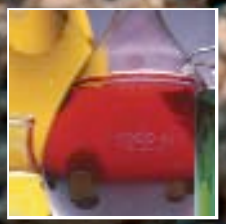
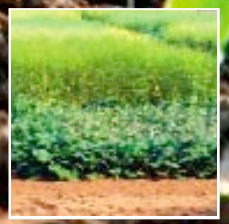
The Connecticut Agricultural Experiment Station

Director's Report

2007–2008





Welcome to The Connecticut Agricultural Experiment Station

Scientists, technicians, and other staff members at The Connecticut Agricultural Experiment Station, a state-supported research institution, have been serving the needs of state residents and the nation since 1875. Important discoveries include the development of hybrid corn, pioneering work that led to the discovery of vitamin A, identification and control of plant diseases, and contributions on ticks and mosquitoes and the disease organisms they transmit. In addition to improving crop systems and reducing damage caused by insects, deer, and plant pathogens, our programs include major initiatives on reducing pesticide use, controlling invasive plants in lakes and ponds, water quality, forestry, growing crops for biodiesel fuel, and on food and product safety issues.

The internet enables us to disseminate information to a broad audience and represents a very effective mechanism for outreach. During 2006-2008, there were 3,905,081 page views to our website: www.ct.gov/caes.

Our main goals are to provide good service to Connecticut residents and to develop and use state-of-the-art scientific procedures to solve problems and improve the quality of life.

Sincerely,

Louis A. Magnarelli

Dr. Louis A. Magnarelli, Director

New Haven Campus

Griswold Research Center

Lockwood Farm – Hamden

Valley Laboratory – Windsor

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Board of Control

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Mr. Leon Zapadka of Bolton, *appointed by the Board of Trustees of the University of Connecticut*

Mr. Paul Larson of Woodstock, *appointed by the Board of Trustees of the University of Connecticut to replace Mr. Zapadka*

Director Louis A. Magnarelli of Durham, *ex officio, appointed by the Board of Control*

PRINTING OF THIS REPORT WAS PAID FOR BY THE LOCKWOOD TRUST FUND & EXPERIMENT STATION ASSOCIATES, INC.

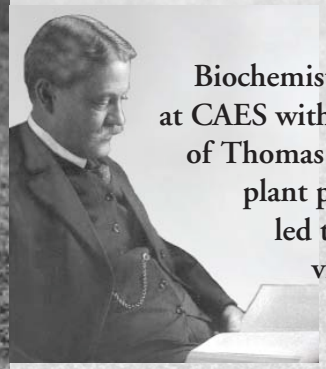
The Station has a 133-year tradition of conducting innovative research and the results are utilized by the residents of Connecticut.

Historic Events at CAES

In 1875, Samuel Johnson, an agricultural chemist at Yale, convinced Governor Ingersoll to establish the nation's first agricultural experiment station.

In 1877, CAES moved from Wesleyan University to the Sheffield Scientific School of Yale in New Haven, Connecticut.

In 1888, six acres of land were purchased from the Eli Whitney, Jr. family on Huntington Street, establishing the current location of CAES.



Biochemistry research began at CAES with the appointment of Thomas Osborne to study plant proteins. His work led to the discovery of vitamin A in 1913.

In 1919, geneticist Donald F. Jones invented a double cross pollination method leading to commercial production of hybrid corn.

Scientific Achievements at CAES

In 1983, Station entomologists developed an antibody test for the diagnosis of Lyme Disease.

In the 1970s, Station scientists were the first in America to utilize hypovirulence to increase survival of chestnuts with chestnut blight disease.

In 1999, Station scientists discovered the introduction of West Nile virus into North America.

In 2002, Station scientists initiated systematic studies on invasive aquatic plants in Connecticut lakes and ponds.

In 2004, Station chemists joined the federal Food Emergency Response Network.

Reaching Out to the Residents of Connecticut

The outreach programs focus on youth groups, including Boy Scouts, Girl Scouts, and school students of all ages. Staff members visit classrooms to give demonstrations and host tours of working labs at the Station. We also host farm tours for students and other citizens' groups at Lockwood Farm and the Valley Laboratory in Windsor.

Donations to the Community

Produce raised at the Lockwood Farm in Hamden, CT and at the Valley Laboratory in Windsor, CT is donated to food banks and to other charitable organizations.

Events Sponsored by the Station

Open House in the Spring, Plant Science Day in August, Nursery and Landscape tours, Christmas Tree Growers, Beginning Farmers, Organic Seed Production, and the Community Farm Coalition.

Station scientists present lectures to the scientific community and to the general public on a variety of subjects, disseminating current information from their research.

Staff members also conduct workshops and teach minicourses for farmers, nursery and landscape professionals, garden clubs, and citizens' groups throughout the state.

Public Service for Connecticut Residents

Soil scientists tested over 19,827 soil samples and answered 2,000 inquiries to advise state residents on growth of turfgrass and gardens. Staff scientists also answer inquiries on household pests including ants, termites, bees, and pantry insects. In addition, our plant disease office advised 12,993 homeowners and a variety of plant care professionals on plant health problems.

Analytical chemists test samples submitted by the Dept. of Consumer Protection, Dept. of Agriculture, and the Dept. of Environmental Protection, maintaining food safety and environmental quality throughout Connecticut. Our laboratory is a member of the Food Emergency Response Network, an integrated team of state and federal scientists responsible for the analysis of samples in the event of a biological or chemical attack on the nation's food supply.

Since 1877, the Station has monitored and reported on insect pests, including ants, termites, bees, wasps, adelgids, and black-legged ticks that carry Lyme disease organisms.

Over 6,000 ticks are identified annually for local and regional health programs. Blood-fed ticks are tested for the causal agent of Lyme disease. CAES participates in community-based programs for the prevention of Lyme disease with the Centers for Disease Control and Prevention.

Mosquito trapping is carried out at 91 permanent stations located in 72 municipalities in the state to assess the threat of West Nile virus to public health. In 2006, 197,793 mosquitoes were tested; there were 219 WNV isolations. Our scientists also visit farms, nurseries, greenhouses, forests, and private landscapes to diagnose problems firsthand.

