Systems Used in Connecticut***
Interested in joining Connecticut's beekeeping community? Many have found that working with honey bees is a very rewarding experience. The honey tastes good too! Did you know that honey bees have been on this planet for over 100 million years? Come and explore the art of beekeeping, learn about the different

styles of hives used in Connecticut, and consider becoming a beekeeper today! One major challenge for bees today is habitat loss. Learn a simple technique using straw bales to plant food for the bees and yourself.

**3:15 p.m.-3:35 p.m.** **TECHNICAL DEMONSTRATION TENT**

(*20-minute demonstration, repeated twice during the day, 10:40 a.m. & 3:15 p.m*.)

**Mr. Gregory J. Bugbee, Associate Agricultural Scientist, Department of Environmental Science and Forestry**

**Assisted by: Ms. Summer Stebbins, Agricultural Research Technician, Department of Environmental Science and Forestry**

***Managing Weeds in Lakes and Ponds***

What happen to the lake? It was once a beautiful waterbody where I use to swim, boat, and fish. Now it is covered with weeds and a total mess. These statements are commonly brought to the CAES Invasive Aquatic Plant Program. Although native species such as waterlilies and duckweed are sometimes to blame, non-native invasive plants such as watermilfoil, fanwort, hydrilla, and water chestnut are often the problem. These plants not only look unsightly and interfere with recreation, but they also disrupt native ecosystems, reduce property values, and can harbor harmful algae. Researchers in the Department of Environmental Sciences (now the Department of Environmental Science and Forestry) have documented our State's invasive aquatic plant problem from 2004 to present. Over 350 Connecticut lakes and ponds have been surveyed. We documented over 100 plant species, 14 of which are invasive. Approximately 60 percent of the water bodies contained one or more invasive species. Do you know of a lake or pond that is choked with weeds? Have you wondered how it got that way and what can be done about it? This demonstration talk will answer these questions.

**3:35 p.m.** **TECHNICAL DEMONSTRATION TENT**

Adjourn Technical Demonstrations

**3:35 p.m. SIGN-OUT** **(For those requesting pesticide credits) (R)**

Attendees can pick up their Pesticide Credit forms at the registration table (R).

# LOCKWOOD FARM WALKING TOUR
# (Meet at the Registration Desk, R)
## 11:00 a.m.–12:00 p.m.

**11:00 a.m. - 12:00 p.m.** **MEET AT REGISTRATION DESK (R):**
**Dr. Robert E. Marra, Associate Agricultural Scientist, Department of Plant Pathology and Ecology**
A one-hour guided tour of selected "off the beaten path" field plots.

# TOUR OF NATIVE WOODY SHRUBS (PLOT 36)
## 1:00 p.m.-1:30 p.m.

**1:00 p.m. - 1:30 p.m.** **MEET AT THE WOOD ARBOR OF THE NATIVE WOODY SHRUBS (Plot 36)**
**Dr. Jeffrey S. Ward, Emeritus Scientist, Department of Environmental Science and Forestry**
**Assisted by: Alexander Amendola, Forester 1, Connecticut Department of Energy and Environmental Protection (CT DEEP)**
A ½ hour guided tour of our Native Shrub planting. Learn about using native shrubs for naturalistic landscapes without the use of pesticides and fertilizers.

# BARN EXHIBITS (BARN B)

**Nano-enabled Agriculture Research at CAES**
*Department*: Analytical Chemistry
*Investigators*: Dr. Nubia Zuverza-Mena, Dr. Washington da Silva, Dr. Susanna Keriö, Dr. Milica Pavlicevic, Dr. Shital Vaidya, Dr. Yi Wang, Dr. Chaoyi Deng, Dr. Inès Karmous, Dr. Wade Elmer (Emeritus), Dr. Christian Dimkpa, and Dr. Jason C. White
*Abstract:* The role of nanotechnology in agriculture is becoming critical in our quest to achieve sustainable food production. With unfavorable crop production conditions such as nutrient-depleted soils and the presence of disease-causing organisms, the need for fertilizers and pesticides for sustaining production is evident. Unfortunately, the use of agrichemicals is very inefficient; plants utilize less than 10% of the pesticides and fertilizers supplied to them. Therefore, growers need to overapply agrichemicals to achieve the desired outcomes. This results in unwanted side-effects in the environment, such as pollution of soil and water. Materials at the nanoscale (~1-100 nm) have unique properties and strong potential to revolutionize food production. Because of their minute dimensions and high reactivity, engineered nanomaterials (ENMs) can be an efficient source of nutrients for improving plant health, or that can serve as nanocarriers of active ingredients that trigger inherent plant defense mechanisms. Our research also involves tunning materials for better control of the material-plant interactions. Collectively, greenhouse and field studies at The CAES have shown that low doses of ENMs can mitigate disease and increase yield in different crops.

**Wild Bee Biodiversity in Connecticut**
*Department*: Entomology
*Investigators*: Ms. Tracy Zarrillo and Dr. Kimberly Stoner (Emeritus), assisted by Ms. Morgan Lowry (Retired)
*Abstract*: Wild bees are a very diverse group of insects, with over 20,000 described species worldwide, over 4,000 species in the United States and Canada, and 378 species in Connecticut. Despite their diversity, most go unnoticed and live in the background of our lives, pollinating the flowers of food crops and other plants in our environment. While there is evidence of decline in certain species of bees in Connecticut, other bee species are increasing in abundance. Some species are stable, and some have too few records to accurately assess. Knowing where bee species live and what they eat are imperative for understanding the threats to their survival, and for making informed conservation directives.

**A New Environmentally-Friendly Phosphate Fertilizer: Delivery of Less Leachable Nutrients from Biochar to Plants**
*Department*: Environmental Sciences
*Investigators*: Dr. Philip Wang, Mr. Tyler Swanson, Dr. Yi Wang, Mr. Alex Waller, Dr. Wade Elmer (Emeritus), and Dr. Joseph Pignatello (Emeritus)
*Abstract*: Phosphorus (P) is highly leachable and a threat to natural resources. We bound P to a chemically modified biochar to be used as new form of fertilizer. We found that the biochar-bound P was effective in delivering P to lettuce in potting experiments, providing sufficient nutrient for its growth. More importantly, the biochar-bound P was far less leachable than conventional soluble P, a major advantage for protecting the environment from the harmful effects of phosphate pollution.

**Mycorrhizae and Urban Tree Health**
*Department*: Forestry and Horticulture
*Principal Investigator*: Dr. Susanna E. Keriö[1]
*Co-Investigators*: Dr. Nubia Zuverza-Mena[2], Dr. Wade H. Elmer[3] (Emeritus), Dr. Adriana (Arango-Velez) Puralewski[1,4],
assisted by Mr. Joseph P. Barsky[1] | [1]Department of Environmental Science and Forestry, [2]Department of Analytical Chemistry, [3]Department of Plant Pathology and Ecology, [4]GreenLight Biosciences, Inc.
*Abstract*: With the intensifying impacts of climate change, information of the most effective methods to reduce tree stress in young trees are needed both in nurseries and in urban areas. Mycorrhizal fungi can boost tree stress tolerance by improving the uptake of water and nutrients from the soil, and by protecting the fine roots from the negative impacts of abiotic stress. This exhibit will provide an overview of the impacts of mycorrhizae on tree health, and presents the current and upcoming CAES research related to mycorrhizae and urban tree health in Connecticut.

**Beech Leaf Disease in Connecticut**
*Department*: Plant Pathology and Ecology
*Investigators*: Dr. Robert E. Marra, assisted by Ms. Alexandra Farah
*Abstract*: Beech Leaf Disease (BLD), caused by the foliar nematode, *Litylenchus crenatae mccannii* (Lcm), was first discovered on American beeches (*Fagus grandifolia*) in Ohio in 2012. Since then, the disease has been found on both American and European beech (*F. sylvatica*) in Connecticut, Maine, Massachusetts, New Jersey, New York, Rhode Island, Virginia, and Ontario, Canada. The disease, first found in Connecticut in 2019 in Fairfield County, is now found in all eight Connecticut counties, with the most severe and extensive occurrences within 15-20 miles of the CT shoreline. As part of the United States Forest Service's region-wide long-term program for monitoring BLD in its current and presumed future distribution, Dr. Robert Marra has installed and annually measures 11

forest monitoring plots distributed throughout the state, and is developing a DNA fingerprinting system for use in testing hypotheses on the spread of the disease, and on the patterns and origins of new infections.

**Armored Scale Pests of Christmas Trees**
*Department*: Valley Laboratory
*Investigator*: Dr. Richard S. Cowles
*Abstract*: Three species of armored scales are commonly found infesting Christmas trees in Connecticut: elongate hemlock scale, circular hemlock scale, and cryptomeria scale. Outbreaks of scale insects, like spider mites and aphids, often indicate there has been disruption of their naturally occurring natural enemies, which include predators, parasitoids, and fungal diseases. Pyriproxyfen, an insect growth regulator, has better prospects than neonicotinoids for shifting management of armored scales to a better balance in Christmas tree plantings.

## THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

The experiments exhibited here depict only a portion of the work performed by Experiment Station scientists. In addition to Lockwood Farm, Griswold Research Center, and laboratories in New Haven and Windsor, Station scientists use state forests, private orchards, lakes, and farms for their experiments. Experiments and surveys are conducted in many widely separated towns of the state.

