The Connecticut Agricultural Experiment Station

108th Plant Science Day

Lockwood Farm, Hamden, CT
Wednesday, August 8, 2018

Health

Food Safety

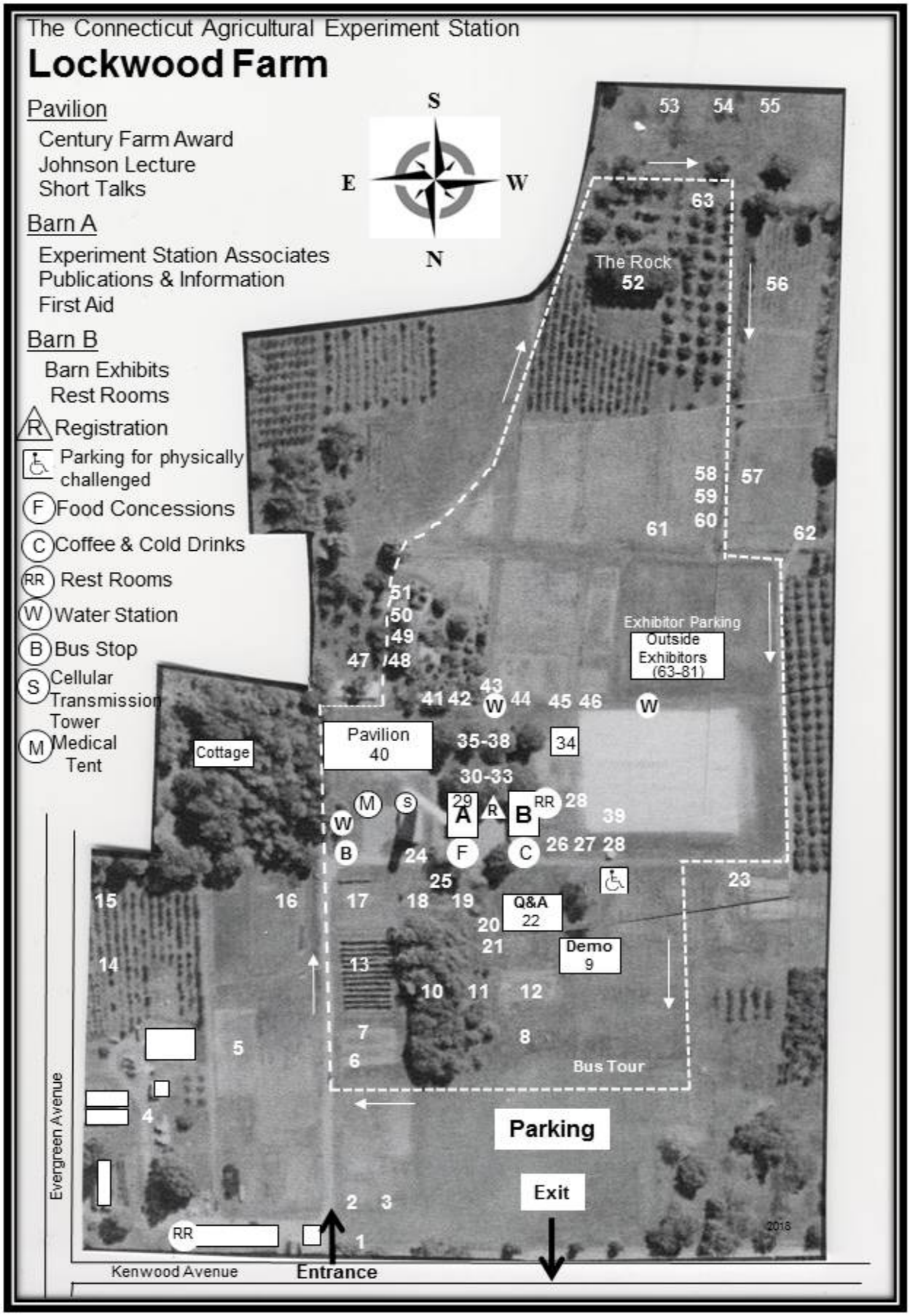
Agriculture

Environment

CAES

The Connecticut Agricultural Experiment Station

Putting Science to Work for Society since 1875


The Connecticut Agricultural Experiment Station
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Kenwood Avenue
2018

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 2018 Planning Committee

Mr. Michael Ammirata
Dr. Theodore Andreadis
Ms. Terri Arsenault
Mr. Joseph Barsky
Ms. Vickie Bomba-Lewandoski
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Dr. Neil Schultes
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Dr. Blaire Steven
Mr. Peter Thiel
Dr. Jason White
Dr. Quan Zeng

Program booklet created, compiled, and edited by Ms. Vickie Bomba-Lewandoski and assisted by Ms. Brandi Marks.

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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.

Revised: July 2018

CENTURY FARM AWARD

The Century Farm Award is given to a farm that has been in family operation for more than 100 years. The recipient is selected by the Connecticut Agricultural Information Council.

Zentek Farms LLC
Cheshire, CT

Proclamation from Governor Dannel P. Malloy:

Zentek Farms can be traced back to 1914 when Pawel and Aneila Zentek, Polish immigrants, put down their roots in Cheshire, Connecticut. They purchased property on Higgins Road to establish a dairy farm and soon began a family that resulted in ten children: Annie, Stella, Michael, Joseph, Stanley, Frank, Helen, Mary, Paul, and Louise. The children had various chores on the farm and they experienced long, hard hours of work. Eventually, Pawel and Aneila decided to shift from dairy to agricultural farming.

As Pawel and Aniela's children grew into adulthood and got married, most of them explored different avenues to make a living. Two of their children, Joseph and Stanley, remained bachelors and resided on the farm to continue in the business.

Paul Walter Zentek, named after his grandfather Pawel, began helping his uncles, Joe and Stanley, on the farm. Paul's interest in farming continued to expand as he grew older. He worked side by side with his uncles and incorporated many new ideas. He continued to farm the land with vegetables, however he also saw the benefits of raising bedding plants and Easter bulbs. Over the years, greenhouses were constructed on the farm. Presently, the greenhouses cover five acres of farmland. Although raising bedding plants has been a primary focus, Paul continues to farm fifty acres of vegetables each year.

In 1987, an eight-by-ten square foot vegetable stand was built. His wife, Donna Strollo Zentek, worked the stand while raising their boys, Joseph and Benjamin. In 2004, a larger vegetable and flower stand was built to accommodate their growing business. The Zentek Farms stand is best known for its sweet corn.

Today, Paul works the farm with his sons, Benjamin and Joseph, and his brother, Michael. Paul and Donna Zentek hope that their fourth-generation sons will continue in the footsteps of their great-grandparents, Pawel and Aniela.

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 22)

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

KIDS' KORNER (Plot 27)

Come to the Kids' Korner 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 28) to collect a CAES patch.

SELF-GUIDED ACTIVITY FOR ALL CHILDREN, INCLUDING GIRL SCOUTS (Plot 28)

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 3:20 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 / 4.50 TOTAL CREDIT HOURS.**

SOCIAL MEDIA LINKS

Keep current with The Connecticut Agricultural Experiment Station by using our SOCIAL MEDIA and E-ALERT resources.

CAES is encouraging our constituents to share their photos about CAES and PLANT SCIENCE DAY on social media using the hashtag **#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/)

Pinterest (www.pinterest.com/caes123)

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

To visit our webpage, go to www.ct.gov/CAES,
or just scan our QR code below with your smartphone.

E-ALERTS

The Connecticut Agricultural Experiment Station (CAES) E-ALERT service.
We are inviting you to subscribe to our free E-ALERT e-mail service to receive CAES news updates by e-mail.
Go to our website, scroll to the bottom left-hand corner of our page,
and click Receive Updates by e-mail e-ALERTS to get started.
Once you have created your CT.gov profile you can now subscribe to our e-alerts.

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.

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

108th 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. Theodore G. Andreadis, Director
The Connecticut Agricultural Experiment Station

10:15 a.m. - 10:45 a.m. **PAVILION**
Dr. Wade H. Elmer, Chief Scientist, Department of Plant Pathology and Ecology
Are Nanoparticles the New Weapon Against Plant Disease?
Recent projections indicate that global demand for food production will need to double by 2050. This alarming prediction becomes increasingly dire as climate change disrupts food production cycles by extending drought events and raising average daily temperatures in many agriculturally sensitive regions. The challenges facing agriculturalists are daunting. Nanotechnology, however, stands as a new weapon in our arsenal against these mounting challenges in disease management and plant health. Nanoparticles are extremely small particles that are less than a millionth of a millimeter (or hundred millionth of an inch). When metallic oxides of essential micronutrients and beneficial elements like silicon (Si) are applied to plant as nanoparticles, they promote growth and suppress diseases more than untreated plants. One surprising discovery is that single applications of nanoparticles to small transplants can result in season-long benefits in terms of yield and disease suppression. Over the last five years, we have explored the use of nanoparticles of the micronutrients boron (B), copper (Cu), manganese (Mn), and zinc (Zn) for their ability to suppress root and foliar diseases of asparagus, chrysanthemum, eggplant, grapes, pumpkins, soybeans, tomatoes, and watermelon. This presentation will highlight the potential for using nanoparticles in an environmentally safe method to enhance crop productivity and fight disease.

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 H. Creighton, Technician I, Department of Entomology
Beekeeping Systems Used in Connecticut
This demonstration will introduce the two most common systems of beekeeping in Connecticut today: the Langstroth hive and Top Bar hive. The Langstroth hive was invented by the Reverend Lorenzo Langstroth in 1852, in Philadelphia. In this hive, frames in which the bees make their combs can easily be separated from all adjacent parts of the hive. This allows for proper health inspection and extraction of honey. This beekeeping system is now the most common system used worldwide and is the preferred method for maximum honey production. This style also supports our mono agricultural system by having easily transportable pollinators in a box. The top bar hive is the oldest and most commonly used hive style in the world. It features individual bars laid across the top of the hive cavity. The bees build their comb down from the bars naturally without the use of plastic foundation. This hive can be built out of scrap materials and even straw. The advantages of this system are low startup cost, simple honey harvest, no heavy lifting and combs are easy to remove. Many beekeepers view this as a more natural style and healthier for the bees.

10:40 a.m. – 11:00 a.m. **TECHNICAL DEMONSTRATION TENT**
(20-minute demonstration, repeated twice during the day, 10:40 a.m. & 3:00 p.m.)
Mr. Gregory J. Bugbee, Associate Agricultural Scientist, Department of Environmental Sciences
Invasive Aquatic Plant Program

Lakes and ponds are one of Connecticut's most important natural resources. These bodies of fresh water face many threats including degradation by non-native invasive plants. Plants such as Eurasian watermilfoil, fanwort and water chestnut 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 300 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 if anything can be done about it? This demonstration talk will answer those questions and give you information on how to identify invasive aquatic plants, why some plants are good and what types of control are available.