Budget

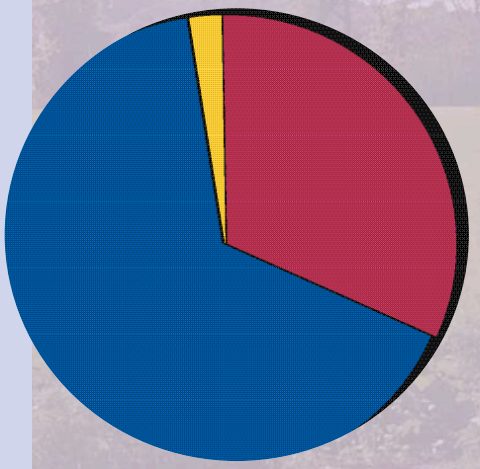
Financial and Position Summary

New Haven – Windsor – Hamden – Griswold

Personnel Summary	2006-2007 (Actual)	2007-2008 (Actual)	2008-2009 (Estimated)
Full-Time Positions			
General Fund	69	70	71
Federal Contributions	30	29	29
Private Funds	1	1	1

Budget Summary	2006-2007 (Actual)	2007-2008 (Actual)	2008-2009 (Estimated)
Personal Services	$ 5,727,042	$ 5,867,415	$ 6,225,651
Other Expenses	704,425	894,852	877,821
Mosquito Control	209,463	215,427	216,170
Wildlife Disease Prevention	72,917	76,799	78,280
Total General Fund	**$ 6,713,847**	**$ 7,054,493**	**$ 7,397,922**
Federal Grants	$ 3,380,256	$ 3,396,170	$ 3,458,987
Other Funds	$ 298,665	$ 258,265	$ 264,358
Total Agency Budget	**$10,392,768**	**$10,708,928**	**$11,121,267**

FY 2008 Funding By Source



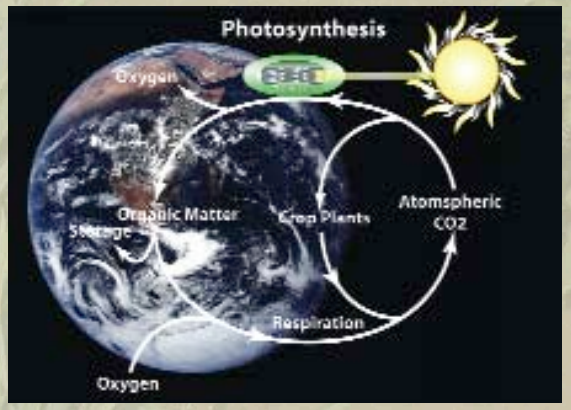
Department of Biochemistry and Genetics

CONTROLLING SOIL-BORNE PESTS

Neil McHale

Many agricultural crops are damaged by nematodes, microscopic roundworms that feed on the plant's root system. Plants in the mustard family *(Brassicaceae)* ward off nematode attack by producing glucosinolates (GSLs), compounds that breakdown to nitriles and isothiocyanates in the soil. We are cloning the genes in *Brassica napus* (canola) that regulate biosynthesis and breakdown of GSLs, and generating transgenic varieties with GSL profiles targeted against the nematodes prevalent in Connecticut's soils.

Impact: Rapeseed cultivars with enhanced nematode suppression would reduce the need for chemical fumigation, reducing the farmers' cost of production and improving environmental quality.



LIMITING SOLAR DAMAGE

Richard Peterson
Neil Schultes

Plant leaves are like solar panels, using solar energy for synthesis of carbohydrate from atmospheric CO_2. During a water shortage, solar energy can be extremely destructive, so plants use a system of secondary pigments that converts excess light energy to heat. Our work is focused on the pigment-binding proteins critical to the operation of this protective process. By cloning and manipulating the genes coding these proteins, we have uncovered key insights on the operation of this photo-protective system.

Impact: This research will open a direct avenue to breeding crop varieties that avoid sun damage during periods of water shortage. This will improve the productivity of marginal farmland substantially, and lower the cost of production under irrigation.

PROTECTING HONEY BEE HIVES

Douglas Dingman

Beekeepers play a critical role in production of crops requiring insect pollination. Early diagnosis of bacterial infections or invasion by parasitic mites is essential for the maintenance of a healthy hive. This program is focused on the bacterium causing American Foulbrood (AFB) disease, a problem often unrecognized in its early stages due to application of antibiotics. We are screening for early infections, developing new sanitation protocols, and investigating the overall effects of AFB on hive health.

Impact: Because agricultural pollination by honey bees contributes greatly to crop yield, pollination services return approximately $150 million annually in the U.S. The annual loss to beekeepers, in equipment and bees, resulting from known AFB infections is approximately $5 million.

Department of Analytical Chemistry

Analytical Chemistry was the foundation of The Connecticut Agricultural Experiment Station at its establishment in 1875 as a separate state agency. Over the ensuing 133 years, the Department has expanded beyond services in support of the agrarian community to encompass work across several focus areas: **ENVIRONMENTAL MONITORING, FOOD SAFETY, NATURAL PRODUCTS.**

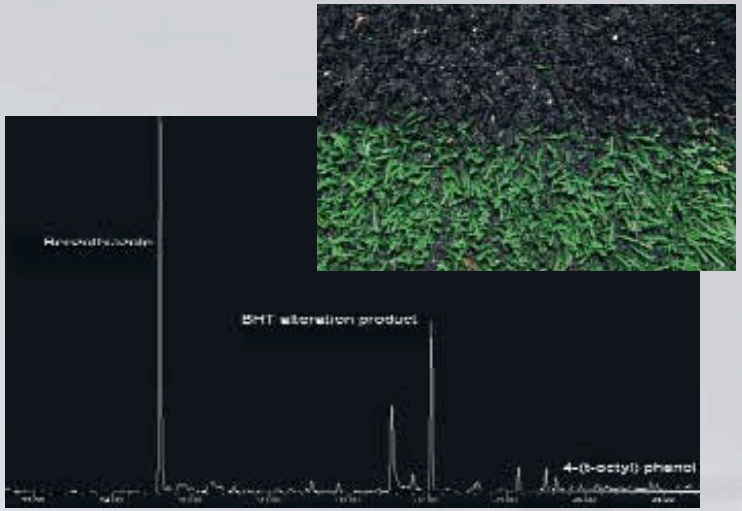
The mission of the Department parallels that of the Experiment Station—to put science to work for society—so as to safeguard the quality of life Connecticut's citizens have come to expect. Its activities include analytical services, research, and outreach to the State of Connecticut and municipal agencies, stakeholders, and the general public.