## THE EXPERIMENT STATION WEB PAGE: http://portal.ct.gov/caes

## EMAIL US AT: CAES@CT.GOV

### TO RECEIVE A COMPLETE LIST OF STATION SPEAKERS:

Inquire at the publications table in BARN A, or write to:
Publications; The Connecticut Agricultural Experiment Station; New Haven, CT 06511, phone 203-974-8447, fax 203-974-8502, e-mail Vickie.Bomba-Lewandoski@ct.gov, or on the web at https://portal.ct.gov/CAES/ABOUT-CAES/Speakers/Available-Speakers

### TO RECEIVE A COMPLETE LIST OF AVAILABLE EXPERIMENT STATION PUBLICATIONS:

Inquire at the publications table in BARN A, or write to:
Publications; The Connecticut Agricultural Experiment Station; New Haven, CT 06511, phone 203-974-8447, fax 203-974-8502, e-mail Vickie.Bomba-Lewandoski@ct.gov, or on the web at https://portal.ct.gov/CAES/Publications/Publications/Publications

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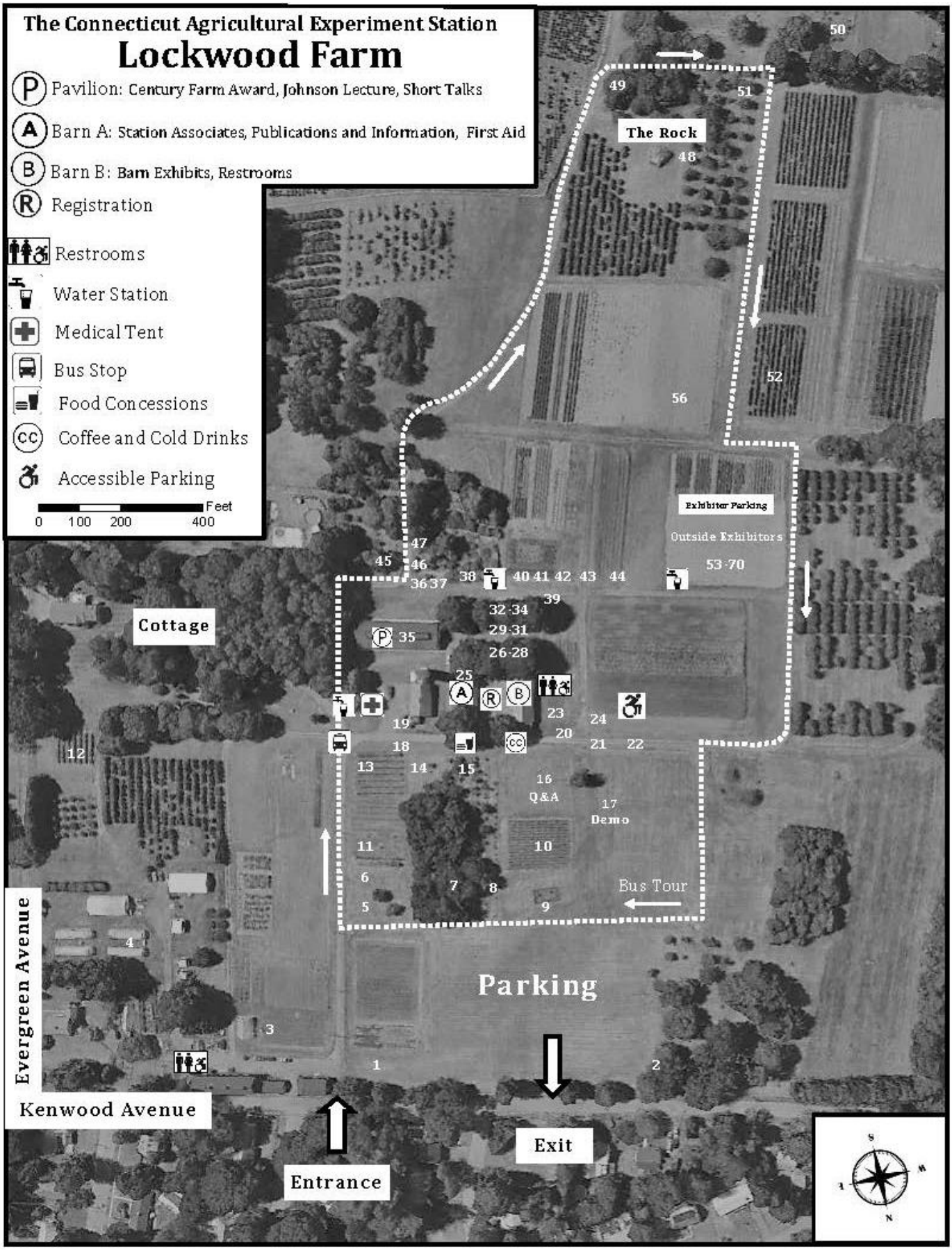
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53-70
Cottage
Q&A
Demo
Bus Tour
Parking
Evergreen Avenue
Kenwood Avenue
Entrance
Exit
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# FIELD PLOT LISTING

***Outside Exhibitors (Plots 18, 19, 20, 25, 53-70) are invited to participate.***

The plots at Lockwood Farm are planted and maintained by The Connecticut Agricultural Experiment Station's scientists and technical staff along with the help of Farm Manager Mr. Richard Cecarelli and his Research Technician Mr. Rollin Hannan as well as seasonal resource assistants Mr. Chris Carnale, Ms. Mary Consoli, and Mr. John DeFrancisco. Other plots here at the farm provide food for the Connecticut Food Bank.

1. Chinese Chestnut Trees
2. Nut Orchard
3. The Fight Against Potato Viruses
4. Figs in Self-watering Pots
5. Commercial Chestnut Cultivars
6. Commercial Chestnut Seedlings
7. Control of Blight on American Chestnuts
8. New Hybrid Chestnut Orchard
9. Remote Access Weather Station
10. Surface Coated Sulfur Nanomaterials Suppress Tomato *Fusarium oxysporum* Infection and Increase the Fruit Yield
11. Grapevine Demonstration Plot: Table Grapes
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35. The Pavilion at Lockwood Farm
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39. The Public Health and Entomology Tent
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    b. Impacts of Fall Acaricide Application on Spring Blacklegged Tick Abundances
    c. Backyard Habitats and Blacklegged Tick Associations
    d. Monitoring Ticks and Tick-borne Pathogens to Better Guide Public Health Action in Connecticut

40. How Do Plant Pathogens Enter Plants?
41. Growing Cannabis in Connecticut - Crop Production and Pest Management
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43. Invasive Aquatic Plant Program
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45. Chestnut Species and Hybrids
46. Healthy Plants—Healthy Business: Support of The Green Industry by Inspection
47. Expanding Biological Control of Hemlock Woolly Adelgid
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49. Asian Chestnut Gall Wasp on Chestnut
50. Hybrid Elm Trees
51. Rocky Hill American Chestnut Trees
52. Grapevine Demonstration Plot: Hybrid and Vinifera Grape Cultivars
53. Connecticut Farm Bureau Association
54. United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine APHIS-PPQ
55. United States Department of Agriculture - Farm Service Agency
56. The Federated Garden Clubs of Connecticut, Inc.
57. Wild Ones – Mountain Laurel Chapter
58. Levo International, Inc.
59. The Connecticut Tree Protective Association
60. Connecticut Professional Timber Producers Association
61. The Connecticut Invasive Plant Working Group
62. The Connecticut Department of Energy and Environmental Protection (CT DEEP) - Pesticide Management Program
63. CT DEEP Forestry - Private and Municipal Lands
64. United States Department of Labor, Wage and Hour Division
65. The Connecticut Department of Energy and Environmental Protection (CT DEEP) - Wildlife
66. University of Connecticut IPM Team
67. United States Department of Labor - Occupational Safety and Health Administration (OSHA)
68. The Connecticut Department of Labor's Division of Occupational Safety and Health (CONN-OSHA)
69. Bonsai Society of Greater New Haven
70. Master Gardeners, University of Connecticut (UConn)

# FIELD PLOT ABSTRACTS

1. **Chinese Chestnut Trees**
   Dr. Sandra Anagnostakis (Emeritus)
   These Chinese chestnut trees, planted by Donald Jones in 1941, were selected by chestnut grower W.C. Deming of Litchfield and grafted by the Hartford Park Department. The second tree from the gate is a graft of the cultivar Bartlett that was developed by the Bartlett Tree Co. in Stamford. All have been used by The Experiment Station and the American Chestnut Foundation in crosses with American chestnut trees to produce blight-resistant forest and orchard trees.
2. **Nut Orchard**
   Dr. Sandra Anagnostakis (Emeritus), *assisted by* Ms. Pamela Sletten (Retired)
   This orchard of nut trees was begun by Richard Jaynes in the spring of 1981. There are several named cultivars of chestnut and other nut trees. Trees that fail to survive or produce well are replaced with new nut cultivars that we want to test for their production potential in Connecticut. All of the recently planted trees are butternuts (*Juglans cinerea*), seedlings from trees that may have some resistance to the butternut canker fungi that have nearly killed the large, grafted butternut trees in this plot.
3. **The Fight Against Potato Viruses**
   Dr. Washington da Silva and Dr. Gale Ridge
   Potato (*Solanum tuberosum* subsp. *tuberosum*) is the fourth main staple crop in the world, behind rice, wheat, and corn. It is grown on all continents and because it is a vegetatively propagated crop, potato is particularly vulnerable to destructive viruses such as potato virus (PVY), potato leafroll virus (PLRV), and potato mop-top virus (PMTV). Endemic and emerging viruses are becoming a major threat to smallholding farms because of the negative effects on yield and quality that they induce on the marketable product. In Connecticut, like much of New England, potatoes are planted primarily for the local market where quality is paramount and any blemishes reduce marketability and value, directly impacting growers' income. The da Silva Laboratory at The CAES is working on new sustainable technologies to help in the fight against potato viruses. The several potato varieties planted in this field will generate tubers that will be used to test such virus control strategies.
4. **Figs in Self-watering Pots**
   Dr. Charles R. Vossbrinck (Emeritus)
   Obtaining fresh figs in Connecticut is difficult. Figs do not transport well; they are not sweet until they are ripe and do not ripen after they are picked. After they are ripe, they are soft and last only a few days. Therefore, home-grown figs are highly prized. We demonstrate the use of self-watering as well as conventional pots to grow figs in Connecticut.
5. **Commercial Chestnut Cultivars**
   Dr. Sandra Anagnostakis (Emeritus), *assisted by* Ms. Pamela Sletten (Retired)
   These trees are potential commercial cultivars of orchard chestnut trees. The largest tree (grafted) is cultivar 'Colossal' (Japanese x European) which is the most frequently planted commercial cultivar in the U.S., with large acreages in Michigan and on the west coast. The other trees are seedlings from a cross of 'Colossal' x 'Lockwood' made here in 2014. We are evaluating the potential of these trees for nut production here in Connecticut.
6. **Commercial Chestnut Seedlings**
   Dr. Sandra Anagnostakis (Emeritus), *assisted by* Ms. Pamela Sletten (Retired)
   These seedling trees are open pollinated (Chinese) Dunstan chestnuts (a trademarked name). They are not a cultivar (clones from a single tree), but a variety (a type) and are widely available for sale in garden centers.
7. **Control of Blight on American Chestnuts**
   Dr. Sandra Anagnostakis (Emeritus), *assisted by* Ms. Pamela Sletten (Retired)
   These American chestnut trees were planted in 1976 when they were 3 years old. Chestnut blight cankers were treated for 4 years, from 1978 to 1981, with our biological control using hypovirulent strains of the blight fungus. The control is working well to keep the trees alive and fruiting. Some of the trees are growing better than others. We do not know which trees were from seed collected in Wisconsin and which were from Michigan. It is possible that the difference in their ability to thrive in the presence of blight and hypovirulence indicates genetic differences in resistance. The grafted tree in the center of the east row is from an "American" chestnut in Scientist's Cliffs, MD, and the original tree resisted blight for many years (it may be a European hybrid). It definitely has some resistance and is the best-looking tree in the plot. Two grafted trees at the southeast corner are (Chinese x American) x American named cultivar 'Clapper' and have intermediate resistance to blight.
8. **New Hybrid Chestnut Orchard**
   Dr. Sandra Anagnostakis (Emeritus), *assisted by* Ms. Pamela Sletten (Retired)
   These trees are from some of our hand-pollinated crosses done in previous years and were planted as seedlings. All are hybrids of American chestnut trees and blight-resistant Chinese, Japanese, or hybrid trees. They are being grown to evaluate their blight resistance in the presence of the biological control that we assume will move over from the adjoining plot. The trees that look most like American chestnut trees and have good blight resistance will be used in future crosses for timber trees. Others will be developed as orchard trees for Connecticut growers. The paper bags on the trees cover hand-pollinated flowers from this year's crosses.