10:45 a.m. - 11:05 a.m. **PAVILION**
CENTURY FARM AWARD
Zentek Farms LLC, Cheshire, CT

11:05 a.m. – 11:10 a.m. **PAVILION**
EXPERIMENT STATION ASSOCIATES
Mr. Skip Hobbs, *President, Experiment Station Associates*

11:10 a.m. – 12:00 noon **PAVILION**
THE SAMUEL W. JOHNSON MEMORIAL LECTURE
Mr. Henry N. Talmage, Director of Member Relations and Economic Services
New York Farm Bureau
Profitability: The Key to Sustainable Agriculture

1:15 p.m.-1:45 p.m. **PAVILION**
Dr. Quan Zeng, Assistant Agricultural Scientist II, Department of Plant Pathology and Ecology
Fire Blight: History, Management, and New Challenges

Fire blight, caused by the bacterium *Erwinia amylovora*, is one of the most devastating diseases of rosaceous plants, such as apple and pear. Fire blight infection can occur on various parts of the host plants, including flowers, shoots, leaves, fruits, trunks and rootstocks, leading to both yield reduction and tree death. Fire blight is prevalent throughout the United States (including CT), and has been observed in 49 other countries worldwide. Annual losses to fire blight and costs of control are estimated at over $100 million in the USA alone. The fire blight pathogen was indigenous in North American on wild hosts, such as crabapple, serviceberry and mountain ash. The introduction of apple and pear to North America by European settlers in the 17th and 18th centuries created the opportunity for the pathogen to shift from its wild hosts to these two agriculturally important crops. After first reported in the Hudson Valley of New York in 1794, fire blight was subsequently observed in northeastern, midwestern and western USA from the early 1800s to the early 1900s, and in other countries in the early to mid-1900s. Because the fire blight pathogen's principle point of entry is through open flowers, control of the disease is mainly through protecting the open flowers with antibiotics or biological control. Antibiotics inhibit pathogen multiplication on apple flowers. However, the intensive, long-term use of antibiotics not only causes resistance in the pathogen population, rendering the antibiotics ineffective in controlling this disease, but also raises concerns relating to human health and the environment. Biological control microorganisms inhibit pathogen growth on apple flowers by competing with the pathogens for nutrients and space. Research at CAES aims to improve the efficacy of biological controls in fire blight disease management by identifying the most effective microbe species, and by integrating biological controls with other organic disease control materials.

1:45 p.m.-2:15 p.m. **PAVILION**
Dr. Carole A. Cheah, Assistant Agricultural Scientist II, Valley Laboratory
Climate Impacts on Hemlocks and Hemlock Woolly Adelgid in the Northeast

Eastern hemlock, *Tsuga canadensis*, is a critical component of many forest and riparian ecosystems throughout the Northeast. Hemlocks provide watershed protection, important wildlife cover and habitat, and are popular trees in recreational and garden landscapes. Prolonged droughts and outbreaks of the native secondary pest, the hemlock borer, *Melanophila fulvoguttata*, are historically serious stressors on eastern hemlocks. Eastern hemlock forests in Connecticut have also been under threat for decades by two non-native and seriously damaging insect pests, hemlock woolly adelgid, *Adelges tsugae* (HWA), and the

elongate hemlock scale, *Fiorinia externa* (EHS). Hemlock woolly adelgid, native to Japan, was first reported in Connecticut in 1985; from 1995-2007, biological control of HWA was implemented throughout Connecticut through the mass rearing and release of > 176,000 *Sasajiscymnus tsugae* ladybeetles for HWA predation to mitigate adelgid damage and spread. However, hemlocks are also facing intensive pressure from more frequent extreme weather events in a changing climate. On the beneficial side, recent severe winters have reduced populations of hemlock woolly adelgid significantly statewide, although EHS has increased in abundance and range. These recent reductions in HWA levels statewide in consecutive years have created new opportunities in 2017 to reintroduce the HWA predator, *S. tsugae*, to augment biological control on emerging adelgid populations resulting from winter survivors. However, recent severe extended droughts in Connecticut have also resulted in a resurgence of hemlock borer activity resulting in heavy mortality of stressed scale-infested hemlocks in poor growing sites. This presentation will discuss the interplay of complex abiotic and biotic interactions affecting eastern hemlock survival against the backdrop of increasingly unpredictable climate extremes, with implications on the hemlocks, pests and the predators that attempt to control them.

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 H. Creighton, Technician I, Department of Entomology
Beekeeping Systems Used in Connecticut
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3:00 p.m.-3:20 p.m. **TECHNICAL DEMONSTRATION TENT**
(20-minute demonstration, repeated twice during the day, 10:40 a.m. & 3:00 p.m.)
Mr. Gregory J. Bugbee, Associate Agricultural Scientist, Department of Environmental Sciences
Invasive Aquatic Plant Program
Lakes and ponds are one of Connecticut's most important natural resources. These bodies of fresh water face many threats including degradation by non-native invasive plants. Plants such as Eurasian watermilfoil, fanwort and water chestnut 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 300 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 if anything can be done about it? This demonstration talk will answer those questions and give you information on how to identify invasive aquatic plants, why some plants are good and what types of control are available.

3:20 p.m. **TECHNICAL DEMONSTRATION TENT**
Adjourn Technical Demonstrations

3:20 p.m. SIGN-OUT **(For those requesting pesticide credits) (R)**
Attendees pick up Pesticide Credit forms at the registration table (R).

BUS TOUR (B)
EVERY HALF HOUR, 10:00 a.m. to 3:30 p.m.

EVERY HALF HOUR
10:00 a.m. – 3:30 p.m.

This is a great way to see the farm. Join us on an air-conditioned bus ride around the farm for approximately 30 minutes. You can be dropped off at any plot, and picked up the next time the bus comes around. Dr. Neil Schultes and Dr. Abigail Maynard will narrate the ride.
The bus will be suspended during the guest lecture from 11:00 a.m. – 12:00 noon.

TOUR OF NATIVE WOODY SHRUBS (PLOT 41)
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 41):
Dr. Jeffrey S. Ward, Station Forester and Head, Department of Forestry and Horticulture
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)

The Gypsy Moth Outbreak of 2017
Department: Entomology
Investigator: Dr. Victoria Lynn Smith
Assisted by: Ms. Tia M. Blevins, Mr. Zachary Brown, and Mr. Jeffrey M. Fengler
Abstract: In 2017, defoliation due to feeding by gypsy moth larvae was significant, amounting to 1,175,000 acres statewide, mostly in the eastern half of the state. Trees most affected were oaks, but many species of tree were damaged, including conifers. Damage was assessed by aerial survey, in cooperation with the US Forest Service; pilots were provided by the Connecticut wing of the Civil Air Patrol. In addition, CAES personnel complete an egg mass survey every winter; this provides an indication of possible severity of gypsy moth damage for the coming season.

Select Agent Analysis at CAES
Department: Analytical Chemistry
Investigators: Dr. Christina S. Robb, Dr. Walter J. Krol, and Dr. Brian D. Eitzer
Abstract: The plant protein based toxins ricin and abrin frequently hit the headlines in attempted poisonings as well as accidental ingestions and exposures. The Department of Analytical Chemistry at CAES performs testing for these plant based toxins for the State of CT and the FDA Food Emergency Response Network (FERN). In this poster, we outline the traditional and state-of-the-art techniques we are applying to this problem and provide an overview of our previous projects on the topic.

Indoor Molds and Their Management
Department: Valley Laboratory
Investigator: Dr. DeWei Li
Abstract: Molds are ubiquitous. In nature, molds play both beneficial and detrimental roles in ecosystems. Some molds can enter our homes or buildings and lead to mold infestation when water damage or dampness occurs. Exposure to indoor molds poses a health risk to building occupants. This is a legitimate public concern. Proper identification of molds can help determine the risk, as some molds may be more harmful than others. The best strategy to avoid a residence/building becoming moldy is proper management of water damage and dampness. Mold remediation will also be discussed.

The New Crops Program – Creating Opportunities for Connecticut's Farmers
Department: Forestry & Horticulture
Investigators: Dr. Abigail A. Maynard
Assisted by: Ms. Valerie Perzanowski
Abstract: Direct retail sales and small farm sizes require that Connecticut farmers grow diversified high value crops. Since 1983, the Connecticut Agricultural Experiment Station has been investigating ethnic and specialty crops to provide new opportunities for Connecticut's farmers. Over 45 fruits and vegetables have been studied including pawpaws, globe artichokes, Belgian endive, radicchio, sweet potatoes, okra, and Chinese cabbage.

Computational Biochemistry Applied to Agriculture
Department: Environmental Sciences
Investigator: Dr. Charles R. Vossbrinck
Assisted by: Dr. Jonas Barandun and Dr. Mirjam Hunziker
Abstract: Leading edge technology in the field of biochemistry allows us to make detailed computer models of enzymes and cellular machines. This is allowing us to propose and test compounds that might block the cellular machinery of organisms harmful to the agricultural ecosystem. Scientists are hoping to design drugs to stop germs, parasites, and cancer cells from reproducing. Microsporidia are single celled parasites that live inside the cells of insects draining their energy, destroying their cells and killing them. We are working on the detailed structure of the microsporidial ribosome hoping to understand eventually how to prevent these parasites from killing honeybees and silkworms.

Using Nanoparticles to Suppress Plant Diseases

Departments: Plant Pathology & Ecology and Analytical Chemistry
Investigators: Dr. Wade H. Elmer and Dr. Jason C. White
Assisted by: Mr. Peter W. Thiel, Dr. Chuanxin Ma, Dr. Roberto De La Torre-Roche, and Dr. Nubia Zuverza-Mena

Abstract: Many of the micronutrients that are required by plants, such as B, Cu, Mn, and Zn, activate enzymes that catalyze defense products against plant pathogens. When the micronutrients are applied as metal oxides at the nanoparticle (NP) scale, plants frequently showed less disease and greater growth and yield when compared to untreated plants or to plants treated with salt equivalents. To date, NPs of B, CuO, MnO, SiO, and/or ZnO have been effective in suppressing diseases on asparagus, chrysanthemum, eggplant, grapes, pumpkin, soybean, strawberry, tomato, and watermelon and some cases have performed as well as conventional fungicides. NPs may be the new weapon in our arsenal against plant disease.

