

The Connecticut Agricultural Experiment Station



At a Glance

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Established – 1875

Statutory authority – CGS 22-79 – 22-118

Central office – 123 Huntington Street, New Haven, CT 06511

Number of employees – 94

Recurring operating expenses:

General Fund – \$ 7,350,753

Federal Funds – \$ 3,392,146

Other – \$ 1,095,328

Total – \$ 11,838,227

Organizational structure – Administration, Analytical Chemistry, Entomology, Environmental Sciences, Forestry & Horticulture, Plant Pathology & Ecology, Valley Laboratory (Windsor, CT), Griswold Research Center (Griswold, CT).

Mission

The mission of The Connecticut Agricultural Experiment Station is to develop, advance, and disseminate scientific knowledge, improve agricultural productivity and environmental quality, protect plants, and enhance human health and well-being through research for the benefit of Connecticut residents and the nation. Seeking solutions across a variety of disciplines for the benefit of urban, suburban, and rural communities, Station scientists remain committed to “Putting Science to Work for Society, Protecting Agriculture, Public Health and the Environment” a motto as relevant today as it was at our founding in 1875.

Statutory Responsibility

Statutory responsibilities for The Connecticut Agricultural Experiment Station (CAES) focus on insects, ticks, plants and related diseases, and the development of methods to reduce pesticide use (i.e., integrated pest management). Within available resources, field and laboratory studies are conducted, as determined by the agency’s Board of Control, state residents (e.g.,

growers), or as requested by the General Assembly, pursuant to Connecticut General Statute (CGS Section 22-81). Scientists and technicians analyze food and other items at the request of any state agency; test ticks for the infectious agents that cause Lyme disease, Babesiosis and Anaplasmosis upon request of a state or municipal health officer or for scientific research purposes; test mosquitoes for public health threat from encephalitis viruses (CGS Sec 22-81a); oversee official control, suppression or extermination of insects or diseases, which are or threaten to become serious pests of plants; conduct research on integrated pest management (CGS Section 22-84a); inspect for diseases of honey bees and register beekeepers (CGS Sections 22-89, 22-90); and survey towns for gypsy moth, Asian longhorned beetle, Emerald ash borer, and other insect pests of economic or public health importance. In many instances, there are interactions with scientists or other officials in federal agencies. The Director is in charge of all matters pertaining to serious pests of plants and has regulatory authority (CGS Sections 22-84); responsibilities include the inspection and certification of nurseries, the registration of dealers of nursery stock, and enforcement of federal and state quarantines or regulations. Findings are reported to the public and scientific community by correspondence, lectures, media interviews, the agency's website, or published works. Emphasis is placed on submitting scientific manuscripts to peer-reviewed journals.

Station staff members provide prompt answers to routine and difficult but important agricultural, food safety, forestry, environmental, consumer protection, or public health questions by performing analyses; providing services to state residents; assisting small and large businesses, municipalities, state agencies and the scientific community; and by giving oral and written reports of research findings. Transferring new scientific information to the public and businesses is a high priority. The enhanced agency website (WWW.CT.GOV/CAES) continues to be an efficient means of communicating research findings and reducing operating costs. There were 173,350 sessions, 385,284 page views and 111,514 users during this reporting period. The average session duration was 2:04 minutes. Social media is also being used to reach out to our constituents via Facebook www.facebook.com/CT.CAES, Twitter www.twitter.com/CT_CAES, and YouTube Channel www.youtube.com/user/CTAGEXPSTATION. CAES also maintains a Wikipedia page http://en.wikipedia.org/wiki/Connecticut_Agricultural_Experiment_Station. Staff members gave 1,094 talks and interviews to civic groups and the media. One open house event was held at our Lockwood Farm facility during the summer; more than 1,183 state residents had an opportunity to meet scientists, hear presentations on scientific progress, see experimental plots and laboratories, and to make comments on research and outreach programs. Tapings of the event are available on the CTN, Connecticut Network, <http://www.ctn.state.ct.us/>