In 2005, the Department of Analytical Chemistry was selected, through a competitive process, as one of eight state laboratories across the country to receive cooperative agreement funding from the United States Food and Drug Administration as a chemistry participant in the FERN (Food Emergency Response Network).

The administrative challenge was to interface our state work with our federal work for the mutual benefit of both. We are pleased to report that the instrumentation, methodologies, and inter-laboratory communications deriving from our participation in FERN have had an enormous positive impact on every aspect of the work in our Department.

Connecticut's citizens may be assured that surveillance of their food and many consumer products has been greatly enhanced; at the same time, the expertise we have developed in support of vigilance over intentional and unintentional chemical adulteration of food and consumables will benefit counter-terrorism preparedness across our country.

On the next page, we provide an overview of highlights in our Department. Space limitations mandate that only a small portion of exciting, recent accomplishments can be presented. You are invited to visit our laboratory during a scheduled event to learn more.



Analysis revealed the presence of volatile organic chemicals in crumb rubber used for artificial turf playing fields (above).

Department of Analytical Chemistry

FOOD SAFETY

The market basket survey of pesticides in foods sold in Connecticut has been significantly expanded as a result of CAES analysts who have expanded our list of active pesticide ingredients, improved the sample preparation method, and incorporated the Liquid Chromatograph/Mass Spectrometer instrument into the food screening program in order to complement the Gas Chromatography/Mass Spectrometry data.

ENVIRONMENTAL MONITORING

CAES analysts work on the Inductively Coupled Plasma/Mass Spectrometer funded through the US FDA. Using this instrument, they can analyze for a wide range of elements at levels much lower than was possible previously in our laboratory. We have detected lead in children's wooden and plastic toys, which in some instances resulted in national recalls. We also use this equipment to detect heavy metals, such as lead and arsenic, in community garden soil.

NATURAL PRODUCTS

Analytical Chemists have been working with colleagues in Biochemistry and Genetics and scientists at the Valley Laboratory to investigate how oil-seed crops might contribute to agricultural sustainability in New England. The conversion of the plant-based oil to biodiesel, as shown in the panel above, is a well-known reaction. However, certain crops may produce more oil and contribute to soil fertility and an IPM approach to control lesion nematodes via plant-produced biofumigants.

Department of Entomology

TICK PROGRAM

Kirby Stafford III
Louis A. Magnarelli

Lyme disease continues to be an important health concern in Connecticut. Current research has focused on the biological control of the tick with the insect fungus, *Metarhizium anisopliae* Strain 52, which readily kills the ticks in the laboratory and field. A new Centers for Disease Control and Prevention grant focuses on development of natural products for tick control.

Additional studies have led to the development of new diagnostic tests and characterized other tick-associated diseases, such as anaplasmosis, babesiosis, and tularemia in wildlife, domesticated animals, and pet populations. A new tick management handbook is available. **Impact:** Development of new products will provide homeowners with an alternative to conventional insecticides for managing ticks in the landscape.

PLANT INSPECTION SERVICES

Victoria L. Smith

The green industry is the biggest component of Connecticut agriculture. Plant inspectors from the Office of the State Entomologist certify nurseries to conduct intra- and interstate business, issue phytosanitary certificates, and conduct nursery inspections. We assist registered beekeepers through inspections for disease by our apiary inspector. Surveys for exotic pests and diseases, such as gypsy moth and Ramorum blight, and forest health monitoring are also conducted in cooperation with state and federal partners.
Impact: Surveys, inspections and registrations safeguard Connecticut agriculture and forests, assure fine quality of our products, and facilitate commerce.

INSECT INQUIRY OFFICE

Gale E. Ridge

Thousands of inquiries and hundreds of specimens are addressed annually through stakeholder telephone calls, letters, visits, and e-mail. The insect inquiry office served 12,879 people in 2007 and 2008, and around 700 different arthropod species are identified each year. Among the inquiries, 810 (6%) were questions on food crop insects, 3,365 (26%) were on pests of humans or person's dwelling, and 8,704 (68%) were related to natural resources. Ants, termites, stinging insects, hemlock woolly adelgid, pantry pests, and bed bugs continue to be leading pests of concern.
Impact: Residents' concerns about a variety of insects, spiders, and other arthropods were addressed.

Department of Entomology

EXOTIC INSECTS

Chris T. Maier

Some of the earliest reports of The Connecticut Agricultural Experiment Station mention exotic insects introduced into Connecticut. Some of these pests cause significant damage to our farms, nursery fields, and forests. Surveys are currently being conducted to detect new alien insects in the state and to determine the distributional range of established pests. Research also focuses on the behavior of wood-boring insects and biological control of apple pests. A minute parasitic wasp has been released into several orchards to determine if it can control the leaf-mining caterpillars of an introduced moth.

Impact: Surveillance for exotic insect pests and studies of those pests that are already here will help mitigate their threat to our crops and forests.

WOOD-BORING INSECTS

Claire Rutledge

A number of wood-boring insects, such as the exotic Emerald ash borer and Asian longhorned beetle, are threats to the forests and suburban trees of Connecticut. Studies are underway to identify and determine the function of the chemical cues used by wood-boring beetles to locate vulnerable trees. We are also examining beetles' mating behavior and chemistry of mate location. Such research is important in the development of better monitoring methods and control strategies for these destructive pests. We are also conducting surveys of the natural enemies of native wood-boring insects.

Impact: Basic knowledge on the chemical ecology of exotic beetles is important to devising better monitoring and control methods.