9. **Remote Access Weather Station**

   Remote-access weather stations are deployed at the three Connecticut Agricultural Experiment Station experimental farms located in Hamden CT, Windsor CT, and Griswold CT. One additional unit is located at Gouveia Vineyards in Wallingford CT, where a wine making trial for Saint Croix grapes is underway. Cumulative precipitation, growing degree days (GDD), frost events, and disease-risk assessments are recorded and/or calculated from the data collected.

10. **Surface Coated Sulfur Nanomaterials Suppress Tomato *Fusarium oxysporum* Infection and Increase the Fruit Yield**

    Dr. Yi Wang, Dr. Jason C. White, and Dr. Wade Elmer (Emeritus)

    An increasing number of studies have shown that engineered nanoparticles (ENP) offer a unique potential to deliver agrochemicals, manage plant pathogens, and increase food productivity; all with much higher efficiency compared with their conventional bulk counterparts. However, metal based ENPs may accumulate in the soil and contaminate the environment. Thus, the use of nanoscale sulfur is promising and has attracted increased interest as a multi-functional sustainable agricultural amendment to improve plant growth, productivity, and control disease. In this study, pristine/surface coated elemental sulfur nanoparticles (nS and cS, respectively) and CuS nanoparticles are applied to tomato (*Solanum lycopersicum*) cultivated in *Fusarium oxysporum* f. sp. *lycopersici* infested soil both under greenhouse condition and in field. Bulk sulfur (bS), ionic sulfate (iS), and healthy controls treated are also included. Measured endpoints include agronomic parameters, disease severity/suppression, and a range of more mechanistic biochemical and molecular measurements. Results from this study will provide significant mechanistic insight into non-metal nanomaterial-based suppression of plant disease and be used to further optimize this sustainable approach in nano-enabled agricultural systems.

11. **Grapevine Demonstration Plot: Table Grapes**

    Dr. Washington da Silva and Mr. Richard Cecarelli

    Wine grapes and wineries are a relatively new industry in Connecticut. In the past 20 years, acreage planted for wine grapes has gone from 160 A to 620 A and the number of wineries has grown from 15 to 42, producing about 550,000 gallons of wine valued at between 12-14 million dollars per year. Four grape plots are being maintained at Lockwood farm to carry on the CAES legacy of grapevine research: Table Grape Plot – 6 vine rows are the seedless table grapes Canadice and Vanessa (red), Himrod (green), and Jupiter (black). The vines were planted in 2006 and bore their first (small) crop in 2008, with full crops since.

12. **Grapevine Demonstration Plot: Chardonnay Wine Grapes**

    Dr. Washington da Silva and Mr. Richard Cecarelli

    Wine grapes and wineries are a relatively new industry in Connecticut. In the past 20 years, acreage planted for wine grapes has gone from 160 A to 620 A and the number of wineries has grown from 15 to 42, producing about 550,000 gallons of wine valued at between 12-14 million dollars per year. Four grape plots are being maintained at Lockwood farm to carry on the CAES legacy of grapevine research: Chardonnay Wine Grape Plot - Chardonnay vines are prized for the quality of the wine they produce but are very susceptible to powdery mildew. This plot was first planted to study the relationship between the onset of powdery mildew and climate in order to attune disease-risk models to our local weather conditions.

13. **Grapevine Demonstration Plot: Wine Grapes**

    Dr. Washington da Silva and Mr. Richard Cecarelli

    Wine grapes and wineries are a relatively new industry in Connecticut. In the past 20 years, acreage planted for wine grapes has gone from 160 A to 620 A and the number of wineries has grown from 15 to 42, producing about 550,000 gallons of wine valued at between 12-14 million dollars per year. Four grape plots are being maintained at Lockwood farm to carry on the CAES legacy of grapevine research: Wine Grapes – these vines are reminiscent of the first grapevines planted at Lockwood Farm in 1978 by CAES scientists when the grape research program was established at CAES. Over decades, many studies were conducted on grape disease susceptibility and winter hardiness, which helped to propel the wine and grape industry in Connecticut by providing important information on the varieties best adapted to the local climate.

14. **Seedlings of Old Surviving American Chestnuts**

    Dr. Sandra Anagnostakis (Emeritus), *assisted by* Ms. Pamela Sletten (Retired)

    In the southern U.S., large surviving American chestnut trees have been found scattered through the range. When we checked the blight fungi in the cankers on these old trees, we found several new kinds of hypovirulence viruses. We believe that these trees have a little more resistance than surrounding trees, which all died of blight, and that allowed viruses from other fungi in the area to infect the blight fungus. The American Chestnut Cooperators Foundation (www.ppws.vt.edu/griffin/accf.html) has been collecting cuttings from these survivors and grafting them together in orchards where they can cross with each other. This will allow any resistance genes present in individuals to be joined together in the resulting seedlings. The ACCF sent us this collection of seedlings that we have inter-planted with seedlings from crosses of American trees here at Lockwood Farm. We will compare their winter hardiness and blight resistance with that of the European chestnut trees from Turkey and the old American chestnut trees north of them.

15. **Wild Chestnuts from Turkey**

    Dr. Sandra Anagnostakis (Emeritus), *assisted by* Ms. Pamela Sletten (Retired)

    These seedling trees are from six wild populations along the Black Sea in Turkey. Those from the eastern border are near the population in the Caucasus Mountains where European chestnuts (*Castanea sativa*) survived the ice ages and are genetically

quite diverse. Those from the western border are much less diverse. We are growing these here to compare their winter hardiness (not very!) and resistance to chestnut blight disease (also not very!) with that of American chestnut trees and with the seedlings from "old survivors" planted next to them.

16. **Questions and Answers Tent**
    Ms. Katherine Dugas, Ms. Rose Hiskes, Dr. Yonghao Li, Ms. Diane Riddle, and Dr. Gale E. Ridge
    This is a great opportunity to ask the experts about growing plants, testing soil, and identifying plants, plant diseases, and insects. Bring samples of soil, symptomatic plants, and insects for testing and identification. Visit the displays and pick up fact sheets about current insect and disease problems.
17. **Technical Demonstration Tent**
    See program page 10 for a schedule of Technical Demonstrations.
18. **Hamden Police Department**
    The Hamden Police Department's goal is to enforce the law in a fair and impartial manner, recognizing both the statutory and judicial limitations of police authority and the constitutional rights of all persons. http://www.hamdenpd.com.
19. **Crown Castle Cellular Tower**
    Learn about the cellular transmission tower.
20. **The Big Dipper**
    Mr. Harry Rowe
    Our home-style ice cream is freshly made on the premises in small batches to ensure the finest product. In our search to bring you premium, gourmet ice cream we use the world's highest quality vanilla from the island of Madagascar and the best cocoa made from Holland. We combine farm fresh dairy cream from one of the leading dairies on the east coast with choice chocolates, nuts, berries, and the purest of flavors and extracts. With over 25 years and two generations of making ice cream, we strive to make your experience one that you will come back to for years to come.
    www.bigdipper.com, email: harry@bigdipper.com, (203) 758-3200, 75 Waterbury Rd., Prospect, CT.
21. **Kids' Corner**
    Bring your children to the Kids' Corner to make fun crafts and learn interesting facts about insects, plants, and more! Don't miss out the opportunity to make your own pipe cleaner insects and plants, do some coloring, play with bubbles, and grab a cold treat! Children can come to this plot to collect an age appropriate, self-guided activity, to earn a patch of their choosing among several options. Children are directed to a few of the many exhibits where age-appropriate activities and speakers are available just for them. In addition, Girl Scouts will have the option to earn the Naturalist Legacy badge appropriate for their level of scouting (Bugs, Flowers, or Trees). Once the activity is complete, return to this location to collect your patch or badge!
22. **Self-Guided Activity for All Children, Including Girl Scouts**
    Ms. Terri Arsenault
    Children can come to this plot to complete an age appropriate, self-guided activity, to earn a patch of their choosing among several options. Children are directed to a few of the many exhibits where age-appropriate activities and speakers are available just for them. In addition, Girl Scouts will have the option to earn the Naturalist Legacy badge appropriate for their level of scouting. On October 1, 2007, Girl Scouts of Connecticut became the largest organization of women and girls in Connecticut, serving over 47,300 girls. The mission of Girl Scouts is to build girls of courage, confidence, and character, who make the world a better place through a diverse range of fun, and horizon-stretching experiences. We encourage everyone to use this opportunity to learn something new about the natural world and use your new knowledge to make the world a better place.
23. **Baby Pools: Low-cost Containers for Vegetable Production in Urban Agriculture**
    Dr. Leigh Whittinghill, *assisted by* The Plant Health Fellows Summer Interns: Oliver Mackinnon, Aaliyah Walker, Brooke Issacson, Renee Smith, Naomi Allen, Mia Varney, Emilie Kendrick, Conor Bendett, Sofia Shubin, and Juniper Allen-Cantu.
    Vegetable production in urban areas is growing in popularity, but cost, contaminated soils, and limited growing space can be a problem. The use of inexpensive containers, such as small plastic pools, could help expand production to contaminated or paved areas. Plastic pools have a lower cost per growing area than most growing containers but may also have different drainage and media needs that have not been studied yet. Students in the Plant Health Fellow summer internship program conducted an experiment 1.) to compare cucumber production in pools to traditional nursery pots, 2.) to find the optimal growing media/compost mixture, and 3.) to optimize the drainage strategy (drainage hole and pine bark placement) for growing vegetables in pools. The students measured soil temperature and moisture content, plant growth, cucumber yield (number of fruits and weight), and cucumber quality based on USDA grading standards, and will use their data to make a recommendation for best growing practices.
24. **Farm Equipment Used at Lockwood Farm**
    Lockwood Farm is a 75-acre working research farm. Here are some examples of the tractors and other equipment used for plowing, cultivating, tilling, and mowing the farm to assist the scientists in their research.