Public Service

Public service remains a high priority. The CAES serves a diverse group of state residents, large and small businesses, municipalities, and the scientific community within its areas of expertise. More than 48,000 jobs in agriculture, wood-products industry, and other business sectors are supported by the services provided by CAES staff members. People bring or mail samples or call with questions to the New Haven or Windsor facilities. Extensive contacts with state residents are particularly important for the early detection of emerging insect or plant disease problems. Global marketing of plants and plant products increases the chances for the introduction of invasive pests, such as the Asian longhorned beetle, Emerald ash borer, Southern pine beetle, and boxwood blight. The Emerald ash borer (EAB) was first detected in

Connecticut on July 16, 2012 and has subsequently spread through a large portion of the state. The internal state quarantine for EAB was dropped in 2014 and all of Connecticut became part of the larger federal EAB regulated area. State regulations control the movement of wood and other regulated articles into Connecticut. Expanding its range, the Southern pine beetle was detected in Connecticut on March 17, 2015 and attacks 'hard' pines such as red pine, Scotch pine, Austrian pine, and our native pitch pine. More than 41,000 state residents received direct assistance from staff members at the CAES during the past year. Station scientists also visit farms when difficult or unique problems arise and provide information to growers and the media when asked. In addition, scientists served on advisory boards and provided information to more than 150 stakeholder organizations. Employees of other state agencies, such as the Departments of Agriculture, Consumer Protection, Public Health and Energy and Environmental Protection, also requested help from Station staff members when they sent specific samples for chemical, biological or microscopic analyses. All of these activities helped identify emerging problems, facilitated prompt and accurate responses to state residents' inquiries, and ensured safe foods and other products. Receiving comments from citizens on evaluation or survey forms at public workshops, open house events, and other agency functions helps administrators gauge the effectiveness of research programs and services, and provides opportunities to realign program goals. In addition, there is an annual assessment of whether or not objectives listed in the agency's 5-year strategic plan are being achieved. This strategic plan and accomplishment reports are requirements for USDA funds. Both documents are reviewed annually by federal officials.

New testing procedures are developed as needed to improve analyses, particularly when samples require more sensitive and specific methods. Scientific research at the CAES involves identifying a problem, investigating existing published knowledge, and designing experiments which will provide new information to help solve the problem, enhance Connecticut's economy, or improve the well-being of state residents. In many instances, scientific results have impacts nationally.

Specific examples include the following:

- **Food Safety:** Connecticut General Statute [Sec. 22-81(c)] directs the CAES to conduct analyses as required by any state agency. In addition, CAES chemists work closely with the US Food and Drug Administration (FDA) in the Food Emergency Response Network (FERN). After completing a 5-year \$2 million grant from the FDA for the FERN last year (August 2015), CAES has successfully acquired an additional 5 years of funding (\$1.89 million) through 2020 that will expand both state and federal food safety activities at the Station. Separately, CAES is in the final year of a 5-year \$1.5 million FDA grant to achieve ISO Accreditation as described in the Food Safety Modernization Act (FSMA); our accreditation application package was submitted to the American Association for Laboratory Accreditation in June of 2016. Last, in conjunction with the CT Department of Agriculture, CAES has been awarded a third 5-year FDA grant (\$750,000) to bring animal feed analysis under ISO accreditation as described in FSMA. Recent work with the FDA has centered on CAES staff validating a new instrument platform, liquid chromatography with high resolution mass spectrometry, for the detection of contaminants in fresh and manufactured food. Based on performance to date, FDA is now strongly considering deployment of this platform throughout its own regulatory laboratories. CAES chemists are also actively using this new platform in many of our state programs. CAES chemists completed participation in a FDA method validation for the determination of nine heavy metals in a wide range of