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: WWW.CT.GOV/CAES

EMAIL US AT: CAES@CT.GOV

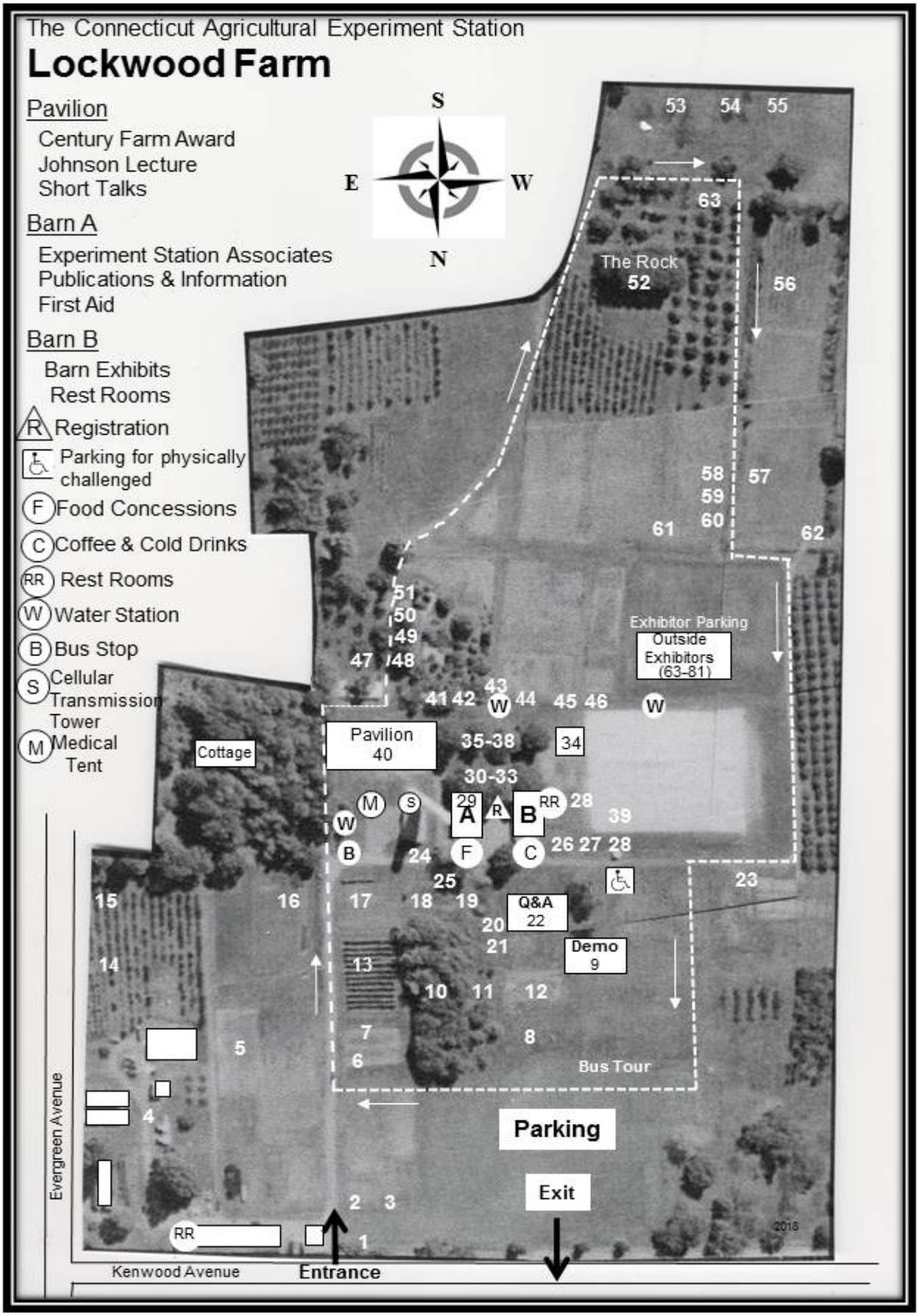
TO RECEIVE A COMPLETE LIST OF STATION SPEAKERS:

Inquire at the publications table in BARN A, or write to:
Publications; The Connecticut Agricultural Experiment Station; P.O. Box 1106; New Haven, CT 06504-1106, phone 203-974-8447, fax 203-974-8502, e-mail Vickie.Bomba-Lewandoski@ct.gov, or on the web at http://www.ct.gov/caes/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; P.O. Box 1106; New Haven, CT 06504-1106, phone 203-974-8447, fax 203-974-8502, e-mail Vickie.Bomba-Lewandoski@ct.gov, or on the web at http://www.ct.gov/caes/publications

CAES
The Connecticut Agricultural Experiment Station
Putting Science to Work for Society since 1875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Experiment Station Associates
Publications & Information
First Aid
Barn B
Barn Exhibits
Rest Rooms
R Registration
Parking for physically challenged
F Food Concessions
C Coffee & Cold Drinks
RR Rest Rooms
W Water Station
B Bus Stop
S Cellular Transmission Tower
M Medical Tent
S
E
W
N
The Rock
52
Exhibitor Parking
Outside Exhibitors (63-81)
Pavilion 40
Cottage
Q&A 22
Demo 9
Bus Tour
Parking
Exit
Entrance
Evergreen Avenue
Kenwood Avenue
2018

FIELD PLOT LISTING

Outside Exhibitors (Plots 24, 25, 26, 63-81) 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 Technicians Mr. Rollin Hannan and Mr. Michael McHill as well as seasonal resource assistants Ms. Jamie Buonocore and Mr. Christopher Dunhill.

1. Chinese Chestnut Trees

2. Sheet Composting with Maple and Oak Leaves

3. Annual Production of Globe Artichokes

4. Demonstration of Figs

5. Use of Nanoparticles on Fusarium Crown Rot of Asparagus

6. Commercial Chestnut Cultivars

7. Commercial Chestnut Seedlings

8. Remote Access Weather Station

9. Technical Demonstration Tent

10. Control of Blight on American Chestnuts

11. New Hybrid Chestnut Orchard

12. Use of Nanoparticles of Metal Oxides to Suppress Diseases of Eggplants, Watermelons, and Cabbage

13. Table Grape Demonstration Plot

14. Environmentally-Friendly Control of Powdery Mildew on Landscape Plants

15. Effect of Nanoparticles of CuO on Powdery Mildew on Wine Grapes

16. Student Research: Chrysanthemum Wilt Disease Trial

17. Comparison of Graft Union Height on Chardonnay Grapevines

18. Seedlings of Old Surviving American Chestnuts

19. Wild Chestnuts from Turkey

20. Integrating Nitrogen Fertilization, Herbicides, and Overseeding for Mugwort (*Artemisia vulgaris* L.) Management

21. Identification and Control of Common Weeds of Home Gardens and Cool Season Home Lawns

22. Questions and Answers Tent

23. Composting Leaves Using the Static Pile Method

24. Hamden Police Department

25. Verizon Wireless

26. The Farmer's Cow

27. Kids' Korner

28. Self-Guided Activity for All Children, Including Girl Scouts

29. Experiment Station Associates

30. Designer Biochars: Capturing Excess Nutrients in Animal Wastes

31. Hands-on Chemistry

32. Nanomaterials in Agriculture: Implications and Applications

33. CAES, CT Department of Agriculture and the FDA AFRPS

34. The Public Health and Entomology Tent

- **a. Statewide Monitoring Program for Mosquito-borne Viral Diseases in Connecticut**
- **b. Tracking Ticks and Tick-associated Diseases in Connecticut**
- **c. The Blacklegged Tick (Deer Tick) *Ixodes scapularis* and Lone Star Tick, *Amblyomma americanum***
- **d. Blood feeding Habits of the Asian Tiger Mosquito, The Potential Vector of Zika and other Viruses**
- **e. Distribution, Survival, and Establishment of the Lone Star Tick, *Amblyomma americanum*, in Connecticut**
- **f. Passive Tick Surveillance and Spatiotemporal Dynamics of the Lyme Disease Spirochete Infection in Blacklegged Ticks in Connecticut, 1996-2016**

35. A World of Viruses

36. Establishing Bee Forage to Assist Honey Bee Genetic Improvement

37. Invasive Insects in the Northeast

38. Organic Control of Fire Blight on Apples

39. Suppression of Powdery Mildew of Pumpkin with Nanoparticles

40. The Pavilion at Lockwood Farm

41. Native Woody Shrubs

42. Influence of Crop Tree Release on Black Birch Growth

43. Bird & Butterfly Garden

44. Variation in Pollinator Visitation Among Cultivated Varieties of Ornamental Plants

45. Environmentally-Friendly Control of Powdery Mildew on Vegetable Plants

46. Invasive Aquatic Plant Program

47. Chestnut Species and Hybrids

48. Healthy Plants—Healthy Business: Support of the Green Industry by Inspection

49. The Cooperative Agricultural Pest Survey (CAPS) Program and Farm Bill Surveys

50. Biological Control of Hemlock Woolly Adelgid and Mile-a-minute Weed

51. It Goes Both Ways: A Native American Borer as a Potential Invasive in Europe and Asia

52. The Rock

53. Beach Plum Trials

54. Pawpaw Trials

55. Japanese Plum Variety Trials

56. Pinot Gris Cultural Trials

57. Hybrid and Vinifera Winegrape Cultivar Trial

58. Butternut Squash Trials

59. Sweet Potato Trials

60. Heirloom Tomato Variety Trials

61. Brussels Sprouts Trials

62. Hops – Variety Evaluation and Integrated Pest Management

OUTSIDE EXHIBITORS (63-81)

63. Connecticut Botanical Society

64. Connecticut Department of Labor / CONN-OSHA

65. Connecticut Department of Energy and Environmental Protection: Wildlife Division

66. Connecticut Department of Agriculture

67. Connecticut Environmental Council

68. Connecticut Farmland Trust

69. Connecticut Horticultural Society

70. Connecticut Northeast Organic Farming Association (CT NOFA)

71. Connecticut Professional Timber Producers Association (TimPro)

72. Federated Garden Clubs of Connecticut, Inc.

73. Lyman Hall High School Agricultural Science and Technology Program

74. Sleeping Giant Park Association

75. The Sound School

76. South Central Connecticut Regional Water Authority

77. UCONN Extension Master Gardener Program

78. US Dept. of Labor/OSHA

79. USDA, Farm Service Agency

80. Connecticut Farm Bureau Association

81. USDA, Animal and Plant Health Inspection Service, Plant Protection and Quarantine

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

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. Any questions, please contact Dr. Anagnostakis at Sandra.Anagnostakis@ct.gov.

2. Sheet Composting with Maple and Oak Leaves
Dr. Abigail Maynard
Many homeowners have a predominance of oak trees in their backyards. Oak leaves are known to be more resistant to decomposition than maple leaves. This experiment is investigating whether this difference in the rate of decomposition leads to decreased yields in soils amended with oak leaves compared to maple leaves and unamended controls. Undecomposed oak and maple leaves were layered about 6 inches thick in the falls of 1995-2017 and incorporated into the soil by rototilling. Yields from plots amended with oak leaves were compared to plots amended with maple leaves and the unamended controls. In 2017, the greatest onion yields were from plots amended with maple leaves (7.4 lbs./plot) followed by plots amended with oak leaves (7.2 lbs./plot) and the unamended control plots (6.6 lbs./plot). Cabbage yields from the different treatments were virtually the same with plots amended with oak leaves averaging 3.3 lbs/head followed by plots amended with maple leaves (3.2 lbs./head) and the unamended control plots (3.0 lbs./head). The greatest pepper yields were from plots amended with maple leaves (4.7 lbs./plant) followed by the unamended control plots (4.6 lbs./plant) and plots amended with oak leaves (4.3 lbs./plant). Average yields of 12 vegetable crops over 22 years show no significant differences between the treatments.

3. Annual Production of Globe Artichokes
Dr. Abigail Maynard
The globe artichoke, a biennial plant, grows vegetatively the first year and matures the second, sending forth its edible flower buds. When artichokes are grown from seed, this two-year cycle requires mild winters for survival and Connecticut's winter are too severe. The growth cycle of the plant, however, can be shortened by vernalization (moist chilling) of the seed or plant. This treatment initiates budding in 5- to 6-month old plants and permits production of artichokes in a single year. Thus, the globe artichoke can be grown as an annual plant. In recent years, varieties of globe artichoke have been developed specifically for annual culture, requiring fewer hours of cool treatments. One is a green colored variety (Imperial Star); the other is a purple colored variety (Colorado Star), both of which can be seen in this plot.