25. **Experiment Station Associates**
    Mr. Skip Hobbs
    Information is available on this organization formed to help promote scientific advances at The Connecticut Agricultural Experiment Station. Visit their website: http://www.agstationfriends.org
26. **The Ministry of Molecular Magic**
    Mr. Michael Ammirata and Ms. Meghan Cahill
    The analytical chemistry department has synthesized a range of experiments which demonstrate the roles of chemistry and energy in everyday life. We have both individually oriented experiments and group demonstrations. Learn scientific principles while having fun conducting or observing the experiments. Come and explore the wonders of science with the Ministry of Molecular Magic.
27. **Microbiome on Plants and Its Role in Plant Disease Management**
    Dr. Mohamed-Amine Hassani, Dr. Salma Mukhtar, Dr. Blaire Steven, and Dr. Quan Zeng
    Microbiomes are the assembly of microorganisms found in a specific environment. Members of a microbiome could include bacteria, virus, archaea, fungi, and protozoa. The microbiome members often interact with each other and with the host, forming commensal, symbiotic, and pathogenic relationships. Plants exudate extra carbon generated from photosynthesis to plant surface in the form of exudate. Such carbon becomes an energy source for various microorganisms, namely the plant microbiome. Microbiome can be found on leaves, stems, roots, flowers, and fruits of a plant. A plant's microbiome is a key determinant of plant health and productivity. Audiences will be educated about general information about plant microbiomes and methods to study it. We will use apple flowers as an example to illustrate the assembly, composition of microbiomes and its impact on apple's resistance to fire blight.
28. **Intercropping Wine-cap Mushrooms in Christmas Trees**
    Dr. DeWei Li, *assisted by* Mr. Ethan Paine, Ms. Christine Grant, and Mr. John Yorder
    A study on cultivating wine-cap mushrooms (*Stropharia rugosoannulata*) as an intercropping crop on Christmas tree farms has been conducted since 2019. Woodchips of hardwoods were used as substrates/mulch at four locations. Mushrooms were produced on the plots from mid-May to Mid-June in all plots and from early October to late October. Mushrooms can produce two crops/year. Wine cap mushrooms survived without irrigation in the plots and kept producing two crops. Yield of the mushrooms can reach up to 2500 kg/acre (fresh weight). Oven drying experiments showed that the mushrooms' water content ranged from 81.5 to 89.5%. Wine-cap mushrooms can be marketed as both fresh and dried produce. Woodchip mulch significantly suppressed weeds. It had the best results when plots are free of weed seeds in the soil prior to woodchip mulch applications. When plots had perennial and woody weeds already established in the soil prior to mulch application, some perennial and woody weeds were able to grow back in a reduced population.
29. **Removal of Pollutants from Water and Soil by Chemical Oxidation using Activated Carbon as a Catalyst**
    Dr. Wael Abdelraheem and Dr. Joseph Pignatello (Emeritus)
    Activated carbon in granular or powdered form is well known for its ability to strongly bind (adsorb) organic pollutants in water and has been used commercially for this purpose by water treatment plants, industries, and homes for decades. However, the pollutant is not broken down in the process, so disposal of the spent carbon remains a problem. In addition to its adsorptive properties, we have discovered that a certain commercial activated carbon can act as a powerful catalyst to accelerate pollutant destruction by a common oxidizing agent called peroxydisulfate. Thus, the carbon not only removes the chemical from the water but catalyzes its destruction. We initially demonstrated this concept on a munition chemical known as NTO. We found that dissolved NTO in water was degraded within 2 hours by peroxydisulfate in the presence of a small amount of added carbon. The carbon could be reused repeatedly (at least 11 cycles) with little loss in catalytic activity. The results will be exhibited. Future studies will determine whether the carbon is an effective catalyst for breaking down other common water contaminants, as well, such as pesticides, herbicides, etc.
30. **Combining Green Synthesis and Nanotechnology Tools for Enhanced Efficiency in *Fusarium virguliforme* L. Disease Suppression**
    Dr. Inès Karmous, Dr. Shital Vaidya, Dr. Nubia Zuverza-Mena, Dr. Christian Dimkpa, Dr. Jason White, and Dr. Wade H. Elmer (Emeritus)
    Nanoparticles are defined as having diameters less than 100 nm. Green synthesis of nanoparticles is the process where plant extracts are exposed to Cu or Zn salts and the Cu or Zn nanoparticles are naturally produced, harvested and used to develop more efficient products to control plants' pathogens. *Fusarium virguliforme* L. is the major causal agent of Soybean Sudden Death Syndrome (SDS) across the US, causing hazardous damage to crops. Herein, copper oxide and zinc oxide nanoparticles (CuONP and ZnONP, respectively) were synthesized using *Cannabis sativa* L. In a greenhouse experiment, the foliar application of hemp- CuONP or ZnONP improved the growth of soybean plants and suppressed disease. The antimicrobial properties of nano-Cu and nano-Zn combined with the antifungal potential of hemp extracts may offer a sustainable tool for disease management and plant health.

**31. Biodegradable Polymer Nanocomposites for Controlled Release and Targeted Delivery of Phosphorus During Plant Growth**

Dr. Shital Vaidya, Dr. Jaya Borgatta, Dr. Christian Dimkpa, Dr. Wade Elmer (Emeritus), Dr. Howard Fairbrother[1], Ms. Leslie Sigmon[1], and Dr. Jason White | [1]=Johns Hopkins University

Phosphorus is an essential element required for plant growth, especially root development. With the application of conventional phosphorus fertilizers long-term phosphorus unavailability occurs, due to the depletion of plant-usable phosphorus from runoff, leaching and the formation of complex insoluble phosphates. We are using recent advancements in nanotechnology to address the problem of unavailability of phosphorous in soil for plant use. We developed fertilizer composites by using biodegradable polymers, such as polyhydroxyalkanoate (PHA) and cellulose, to incorporate phosphorus fertilizers, including superphosphate, calcium pyrophosphate and hydroxyapatite nanoparticles. In the greenhouse, we assessed the polymer fertilizer nanocomposites in tomato plants to evaluate the microbial biodegradation of polymers, the release of phosphorus, and the leaching of phosphorous in the soil microcosm. Our studies suggest that the developed polymer-fertilizer composites can effectively deliver phosphorus during plant growth and reduce the phosphorous run off into the environment.

**32. A World of Viruses**

Dr. Zannatul Ferdous and Dr. Rebecca Johnson, *assisted by* Mr. Duncan Cozens

Viruses are parasitic microorganisms that replicate within infected cells. Composed of genetic material bundled in a protein shell, viruses are relatively simple. Yet, despite their simplicity, viruses play a significant role in shaping the world we live from global economics to human health. They infect all living organisms from bacteria in deep-water vents to plants and animals. This exhibit will explore the fascinating world of viruses from their diversity and size to their medical and agricultural importance. Bring the kids and join us in constructing our own virus models.

**33. Preemergence Herbicide Tolerance Trials in Cut Flowers**

Dr. Jatinder S. Aulakh

Preemergence herbicide safety trials were conducted in cut flowers in Windsor at the Valley Laboratory from 2018-2020. Cut flower species tested were goldenrod (*Solidago* spp.), purple coneflower (*Echinacea purpurea*), sunflower (*Helianthus annuus*), and zinnia (*Zinnia* spp.). Pendulum (Pendimethalin) 2G, preemergence herbicide, was applied over-the-top at 150, 300, and 600 lb/a. Two applications were made at 5 to 6 weeks interval. Cut flower species were evaluated for phyto-toxicity (chlorosis, necrosis, and stunting) at weekly intervals on a 0 to 10 scale where 0 = no injury, 10 = dead plant. Goldenrod was highly tolerant to Pendulum 2G. No phyto-toxicity was observed following two applications up to 600 lb/a. Purple coneflower showed slight stunting injury, which was commercially acceptable, and was rated 1.8 and 1.1 with Pendulum 2G 600 lb/a following the first and second application, respectively. Sunflower showed minor necrotic (leaf burn) and stunting injuries following the second application. However, both necrotic and stunting injuries were within commercially acceptable limits with pendulum 2G rates up to 300 lb/a.