foods; this method will be used by both the FDA and CT on food samples from foreign and domestic producers. In addition, CAES chemists are preparing to use this newly validated method to analyze samples for FDA as part of a European Union (EU) assignment; this will involve determining the metal content of milk bound for export to the EU. CAES chemists also participated in a method development assignment from the FDA Center for Food Safety and Applied Nutrition; this assignment involved the determination of part per billion levels of ten mycotoxins in a range of food products. CAES chemists have continued to participate in FDA Working Groups that are developing more robust and accurate methods to detect mycotoxins and antibiotics in food. Two CAES staff chemists have continued to serve as primary instructors for FDA training courses that deploy FERN food safety methods to both federal and state laboratories across the country. With increased international food sources and more emphasis on large-scale food processing domestically, there is a greater potential for foods and beverages to be contaminated with toxic chemicals, such as pesticides, melamine, mycotoxins, pharmaceuticals and heavy metals. The CAES Manufactured Food Regulatory Program Standards or MFRPS, which is run in conjunction with the CT Department of Consumer Protection and the FDA, serves as the sole chemical surveillance and monitoring effort in the state, assuring that the food supply within CT is free from adulteration and contamination. In addition, CAES chemists provided technical briefings to Special Agents from the Federal Bureau of Investigation Weapons of Mass Destruction Directorate on the potential threats posed by nanotechnology. Last, staff continue to work with 14th Connecticut National Guard Civil Support Team, CT State Police Emergency Services Unit, and CT Department of Public Health Bioterrorism Coordinator as a part of state-wide counter-terrorism programs.

- **Lobster Pesticide Study:** CAES chemists have completed work for the Lobster Pesticide Study 2014 Steering Committee. The CT Department of Energy and Environmental Protection (DEEP) initiated formation of the Committee, which also includes the US Environmental Protection Agency and the Pyrethroid Working group, after investigators at the University of CT (UCONN) reported preliminary findings of significant concentrations of synthetic pyrethroids in Long Island Sound (LIS) lobsters. Subsequent analysis by CAES was unable to confirm those findings. After CAES and UCONN completed a full method validation study that was approved by the Committee, we analyzed meat and hepatopancreas samples from 45 newly harvested LIS lobsters. No pyrethroids or related contaminants were detected in any of the samples; a final report is available through DEEP.
- **Mosquito-Borne Disease Surveillance:** Mosquito surveillance for eastern equine encephalitis (EEE) and West Nile virus (WNV) is integral to the public health response to these mosquito-transmitted diseases in Connecticut and provides an effective early warning system for citizens of the State (CGS Section 22-81a). CAES scientists and technicians monitor mosquito and encephalitis virus activity at 91 trapping sites from June through October. In 2015, a total of 177,509 mosquitoes representing 41 species were trapped and tested. WNV was detected in 157 mosquito pools collected at 29 sites in 24 towns in 6 counties (Fairfield, Hartford, Middlesex, New Haven, New London, and Windham). The first positive mosquitoes were collected on July 20, and the last on September 29. The majority of WNV activity was detected in densely populated urban and suburban regions in southern Fairfield and New Haven counties. Ten human cases of WNV-associated illness were locally acquired (8 = encephalitis/meningitis, 2 = fever) with no fatalities. Date of onset ranged from August 9 to October 9. Human cases were temporally and spatially

consistent with WNV isolations from mosquito pools. No equine cases of WNV infection were reported. There were no EEE isolations made from mosquitoes, and there were no equine or human cases reported. CAES continues to closely monitor the expansion in Connecticut of two exotic mosquito species from Asia, *Aedes albopictus* (Asian tiger mosquito) and *Aedes japonicus*, which are aggressive human biters and have been implicated in the transmission of several human pathogens, including dengue, chikungunya, EEE, and WNV.