4. Demonstration of Figs
Dr. Charles R. Vossbrinck *Assisted by* Mr. Mario DiNatale
Figs are one of the oldest recorded fruit crops propagated by humans. Figs are the most mentioned fruit in the Bible and mentioned as one of the 6 fruits of paradise in the Quran. Figs promise to be a rewarding crop for agriculturists in Connecticut both for home gardeners and for commercial growers. For commercial applications we have been testing 5 fig varieties in 25-gallon self-watering (sub-irrigation) pots. Growing figs is a potentially rewarding experience for the home gardener because they are easy to propagate from cuttings, can be grown in relatively small pots, and produce delicious fruit which cannot be easily obtained elsewhere. Diseases we have encountered include: mosaic virus, rust, spider mites, scale insects, and sooty mold.

5. Use of Nanoparticles on Fusarium Crown Rot of Asparagus
Dr. Wade Elmer *Assisted by* Mr. Peter Thiel
Asparagus plants suffer from a disease called Fusarium crown and root rot caused by species of the fungus *Fusarium*. Growers strive to establish a vigorous planting in the first few years to help suppress the disease. Metals of boron (B), copper (Cu), manganese (Mn), molybdenum (Mo), and Zinc (Zn) promote vigor in young plants. These plots were designed to compare the effect of the nano-metals on the vigor and stand establishment of asparagus. These metals were applied in the nano-form at planting as a crown soak. Fern health and disease severity will be monitored in 2018 and 2019. Yield will be taken in 2020.

6. Commercial Chestnut Cultivars
Dr. Sandra Anagnostakis, Emeritus
These trees are commercial cultivars of orchard chestnut trees. The largest trees are 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 cultivar CAES hybrids, planted last year. We are evaluating the potential of these commercial chestnut cultivars for nut production here in Connecticut. Any questions, please contact Dr. Anagnostakis at Sandra.Anagnostakis@ct.gov.

7. Commercial Chestnut Seedlings
Dr. Sandra Anagnostakis, Emeritus
These seedling trees are open pollinated (mostly Chinese) Dunstan chestnuts. They are not a cultivar (clones from a single tree), but a variety (a type) and are widely available for sale in garden centers. We will compare their growth and nut production with the orchard cultivars in plot #6. Any questions, please contact Dr. Anagnostakis at Sandra.Anagnostakis@ct.gov.

8. Remote Access Weather Station
Dr. Francis J. Ferrandino *Assisted by* Ms. Joan L. Bravo
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. Cumulative precipitation, growing degree days (GDD), frost events, and disease-risk assessments are recorded and/or calculated from the data collected.

9. Technical Demonstration Tent
See program pages 10-12 for a schedule of Technical Demonstrations.

10. Control of Blight on American Chestnuts
Dr. Sandra Anagnostakis, Emeritus
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. Any questions, please contact Dr. Anagnostakis at Sandra.Anagnostakis@ct.gov.

11. New Hybrid Chestnut Orchard
Dr. Sandra Anagnostakis, Emeritus
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 will be 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. Any questions, please contact Dr. Anagnostakis at Sandra.Anagnostakis@ct.gov.

12. Use of Nanoparticles of Metal Oxides to Suppress Diseases of Eggplants, Watermelons, and Cabbage
Dr. Wade Elmer, Dr. Lindsay Triplett, Dr. Roberto De La Torre-Roche, Dr. Nubia Zuverza-Mena, Dr. Chuanxin Ma, and Dr. Jason White *Assisted by* Mr. Peter Thiel
When metallic oxides of copper (Cu), manganese (Mn), zinc (Zn), and silicon (Si) are manufactured at the nanoscale (<0.000,001 mm), they are called nanoparticles (NP). These particles have unique chemical and physical properties not observed in equivalent bulk materials. We have observed that applying NP to young plants results in season-long benefits. These plots are designed to examine several hypotheses. The effect of evaluating combinations of CuO, MnO, and ZnO on eggplant, assessing different rates of NP of Si on watermelon and comparing NP of Cu with conventional bactericides/fungicides on cabbage will be addressed.

13. Table Grape Demonstration Plot
Dr. Francis J. Ferrandino *Assisted by* Ms. Joan L. Bravo
Three 12-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. Each row is trained to a different training system: Vertical Shoot Positioning, Hudson River Umbrella, and Smart-Dyson.

14. Environmentally-Friendly Control of Powdery Mildew on Landscape Plants
Dr. Francis J. Ferrandino *Assisted by* Ms. Joan L. Bravo
Many ornamental plants commonly used around Connecticut homes are subject to powdery mildew. This disease is caused by a fungus that grows on the surface of plant tissue giving the foliage a white powdery appearance. The result is relatively unsightly and the fungus weakens infected plants by feeding on the sugar the plant produces and by blocking sunlight, which limits the ability of the

plant to produce more sugar. This plot is planted to a number of common perennial landscape plants (lilac, deciduous azalea, bee balm, peony and phlox, rudbeckia (commonly called "black-eyed susan"), which are susceptible to powdery mildew. Environmentally-friendly foliar sprays, including milk (20% in water), potassium bicarbonate (1% in water), and light horticultural oil (1% in water), will be compared to chemical fungicides in their ability to control the disease.

15. Effect of Nanoparticles of CuO on Powdery Mildew on Wine Grapes
Dr. Wade H. Elmer and Dr. Francis J. Ferrandino *Assisted by* Ms. Joan L. Bravo and Mr. Peter Thiel
Of all the pathogens, powdery mildew of grapes has the greatest impact on the industry. This plot is planted to a variety of wine grapes that is very susceptible to powdery mildew. In 2017, we learned that nanoparticles (NPs) of CuO had potential for suppressing powdery mildew, but did not control the disease when applied solely. This experiment is designed to evaluate if NPs of CuO or ZnO are effective when applied in rotation with conventional fungicides. Disease measurements will be taken during 2018 along with yield.

16. Student Research: Chrysanthemum Wilt Disease Trial
Mr. Zach Seltzer, Mr. Lance Moore, Mr. Steven Miller, Ms. Tia Brown, Ms. Victoria Romero, Ms. Jillian Tate, Ms. Gillian Page, Ms. Ceara Wetterman, Ms. Collette McMahon, Mr. Melvin Mercado Ayala, and Mr. Kelvin Mintah *Assisted by* Dr. Lindsay Triplett and Dr. Wade Elmer
Root-associated fungi cause many problems of ornamental plants, some with few treatments. In a summer group project, we tested the effects of three metal nanoparticles on the growth of Chrysanthemum and its resistance to wilt disease caused by *Fusarium* fungi.

17. Comparison of Graft Union Height on Chardonnay Grapevines
Dr. Francis J. Ferrandino *Assisted by* Ms. Joan L. Bravo
The coldest layer of air during a radiation freeze (clear sky) is immediately above the soil or snow level. By elevating the graft union, the labor and expense of burying the graft union might be avoided. Chardonnay vines, Dijon clone 95 on C3309 rootstock, were transplanted to the vineyard in spring, 2007. Half are of standard grafting height and half have the graft union 26 inches above ground. Over the past 3 years, yields have remained the same in spite of the height of the graft union.

18. Seedlings of Old Surviving American Chestnuts
Dr. Sandra Anagnostakis, Emeritus
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. Any questions, please contact Dr. Anagnostakis at Sandra.Anagnostakis@ct.gov.

19. Wild Chestnuts from Turkey
Dr. Sandra Anagnostakis, Emeritus
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. Any questions, please contact Dr. Anagnostakis at Sandra.Anagnostakis@ct.gov.

20. Integrating Nitrogen Fertilization, Herbicides, and Overseeding for Mugwort (*Artemisia vulgaris* L.) Management
Dr. Jatinder S. Aulakh *Assisted by* Mr. Nicholas Keegan and Ms. Jordan Wojciekofsky
Mugwort has invaded diverse habitats in the United States and is rapidly spreading into new areas. Dense monotypic stands of mugwort are commonly found along roadsides, floodplains and riparian areas, pasture and rangeland, rights-of-way, and in various agronomic, turf and landscape settings. A multiyear trial is underway at the CAES's Lockwood Research Farm at Hamden, CT for mugwort control using an integrated weed management approach encompassing nitrogen fertilization, herbicide treatment and overseeding to restore native cool season grasses. Nitrogen treatments were: 0, 50, and 110 lb. N/a, herbicide treatments were three different rates of aminopyralid (3.5, 7.0, and 14 fl. oz./a), clopyralid (5.3, 10.6, and 21.2 fl. oz./a), and glyphosate (14, 28, and 56 fl. oz./a), and the overseeding treatments were seeded and not-seeded. Each year, nitrogen was applied in the fall (August-September) followed by herbicide treatments a month later (September-October). Two years after initial herbicide treatment, all rates of aminopyralid, and glyphosate rates of ≥28 fl. oz./a resulted in at least 85% control of mugwort. Clopyralid failed to control mugwort; the highest rate of clopyralid did not control mugwort >50%. Although the nitrogen fertilization did not affect herbicide efficacy against mugwort, it significantly benefited the native vegetation.

21. Identification and Control of Common Weeds of Home Gardens and Cool Season Home Lawns
Dr. Jatinder S. Aulakh *Assisted by* Mr. Nicholas Keegan and Ms. Jordan Wojciekofsky
Several undesirable grasses, broadleaf plants, and sedges interfere with the successful production of home garden plants and cool season grasses. Correct identification is very critical for selecting the right tool for weed management. The weed science booth displays live specimens of the common weeds of home gardens and lawns. Literature on their identification and chemical and nonchemical control options will also be available.

22. Questions and Answers Tent
Mr. Robert Durgy, 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**.**

23. Composting Leaves Using the Static Pile Method
Dr. Abigail Maynard
Since the 1991 ban on disposing leaves in landfills, large-scale leaf composting has spread throughout Connecticut. Some 84 municipalities are currently composting their leaves. In static pile composting, leaves are piled and the internal temperature of the pile is monitored. As the leaves decompose, the temperature in the center of the pile reaches a temperature of about 140^{o}F. When the temperature decreases, the pile is turned and fresh material is introduced to the center of the pile. Turning also aerates the pile. Leaf compost is seen here in various stages of decomposition. The finished compost is used in experiments here at Lockwood Farm and at the Valley Laboratory in Windsor.

24. 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/.

25. Verizon Wireless
Learn about the cellular transmission tower.

26. The Farmer's Cow
Ms. Kathy Smith
The Farmer's Cow is an innovative, premium milk brand produced and marketed by Connecticut family-owned dairy farms. The Farmer's Cow was formed in response to consumers' interest in purchasing fresh, naturally produced, local products. Collectively, The Farmer's Cow member farms milk 2,300 cows and manage over 6,000 acres of Connecticut farmland. The Farmer's Cow milk is currently available in over 100 grocery stores throughout the state. A complete listing of retailers is shown at www.thefarmerscow.com. The Farmer's Cow is sold in half gallon cartons in whole, 2 percent, 1 percent, and skim varieties. Chocolate milk and single-serve packaging are under development. The owners of The Farmer's Cow are active members in The Connecticut Farmland Trust and The Working Lands Alliance who are working to protect and preserve Connecticut farmland. They were also the founding members of "Very Alive," a non-profit organization dedicated to the promotion of Connecticut Agriculture. Connecticut farms contribute $2 billion annually to the local economy. 51 percent of Connecticut farmland is in dairy or dairy support. In 2003, there were 191 dairy farms remaining in Connecticut. The Farmer's Cow owners are: Paul and Diane Miller, Fairvue Farms, Woodstock; Bill, Tom and Greg Peracchio, Hytone Farm, Coventry; Ned and Renee Ellis, Mapleleaf Farm, Hebron; Jim and Don Smith, and Nate Cushman, Cushman Farms, Franklin; Peter Orr and Family, Fort Hill Farms, Thompson; Robin and Lincoln Chesmer, Graywall Farms, Lebanon. Further information can be found at www.thefarmerscow.com; www.ctfarmland.org; and www.workinglandsalliance.org.