**34. The Role of $Fe_3O_4$ Nanoparticle Surface Charge on Disease Suppression in Tomato Plants (*Solanum lycopersicum*)**

Dr. Chaoyi Deng, Dr. Yi Wang, Dr. Christian Dimkpa, Dr. Wade Elmer (Emeritus), Mr. Christopher Castillo[1], Dr. Juan Pablo Giraldo[1], Dr. Robert Hamers[2], and Dr. Jason White | [1]=University of California Riverside, [2]=NSF Center for Sustainable Nanotechnology

Nanoparticles (NPs) have been proposed to provide micronutrients in agriculture to increase plant health and inhibit disease. Nanoscale properties, such as morphology, size, composition, and surface chemistry, have all been shown to affect the interaction of nanomaterials with plant systems. However, the relationship between the surface charge of nanomaterials and plants remains largely unknown. Especially when the plant is in a state of being infected with fungi. In this study, we used $Fe_3O_4$ NPs with positive and negative surface charges for the treatment of *Fusarium oxysporum* in tomato plant species via foliar application. We found that all Fe compound treatments significantly reduced disease progression and increased biomass, whereas positively charged $Fe_3O_4$ NPs worked best. In the control experiment of the healthy group, the negatively charged $Fe_3O_4$ NPs had the most obvious effect on plant biomass. By using ICP-OES to understand the enrichment of nanoparticles in plants. The data show that the Fe element stays in the aerial part of the plant without being transferred to the underground part, which may be related to the distribution of Fe element in the plant, and the presence of fungi in the soil. To obtain more realistic data, the experiment will be redone in the field. These findings have important implications for the tunable design of materials, such as the utilization of nano-agriculture strategies to increase plant disease resistance and food production.

**35. The Pavilion at Lockwood Farm**

See program page 10 for a schedule of short talks under the pavilion.

The pavilion at Lockwood Farm was commissioned by the Experiment Station's Board of Control with funds provided by the William R. Lockwood Trust. Completed in May of 2016, it was designed and built by Steven Strong of Strong Timber Frames, East Hampton, CT. All wood products used in construction of the pavilion are Connecticut grown. The posts, beams and walls are eastern white pine, grown and harvested from Babcock Pond Wildlife Management Area in Westchester, CT. The pegs and splines are white oak, harvested from the Strong's 50-acre farm in East Hampton, CT. The pavilion is constructed using traditional timber framing post and beam techniques with large heart sawn timbers. The pavilion design

features a large cupola with window and louver units that were constructed from the edges of the timbers. It functions to allow natural light and ventilation, which provide an open feel in the interior of the building.

**36. Native Woody Shrubs**

Dr. Jeffrey S. Ward (Emeritus), *assisted by* Mr. Joseph P. Barsky and Ms. Jessica Shanley

Native woody shrubs offer an alternative to exotics commonly used in landscaping. This collection of shrubs was assembled in 1962 and in 1976 it was arranged in its present form with a dry site on the gravel mound and moist site in the shallow, plastic-lined depression. Many of these shrubs flower in the spring; their flowers can be seen in the photographs. Others, such as sweet pepperbush, spirea, and buttonbush, flower in summer. Witch-hazel flower in early autumn. Birds are frequent visitors to the garden and quickly eat the mature fruit. These shrubs survive with minimal maintenance. Occasional mowing, annual removal of dead stems, and replenishment of mulch are performed. These shrubs have never been fertilized, watered, or treated for disease.

**37. The Connecticut Oak Mast Surveillance Program**

Mr. Joseph P. Barsky and Mr. Michael A. Gregonis[1] | [1]=Connecticut Department of Energy and Environmental Protection

Beginning in 2007, the Wildlife Division of the Connecticut Department of Energy and Environmental Protection began a surveillance program to quantify oak mast abundance along with several states throughout the region. Fifty mature trees (25 red oak group, 25 white oak group) were identified in each of the twelve deer and turkey management zones across Connecticut and mast abundance was annually assessed during a two-week period in August. The Connecticut Agricultural Experiment Station (CAES) was approached in 2019 with a request to assume future monitoring and has recently become lead investigator. Oaks are the keystone species of many forest ecosystems in Southern New England, and their health is synonymous with the health of the forest. Several challenges to the perpetuation of oak species in Southern New England have been well documented. Four major challenges include: 1) hindrance of oak recruitment by browse damage from locally abundant white-tailed deer (*Odocoileus virginanus*), 2) changes in forest composition due to invasive plant species, 3) widespread caterpillar (*Lymantria dispar*) outbreaks which have led to oak mortality and acorn crop failure throughout the region, and 4), recent weather events (e.g., drought, tornado, hurricane, ice storm) have negatively impacted tree vigor and health. Due to the challenges of growing oaks in Southern New England, land managers face difficult decisions on the best course of action to perpetuate oaks species, and access to timely information regarding oak mast abundance is imperative for successful implementation of silvicultural prescriptions. The continuation of the oak surveillance program will provide insight on the best silvicultural course of action and will continue to be useful for predicting annual fluctuations in certain wildlife populations. It is also the intent of The CAES to expand upon current research activities to explore the impact of local weather patterns and tree vigor on annual acorn abundance.

**38. Bird & Butterfly Garden**

Mr. Jeffrey Fengler and Ms. Lisa Kaczenski-Corsaro

The Bird & Butterfly Garden creates several favorable habitats for our native birds, butterflies, and pollinating insects and helps us determine which plants may work best in southern Connecticut gardens. At this time of year, the garden is at its peak performance with plants thriving in the garden and meadow. Plant labels are placed near the plants in the garden to provide the botanical and common name. Throughout the day, we update our list of birds, butterflies, and moths spotted in the garden. The Bird & Butterfly Garden at Lockwood Farm is listed in the "Nature Conservancy Open Days Directory for New England." Do you have a butterfly garden or would like to start one? Experiment Station staff members can provide you support by answering your questions and suggesting ways for you to enjoy a butterfly garden small or large on your patio or in your yard.

**39. The Public Health and Entomology Tent**

**a. Statewide Monitoring Program for Mosquito-borne Viral Diseases in Connecticut**

Dr. Philip Armstrong, Mr. John Shepard, Dr. Andrea Gloria-Soria, Ms. Angela Bransfield, Mr. Michael Misencik, Ms. Tanya Petruff

Mosquito-borne viral diseases constitute an annual threat to human health in Connecticut. A comprehensive surveillance program complemented by science-based controls and timely public outreach are the most effective ways to protect the public and reduce the risk of human disease. The Connecticut Agricultural Experiment Station (CAES) maintains a network of 108 mosquito-trapping stations in 86 municipalities throughout the state. The surveillance program monitors the types, numbers and locations of mosquitoes and tests them for the presence of viruses that can cause illness including West Nile virus (WNV) and eastern equine encephalitis virus (EEEV). To date, more than 3 million mosquitoes representing 47 different species have been collected, identified, and tested since 1997. A total of 2,791 WNV isolations have been recovered from 24 different mosquito species and a total of 538 isolations of EEEV isolations have come from 21 species of mosquitoes. WNV has been detected every year since its introduction into Connecticut in 1999, virus activity peaks from July-September and is most frequently detected in densely-populated areas of lower Fairfield and New Haven Counties, and Hartford metropolitan area. Seasonal transmission of EEEV occurs sporadically and the focal areas are located near forested swamps in southeastern Connecticut. Further information on weekly test results and annual summaries for previous years can be found on The CAES web site www.ct.gov/caes/mosquitotesting

**b. Impacts of Fall Acaricide Application on Spring Blacklegged Tick Abundances**

Dr. Scott C. Williams and Dr. Megan Linske, *assisted by* Ms. Heidi Stuber, Ms. Jamie Cantoni, Ms. Hannah Litwak, Ms. Claire Keanna, and Ms. Alexa Garbiel

*Presented by* Ms. Hannah Litwak

Synthetic acaricide sprays have been very effective in reducing tick densities in areas where it is applied, however, they are fairly indiscriminate in the species they kill, which can include beneficial insects like pollinators and butterflies. As a result, we are investigating the impacts of a fall synthetic acaricide spraying, when beneficial insects are dormant or have migrated, on spring tick populations. We are evaluating the efficacy of acaricide applications in the fall, spring, and in combination to determine if an altered temporal treatment could be effective in reducing public health risk without harming beneficial pollinator species.

**c. Backyard Habitats and Blacklegged Tick Associations**

Dr. Scott C. Williams and Dr. Megan Linske, *assisted by* Ms. Heidi Stuber, Ms. Jamie Cantoni, Ms. Claire Keanna, Ms. Hannah Litwak, and Ms. Alexa Garbiel

*Presented by* Ms. Claire Keanna

Backyards provide great tick habitats. Ticks can survive in a variety of habitats that increase the opportunity for encounters with hosts, including people and their pets. We evaluated the various residential habitats to determine where there were significantly higher densities of ticks in order to create a more targeted approach to backyard treatment strategies. A more targeted approach would also reduce the indirect impact to the surrounding ecosystem which includes beneficial insects and wildlife.

**d. Monitoring Ticks and Tick-borne Pathogens to Better Guide Public Health Action in Connecticut**

Dr. Goudarz Molaei, *assisted by* Ms. Noelle Khalil, Ms. Morgan Fitch, and Ms. Kristy Lok

Native and invasive tick species pose a serious public health concern in the United States. Over the past two decades, the rate of novel tick-borne pathogen discoveries has accelerated, and the geographic ranges of medically important ticks have expanded. As a result, an increasing number of communities are at risk of exposure to tick-borne diseases (TBDs). TBDs comprise nearly 90% of nationally notifiable human vector-borne disease cases in the U.S. The majority of TBDs cases are associated with the blacklegged (deer) tick, which serves as a vector of several pathogens, including those responsible for Lyme disease, *Borrelia miyamotoi* disease, anaplasmosis, ehrlichiosis, babesiosis, and Powassan virus disease. Monitoring tick populations in Connecticut has historically been conducted by the CAES-Tick Testing Laboratory (CAES-TTL) within the framework of a passive tick and tick-borne diseases surveillance program. Established in 1990, the CAES-TTL screens blacklegged (deer) ticks for the causative agent of Lyme disease, and in 2015, it was expanded to include testing for the disease agents responsible for babesiosis and anaplasmosis. Historically, the CAES-TTL has received approximately 3000 ticks annually from residents of Connecticut, health departments, and clinicians. However, in recent years, the number of submitted ticks has reached nearly 6,000 per year. In 2021, the CAES-TTL received nearly 5,685 ticks, of which 76.8% were blacklegged ticks, 19.2% American dog ticks, and 3.7% lone star ticks. Of the 4,196 engorged nymph and adult female blacklegged ticks that were tested in 2021, 31.8%, 4.5%, and 9.7% tested positive for the causative agents of LD, anaplasmosis, and babesiosis, respectively. The CAES-TTL also continues to monitor the range expansion of invasive ticks such as the lone star tick, Gulf Coast tick, and Asian longhorned tick.