HONEY BEES

Kimberly A. Stoner

Ira Kettle

Honey bees are important pollinators under stress from mites, diseases, and possibly pesticides. In order to determine the exposure of honey bees to pesticides in pollen, we are collecting pollen from the hives and testing it for pesticide residues, in collaboration with the Department of Analytical Chemistry, the Apiary Inspector, and state beekeepers. Certain pesticides applied to plants can travel throughout the plant and contaminate pollen and nectar. Honey bees are also exposed to pesticides applied by the beekeepers to control mites in the hive, and these pesticides are also found in pollen.

Impact: Measuring the exposure of honey bees to pesticides in the field is an important step in determining the effects of these chemicals on honey bee health.

Department of Forestry and Horticulture

NEW CROPS PROGRAM

Abigail A. Maynard

There have been vast changes in agriculture in the past three decades. Tobacco and dairy farming, once the largest agricultural industries, have diversified with vegetables, nursery stock, and Christmas trees now occupying over 10,000 acres. The marketing of produce has shifted from wholesale contracts with local supermarkets to direct retail sales at 560 farms and more than 100 farmers' markets.

As the popularity of farmers' markets in Connecticut has surged, so too has the need for growers to find a diversity of high-value niche crops. Since 1983, The Connecticut Agricultural Experiment Station has been investigating specialty crops to provide new opportunities for Connecticut's farmers.

Over 30 fruits and vegetables have been field-tested resulting in the introduction of new cultivars. The crops studied include globe artichoke, Belgian endive, radicchio, pak choi, specialty melons, sweet potato, okra, and Chinese cabbage. These crops were chosen because they have a high market value and an existing or expanding market that would readily accommodate these commodities.
Impact: Improved cultural techniques and awareness of high-yield cultivars, including ethnic vegetables, benefit growers, especially those who serve inner city consumers and others who purchase their vegetables at local farmers' markets.

REDUCING WILDLIFE DAMAGE

Scott C. Williams

Connecticut's deer population has dramatically increased over the past several decades to 70,000 or more. The beauty of these majestic animals has a cost: increased damage to agricultural crops and landscape plantings, high numbers of deer/vehicle collisions, spread of ticks that transmit the Lyme disease organism, and ecological changes.

The resurgence of the Connecticut deer population over the past century coincided with the human population increasing four-fold. This has lead to increased interactions between people and wildlife.

Our research has focused on alleviating human/deer conflicts. The study of deer/vehicle collisions will provide a scientific basis for reducing accidents. Nearly 44% of deer/vehicle accidents occur from October-December, and accidents were more common in areas with high deer density. Results of the deer repellent study indicate large differences among products in effectiveness and ease of application. In other work, we found that deer alter native ecosystems by transporting seeds of invasive species and by preferential browsing of native wildflowers and tree regeneration.
Impact: A more accurate assessment of deer/vehicle collisions and the environmental conditions that increase the probability of accidents will prevent human deaths, human injuries, deer deaths, and economic losses.

Department of Forestry and Horticulture

FOREST MANAGEMENT

Jeffrey S. Ward

Sixty percent of Connecticut is a quilt of forests that filter drinking water, support diverse wildlife habitats, provide outdoor recreational opportunities, and supply wood for a vibrant forest products industry. Responsible stewardship of our forest is a commitment of this generation to provide future generations with healthy, sustainable forests. Ongoing research is developing innovative methods of forest management that extend the period of intact high forest canopy while maintaining forest health. Other studies are examining the potential of prescribed fire to enhance oak regeneration, tree populations in our cities and towns, and forest dynamics over an 80-year period – the oldest such study in the United States.

Impact: A carefully timed series of crop tree releases could increase regional forest productivity by 60%.

GREENHOUSES

Martin P. N. Gent

Greenhouse production is an important component of the agricultural industry in Connecticut with nearly $2,000,000 of sales in 2006. Potted plants can be watered by sub-irrigation or ebb and flood watering, whereby water is supplied through the base of the pot by flooding the bench or floor on which the pots sit. Ebb and flood watering combats the waste of water and fertilizer in traditional overhead watering systems used in greenhouses for production of potted ornamental plants. This research is optimizing watering and disease control strategies for partial saturation ebb and flood watering. Wide adoption of this novel method will reduce fertilizers flowing to watersheds.

Impact: Recirculation of water and nutrient solutions can be used to improve use of fertilizer and eliminate nutrient runoff from greenhouse operations in sensitive watersheds.

VITICULTURE

William R. Nail

The wine grape industry in Connecticut is rapidly expanding. There are currently 22 wineries with more scheduled to open. These wineries add substantially to local economies and ambiance. Wine grape growers face several challenges including cultural information for growing more cold hardy and disease resistant hybrid varieties in the state. Current studies are evaluating cultivars such as Cabernet Franc, Merlot, and Cabernet Sauvignon, along with native varieties and hybrids. Other research is conducted on a wide range of cultural practices, such a root stocks, pruning practices, training methods, graft union height, different spacing intervals, and application of stylet oil to harvest rots and pesticide use.

Impact: This research will allow growers to more accurately assess their sites and select cultivars and management techniques for greater yield, fruit quality, and disease resistance.

Department of Plant Pathology and Ecology

PLANT DISEASE DIAGNOSTICS

Sharon M. Douglas
Botond Balogh

Specialists in the Department's Plant Disease Information Office (PDIO) diagnose plant health problems for all Connecticut residents. This includes Connecticut's farmers and members of the Green Industry, which contribute over 71 percent, or $372.4 million, to the state's economy. We use traditional and molecular tools to provide rapid disease diagnosis and pathogen identification.

The PDIO is a member of the National Plant Diagnostic Network. This system was created to enhance national agricultural security and to protect the nation's borders from intentional or unintentional introduction of exotic pests and pathogens. The PDIO also conducts yearly surveys to determine the types and numbers of plant diseases in Connecticut. These data allow us to evaluate the current status of plant health and enhance our ability to detect new or emerging diseases that could threaten the health of landscapes, forests, and crops in the state. The PDIO has active outreach programs, with fact sheets, web-based information, workshops, town meetings, and presentations for grower groups, garden and horticultural clubs, special interest groups, and students.