27. Kids' Korner
Ms. Terri Arsenault
Come to the Kids' Korner to pick up an age appropriate, self-guided activity and a free gift. Younger kids can pick up a passport to help them enjoy and explore our Lockwood Farm. There are six different stations where they can ask questions, learn about the topic featured at the station, and then receive a special stamp for their passport. Older kids have several options of self-guided worksheets for differing age levels. The worksheets will direct them to different plots where they can talk to experts about topics like bugs, flowers or trees.

28. Self-Guided Activity for All Children, Including Girl Scouts
Ms. Terri Arsenault
Once their chosen activity is completed, kids must return to this area to receive their special patch. In addition, Girl Scouts will have the option of receiving one of the badges: Bugs (Brownies), Flowers (Juniors), or Trees (Cadettes). 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.

29. 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 webpage at: http://www.ct.gov/caes/ESA or http://www.agstationfriends.org.

30. Designer Biochars: Capturing Excess Nutrients in Animal Wastes
Dr. Joseph J. Pignatello *Assisted by* Mr. Connor McLaughlin
Animal wastes contain high concentrations of nutrients such as phosphate, nitrate, and ammonia that after field application can prematurely leach into surface or ground waters, posing an environmental hazard such as eutrophication or toxicity. Biochar is a charcoal-like material made from biomass wastes—wood chips, yard waste, forest litter, crop residue, and the like—by heating at about 600-1400^{o}F in a reactor without air (a process known as *pyrolysis*). Biochar has attracted interest as a soil amendment in agriculture and environmental management. Part of our research has focused on tailoring the physical-chemical properties of biochar for specific purposes. This display will describe modification of biochar to greatly increase its binding capacity for phosphate and nitrate such that, when mixed with animal wastes, will render these nutrients in less leachable, but still bioavailable forms. Tailoring was accomplished by introducing substances into the plant waste material, manipulating the pyrolysis conditions, and/or introducing substances into the final char product. Plans are underway to test the tailored biochars in the field.

31. Hands-on Chemistry
Mr. John Ranciato, Mr. Michael Ammirata, and Dr. Jason C. White
This display will include a number of "hands-on" experiments that will allow you to get up close and personal with chemistry in action. You will not only get to "play" with our chemists but also CAES staff members will explain the mechanisms and principles behind the chemistry.

32. Nanomaterials in Agriculture: Implications and Applications
Dr. Roberto De La Torre-Roche, Dr. Chuanxin Ma, Dr. Nubia Zuverza-Mena, Dr. Wade Elmer, Mr. Peter Thiel, and Dr. Jason C. White
Nanomaterials (NMs) have at least one dimension less than 100 nanometers (one billionth of a meter) and this small size results in unique and useful properties. For example, at that size range, materials that are normally good insulators actually become conductive (silicon) and other elements that are generally stable actually become chemically reactive (gold). Current nanomaterial use is ubiquitous; over 1600 NM-containing products are commercially available in areas such as electronics, health-care, cosmetics, pharmaceuticals, agriculture, and food processing/packaging. One area of research within the Department of Analytical Chemistry is investigating the interactions of NMs with co-existing contaminants, such as pesticides and heavy metals. In one set of experiments, nanomaterials were added to soils containing the neonicotinoid insecticide imidacloprid. Plants were then added to the soils and the movement of the NM and the pesticide into the organisms was then tracked as a function of co-exposure. In separate experiments conducted in collaboration with the NSF-funded Center for Sustainable Nanotechnology, the use of nanoscale micronutrients to suppress crop disease is being investigated. In one set of experiments, nanoscale copper in different forms (sheets, rods) were investigated for their ability to suppress fungal infection of watermelon.

33. CAES, CT Department of Agriculture and the FDA AFRPS
Dr. Nubia Zuverza-Mena, Dr. Brian D. Eitzer, Dr. Jason C. White, Mr. Wayne Nelson, and Ms. Kate Ciarletta
In 2011, the FDA and the Association of American Feed Control Officials (AAFCO) partnered to develop the Animal Feed Regulatory Program Standards or AFRPS. These standards establish a uniform foundation for the design and management of State programs responsible for the regulation of animal feed. Animal feeds include foods manufactured for livestock and poultry feeds, pet foods, pet treats, foods for fish, amphibians, reptiles, and insects and foods for birds and wildlife. To ensure achievement of compliance, the FDA instituted a Cooperative Agreement Program, which provides funding from 2015 to 2020. By implementing these feed standards with the FDA's support, CT will be better able to achieve and maintain programmatic improvements that help ensure the safety and integrity of both the CT and U.S. animal feed supply. The goal of these standards, eleven in total, is to leverage resources and share common successes to build systems within state regulatory feed programs. Training, inspection programs, auditing, outreach activities, and sampling plans are examples of the systems covered by the AFRPS. Standard ten, in particular, concerns laboratory services. The Department of Agriculture works closely with the Connecticut Agricultural Experiment Station's Department of Analytical Chemistry to develop a system in which sampling, testing, and regulatory action occur smoothly and efficiently as a result of open communication and coordination between the two agencies. On the laboratory end, CAES added the AFRPS to its scope of ISO/IEC 17025 Accreditation earlier this year and we've begun to expand the pet feed types that we are analyzing.

34. The Public Health and Entomology Tent

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

Dr. Philip Armstrong, Dr. Theodore Andreadis, and Mr. John Shepard *Assisted by* Ms. Angela Bransfield, Mr. Michael Misencik, Ms. Tanya Petruff, Ms. Stephanie Canales, Mr. Daniel Cole, Mr. Duncan Cozen, Mr. Christopher Driscoll, Mr. Ryan Gregory, Ms. Noelle Khalil, Mr. Jack Miller, Mr. Michael Olson, Ms. Demi Rodriguez, and Ms. Danielle Sohai

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 of protecting the public and reducing the risk of human disease. The Connecticut Agricultural Experiment Station (CAES) maintains a network of 91 mosquito-trapping stations in 72 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), eastern equine encephalitis virus (EEE), and Zika virus. To date, more than 3 million mosquitoes representing 52 different species have been collected, identified, and tested since 1997. A total of 1,965 WNV isolations have been recovered from 21 different mosquito species and a total of 406 isolations of EEE isolations have come from 19 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 the Hartford metropolitan area. Seasonal transmission of EEE 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. Tracking Ticks and Tick-associated Diseases in Connecticut

Dr. Goudarz Molaei *Assisted by* Mr. Alex Diaz, Ms. Mallery Breban, and Ms. Darya Pokutnaya

First described in 1977 following the investigation of a cluster of children with arthritis-like symptoms in Lyme, Connecticut, Lyme disease (LD) is now considered the most prevalent arthropod-associated disease in the U.S., with an estimated 330,000 diagnosed human cases annually. In 2016, greater than 95% of confirmed LD cases in the U.S. were reported from 14 states including Connecticut with the 7th highest number of confirmed cases of LD (n=1,238) and 8th highest incidence (confirmed cases per 100,000 persons) rate of 34.6. The blacklegged or deer tick is the primary vector of the bacterium that causes LD. In addition to LD, other blacklegged tick-associated diseases, particularly, babesiosis and anaplasmosis pose considerable risks to human health in Connecticut. It also appears that the relatively uncommon Powassan virus, which is transmitted to humans by blacklegged ticks, should be added to the growing list of pathogens of concern. Established in 1990, the Tick Testing Laboratory at The Connecticut Agricultural Experiment Station receives an average of 3,000 ticks from residents, health departments, and physicians' offices for testing, primarily for evidence of infection with the LD pathogen. In 2015, the program was expanded to include testing for the causative agents of babesiosis and anaplasmosis. In 2017, the Tick Testing Laboratory received nearly 5,600 ticks, of which 4,458 were blacklegged ticks. Of the 3,993 blacklegged ticks tested, nearly 40% were infected with at least one pathogen, and 32%, 6% and 7% were positive for the causative agents of LD, babesiosis, and anaplasmosis, respectively.

c. The Blacklegged Tick (Deer Tick) *Ixodes scapularis* and Lone Star Tick, *Amblyomma americanum*

Dr. Kirby C. Stafford III *Assisted by* Ms. Heidi Stuber, and Ms. Sarah Hemstock

The blacklegged tick or "deer" tick *Ixodes scapularis* carries six human pathogens including the agents of Lyme disease, babesiosis, and anaplasmosis. The lone star tick is the vector for the agents of ehrlichiosis. Observe live and/or preserved ticks under the microscope. The latest information on natural, biological, and integrated control is available.

d. Blood feeding Habits of the Asian Tiger Mosquito, The Potential Vector of Zika and other Viruses

Dr. Olivia T. Harriott and Dr. Goudarz Molaei *Assisted by* Mr. Alexander Diaz

The yellow fever and Asian tiger mosquitoes garnered international attention in 2015 after the emergence and rapid spread of Zika virus in Brazil and other countries in Central and South America, the Caribbean, and in the state of Florida. The yellow fever mosquito was identified as the primary vector with involvement of other mosquito species, such as the Asian tiger mosquito, suspected. These two mosquito species have been rapidly expanding beyond their native boundaries in Africa and Asia into temperate zones in North America and Europe heightening concern about possible human health implications. The Asian tiger mosquito has been implicated in outbreaks of Dengue and Chikungunya viruses in several countries in Europe and Asia prompting public health agencies in the United States to closely monitor local populations of this mosquito species. Connecticut is among 40 states and the District of Columbia where established populations of the Asian tiger mosquito have been reported. As mosquito-borne disease agents are transmitted primarily during blood feeding, knowledge of vector feeding patterns and blood meal sources can aid in assessing the role of mosquitoes and their host species in disease transmission, maintenance, and amplification. We have investigated blood-feeding behavior of the Asian tiger mosquito collected from Suffolk, Virginia, in 2017, using molecular methods. Of the blood meals analyzed to date, over 98% were from mammalian and occasionally from reptilian hosts. These findings are consistent with reported feeding tendencies ascribed to this mosquito species.

e. Distribution, Survival, and Establishment of the Lone Star Tick, *Amblyomma americanum*, in Connecticut

Dr. Kirby C. Stafford III, Dr. Goudarz Molaei, Dr. Scott C. Williams, Dr. Megan Linske, and Dr. Eliza Little *Assisted by* Ms. Heidi Stuber, Mr. Michael Short, and Ms. Sarah Hemstock

The number of lone star tick specimens submitted to the Tick Testing Laboratory (TTL) increased by 58% from the period of 1996-2006 (n = 488) to 2007-2017 (n = 773), mainly from Fairfield County. A long established population of adult and nymphal lone star ticks was discovered on Manresa Island in Norwalk, CT in June 2017. Infection with *Ehrlichia* species, mainly *E. chaffeensis*, in the adult ticks was high (48%). Monitoring the tick population on Manresa Island and control efforts using the 4-poster deer treatment stations began in summer 2018. In another study, we found that a high proportion of adult lone star ticks (33-69%) successfully overwintered in Connecticut. As this tick slowly expands its established range into new areas, it is expected that the lone star tick and its associated pathogens will become an increasing public health and veterinary concern in southern New England.