**40. How Do Plant Pathogens Enter Plants?**

Ms. Felicia Millett and Dr. Quan Zeng

Plant pathogens often proliferate internally in the plants to cause infection. However, plant surface is usually covered with a cuticle layer that prevented foreign organisms to penetrate through such layer of defense. Thus, it is important to understand mechanisms of pathogens penetrating into the plant hosts. In this presentation, we will learn different modes of host entry by various pathogen groups including fungi, bacteria, and viruses. Fungal penetration, bacterial entry through natural openings and wounds, as well as viral entry through insect vectoring will be covered. We will also present research progress of using molecular methods to artificially label a bacterial plant pathogen, *Erwinia amylovora*, and use it to track the pathogen colonization on apple leaves. Findings showed that trichomes (leaf hairs) and hydathodes (water pores) represent sites of colonization and host entry points of *E. amylovora* on apple leaves.

**41. Growing Cannabis in Connecticut - Crop Production and Pest Management**

Dr. Quan Zeng

Cannabis is a genus of flowering plants in the family Cannabaceae. Two important species within this genus are *Cannabis sativa*, and *Cannabis indica*. Based on the use, the Cannabis crops are categorized into cannabidiol (CBD) production (hemp), seed and fiber production (hemp) and medical and recreational use (marijuana). In this presentation, we will discuss the biology, production, and pest and disease management of Cannabis. Plant classification, cultivation and harvest strategies, as well as common pests and diseases will be presented and discussed.

**42. If You Plant It, Will the Bees Come?**

Ms. Tracy Zarrillo and Dr. Kimberly Stoner (Emeritus)

Connecticut is home to 378 species of wild bees, of which 67 are known to be pollen specialists. Specialist bees are bee species that can only use specific types of pollen to feed their developing larvae. Some bee species can only use pollen from a specific plant family, and others are more restricted and can only use pollen from a specific plant genus. Lists of pollinator plants for farms, gardens and larger habitat restoration projects vary according to ecozone and are often aimed at providing food for generalist bee species (species that can use a wide variety of pollen types).Often, generalist bee species are not the ones at risk because pollen specificity is not a limiting factor in their diet. Some specialist bee species, such as the squash bee *Peponapis pruinosa*, are ubiquitous in the Connecticut landscape and consequently will show up wherever their host plant is grown. In this experiment, we are exploring the question how readily the following less common specialist bee species, *Melissodes denticulata*, *Dufourea monardae* and *Osmia distincta*, will find their host species, *Vernonia noveboracensis*, *Monarda fistulosa*, and *Penstemon* spp. respectively, in a location where the bee species have not yet been detected. The host plants are being grown at Lockwood Farm in Hamden, the Griswold Research Station, and the CAES Windsor campus. The seeds for this project were generously donated by The Hickories Farm in Ridgefield, CT, and are specific to our ecoregion. The seeds grown out from this experiment will be distributed to other state agencies for use in habitat restoration projects.

**43. Invasive Aquatic Plant Program**

Mr. Gregory Bugbee and Ms. Summer Stebbins, *assisted by* Ms. Eva Ramey and Ms. Meara Burns

Connecticut lakes and ponds are degraded by the spread of non-native invasive plants. Plants such as Eurasian watermilfoil, variable watermilfoil and fanwort are of great concern because they disrupt native ecosystems, interfere with recreational uses, reduce property values, and can harbor harmful algae. Researchers in the Department of Environmental Sciences have documented our State's invasive aquatic plant problem from 2004 to present. Over 250 Connecticut lakes and ponds have been surveyed. We documented over 100 plant species, 14 of which are invasive. Approximately two-thirds of the water bodies contained one or more invasive species. In 2010, we began resurveying lakes that were originally done over five years ago and are beginning to quantify long-term changes. In 2018, we discovered a new biotype of hydrilla in the Connecticut River and in 2021 we completed a survey of the river from the CT/MA border to Long Island Sound and documented an extensive well-established population. We have found and continue to search for novel management options including reduced risk herbicides, biological controls, and winter drawdown. We also have developed models to predict at-risk lakes based on their water chemistry. Requests for Station assistance in managing unwanted aquatic vegetation are common and we often visit water bodies to help solve imminent problems. At this plot you will see our aquatic plant surveillance boats, state of the art global positioning systems and the underwater video equipment we use to conduct our surveys. In addition, there will be live specimens of invasive plants on display to hone your identification skills. A researcher will be available to discuss our program and answer questions about lakes and ponds.

**44. Hemp Demonstration Plot**

Ms. Terri Arsenault, Mr. Richard Cecarelli, Dr. Anuja Bharadwaj, Dr. Christian Dimkpa and Dr. Jason C. White

There is significant interest in growing hemp in CT; The CAES has developed testing methods for total delta-9 THC and CBD that meet the needs of the Department of Agriculture's requirements for pre-harvest test samples. However, for hemp to be a viable industry in the state of CT, growers need stable seeds sources that produce a consistent quality product. For this demonstration plot, several seed sources were identified, and different cultivars are currently being grown at Lockwood Farm. The plants will be tested during the growing season to assess the consistency of various varieties in terms of potency (THC, CBD) as well as how growing conditions may affect potency. In addition, testing will include analysis for pesticides, terpenes and possibly mycotoxins.

**45. Chestnut Species and Hybrids**

Dr. Sandra Anagnostakis (Emeritus), *assisted by* Ms. Pamela Sletten (Retired)

These trees are part of the large collection of species and hybrids of chestnut maintained by The Experiment Station. Great differences can be seen in chestnut blight resistance, Asian chestnut gall wasp resistance, form, and nut production. Hypovirulent strains of the blight fungus help protect the trees from lethal cankers (see Control of Blight on American Chestnuts). Plants of all seven species of chestnut are growing here. One seedling from the Caucasus Mountains of Russia (a true European chestnut), planted in 1994, has not survived well through our Connecticut winters. Commercial European chestnut trees from Northern Turkey have also done poorly. Two trees of the chinquapin native to northern Florida are planted across the road from an Allegheny chinquapin from Ohio. The original tree (the "ortet") of the cultivar 'Lockwood' is at the southwest corner of the plot.

**46. Healthy Plants—Healthy Business: Support of The Green Industry by Inspection**

Dr. Victoria Lynn Smith, *assisted by* Ms. Tia Blevins, Ms. Dana Crandall, Mr. Mark Creighton, and Mr. Jeffrey Fengler, and Ms. Gerda Magana

We work to assure the quality of the agricultural products leaving the state and to maintain the health of forests and Connecticut's agricultural industry. In 2021, the Office of the State Entomologist completed registration and inspections for 185 nursery growers and dealers of plants and plant products. Over 431 certificates of export were issued for plant commodities moving out of country, to 45 destination countries. Over 386 certificates of export were issued for plant commodities moving out of state, to 34 destination states or U.S. territories. Nearly 700 beekeepers registered 6,750 hives, and over 1,000 of these were inspected for diseases of honeybees. In addition, surveys were conducted for a variety of exotic

pests and diseases, including many non-native moths and wood boring insects. Box tree moth, a federally regulated pest, was found at one location in CT. The health of our forests was assessed by aerial survey and by winter-time gypsy moth egg mass survey. Our goal is to safeguard agriculture and forests of Connecticut through surveys to detect infestations, through monitoring of the health and vitality of the forests, and through inspection and registration of commodities and producers to assure their fine quality.

**47. Expanding Biological Control of Hemlock Woolly Adelgid**

Dr. Carole Cheah

Hemlock woolly adelgid, *Adelges tsugae* (HWA), continues to be a serious exotic forest and landscape pest of native hemlocks in eastern North America. The adelgid was first identified in Connecticut in 1985 and most towns were fully infested by 1997. Severe winters can reduce winter populations of HWA but recent warm winters have led to renewed incursions of HWA into the state and widespread resurgence of the adelgid. Biological control of HWA using the introduced specialist predatory ladybeetle, *Sasajiscymnus* (=*Pseudoscymnus*) *tsugae*, native to southern Japan, continues to be Connecticut's major strategy of managing HWA and saving the hemlock forests in an environmentally friendly way. Long term data indicate the efficacy of this strategy with many original hemlocks surviving for over 20 years in many Connecticut state forests and parks where the beetle was introduced 21-23 years ago. In recent years, biological control with *S. tsugae* has been increasingly expanded to other private and municipal hemlock stands through partnerships with towns, land trusts, water companies, nature preserves, residential communities and homeowners. This strategy is particularly important after mild winters. Tree-Savers of Pennsylvania is the sole commercial producer of *S. tsugae* and is an example of technology transfer of predator rearing methods developed at the Valley Laboratory to the commercial sector. This has subsequently allowed the public to access and implement biological control of HWA and *S. tsugae* remains the only HWA predator readily available to the public. Through purchases and generous donations of *S. tsugae* from Tree-Savers, new releases of *S. tsugae* in Connecticut in 2017, 2020 and 2021 have increased to >60 hemlock sites. Currently, > 200,000 *S. tsugae* have been released throughout Connecticut since 1995, with >20,000 to be released on state and private lands in 2022.

**48. The Rock**

This rock is (technically) a Glacial Boulder composed of DIABASE. It was moved by flowing ice from its place of origin and is therefore also known as a Glacial Erratic. The boulder probably fell onto the top of the glacier oozing its way down past the Sleeping Giant's head during the waning stage of the last continental glaciation. It was deposited here, near the toe of the waning glacier, onto "till", an unsorted mass of sandy or silty material mixed with rounded pebbles and boulders that had been pushed in front of, or under, the glacier, and deposited as the ice melted. Most of the boulders around the area, such as those in the nearby stone walls, are rounded and their surfaces have been ground smooth by abrasion beneath the glacier. Diabase has a fine crystalline texture, having been pushed up as magma close to the surface where it cooled quickly. The "trap rock" of this region is either diabase, or its compositional equivalent basalt that was extruded onto the surface as lava flows that form topographic "trappa" or "trappe" (steps or stairs).

**49. Asian Chestnut Gall Wasp on Chestnut**

Dr. Sandra Anagnostakis (Emeritus), *assisted by* Ms. Pamela Sletten (Retired)

Many of the chestnut trees here at Lockwood Farm are heavily infested with Asian chestnut gall wasp (*Dryocosmus kuriphyllis*). The insect was first detected in CT in 2011 but has done serious damage to commercial orchards in the mid-west and in Italy. We have been making crosses of susceptible trees with species of chinquapins which seem to have good resistance to this insect, and some are planted here. There are more wasp galls on some of these trees than on others, and we will continue to evaluate the effect of these galls on the growth and nut production of the trees.