Impact: Accurate diagnosis of plant health problems, design and implementation of integrated strategies for disease management, communication, and education of stakeholders reduce pesticides introduced into the environment and waters of Connecticut.

SUDDEN VEGETATION DIEBACK OF SALT MARSHES

Wade H. Elmer

The sudden loss of *Spartina* species in salt marshes was first noted along Connecticut's Long Island Sound shoreline in 2002. This phenomenon, called Sudden Vegetation Dieback (SVD), has been reported from Maine to Louisiana. The cause is unclear, but drought and rising sea levels may have been the initial stressors. What remains unknown is why these areas show no recovery, even years after the dieback initially occurred.

Epiphytic fungi in the genus *Fusarium* were identified on *Spartina* in SVD areas. Our research showed that these fungi could incite black leaf spots and stem rots when inoculated into healthy *Spartina.* Our objective is to determine if these fungi could kill *Spartina* plants that have been predisposed by drought, high salinity, and/or flooding.

Impact: Salt marshes are the most productive ecosystems in New England. They provide habitats for fish, shellfish, birds, and animals. Salt marshes absorb nitrogen, filter toxins, and provide protection for oceanfront property against storm surges. Loss of salt marshes would be devastating to Connecticut's economy. Efforts to decipher the cause of SVD may lead to restoration of dieback sites.

Department of Plant Pathology and Ecology

CHESTNUT RESEARCH

Sandra L. Anagnostakis

Chestnuts were important trees in hardwood forests of Connecticut before the chestnut blight fungus reduced them to understory shrubs during the early 1900s.

Our ongoing breeding program has yielded promising hybrid blight-resistant chestnut trees with good timber or nut qualities. Our research is also focused on developing biological controls for blight and other important diseases and pests of chestnut such as the gall wasp.

Impact: Trees with timber quality promise to return chestnut lumber to its position as an important forest product in the state. Trees yielding nut crops of commercial quality could provide a niche crop of economic value for Connecticut farmers.

GRAPE DISEASE INFORMATION NETWORK

Francis J. Ferrandino

Connecticut's vineyard industry is thriving, with over 40 farms on 320 acres. Production for 2008 is projected at 300,000 gallons and a value of $7–10 million. Wine grapes are challenged by a daunting array of fungal diseases. We are collaborating with scientists and extension specialists at the Universities of Connecticut, Massachusetts, and Rhode Island to develop research-based disease management strategies. This involves on-site measurement of weather, inoculum, and vine development to deliver real-time, disease-risk information to grape growers tailored to their local conditions.

Impact: The economic value of crops will be maintained and the health of vineyard workers and consumers will be protected by reducing or eliminating unneeded pesticide applications.

NEONECTRIA CANKER OF BLACK BIRCH

Robert E. Marra

Neonectria ditissima is a plant pathogenic fungus often considered the most widespread and damaging canker species of northeastern forests. It is particularly devastating to black

birch, a species of increasing abundance in Connecticut. Our research has focused on the ecology and genetics of this pathogen with the goal of gaining a fuller understanding of the life history, evolution, and population dynamics of the organism and its interactions with its hosts. We are using classical and molecular genetics to elucidate the mating structure and dispersal patterns of the fungus.

Impact: Trees infected with Neonectria Canker can persist for decades, although the extensive scarring caused by the cankers renders them of little value for lumber or veneer. Our efforts to understand the biology and natural history of *N. ditissima* will contribute to the identification of effective control strategies.

Department of Soil and Water

MOSQUITO RESEARCH

Theodore G. Andreadis
Philip M. Armstrong
Goudarz Molaei

Research on mosquitoes and mosquito-borne disease agents is a long-standing tradition at The Connecticut Agricultural Experiment Station dating back to 1904. More recently, Station scientists were the first to isolate West Nile virus from mosquitoes in North America and identify the mosquito vectors and wild bird reservoir hosts. Accomplishments have also included the discovery of exotic invasive mosquitoes from Asia and the isolation and characterization of two new mosquito-transmitted viruses in the state.

Current investigations focus on the biology, behavior, and ecology of mosquito vectors of West Nile and other disease-causing viruses. We are also documenting genetic changes in these viruses and exploring for new natural enemies that may be used as biological agents for mosquito control.
Impact: Our research has led to a better understanding of the natural history of West Nile virus in Connecticut.

WEST NILE VIRUS

John F. Anderson
Andy J. Main

West Nile virus is maintained naturally in Connecticut during the warm months of the year in a mosquito-bird cycle and may infect humans. This virus needs another means of survival during winter when mosquitoes are inactive. In late fall, female mosquitoes mate and become dormant without feeding on blood. In spring, surviving females become active and feed on birds or mammals. We have found that some *Culex pipiens* mosquitoes inherit West Nile virus from infected female parents and that the virus survives in unfed females during winter. We have further shown that infected females, which have been dormant for several months, are able to transmit the virus to host animals during their first feeding in spring.
Impact: Our field and laboratory data suggest that West Nile virus survives throughout the year in Connecticut and will remain a threat to citizens for years to come.

INVASIVE AQUATIC PLANT PROGRAM

Gregory J. Bugbee
Charles R. Vossbrinck
Jason C. White

Invasive aquatic plants can displace native species and reduce the aesthetic and recreational value of Connecticut's lakes and

ponds. We began studying the state's lakes in the 1970s and established our Invasive Aquatic Plant Program in 2001. This program combines surveillance and monitoring with the testing of innovative management techniques.

To date, we have mapped aquatic vegetation in 133 lakes and ponds and discovered 11 invasive plant species in 62% of the water bodies surveyed. We are documenting the underlying causes that influence invasion including water chemistry, public access, bathymetry, watershed characteristics, and associated native plants. New techniques in molecular biology more accurately identify invasive species. Innovative methods for managing these plants are being investigated. Results may be viewed at our web page (www.ct.gov/caes/iapp).
Impact: The survey data are being used to direct specific protocols for weed management in lakes.