f. Passive Tick Surveillance and Spatiotemporal Dynamics of the Lyme Disease Spirochete Infection in Blacklegged Ticks in Connecticut, 1996-2016

Dr. Eliza A. H. Little, Dr. John F. Anderson, Dr. Kirby C. Stafford III, and Dr. Goudarz Molaei *Assisted by* Mr. Alexander Diaz, Ms. Mallery Breban, and Ms. Darya Pokutnaya

Lyme disease (LD) is the most prevalent arthropod-associated disease in the United States with an estimated 330,000 diagnosed human cases annually. The blacklegged or deer tick is the vector of the bacterium that causes LD in the northeastern United States. Connecticut has had pervasive populations of blacklegged ticks in all of its 8 counties since 1996, and remains a hotspot of disease transmission. Engorged nymph and adult blacklegged ticks submitted to the Tick Testing Laboratory (TTL) at The Connecticut Agricultural Experiment Station were screened for evidence of infection with the Lyme disease pathogen. From this passive surveillance data, tick submissions and infection rates were calculated. We use reported LD cases to determine LD incidence for each town and county. In this study we aim to ascertain spatiotemporal differences in tick submissions, tick infection prevalence, and LD cases and to define the relationship between this passive surveillance dataset and LD cases. Of 91,671 submissions to the TTL between 1996 and 2017, 78,122 were adult females or nymphs submitted and acquired in the same County. The average rates of infection were 33% in adults and 21% in nymphs in 65,065 ticks tested. Tick infection prevalence were similar across the state, but tick submission patterns were highly clustered and concentrated to Fairfield and New Haven Counties (82%). Due to discrepancies in surveillance methods used in Connecticut between 1996 and 2017, we restricted the time period used to investigate LD cases to between 2007 and 2017 when both physician and laboratory cases were reported. During this period, there were 23,432 LD cases reported in Connecticut and we observed spatial and temporal structure in LD incidence. The data presented here, relying on passive tick submissions and LD cases, mirror known epidemiological patterns of tick seasonality and LD. We find an association between tick submissions and LD incidence. Our findings underscore the relevance of using passive surveillance to determine underlying epidemiological patterns in tick infection rates to guide informed decisions concerning prevention and treatment.

35. A World of Viruses

Dr. Douglas Brackney

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.

36. Establishing Bee Forage to Assist Honey Bee Genetic Improvement

Dr. Richard S. Cowles

Beekeepers in Connecticut often lose hives during the winter, which often is believed to be due to high levels of viruses transmitted by parasitic varroa mites. Breeding honey bees with hygienic traits, in which honey bees remove from their hive bee pupae on which varroa mites are reproducing, may resolve this problem. If Connecticut beekeepers were to keep bees that are relatively free of varroa mites, this will have an added benefit to native bees by protecting them from being exposed to viruses left by honey bees on flowers they share. A honey bee breeding project requires having a large number of colonies. In 2017 we discovered that the floral resources at Lockwood Farm were insufficient for the 30 hives we were keeping here. A $2,500 grant from the Feed A Bee project is supporting the establishment of bee forage on this farm and the queen breeding project. The planned bee forage includes a wildflower meadow, overseeding legumes within the turf in the parking area, sunflowers and blue tansy planted near the entrance, and high-value bee forage intercrops grown within an experimental Christmas tree plot and on a steep slope.

37. Invasive Insects in the Northeast

Dr. Chris T. Maier *Assisted by* Ms. Tracy Zarrillo and Ms. Morgan Lowry

Invasive insects pose a significant threat to the economy and the biodiversity of our region. Annually, state and federal workers conduct surveys to detect new non-native insects and to determine the distributional range of established ones. Early detection, in

particular, greatly decreases the cost of coping with invasive insects. The cost of foreign insects can be reduced even further by conducting research on their behavior and ecology to develop effective strategies to slow their spread or to eradicate them. During the last few years, we have examined the distribution and biology of the brown marmorated stink bug, the Japanese cedar longhorned beetle, the lily leaf beetle, and the viburnum leaf beetle. During surveys conducted in 2016 and 2017, we have discovered that the Japanese cedar longhorned beetle and the viburnum leaf beetle have expanded their distributional range to include the entire state of Connecticut. Thus, the wild and cultivated host plants of these beetles are now at risk of attack throughout the state.

38. Organic Control of Fire Blight on Apples

Dr. Neil Schultes, Dr. Quan Zeng, and Dr. Zhouqi Cui *Assisted by* Ms. Sali Diallo

Fire blight is a serious bacterial disease of apple and pears in Connecticut and in the United States. Most apple and pear varieties sought after by consumers, such as 'Gala', 'Fuji', and 'Bartlett', are either susceptible or highly-susceptible to fire blight. As the fire blight pathogens enter the plant through flowers during bloom, application of antibiotic streptomycin at bloom is by far the most effective management option for fire blight. However, the intensive, long-term use of streptomycin not only leads to the evolution of streptomycin resistance in the pathogen population, but also raises concerns of its potential impact to the environment and human health. On October 21, 2014, the National Organic Standards Board terminated the use of streptomycin in the organic fruit production in the US. We aim to develop effective, environmentally-friendly, non-antibiotic management options of fire blight. This plot demonstrates the 'Red Delicious' apple trees infected with fire blight. We are testing the efficacy of non-antibiotic treatments, a plant sanitizing product (hydrogen peroxide), copper, and three different biological control agents, to the antibiotic treatment (streptomycin) in controlling fire blight.

39. Suppression of Powdery Mildew of Pumpkin with Nanoparticles

Dr. Wade Elmer and Dr. Jason White *Assisted by* Mr. Peter Thiel

Pumpkins routinely get powdery mildew, a destructive disease caused by a pathogenic fungus. Growers typically spray pumpkin fields with expensive fungicides 5 to 8 times during the summer to suppress powdery mildew, which places exorbitant costs on the grower along with possible threats to the environment. In 2017, we observed suppression of powdery mildew with NPs of Cu and Si. The suppression was equal to plants treated with conventional fungicides. These plots are designed to repeat the 2017 study.

40. The Pavilion at Lockwood Farm

See program pages 10-12 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 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 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.

41. Native Woody Shrubs

Dr. Jeffrey S. Ward *Assisted* by Mr. Joseph P. Barsky

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.

42. Influence of Crop Tree Release on Black Birch Growth

Dr. Jeffrey S. Ward *Assisted by* Mr. Joseph P. Barsky

Black birch (*Betula lenta* L.) is a largely unrecognized, yet increasingly important component of the Connecticut forest. It is the second most numerous species in the sapling (1.0-4.9") and pole (5.0-10.9") size classes and third most common small sawtimber tree (11.0-14.9"). In 1996-97, plots were established in five stands ranging from 20-99 years old to examine diameter and volume growth response of black birch to crop-tree release. If crop-tree management was initiated in young stands of large sapling black birch and again twenty years later, the time required to grow those trees to sawtimber could be reduced from 80 years to only 50 years.

43. Bird & Butterfly Garden

Ms. Jane Canepa-Morrison and Mr. Jeffrey Fengler

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.

44. Variation in Pollinator Visitation Among Cultivated Varieties of Ornamental Plants

Dr. Kimberly A. Stoner *Assisted by* Ms. Morgan F. Lowry and Ms. Tracy Zarrillo

Flowering plants evolved in nature to attract pollinators, but plant breeders select and breed cultivated varieties of plants to look pretty and for novelty, which may change their attractiveness to pollinating insects. We are examining cultivated varieties of ornamental plants to see to what extent they are visited by pollinators. Our team is part of a large project looking at different popular annual and perennial ornamental plants. In this plot we are comparing varieties of the perennials *Echinacea*, *Phlox* (summer blooming species and hybrids), and *Sedum*, and the annuals *Zinnia* and *Celosia*. Our plot also includes standards used by all the cooperators in this study, including *Nepeta* (catmint) "Walker's Low" and *Tagetes* (marigold) "Alumia Vanilla Cream."

45. Environmentally-Friendly Control of Powdery Mildew on Vegetable Plants

Dr. Francis J. Ferrandino *Assisted by* Ms. Joan L. Bravo

Many vegetable plants commonly used in Connecticut gardens are subject to powdery mildew. This disease is caused by a fungus that grows on the surface of plant tissue giving the foliage a white powdery appearance. The result is relatively unsightly and the fungus weakens infected plants by feeding on the sugar the plant produces and by blocking sunlight, which limits the ability of the plant to produce more sugar. This plot is planted to a number of common vegetables (tomato, pepper, eggplant, pumpkin, and muskmelon) which are susceptible to powdery mildew. Environmentally-friendly foliar sprays, including milk (20% in water), Potassium bicarbonate (1% in water) and light horticultural oil (1% in water), will be compared to chemical fungicides in their ability to control the disease.

46. Invasive Aquatic Plant Program

Mr. Gregory Bugbee *Assisted by* Ms. Summer Stebbins

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 the present. Over 300 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. 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.

47. Chestnut Species and Hybrids

Dr. Sandra Anagnostakis, Emeritus

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, plot #10). 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 Florida are planted across the road from an Allegheny chinquapin from Pennsylvania. The original tree (the "ortet") of the cultivar 'Lockwood' is at the southwest corner of the plot. Any questions, please contact Dr. Anagnostakis at Sandra.Anagnostakis@ct.gov.

48. Healthy Plants—Healthy Business: Support of the Green Industry by Inspection

Dr. Victoria L. Smith *Assisted by* Ms. Tia Blevins, Mr. Zachary Brown, Mr. Mark Creighton, and Mr. Jeffrey Fengler

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 2017, the Office of the State Entomologist completed registration and inspections for 292 nursery growers and dealers of plants and plant products. Over 386 certificates of export were issued for plant commodities moving out of state or out of country. Nearly 650 beekeepers registered 5,000 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 a comprehensive honeybee disease survey. The health of our forests was assessed by aerial 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.

49. The Cooperative Agricultural Pest Survey (CAPS) Program and Farm Bill Surveys

Ms. Katherine Dugas *Assisted by* Mr. Zachary Brown, Mr. Adam Cohen

The Cooperative Agricultural Pest Survey (CAPS) Program conducts science-based national and state surveys targeted at specific exotic plant pests, diseases, and weeds identified as threats to U.S. agriculture and/or the environment. These activities are accomplished primarily under USDA funding, which is provided through cooperative agreements with state departments of agriculture, universities, and other entities. Surveys conducted through the CAPS Program represent a second line of defense against the entry of harmful plant pests and weeds. This year in Connecticut, CAPS pest surveys are being conducted in nurseries, in forest lands, and in Christmas tree farms. Additionally, CAES is also conducting pest surveys with funding from the Farm Bill in orchards and farms that grow solanaceous crops.