- **Invasive Aquatic Plants:** CGS Section 22-81(c) directs the CAES to perform experiments on plants. Invasive aquatic plants have been introduced in Connecticut from other parts of the world. With no natural enemies, they spread rapidly and threaten the ecological and recreational value of Connecticut's lakes. Since 2004, the CAES Invasive Aquatic Plant Program (IAPP) has completed aquatic vegetation surveys of 206 Connecticut lakes and found 60% contain invasive plants. A total of 44 water bodies have been resurveyed, at least five years later, to determine how invasive plants are changing the quality of lakes over time. In addition, Lake Candlewood, Connecticut's largest lake, was surveyed for the ninth consecutive year to determine the effects of alternate year deep and shallow winter drawdown on Eurasian watermilfoil (*Myriophyllum spicatum*), minor naiad (*Najas minor*) and curlyleaf pondweed (*Potamogeton crispus*). Lakes Lillinonah, Zoar and Squantz Pond were also surveyed to track changes in the population of invasive species. Government and local officials request CAES assistance in finding methods to protect their bodies of fresh water. In fiscal year 2015-16, CAES IAPP surveyed 20 lakes and performed multifaceted research including: the effects of winter drawdown and grass carp (*Ctenopharyngodon idella*) on Eurasian watermilfoil in Candlewood Lake (Danbury), and the efficacy of herbicide treatments of variable water milfoil in Bashan Lake (East Haddam) and Brazilian waterweed in Fence Rock Lake (Guilford). The CAES IAPP has extensive public outreach via workshops, speaking engagements and a comprehensive web site available at www.ct.gov/caes/iapp. Results are published in scientific journals, technical reports and in CAES bulletins.
- **Tick-Borne Disease Research:** Human cases of Lyme disease are prevalent and other tick-borne diseases are increasing. The fourth year of an integrated tick management project to reduce the abundance of the blacklegged tick and risk of disease using a natural entomopathogenic fungus product (*Metarhizium anisopliae*) and mouse bait boxes is being conducted in the town of Redding. The project is funded by the CDC. The combination of the fungus and mouse bait boxes reduced tick abundance on residential properties by 71-92% over the first three years of the study and there was a significant reduction in the number of ticks feeding on white-footed mice. A new project to evaluate rodent targeted Lyme disease vaccine bait was continued at homes in the town of Redding. There was high acceptance of the bait, with 81-92% of mice showing evidence of a wildlife marking dye placed in the bait.
- **Tick Testing Program:** Tick testing for infectious agents that cause human disease is freely available to State residents. The objectives are to: 1) examine ticks for evidence of infection in order to better understand the epidemiology of tick-associated diseases in Connecticut, 2) inform residents of any potential health risk, and 3) assist physicians and residents concerning treatment. In 2015 the Tick Testing Laboratory was expanded to test blacklegged ticks, *Ixodes scapularis*, for the two additional pathogens. In the past, testing was limited to *Borrelia burgdorferi*, the Lyme disease agent, but in view of increasing human cases of tick-related illnesses in the state, testing has been expanded to include *Anaplasma*

phagocytophilum, the causative agent of Human Granulocytic Anaplasmosis, and *Babesia microti*, the causative agent of Babesiosis, for which 4.4% and 8.2% of ticks have tested positive, respectively, during 2015-2016. New molecular-based testing methods have additionally been implemented to reduce the average turnaround time to three days or less representing a significant enhancement of the tick testing services.

Improvements/Achievements 2015-2016

Statutory authority (CGS 22-82a) permits the CAES to seek patents, trademarks, and licensing agreements. License agreements have been established for a new cultivar of strawberry and a disease-resistant tobacco cultivar. Portions of the royalties are being used for operating costs and reinvesting into the crop research programs.

Efforts continue to reduce energy and other operating costs to become more efficient in performing research and delivering services to our residents. The agency has actively participated in the Governor's Lead by Example Energy Efficiency Program over the years. The agency has converted all interior and exterior lighting to LED technology, changed over from heating oil to natural gas to heat out buildings and is in the process of replacing old drafty windows with energy efficient windows to lower heating and other operating costs. Our Jenkins-Waggoner Laboratory building which opened in January, 2015 received a federal LEAD gold energy efficiency certification.

Plant pathologists at the CAES continued their research on boxwood blight, a disease caused by the fungus *Calonectria pseudonaviculata*. New to North America, the disease was first detected on boxwoods in nurseries in Connecticut in 2011 and on pachysandra in landscapes in 2012. This disease has continued to spread and is now found in 16 other states in addition to three provinces in Canada. Boxwood is an economically important crop for the Connecticut nursery industry and is a popular ornamental plant in landscapes. With input from the nursery industry, personnel at the CAES responded to industry concerns by researching and developing best management practices (BMPs) in the mitigation of boxwood blight; these BMPs are suitable for use by landscapers, commercial plant producers, as well as homeowners. Research programs at CAES have made advances in developing molecular tools for early detection in plants, soil, and water, understanding survival and longevity of the fungus on hard surfaces in nursery production, identifying effective sanitizers for disinfecting tools and equipment, identifying effective fungicides and spray programs to prevent new infections, fungicides capable of curative activity for up to 48 hours after infection, boxwood accessions with resistance to infection, and understanding the genetic mechanisms underlying the potential for fungicide resistance. BMPs have been updated whenever new, science-based information from our ongoing research programs becomes available. BMPs and basic information on the fungus (including pictures of infected plants) are posted on the CAES website (www.ct.gov/caes).