Department of Soil and Water

MOSQUITO ARBOVIRUS SURVEILLANCE PROGRAM

Theodore G. Andreadis
Philip M. Armstrong

Mosquito-transmitted diseases such as West Nile virus and Eastern equine encephalitis are significant public health and veterinary threats that re-emerge each summer in Connecticut. CAES scientists maintain a comprehensive network of 91 mosquito-trapping stations throughout the state to monitor mosquitoes for these and other disease-causing viruses from June through October. Each summer, about 165,000 mosquitoes are trapped in the field and tested in our Biosafety Level 3 laboratory.
Impact: This surveillance program serves as an early warning system and provides critical information on local virus activity in mosquitoes. Results are used to evaluate the threat of these viruses to residents of the state and guide the implementation of mosquito control measures when necessary.

CONTAMINANTS IN SOIL, SEDIMENT, AND WATER

Joseph Pignatello

Contamination through industrial and agricultural activities and the use of consumer products continue to pose a threat to human and ecological health. Our research focuses on fundamental and applied aspects of organic pollutant behavior in soil, and in novel methods for cleaning up contaminants in soil and water. Our interests in pollutant behavior center on the binding of molecules to natural soil particles and factors that govern bond strength, uptake and release rates, and availability to organisms. Our interests in remediation include novel techniques based on chemical oxidation, bio-remediation, and retrievable adsorbents and adsorbent-catalysts.
Impact: Improved predictability of environment mobility and bioavailability of harmful chemicals form the basis for more effective cleanup strategies.

PHYTOREMEDIATION

Jason C. White

The use of plants to decontaminate soil, sediment, or water is called phytoremediation. Plants are able to clean polluted soil by accumulating pollutants in their tissues, where the chemicals may be degraded by enzymes, stored, or transpired

to the air. Other plants can degrade contaminants outside of their roots, either by releasing enzymes or by stimulating bacteria that will eliminate the toxins. Our research is focused on persistent organic pollutants (POPs), chemicals that are particularly difficult to remediate from soil and include such notorious toxic chemicals as DDT and PCBs. We have discovered that a particular subspecies of cucurbit accumulates POPs within its roots and stems, with little transfer to leaves or fruit. Current research is seeking to uncover the physiological and molecular basis of this unique ability, as well as exploring the potential for implementation as a remediation strategy at hazardous waste sites.
Impact: We are developing a plant-based strategy to expand remedial options and decrease the overall exposure and risk posed by such contaminated sites.

Valley Laboratory

BIOFUEL OILSEED CROPS

James A. LaMondia

Oils pressed from the seeds of certain plants such as canola or soybean can be used to produce biodiesel fuels, a renewable energy source that can be blended with home heating oil or to replace diesel fuel. Research is being conducted to identify plants that grow and yield well in New England and also have the ability to control plant pathogens in soils. For example, *Brassica* oilseed crops can produce plant defense chemicals in seeds that can suppress plant pathogens. Seed meals left over after pressing to remove oils can be used in an integrated pest management program and are also useful as an organic source of plant fertilizer.

Impact: The local production of biodiesel oilseed crops will aid in the development of the biofuels industry. Non-chemical management of soilborne plant pathogens can reduce economic crop losses, reduce human and environmental exposure to pesticides, and create a value-added use for the plant seed meals remaining after removing oils for biodiesel fuel production.

HEMLOCK WOOLLY ADELGID CHEMICAL CONTROL

Richard S. Cowles

Hemlock woolly adelgid is a sucking insect pest native to Japan. In Connecticut, adelgids can kill eastern hemlock trees in the forest and landscape in as little as four years following initial infestation. Hemlocks can be protected with sprays of horticultural oil to the foliage, but this is impractical for treating large trees, dense hedges, and forest trees. Systemic insecticides, which are applied to the soil, absorbed by the roots and transported throughout the tree in sap, protected trees for 5-6 years following one application. This research determined the optimal dose of insecticide based on the size of the tree. A controlled-release tablet formulation also worked well and will limit the initial release of the insecticide into the soil.

Impact: Insecticides are now being used most efficiently to prevent tree mortality, while protecting nearby streams and groundwater from pollution.

BIOLOGICAL CONTROL OF HEMLOCK WOOLLY ADELGID

Carole A. S.-J. Cheah

Eastern hemlock is a native conifer important for wildlife habitats and protecting watersheds. Biological control is a major long-term strategy for reducing the impact and spread of Hemlock wooly adelgid (HWA) in our eastern forests. In Connecticut, we have been conducting long-term research, release, and evaluation of an imported Japanese ladybeetle predator *(Sasajiscymnus tsugae)* against HWA. Current research is now focused on the development of artificial diets and supplements to augment and improve the mass-rearing of adelgid predators for use in infested forests.

Impact: *S. tsugae* is the most widely reared and released predator of HWA in eastern North America. Hemlock stands where the beetle has been released and established exhibit sustained crown recovery with little or no tree mortality resulting in improved forest health. Improving mass rearing for this and other introduced predator species with diet supplements will expand and enhance the efforts to mitigate the impact of HWA.

Valley Laboratory

INDOOR MOLDS

DeWei Li

Some of the molds that develop in indoor environments following water damage can trigger allergies, cause infection, or impact medical conditions by exposure to mycotoxins. Some common molds are also common allergens, such as species of *Cladosporium, Penicillium,* and *Aspergillus.* Research is being conducted to determine the composition and concentrations of airborne molds in Connecticut, and to determine the succession of molds on water-damaged drywall.

Impact: The study will provide a baseline fungal exposure and composition level for public health officials, medical-care providers, and indoor air quality (IAQ) professionals. The identification of mold species has assisted medical professionals in the diagnosis and evaluation of mold-related health risks in public school buildings and aided IAQ professionals in the mitigation of indoor mold problems.

INQUIRY OFFICE AND SOIL TESTING

Thomas Rathier and John Winiarski

Growers, IPM and extension personnel, industry advisors, researchers and homeowners submit nearly 10,000 samples or questions to the Valley Laboratory annually.

Inquiries are handled in person by phone, email, or by on-site visits and typically concern arthropod pests, plant diseases, general horticulture, soil fertility and water issues, pesticide use, weed control, and animal questions. About 5,000 soil tests are conducted annually to determine the physical and chemical characteristics important to healthy plant growth.