50. Biological Control of Hemlock Woolly Adelgid and Mile-a-minute Weed

Dr. Carole A. Cheah

Updates on the status of 2 Connecticut biological control programs are presented. Hemlock woolly adelgid, *Adelges tsugae* (HWA), a serious forest and nursery threat to native eastern and Carolina hemlocks, currently impacts 20 states in the Eastern U.S. and Canada. However, recent severe winters from 2014-2018 have greatly reduced populations of HWA in the Connecticut landscape. In addition, >178,000 of the tiny ladybeetle, *Sasajiscymnus (=Pseudoscymnus) tsugae*, native to southern Japan, were implemented by the CAES for biological control of HWA in Connecticut between 1995 and 2007 with recent new releases in 2017. This predator is now commercially available to the public to combat the resurgence of HWA after milder winters. Another threat to native vegetation diversity is the invasive mile-a-minute weed, *Persicaria perfoliata* (MAM). This non-native vine was initially reported in CT in 2000 but has now spread to 50 towns. As part of the federal biological control program for MAM (funded by USDA APHIS PPQ), >51,000 *Rhinoncomimus latipes*, a small weevil that feeds and reproduces exclusively on MAM, have been released to counter the spread of MAM. This project is a collaboration with the University of Connecticut since 2009. Weevils have survived Connecticut winters, adapted to challenging environmental conditions, and spread widely in many areas to feed on MAM.

51. It Goes Both Ways: A Native American Borer as a Potential Invasive in Europe and Asia

Dr. Claire E. Rutledge *Assisted by* Ms. Mioara Scott and Mr. Dennis Hicks

By now, Connecticut residents are well aware of the Emerald Ash Borer, an exotic Asian beetle that is decimating the North American population of ash trees. But did you know that a close relative of the Emerald Ash Borer, the Bronze Birch Borer, is a potential threat to Asian and European birches? Both species are members of the genus *Agrilus*, and both feed on weakened host trees in their own native habitat. Emerald Ash Borer was accidently imported into North America and it was discovered that it could feed on healthy North American ashes, thus becoming a serious threat to ashes in the US and Canada. Bronze Birch Borer, a native North American beetle, is unable to feed on healthy native species of birch, but happily eats healthy European and Asian species of birch we import for landscaping. If it were to escape to Europe or Asia, it has the potential to devastate birch populations there. Hopefully this will not happen, but better safe than sorry! We are working on modifying the tools for Emerald Ash Borer monitoring for use with Bronze Birch Borer. Come see how it worked.

52. 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, which was extruded onto the surface as lava flows that form topographic "trappa" or "trappe" (steps or stairs).

53. Beach Plum Trials

Dr. Abigail Maynard

Beach plum (*Prunus maritime* Marsh.) is a fruiting shrub native to the coastal dunes of the northeastern United States. Beach plum jam has become a premium product especially in the Cape Cod region. Currently, consumer demand for beach plums is greater than the supply. Commercial production is the only way to meet the demand for beach plums and its relatively low growth habit makes it ideal for a pick-your-own operation. In its native seaside habitat, beach plums grow very slowly and bear fruit sporadically. Growth in more fertile soil should be more vigorous and crop size will be improved. In spring 2003, 210 beach plum seedlings were planted at Lockwood Farm and 96 at the Valley Laboratory. These seedlings were raised at Cornell University from seeds collected from 35 sites from Maine to Delaware. The trees are evaluated annually and select elite individuals will be propagated as possible cultivars in the future.

54. Pawpaw Trials

Dr. Abigail Maynard

Pawpaws are shrubby trees that are native to the temperate woodlands of the eastern United States. The American Indian is credited with spreading pawpaws across the eastern U.S. to eastern Kansas and Texas, and from the Great Lakes almost to the Gulf. They are woodland understory plants that need shade to protect the seedlings but once established prefer full sun. They produce maroon, upside-down flowers which are self-incompatible, requiring cross pollination from another unrelated pawpaw tree. They are not pollinated by bees but by flies and beetles. The pawpaw is the largest edible fruit native to America. Individual fruits weigh 5 to 16 ounces and are 3 to 6 inches in length. The tasty fruit has a smooth, custard texture. In this trial, 4 cultivars of pawpaws were planted in 2002. Since 2013, annual yields were recorded from each tree. Thus far, the cultivars Rebecca's Gold and Overleese have averaged the greatest yields (43 and 39 fruit/tree, respectively) with Sunflower producing the largest fruit (6.9 oz./fruit).

55. Japanese Plum Variety Trials

Dr. Abigail Maynard

As wholesale marketing of major tree fruits becomes unprofitable, many Connecticut growers are turning to retail sales of their fruit. For a retail operation to be successful there must be a diversity of products. Thus, many growers are interested in adding minor specialty fruits to their operations. Consequently, we have expanded our New Crops Program to include fruits. This trial, also repeated at the Valley Laboratory in Windsor, includes 12 cultivar/rootstock combinations of Japanese plum. Many trees were severely damaged by black knot disease and were removed from the orchard. However, the cultivar Obilinaja (planted in the first row) has been relatively free of the disease.

56. Pinot Gris Cultural Trials

Ms. Joan L. Bravo and Dr. Francis J. Ferrandino

A planting of 288 Pinot Gris vines was established in 2004. Half of the vines are on 101-14 rootstock, and the other half are on C3309. Vines on C3309 have had greater winter mortality and increased incidence of crown gall. Horticultural oil was applied at bloom in 2006-2008. Application of oil reduced photosynthesis and fruit set, resulting in less compact clusters that may be more resistant to late-season fruit rot diseases. This summer, the half-acre plot is being used to measure detailed wind statistics in the vineyard.

57. Hybrid and Vinifera Winegrape Cultivar Trial

Ms. Joan L. Bravo and Dr. Francis J. Ferrandino

This vineyard was planted in late spring, 2008. Some of the new cultivars are selections from breeding programs at Cornell University and the University of Minnesota and have not yet been released, while others are newly available cultivars from cool and cold climate areas of Europe. The new cultivars are being compared to established cultivars. Another smaller cultivar evaluation plot has been established at the Windsor station.

58. Butternut Squash Trials

Dr. Abigail Maynard

Winter squash varieties such as butternut, buttercup, acorn, and Hubbard have long been favorite fall crops for vegetable growers who operate roadside stands and attend farmers' markets. An Experiment Station survey of vegetable growers found that 93% grow winter squash with butternut squash the most popular. Consumers often purchase by the bushel because they store well and can be eaten well into the winter months. Most squash varieties are long-vined and discourage home growers with limited space. New cultivars have been developed that produce fruit on shorter vines, allowing closer spacing. We are evaluating the yield and quality of 5 semi-bush butternut squash varieties and comparing them to 5 traditional long-vined varieties. Last year, Ultra (long-vined) has the greatest yields (21.6 lbs./plant) followed by Atlas (semi-bush) (15.2 lbs./plant). This 3-year trial is repeated at our Valley Laboratory in Windsor.

59. Sweet Potato Trials

Dr. Abigail Maynard

A 1998 Connecticut Department of Agriculture survey showed that sweet potato is one of the most popular specialty vegetables. In the South, the sweet potato is also called yam, but both are identical species. In the United States, North Carolina and Louisiana are the leading producers where they are grown in hilled soil. Since they have a long growing season and thrive in warm soil, they have always been grown in the Northeast with black plastic mulch. However, black plastic mulch and hilling the soil increases both the labor and the cost per acre of producing the crop. In this trial, we are determining whether black plastic mulch and hilled soil are necessary for optimum production of sweet potatoes in Connecticut. We have 4 treatments: black plastic/flat soil, black plastic/hilled soil, no mulch/flat soil, and no mulch/hilled soil. In this way, we will determine which cultural method for growing sweet potatoes is the most productive and economically the most feasible. Last year, the greatest yields were from the black plastic/flat soil (7.2 lbs./plant) compared to black plastic/hilled (6.9 lbs./plant), bare soil/flat (4.1 lbs./plant), and bare soil/hilled (3.9 lbs./plant).

60. Heirloom Tomato Variety Trials

Dr. Abigail Maynard

In 2012, tomatoes were the most popular vegetable crop grown in Connecticut with 631 farms growing the fruit. According to an Experiment Station survey, 78% of tomato growers grow heirloom tomatoes. A strong market for heirloom tomatoes has developed because home gardeners and consumers seek tomatoes with excellent flavor in a variety of colors, shapes, and sizes. Consumers perceive that heirlooms taste better and have thinner skins than hybridized tomatoes. Heirloom tomatoes provide an excellent opportunity for local growers, despite several production problems. Most heirloom tomatoes have little disease resistance. In addition, because their skin is tender, heirloom varieties may crack easily. Earlier variety trials were conducted on heirloom tomatoes 2004-2006 and 2007-2009 in which a total of 57 varieties were evaluated. A 2018 catalog from Totally Tomatoes lists 138 different heirlooms. In this trial, we are evaluating the yield and quality of 10 (previously not tested at CAES) heirloom tomato varieties here at Lockwood Farm and at our Valley Laboratory in Windsor. This is the first of a 3-year study.

61. Brussels Sprouts Trials

Dr. Abigail Maynard

Brussels sprouts are related to other better-known vegetables in the mustard family including broccoli, cabbage, and cauliflower. Typically, it is grown as an annual and the axillary buds, which resemble miniature cabbages, are harvested either by hand with several harvests of 5-15 sprouts, or by cutting the entire stalk at once for processing. Each stalk can produce 2-3 lbs. per stalk. Brussels sprouts grow best in temperature ranges of 45-75^{o}F with the highest yields at 60-65^{o}F. Quality does not decrease from freezing, and, in fact, sprouts are considered to be sweetest after a frost. Sprouts that develop in hot weather often do not form compact heads and can be bitter. In this trial, we are growing 10 cultivars of Brussels sprouts to determine which performs best in Connecticut's climate and soils. In addition, we are growing the crop with and without black plastic mulch. Black plastic mulch controls weeds. However, as Brussels sprouts are cool-loving plants and black plastic raises the soil temperature, it is important to determine the effect of plasticulture on the yield and quality of marketable sprouts in Connecticut. Last year, Jade Cross E averaged the greatest yields (108 sprouts/plant) with Dagon with the second greatest yields (89 sprouts/plant). There was no difference in yields between the plots amended with black plastic mulch and plots with bare soil. This 3-year trial is also repeated at our Valley Laboratory in Windsor.

62. Hops – Variety Evaluation and Integrated Pest Management

Dr. James A. LaMondia *Assisted by* Ms. Michelle Salvas

There is wide interest in the production of locally grown hops among commercial growers, craft brewers, home brewers, and hobby gardeners. CAES scientists have established two hop yards with several cultivars using high and low trellis systems at the Lockwood Farm in Hamden and at the Valley Laboratory in Windsor. The main hop yards with five varieties have proven the general feasibility of successful hop production in CT. In 2016 and 2017, 23 more varieties were planted at Lockwood Farm, in total 46 varieties over the last 4 years, and 10 more varieties were planted in Windsor. We are evaluating growth, yield, disease resistance, and quality characteristics for this large number of hop varieties to enable growers to plant suitable varieties for successful commercial production. Not every variety does well in CT. We have also developed an IPM program for the most common diseases and pests such as downy and powdery mildew, two-spotted spider mites, potato leafhoppers, hop aphids, and weeds. The IPM program includes cultural, biological, and chemical controls in a region-specific approach, which includes intensive scouting and timely control measures.

OUTSIDE EXHIBITORS (63-81)

63. Connecticut Botanical Society

Ms. Truda Steinnagel, Mr. David Yih, and Mr. Frank Kaputa

We are a group of amateur and professional botanists who share an interest in the plants and habitats of Connecticut and the surrounding region since it was founded in 1903. We strive to increase knowledge of the state's flora, to accumulate a permanent botanical record, and to promote conservation and public awareness of the state's rich natural heritage.