**50. Hybrid Elm Trees**

Dr. Sandra Anagnostakis (Emeritus), *assisted by* Ms. Pamela Sletten (Retired)

The late Eugene Smalley spent his whole career at the University of Wisconsin breeding elm trees for resistance to Dutch Elm Disease and for the tall, vase-shaped form of American elm trees *(Ulmus americana*). The problem with this kind of breeding is that American elms have four sets of chromosomes, and all the other species of elm have two sets. They bloom at different times, but stored pollen can be used to make crosses. In 1992, Dr. Smalley sent us trees of Chinese elm (*Ulmus parvifolia*) and some of his successful crosses. Mortality has been high, but some of the trees still survive. A few of them look like good replacements for American elms as street trees.

**51. Rocky Hill American Chestnut Trees**

Dr. Sandra Anagnostakis (Emeritus), *assisted by* Ms. Pamela Sletten (Retired)

Seed collected from selected American chestnut trees in a woodlot in Rocky Hill, CT in 1985 grew into the trees planted here. They are used as female parents in our crosses and are being treated with hypovirulence (see Control of Blight on American Chestnuts) to keep them alive.

**52. Grapevine Demonstration Plot: Hybrid and Vinifera Grape Cultivars**

Dr. Washington da Silva and Mr. Richard Cecarelli

Wine grapes and wineries are a relatively new industry in Connecticut. In the past 20 years, acreage planted for wine grapes has gone from 160 A to 620 A and the number of wineries has grown from 15 to 42, producing about 550,000 gallons of wine valued at between 12-14 million dollars per year. Three grape plots are being maintained at Lockwood farm to carry on

the CAES legacy of grapevine research: Hybrid and Vinifera Grape Cultivars - these vines were planted in late spring, 2008. Some of the newer cultivars were selections from breeding programs at Cornell University and the University of Minnesota and have not yet been released. Others are newly available cultivars from cool and cold climate areas of Europe.

53. **Connecticut Farm Bureau Association**
    Ms. Joan Nichols
    The Connecticut Farm Bureau Association is a non-profit membership organization dedicated to farming and the future of Connecticut farms. Representing the interest of nearly 3,000 members, CFBA serves its members by advocating for agriculture. Representing the cross-section of Connecticut agriculture, CFBA focuses on the issues that keep farm families productive. Display is focused on educating visitors about Connecticut agriculture and Connecticut Farm Bureau. www.cfba.org, email: joann@cfba.org, 860-768-1100
54. **United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (APHIS-PPQ)**
    Ms. Erica Willey
    APHIS' Plant Protection and Quarantine (PPQ) program safeguards U.S. agriculture and natural resources against the entry, establishment, and spread of economically and environmentally significant pests, and facilitates the safe trade of agricultural products. https://www.aphis.usda.gov/aphis/ourfocus/planthealth, email: erica.willey@usda.gov, 203-741-5646.
55. **United States Department of Agriculture - Farm Service Agency**
    Ms. Teresa Peavey
    USDA FSA assists producers with commodity loans and programs, Ad-Hoc disaster programs, Non-Insured Crop Disaster Program Insurance for annually tilled crops not covered by RMA, Tree Assistance Program for Orchard or vine damage, Conservation programs and disaster assistance, Farm Storage Facility Loans for low interest financing of storage needs; Reports of Acreage to remain in compliance with FSA and NRCS programs; County Committees represent grassroots input and local administration of federal farm programs to local producers; Organic Certification Cost Share Program; Farm Ownership Loans; and many more program. https://www.fsa.usda.gov, email: teresa.peavey@usda.gov, 203-303-5528
56. **The Federated Garden Clubs of Connecticut, Inc.**
    Ms. Nan Merolla
    The Federated Garden Clubs of CT, Inc. is an educational and charitable organization made up of over 6,200 members, 118 clubs and 26 affiliated organizations. We encourage high standards in all aspects of garden work and are dedicated to protect and conserve our natural resources, preserve our heritage and promote civic beauty. We offer National Garden Club Schools to the public as well as to our members in the areas of: Environmental, Flower Show, Gardening, and Landscape Design. We welcome opportunities to assist those in search of a garden club and are always delighted to participate in Plant Science Day. ctgardenclubs.org, email: nan.merolla@gmail.com, 203-216-0884
57. **Wild Ones – Mountain Laurel Chapter**
    Ms. Lydia Pan, Chapter President
    Wild Ones is a national 501(c)(3) organization that promotes environmentally sound landscaping practices to preserve biodiversity through the preservation, restoration, and establishment of native plant communities. Wild Ones awards Seeds for Education grants and certifies native plant butterfly gardens. The Mountain Laurel Chapter is based in New London, CT and sponsored by the Connecticut College Arboretum. We raise awareness about the importance of landscaping with native plants in urban and suburban gardens to support pollinators and other wildlife. Our monthly programs are generally free and open to the public. Our exhibit will have literature about ecological landscaping, lists of native plant alternatives, best native plants for wildlife, instructions on how to propagate native plants from seed and where to obtain seed-grown plants and seeds for species native to our ecoregion.
    www.wildones.org, email: wild.native.plants@gmail.com, 860-383-3580
58. **Levo International, Inc.**
    Mr. Nate Heiden
    Levo International is a non-profit 501(c)3 organization dedicated to eliminating food insecurity through innovation and partnership. Levo's main focus has been delivering assistance to food insecure neighborhoods in Connecticut and in Haiti. Hydroponics is the growth of plants without soil in a water-based system. Simplified forms of hydroponics are the main mechanisms Levo uses to increase food access. Levo's research program has therefore focused on reducing the inputs required for hydroponic farming to increase its accessibility and impact. With the support of the Connecticut Agricultural Experiment Station, Levo is evaluating yield differences between constantly circulating and intermittently circulating regimes in its deep flow technique systems. Levo also has ongoing research efforts exploring the development and deployment of effective natural fertilizers and evaluating yield differences between hydroponic and soil-based farming. https://levointernational.org, email: nheiden@levointernational.org, 860-655-5228
59. **The Connecticut Tree Protective Association**
    Ms. Cathy Dvorsky
    The Connecticut Tree Protective Association is in its 100th year as an association and is going strong. We are a non-profit organization that supports arboriculture in the State of Connecticut. www.ctpa.org, email: cathy@ctpa.org, 203-484-2512

60. **Connecticut Professional Timber Producers Association**
    Ms. Joan Nichols
    The Connecticut Professional Timber Producers Association is a non-profit organization representing the forest products industry of CT. Our membership works to enhance the image and understanding of the forest products profession in Connecticut through public outreach programs, education, and a commitment to professionalism amongst its members.
    www.timproct.org, email: info@timproct.org
61. **The Connecticut Invasive Plant Working Group**
    Ms. Rose Hiskes
    The mission of the Connecticut Invasive Plant Working Group is to gather and convey information on the presence, distribution, ecological impacts, and management of invasive species; to promote uses of native or non-invasive ornamental alternatives throughout Connecticut; and to work cooperatively with researchers, conservation organizations, government agencies, green industries, and the general public to identify and manage invasive species pro-actively and effectively. www.cipwg.uconn.edu, email: rose.hiskes@ct.gov
62. **The Connecticut Department of Energy and Environmental Protection - Pesticide Management Program**
    Mr. Zachary Donais
    The Connecticut Department of Energy and Environmental Protection (CT DEEP) Pesticide Management Program's main goal is to prevent adverse human health or environmental effects from the misuse of pesticides. We work with all people, products, permits, and businesses that are related to pesticides and arboriculture and make sure that they are properly certified and knowledgeable in the work they are doing. We would be happy to answer any questions about pesticides or help anyone looking to get certified!
    https://portal.ct.gov/DEEP/Pesticides/Pesticide-Management-Program, email: zachary.donais@ct.gov, 860-424-3326
63. **CT DEEP Forestry - Private and Municipal Lands**
    Mr. Frank Cervo
    DEEP Forestry performs a wide range of public services regarding the State of Connecticut's urban and rural forests. This includes forests on both public and private land. The Private and Municipal Lands component of DEEP Forestry will be out in force at Plant Science Day, as we have found it to be an excellent venue at which to make contact with our constituents, be that public officials, private forestland owners or just people in general interested in trees and in the welfare of the trees and forests in the state. https://portal.ct.gov/DEEP/Forestry/Service-Forestry-in-CT, email: frank.cervo@ct.gov, 860-930-5037
64. **United States Department of Labor, Wage and Hour Division**
    Heather Callahan
    The U.S. Department of Labor, Wage and Hour Division's (WHD) mission is to promote and achieve compliance with labor standards to protect and enhance the welfare of the nation's workforce. WHD enforces federal minimum wage, overtime pay, recordkeeping, and child labor requirements of the Fair Labor Standards Act. WHD also enforces the Migrant and Seasonal Agricultural Worker Protection Act, the Employee Polygraph Protection Act, the Family and Medical Leave Act, wage garnishment provisions of the Consumer Credit Protection Act, and a number of employment standards and worker protections as provided in several immigration-related statutes. Additionally, WHD administers and enforces the prevailing wage requirements of the Davis-Bacon and Related Acts and the Service Contract Act and other statutes applicable to federal contracts for construction and for the provision of goods and services.
    www.dol.gov/agencies/whd, email: callahan.heather@dol.gov, 860-240-4911
65. **The Connecticut Department of Energy and Environmental Protection - Wildlife**
    Mr. Paul Benjunas
    The Wildlife Division is part of the Connecticut Department of Energy and Environmental Protection (DEEP) and is responsible for advancing the conservation, use, and appreciation of Connecticut's wildlife resources. This display will highlight some of the Division's ongoing research with an emphasis on black bears and bobcats. https://portal.ct.gov/DEEP/Wildlife/Wildlife-in-Connecticut, email: paul.benjunas@ct.gov, 203-909-5004
66. **University of Connecticut IPM Team**
    Mr. Shuresh Ghimire
    UConn's College of Agriculture, Health and Natural Resources IPM Team works with residents to utilize IPM tactics when dealing with pest issues in plants. The IPM Team covers the green industry and commercial agriculture.
    https://ipm.cahnr.uconn.edu, email: shuresh.ghimire@uconn.edu, 360-202-4122.
67. **United States Department of Labor - Occupational Safety and Health Administration (OSHA)**
    Ms. Marianne Bonito
    OSHA's Mission: With the Occupational Safety and Health Act of 1970, Congress created the Occupational Safety and Health Administration (OSHA) to ensure safe and healthful working conditions for workers by setting and enforcing standards and by providing training, outreach, education and assistance. www.osha.gov, email: bonito.marianne@dol.gov
68. **The Connecticut Department of Labor's Division of Occupational Safety and Health (CONN-OSHA)**
    Ms. Catherine Zinsser

The Connecticut Department of Labor's Division of Occupational Safety and Health is referred to as CONN-OSHA. CONN-OSHA administers Connecticut's Public Employer Only State Plan and enforces occupational safety and health standards as they apply to all municipal and state employees. As a State Plan state, CONN-OSHA adopts and enforces standards that are at least as effective as the federal requirements. CONN-OSHA also offers comprehensive training and education programs covering all aspects of occupational safety and health. Provided at no charge, these programs are designed to be utilized in conjunction with both consultation and enforcement activities.
https://www.ctdol.state.ct.us/osha/osha.htm, email: catherine.zinsser@ct.gov, 860-263-6942.