Impact: The correct identification and diagnosis of problems and the management information supplied reduce crop losses due to pests, reduce costs, and reduce human and environmental pesticide exposure. Soil nutrient testing results in optimal plant growth, reduced production costs, and reduced nutrient runoff, protecting our soil and water resources.

WEED MANAGEMENT

Todd L. Mervosh

Weeds are problems in many crop systems, and non-native invasive plants are displacing

native plants and disrupting ecosystems throughout Connecticut and beyond. Research is being conducted to evaluate new treatments for preventing weeds in ornamental nurseries. Also, experiments designed to identify effective and environmentally sound management options for invasive plants such as Oriental bittersweet, phragmites, Japanese knotweed, pale swallow-wort, and mile-a-minute vine, are being conducted in a variety of locations.

Impact: Better weed prevention options for container-grown ornamentals will improve plant quality and reduce costs. Developing controls for a wide range of invasive plants will provide land conservation organizations with information needed to remove or stop the spread of these invaders, protecting natural ecosystems in woodlands, meadows, and wetlands.

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GIFTS AND GRANTS
(2006-2008)

PRIVATE GIVING

Generous donations of funds allow the Station to pursue original research that benefits residents of Connecticut and the nation.

American Chestnut Foundation Massachusetts Chapter
Commonwealth of Pennsylvania
Connecticut Grounds Keepers Association, Inc.
Connecticut Northeast Organic Farming Association
Connecticut Tree Protective Association
East Haven Garden Club
Evergreen Garden Club
Fairfield County Master Gardeners
Federated Garden Clubs of Connecticut
Fred Auger (private citizen)
GMPro Magazine
Guilford Garden Club
Herb Nichols
Heritage Village Garden Club
Killingworth Land Trust
Menunkatuck Audubon
Milford Garden Club
Mystic Seaport Museum
Naugatuck Valley Audubon Society
New England Vegetable & Fruit Conference
Nick Williams (In Memory of)
Peerless Tree
Sanctuary Whitetail Services
Shoreline Gardeners Club
Society of American Foresters, Yankee Division
University of Massachusetts Extension
Western Massachusetts Gladiolus Society

COOPERATIVE RESEARCH GRANTS AND AGREEMENTS

American Floral Endowment Fund
Aquarion Water Company
Auburn University
BASF Corporation
Bashan Lake Association, East Haddam
Bayer Corporation

COOPERATIVE RESEARCH GRANTS AND AGREEMENTS

(continued)

Centers for Disease Control and Prevention
Central Connecticut State University
Connecticut Christmas Tree Growers' Association
Connecticut Department of Environmental Protection
Long Island Sound License Plate Fund
Connecticut Department of Public Health
Connecticut Nursery and Landscape Association
Connecticut Sea Grant
Connecticut Tree Protective Association
Environment and Human Health, Inc.
FirstLight Power Resources, Hartford
Grannis Lake Association, East Haven
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International Journal of Phytoremediation
IR-4 Ornamentals Program
National Science Foundation (NSF)
Naugatuck Valley Audubon Society
Northeast Organic Farming Association of Connecticut
Northeast Organic Farming Association of Massachusetts
Northeast Sustainable Agriculture Research and Education Program
Northeastern Mosquito Control Association
Northeast Sun Grant Initiative
Novozymes Biologicals, Inc.
Orange County Vector Control District
Propane Education and Research Council
South Central Connecticut Regional Water Authority
State Forestry Administration, PR China
Syngenta Crop Protection, Inc.
The Nature Conservancy, Connecticut Chapter
The Nature Conservancy, Weed-It-Now program
The Saint Lawrence School of Nursing, New London
US EPA Science to Achieve Results (STAR) Program
US EPA Small Business and Innovative Research (SBIR) Program
USDA Challenge Grant Program
USDA CSREES, National Plant Diagnostic Network (NPDN)
USDA CSREES, National Research Initiative (NRI)
USDA CSREES, Northeast Research/Extension Grant
US FDA-Chemistry Cooperative Agreement Laboratory
USDA Forest Service, Northern Research Station
USDA National Resource and Conservation Service EQIP Program
USDA NE-SARE Professional Development Program
USDA Northeast IPM Program
USDA Small Business Initiative Research (SBIR) Program
USDA Small Business Innovation Research Grant
USDA/ARS
USDA/CSREES
USDA-APHIS-Plant Protection and Quarantine
USDA-Forest Service
Valent USA Corporation
Windsor Shade Tobacco Association
Yale Peabody Museum

PARTNERS

Donations of materials, labor, and use of land provide valuable contributions to advancing the research and outreach goals of the Station. Much of the Station's research is accomplished with our partners in agriculture, natural resources, and public health. In addition to the numerous farms, nurseries, homeowners, and landowners, Station scientists have worked closely with the following organizations:

Adnan Menderes University, Aydin, Turkey
American Chestnut Cooperators
American Chestnut Foundation
American Phytopathological Society
Aquarion Water Company
Aquatic Control Technologies, Inc.
Bashan Lake Association
Boston University Marine Program, Woods Hole
Bristol County Mosquito Control Project
Candlewood Lake Authority
Central Massachusetts Mosquito Control Project
Cheshire Public Schools
Chestnut Growers of America
City of New Haven
Cold Spring School, New Haven
Common Ground High School, New Haven
Connecticut Audubon Society

PARTNERS
(continued)