We have goals to:

1.) Build awareness of the botanical resources in other CT groups' beloved places, and in the neighborhoods of our members.

2.) To have a site where people feel comfortable posting photos of plants and asking for help with ID, to encourage hands-on botany.

3.) From a practical standpoint, a place to post weather updates and supplemental directions for the nearly weekly CBS field trips, and lectures and indoor programs as well.

4.) A place to share informal photos of botanists exploring together, to increase membership and build our sense of camaraderie.

5.) A place to resolve serious identification challenges or post photos of new varieties for scientific feedback from the experts among us.

Our social media connections are: www.ct-botanical-society.org; www.facebook.com/pages/CT-Botanical-Society/486881834720804; www.facebook.com/CTNotableTrees; trudalynns@gmail.com; 860-235-1914.

64. Connecticut Department of Labor / CONN-OSHA
Ms. Catherine Zinsser
The Connecticut Department of Labor's Division of Occupational Safety and Health is referred to as 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. In addition to having enforcement responsibilities in the public sector, CONN-OSHA provides on-site consultations to both public and private sector employers. The mission of the Connecticut Consultation Program is to provide timely, courteous, and professional service to Connecticut employers to help them recognize and control workplace hazards and prevent work-related injuries, illnesses, and fatalities. Our consultants also provide assistance in developing and implementing effective safety and health programs. These consultations are provided at the request of the employer and are free of charge. CONN-OSHA 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.
http://www.ctdol.state.ct.us/osha/osha.htm; 860-263-6942.

65. Connecticut Department of Energy and Environmental Protection: Wildlife Division
Mr. Paul Benjunas and Ms. Laura Rogers-Castro
The CT DEEP Wildlife Division is mandated to conserve Connecticut's wildlife through a program of research, habitat management, and outreach. We will be displaying hands-on materials, and will provide information on current wildlife issues.
www.ct.gov/deep/wildlife; 860-424-3036.

66. Connecticut Department of Agriculture
Ms. Rebecca Eddy
The Connecticut Department of Agriculture's mission is to foster a healthy economic, environmental and social climate for agriculture by developing, promoting and regulating agricultural businesses; protecting agricultural and aquacultural resources; enforcing laws pertaining to domestic animals; and promoting an understanding among the state's citizens of the diversity of Connecticut agriculture, its cultural heritage and its contribution to the state's economy. www.CTGrown.gov; 860-713-2503.

67. Connecticut Environmental Council
Ms. Erica Fearn
Building Blocks For Success: Observe, Identify, Solve, and Prevent. Every backyard boss needs an integrated pest management (IPM) strategy. Learn more about building blocks for success. www.ctenvironmentalfacts.org, efearn@environmentalfacts.org; 860-586-7508.

68. Connecticut Farmland Trust
Ms. Brianna Dunlap and Ms. Kathleen Doherty
Connecticut Farmland Trust is a statewide nonprofit organization working to protect farmland from the constant threat of development. Keeping land in farms helps establish a local, sustainable food system, supports our economy, and contributes to improving the quality of land, air, and water. Our goal is to make working lands available to Connecticut farmers for the indefinite future. www.ctfarmland.org; outreach@ctfarmland.org; 860-247-0202.

69. Connecticut Horticultural Society
Ms. Cheryl Marino
The Connecticut Horticultural Society is an educational organization dedicated to encouraging and improving the practice of gardening and the dissemination of horticultural information to its members and the public. The society through its many and varied programs seeks to encourage the enjoyment, appreciation and understanding of plants, the environment, and the art and science of gardening. Established in 1887, we are a 501(c)3 non-profit, membership-supported organization with an office in Rocky Hill. The society was established as a means for estate gardeners, florists and gardening enthusiasts to socialize, share their common interests and learn from each other. Its hallmark has always been an off-season speakers program featuring experts in the art and science of horticulture. Over time its offerings to members have expanded to include hands on workshops and a travel program. For nearly five decades, the society has honored and supported students of horticulture with scholarships. Each February, for more than forty years, the society has participated in the CT Flower & Garden Show as a branding and membership opportunity that helps promote its educational mission to show-goers. We welcome others to join our organization in promoting healthy horticultural practices in Connecticut. www.cthort.org; membership@cthort.org; 860-529-8713.

70. CT NOFA Northeast Farming Association
Mr. Patrick Corelli
CT NOFA Educators of Organics, The Northeast Organic Farming Association of CT's mission is to ensure the growth and viability of organic agriculture, organic food, and organic land care. We envision a healthy, organic Connecticut founded on ecologically,

socially, and economically just principles. In addition to our food-based initiatives, we also run the NOFA Organic Land Care program to train the next generation of organic landscapers, land managers, and conservationists. www.ctnofa.org; pat@ctnofa.org; 203-308-2584.

71. CT Professional Timber Producers Association
Mr. Brennan Sheahan
Our organization represents the forest products industry within the State of Connecticut. The mission of the Association is 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. The Association strives to enhance the image of the industry by:

- Communicating information to members.
- Instituting ethical guidelines and demanding a high degree of professional ethics among its members.
- Establishing forest practice standards for the timber harvesting and forest products profession.
- Promoting safety within the profession.
- Promoting Best Management Practices for the timber harvesting profession.
- Promoting education in the fields of forestry, timber harvesting, & forest products both within and outside the Association.
- Promoting superior utilization of forest products.
- Promoting the use of Connecticut wood products.
- Publishing a Connecticut Forest Profession Directory and a periodic newsletter.

Contact us at www.timproct.org; Sheahan@hullforest.com; 860-948-0432.

72. Federated Garden Clubs of Connecticut, Inc.
Ms. Polly Brooks
The Federated Garden Clubs of Connecticut, Inc. is an educational, charitable organization made up of over 6,500 individual members, 123 clubs and 23 affiliated organizations. We offer National Garden Club Schools to the public as well as to members. We welcome opportunities to assist those in search of a garden club, and are always delighted to participate in Plant Science Day. www.ctgardenclubs.org; MLBrooks@optonline.net; 860-567-4292.

73. Lyman Hall High School Agricultural Science and Technology Program
Ms. Emily Picard
Lyman Hall High School's Agricultural Science is a hands-on program that supplements a regular academic curriculum. Students choose one agricultural field to specialize in for their four years including plant science, ag mechanics, wildlife biology, food science, large animal science, small animal science, and aquaculture. Students learn through classroom and laboratory instruction while developing skills to apply this in real-world settings. The program offers enrollment to students from 9 sending towns, including West Haven, East Haven, Branford, North Branford, North Haven, Hamden, Meriden, Cheshire and Wallingford. Students entering 8th grade who are interested in applying should talk to their guidance counselors in the fall or contact the ag science program directly. For more information, go to www.LHAgEd.org; epicard@wallingfordschools.org; 203-927-9193.

74. Sleeping Giant Park Association
Ms. Julie Hulten
Sleeping Giant Park Association is a "friends' group" founded in 1924 and dedicated to preserving open space for recreational and nature study purposes on Sleeping Giant. Our efforts include monitoring and controlling invasive plant species, monitoring invasive insect activity, maintaining a pollinator garden, trail maintenance, and educating the public in these areas. To encourage exploration of the Giant we offer at least 15 guided and/or themed hikes throughout the year and promote hiking through our Giant Master's program (hike all 32 miles for a badge and certificate). We welcome all who hold the Giant dear. www.sgpa.org; Julie.hulten@gmail.com; 203-407-1818.

75. The Sound School
Ms. Pebbles Lacross
The Sound School Plant Technology Department is made up of students from New Haven who learn about a variety of topics including Plants, Greenhouse Management, Bee Keeping, Maple Sugaring, etc. This summer, students will participate in activities such as helping at the CAES Lockwood Farm, maintaining the Sound School/ City Points Community Garden and other plant activities. www.soundschool.com; pebbles.lacross@new-haven.k12.ct.us; 860-874-2456.

76. South Central Connecticut Regional Water Authority

Ms. Kate Powell, Ms. Lisa DiFrancesco, Mr. Jeff Yale, Mr. Ron Walters, and Ms. Nicole Smith

The South Central Connecticut Regional Water Authority is a non-profit public corporation. We own more than 27,000-acres of land and provide a wide array of recreational opportunities and water-related services. Through our Whitney Water Center, we offer hands-on water science programs to thousands of students annually. On average, we supply 46 million gallons of water a day to a population of some 430,000 persons. We provide water and other services in all or portions of Ansonia, Bethany, Branford, Cheshire, Derby, East Haven, Hamden, Milford, New Haven, North Branford, North Haven, Orange, Seymour, West Haven and Woodbridge. We own land in Beacon Falls, Guilford, Killingworth, Madison, and Prospect. Our display emphasizes the importance of forest management practices in maintaining healthy land around our reservoirs and the impact on water quality. http://www.rwater.com; kpowell@rwater.com; 203-777-1142.

77. UCONN Extension Master Gardener Program

Mr. Jude Hsiang and Ms. Cheryl Cappieli

The UCONN Master Gardener Program trains volunteers who provide science-based horticultural information to CT home owners and collaborates with community organizations such as schools, community gardens, land trusts, and more. We have information on a wide variety of horticultural and environmental topics. The UConn Extension Master Gardener Program is an Educational Outreach Program of the University of Connecticut Extension System. The University of Connecticut is an Equal Opportunity Employer and Program Provider. New Haven County Extension Center, 305 Skiff Street, North Haven, CT 06473; 203-407-3167; http://mastergardener.uconn.edu/

78. US DEPARTMENT OF LABOR / OSHA

Ms. Leona May

Our agency's purpose is to assure safe and healthy working conditions for working men and women. We have literature available on topics including, but not limited to: chemical safety, tree trimming, chain saws, wood chippers, heat stress, teen worker safety, and construction. Our local offices are located in Hartford and Bridgeport, CT. To contact your local office call: Hartford 860-240-3152 or Bridgeport 203-579-5583. The Federal website is: www.osha.gov

79. USDA Farm Service Agency

Ms. Kathy Dangelo and Ms. Teresa Peavey

USDA Farm Service Agency delivers timely, effective programs and services to meet the needs of America's farmers and ranchers to sustain our nation's agricultural economy. For more information, visit us at http://www.fsa.usda.gov; 203-269-6665 x100.

80. Connecticut Farm Bureau Association

Ms. Joan Nichols

The Mission of the Connecticut Farm Bureau is to elevate the stature of agriculture in our state. Through education, market promotion and legislative advocacy, we strive to increase farm income and to improve the quality of life not only for Connecticut farmers, but also for their consumers. www.cfba.org 860-768-1100.

81. USDA, Animal and Plant Health Inspection Service, Plant Protection and Quarantine

Mr. Eric Chamberlain and Mr. Ken DiVito

APHIS-PPQ safeguards U.S. agriculture and natural resources against the entry, establishment, and spread of animal and plant pests and noxious weeds. Fulfillment of its safeguarding role ensures an abundant, high-quality, and varied food supply, strengthens the marketability of U.S. agriculture in domestic and international commerce, and contributes to the preservation of the global environment. 203-741-5643. http://www.aphis.usda.gov/aphis/ourfocus/planthealth Eric.a.chamberlain@aphis.usda.gov

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

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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.

Revised: July 9, 2018

NOTES

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: WWW.CT.GOV/CAES
or just scan our QR code below with your smartphone.

Revised: Wednesday, July 11, 2018, 2:25:19 PM