69. **Bonsai Society of Greater New Haven**
Mr. Alexander J. Amendola
The Bonsai Society of Greater New Haven (BSGNH) is a diverse group of folks who practice the art/science of Bonsai. Why art and science? That's because Bonsai is 50% horticulture/plant physiology and 50% art and creativity. A healthy, vigorous tree is a prerequisite to the breathtaking, artistic masterpiece one can create in a Bonsai pot.
www.bonsainewhaven.com, email: alexanderamendola47@gmail.com, 203-824-7224

70. **Master Gardeners, University of Connecticut (UConn)**
Mr. Eric Larson
The UConn Extension Master Gardener Program trains citizens to develop skills in botany, horticulture, and gardening to assist the community in best practices for diagnosing diseases and pests by presenting the clients with scientifically based choices. https://www.uconnmastergardeners.com, email: newhavenmastergardeners@uconn.edu, 203-285-4918

*Other plots at the farm provide food for the Connecticut Food Bank.

# SPEAKER BIOGRAPHIES

**MR. GREGORY J. BUGBEE**

Mr. Gregory J. Bugbee is an Associate Scientist at The Connecticut Agricultural Experiment Station where his career has spanned over 40 years. He is the principal investigator in the Invasive Aquatic Plant Program and directs the Station's soil testing laboratory. He has led aquatic plant surveys of over 350 Connecticut lakes and ponds and has directed research projects on invasive aquatic plant control statewide. He has numerous popular and scientific publications and is the recipient of the *Journal of Aquatic Plant Management* "Outstanding Paper Award." Recently, his surveillance of the Connecticut River has documented an extensive infestation of a genetically distinct strain of hydrilla that poses a severe threat to the native ecosystem.

**MR. MARK CREIGHTON**

Mr. Mark Creighton began his work at The Connecticut Agricultural Experiment Station in 2010 in the Department of Entomology as the State Bee Inspector working within the office of the State Entomologist. His primary responsibility is to inspect honey bee colonies looking for disease and parasites in order to keep Connecticut's honey bee population healthy. Honey bees are important in support of Connecticut's agricultural industry. In addition, Mark is the Station's Apiculturist, keeping bees at Lockwood Farm and assisting researchers in various projects requiring bees. Mark is a frequent speaker at bee clubs, garden associations, and local high schools and colleges. He also completed the Master Beekeeper program from the University of Montana.

**DR. ITAMAR SHABTAI**

Dr. Itamar Shabtai received his BS, MS, and Ph.D. (Soil and Water Sciences) at The Hebrew University of Jerusalem in Israel. After working as a postdoctoral researcher at Cornell University, Itamar joined the Department of Environmental Sciences (now the Department of Environmental Science and Forestry) at The CAES in January 2022 as an Assistant Agricultural Scientist. His research focuses on abiotic conditions that control soil organic carbon cycling and sequestration.

**DR. CARLOS TAMEZ**

Dr. Carlos Tamez received his doctoral degree in Environmental Science and Engineering from the University of Texas at El Paso in 2019. He joined the Department of Analytical Chemistry at the Connecticut Agricultural Experiment Station in September 2021. Currently, Carlos performs analyses for pesticides in raw agricultural commodities, aflatoxins in animal feeds, and other environmental samples that may contain organic contaminates. Additionally, he assists in DAC's research efforts in understanding the implications and applications of nanoscale science and technology in agriculture, and the detection of PFAS in environmental matrices.

**DR. LEIGH WHITTINGHILL**

Dr. Leigh Whittinghill joined The Connecticut Agricultural Experiment Station (CAES) in October 2021. Her expertise is in vegetable production and green roofs. Her research focuses on urban agriculture, novel production systems that could help increase production area and reduce costs, and the potential environmental impacts of urban agricultural practices. Dr. Whittinghill's doctorate research at Michigan State University focused on the use of green roof systems for food production, examining both crop yields and the potential impact that crop production could have on the known benefits of green roofs. As a Postdoctoral Fellow at The Earth Institute at Columbia University, she helped to examine impact of a full-scale rooftop farm on green roof runoff water quality and quantity. At Kentucky State University, Dr. Whittinghill expanded this research to include the examination of runoff water quality from ground level container and raised beds systems as well. She also examined the production of several high value crops in these systems including varieties of greens and saffron. Dr. Whittinghill's research at The CAES will include working with urban farmers to test the efficiency of their nutrient use, the development of best management practices for cut-and-come-again harvesting of greens to promote both high yields and good nutritional quality, and continuing to look at issues of yield and nutrient losses from urban agricultural systems.

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# History of The Connecticut Agricultural Experiment Station

The Connecticut Agricultural Experiment Station (CAES) is one of a national network of state agricultural experiment stations. Experiment Station scientists collaborate with researchers in other states and the federal government to solve local, regional, and national problems.

The CAES is the first state agricultural experiment station in the United States. It was founded by the efforts of Samuel W. Johnson, a professor of agricultural chemistry at Yale University. Johnson had seen an agricultural experiment station when he did his studies in Germany during the 1850s. He saw how the science of chemistry could be used to aid farmers and campaigned for 20 years until one was established by the Connecticut legislature in 1875. Initially opened as a chemistry laboratory at Wesleyan University in Middletown, the Station was moved to Yale in 1877, where its first bulletin reported on analysis of a fertilizer that had little agricultural value. In 1882, the Experiment Station moved to its present location on Huntington Street (previously named as Suburban Street) in New Haven. Besides Lockwood Farm, its outdoor laboratory in Hamden, the Experiment Station also has a research farm and laboratories in Griswold and Windsor.

Through the years, many important discoveries have been made by researchers at the CAES. For example, vitamin A was discovered as an outgrowth of studies of the chemical composition of foods. The first practical hybrid of corn was developed, and many experiments in increasing the yield of corn were conducted at Lockwood Farm by Donald F. Jones. This discovery led to the doubling of yields of corn crops throughout the nation and led to more abundant and lower cost of food for mankind. Also, at Lockwood Farm, experiments were conducted, which led to the development of organic fungicides, some of which are still in use to combat plant diseases. These fungicides replaced toxic heavy metals previously used to control plant pathogens. The first culture of the West Nile virus in North America was made at the main campus in New Haven.

Research at the Experiment Station covers plants and their pests, such as diseases and insects; the pests of man and animals such as mosquitoes and ticks; growth of the state's forests; methods of enhancing the growth of plants by protecting them from pests and increasing crop yields through cloning of genes; and studies of environmental contamination and ways to reduce application of pesticides or their impact on the environment. Research continues on crops for biodiesel fuel production and for nematode control. Staff at the Station also analyze fresh fruits and vegetables for excess pesticide residues, test fertilizers and animal feeds for compliance with label claims, and screen a wide variety of foods as a part of the federal and state's food and product safety monitoring programs.

Some current research includes:

- Release of a lady beetle to control the hemlock woolly adelgid, which can kill hemlocks throughout the state.
- Studies of the pathogen that causes Lyme disease and means of controlling the tick vector.
- Treatments to reduce the toxicity of organic contaminants in soil and water.
- Studies of natural changes in Connecticut's forests and control of exotic plant species.
- Ways to control insect pests of plants using non-chemical means.
- Surveys and studies of the eastern equine encephalitis virus, West Nile virus, and other encephalitis viruses in mosquitoes.
- Enhancing growth of crops through the use of compost as a substitute for fertilizer.
- Finding new crops for Connecticut farmers and developing the best growing practices for existing crops in Connecticut.
- Studies of invasive aquatic plants and methods of control.
- Deciphering the cause of Sudden Vegetation Dieback in Connecticut salt marshes.
- Surveys for the emerald ash borer and the release of parasitoids to help control this invasive insect.
- Studies of native pollinators and floral resources for wild bees.

The experiments at Lockwood Farm are only a portion of these conducted by Station scientists. Scientists also perform experiments in New Haven, Griswold, and Windsor and carry out other experiments in state forests and on private lands.

CAES

The Connecticut Agricultural Experiment Station

*Putting Science to Work for Society since 1875*

***THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION***, founded in 1875, is the first state agricultural experiment station in America. It is chartered by the General Assembly to make scientific inquiries and experiments regarding plants and their pests, insects, soil, and water, and to perform analyses for State agencies.

**OFFICE AND MAIN LABORATORIES**
123 Huntington Street; New Haven, CT 06511-2016, (203) 974-8500,
toll-free, statewide, 1 (877)-855-2237

**VALLEY LABORATORY**
153 Cook Hill Road; Windsor, CT 06095-0248, (860) 683-4977

**LOCKWOOD FARM**
890 Evergreen Avenue; Hamden, CT 06518-2361, (203) 974-8618

**GRISWOLD RESEARCH CENTER**
190 Sheldon Road; Griswold, CT 06351-3627, (860) 376-0365

**THE EXPERIMENT STATION'S WEB PAGE: http://portal.ct.gov/caes**
or just scan our QR code below with your smartphone.

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