New programs in Plant Pathology have also been initiated on the molecular genetics of plant pathogenic bacteria. Efforts are underway to advance our understanding of the host/pathogen interactions using genomics and transcriptomic analysis along with new phylogenetic studies to assess the relationships between pathogenic and nonpathogenic bacteria.

CAES scientists are increasing our knowledge and understanding of the appropriate selection, location, and maintenance of trees in urban and suburban spaces to increase utility reliability, public safety, public health, environmental benefits, and reduce costs and risks for municipalities. Roadside trees and branches that fall during severe weather often cause extended

power outages and extensive road blockages. CAES foresters are collaborating with utilities, environmental groups, land owners, and other state agencies to develop practical, cost-effective protocols to proactively foster healthy, storm resistant roadside forests by integrating silvicultural and arboricultural practices. Ten demonstration areas including over 4,300 trees have been established throughout Connecticut. Lessons learned on tree selection and coordination from implementation at nine areas are being incorporated into treatments scheduled at the remaining sites.

The CAES reaffirms its continuing policy of commitment to affirmative action and equal opportunity employment as immediate and necessary objectives and relies solely on merit and accomplishment in all aspects of the employment process and research programs. The CAES employed 12 white male, 17 white female, and 6 minority seasonal research assistants during the summer as a part of a mentoring program. The student intern program, designed to teach scientific methods in brief periods, was continued to include 35 persons. The goals of mentoring programs are to promote interest in science and provide specialized training. Station scientists also participated as judges in science fairs in New Haven and Hamden. Through these and other direct interactions, staff encouraged high school students to further their science education. The CAES continues to comply with diversity training requirements and is also participating in the University of Connecticut's Employee Assistance Program. The agency's goals in awarding contracts to small businesses and minority business enterprises were exceeded.

Information Reported as Required by State Statute

Scientists and technicians performed chemical, seed, soil, fertilizer, pesticide, animal feed, mosquito, and tick tests; answered inquiries; conducted plant, nursery, and bee inspections; and surveyed for the gypsy moth and other insect pests as listed below.

Service or Test Number	2015-2016
Inquiries answered (all departments)	26,210
Field visits and diagnostic tests	250
Nematode diagnostics	163
Soil Tests Completed	
New Haven and Windsor	12,208
Samples Tested	
Department of Agriculture	25
Department of Consumer Protection (DCP)	385
Department of Energy & Environmental Protection	82
CAES Departments	221
FDA, Municipal Health Departments, Cities/Towns, and Misc. Foundations	45
UConn Cooperative Extension	12
University Research Collaborations	2,215
Seed Samples Tested (vegetable, lawn, field crop)	261
Consumer Plant Samples Tested	2,270
Wine Grapes Tested	27
Nursery and Seed Inspections	
Greenhouse plants	2,730
Nursery stock containers and bare root	51,982

Perennial plants	1,585
Nursery inspections	699
Tobacco (bales, boxes, bundles, and cartons)	161,333
Permits to move homeowner plants out of state	5
Seed (cartons and bags)	275
Acres of nursery stock inspected	5,000
Gypsy Moth Survey	
Forest acres surveyed for gypsy moth by air	1.8 million
Bee Inspection	
Beekeepers registered	1,488
Beehives examined for mites and foulbrood	1,089
Tick Identification and Testing	
Ticks identified	2,328
Ticks tested for human pathogens	2,328
Ticks infected with <i>Borrelia burgdorferi</i> (Lyme disease)	654 (28.1%)
Ticks infected with <i>Babesia microti</i>	190 (8.2%)
Ticks infected with <i>Anaplasma phagocytophilum</i>	102 (4.4%)
Mosquito Testing	
Mosquitoes trapped, identified, and tested for EEE, West Nile, and other encephalitis viruses	177,509
Number of trapping sites	91