Connecticut Christmas Tree Growers Association
Connecticut Community Gardens Association
Connecticut DEP Fisheries
Connecticut DEP Division of Forestry
Connecticut DEP Lakes Program
Connecticut DEP Natural Diversity Database
Connecticut DEP Wetland Habitat and Mosquito Management Program
Connecticut Department of Agriculture
Connecticut Department of Consumer Protection
Connecticut Department of Public Health
Connecticut Department of Transportation
Connecticut Farm Bureau
Connecticut Forest and Park Association
Connecticut Gladiolus Society
Connecticut Greenhouse Growers Association
Connecticut Grounds Keepers Association
Connecticut Northeast Organic Farming Association
Connecticut Nursery and Landscape Association
Connecticut Poison Control
Connecticut Pomological Society
Connecticut Tree Protective Association
Connecticut Tree Wardens Society
Cornell University
Drazen Orchard, Cheshire
Ellsworth Hill Orchard, Ellsworth
EnviroScience, Inc
Estuarine Research Foundation
Federated Garden Clubs of Connecticut
FirstLight Power Resources
Friends of Hammonasset, Madison
Gardner's Nurseries, Rocky Hill
Geremia Greenhouses, Wallingford
Gouveia Vineyard, Wallingford
Grannis Lake Association, East Haven
Great Mountain Forest, Norfolk
Greater Waterbury Interfaith Ministries
Holbrook Farm, Bethel
International Society for Horticultural Science
Imperial Nurseries, Granby
Jones Family Farm, Shelton
Kogut's Hemlock Hill Tree Farm, Somers
Lord Creek Farm, Lyme
Louisiana State University School of Veterinary Medicine
Lyman's Orchard, Middlefield
L2 Diagnostics, New Haven
Massachusetts Department of Public Health
Metropolitan District Commission
Michigan State University
Mile Creek School, Old Lyme
Missouri University of Science and Technology
Muhlenberg College, Pennsylvania
National Park Service, Cape Cod National Seashore
National Plant Diagnostic Network (Northeast Plant Diagnostic Network)
New England Estuarine Research Society
New Hampshire Department of Health & Human Services
New York Botanical Garden
New York City Department of Public Health
New York State Department of Health
Northeast Massachusetts Mosquito Control and Wetlands Management District
Northeast Utilities
Northern Nut Growers Association
Ondokuz Mayis University, Samsun, Turkey
Pennsylvania State University
Pennsylvania DCNR
Priam Vineyards, Colchester
Prides Corner Farms, Lebanon
Purdue University, Indiana
Quinnipiac University Department of Biology
Rogers Orchard, Southington
Royal Military College, Ontario
Rutgers University, New York
Sleeping Giant Park Association, Hamden
Sound School, New Haven
South Central Connecticut Regional Water Authority
The Nature Conservancy, Connecticut Chapter
The Nature Conservancy, Weed-It-Now program
Tomsk State University, Russia
Torrington Water Company
Town of East Haddam
Town of East Haven
Town of Manchester
Town of Mansfield
Uludag University, Bursa, Turkey
United States Fisheries and Wildlife Service, Wells, ME
University of Connecticut Department of Extension
University of Connecticut Department of Natural Resources Management and Engineering
University of Connecticut Department of Plant Science
University of Connecticut Department of Pathobiology and Veterinary Sciences
University of Florida
University of Georgia
University of Massachusetts
University of Massachusetts, Cranberry Station
University of Melbourne, Australia
University of Missouri
University of New Hampshire
University of Notre Dame
University of Rhode Island
University of South Carolina
University of Southern Illinois
University of Tennessee at Chattanooga
University of Tennessee at Knoxville
University of Texas Medical Branch at Galveston
University of Torino, Italy
University of Zagreb, Croatia
US EPA - Cincinnati, OH
USDA ARS – Gainesville, FL
USDA ARS – Orlando, FL
USDA ARS Beltsville Agricultural Research Center
USDA ARS National Center for Agricultural Utilization Research
USDA ARS, South Central Agricultural Research Laboratory
USDA Forest Service Northern Research Station
USDA Forest Service Southern Research Station
USDA APHIS, PPQ
Utah State University, Department of Wildland Resources
Virginia Polytechnic Institute and State University
Wesleyan University Biology Department
Westport Rivers Vineyard
White Buffalo, Inc., Hamden
White Memorial Foundation, Litchfield
Yale University School of Forestry & Environmental Studies
Yale University School of Medicine

STATION PERSONNEL

Director's Office
Magnarelli, Louis A. - Director
Stafford III, Kirby C. - Vice Director, State Entomologist
M.-Ottenbreit, Roberta - Executive Secretary

Business Office
Last, Michael P. - Chief of Services
Albertini, Dianne - Fiscal Administrative Officer
Foley, Tess - Grants and Contracts Manager
Ives-Parisi, Joan - Associate Fiscal Administrative Officer
Kaczenski, Lisa - Fiscal Administrative Assistant
Soleski, Kathryn - Purchasing Assistant
Bomba-Lewandoski, Vickie M. - Information Officer

Maintenance
Nicholson, Bancroft - Maintenance Supervisor II
Gagliardi, Alfred – Skilled Maintainer (retired)
LaFrazier, Ronald A. - Custodian
Mach, Gloria - Custodian
Roman, Miguel A. - Custodian
Russell, Ralph - Lead Custodian (retired)
Scott, Michael - Custodian
Wachter, Nicole - Custodian

Lockwood Farm
Cecarelli, Richard - Research Farm Manager
Hannan, Rollin J. - Agricultural Research Technician II
McHill, Michael M. - Farmer

Analytical Chemistry
Mattina, MaryJane Incorvia - Chief Scientist/State Chemist
Eitzer, Brian D. - Associate Agricultural Scientist
Krol, Walter J. - Assistant Agricultural Scientist II
Robb, Christina S. - Assistant Agricultural Scientist II
Stilwell, David E. - Associate Agricultural Scientist (retired)
Arsenault, Terri - Agricultural Research Technician II
Berger, William - Agricultural Research Technician II
Musante, Craig - Agricultural Research Technician II
Pyles, Mamie O. - Agricultural Research Technician I
Ranciato, John F. - Agricultural Research Technician I

Biochemistry and Genetics
McHale, Neil A. - Chief Scientist
Dingman, Douglas W. - Associate Agricultural Scientist
Peterson, Richard B. - Agricultural Scientist
Schultes, Neil P. - Associate Agricultural Scientist
Zelitch, Israel - Biochemist, *Emeritus*
Clark, Carol B. - Agricultural Research Technician II
Huntley, Regan B. - Agricultural Research Technician II
Musante, Cynthia - Agricultural Research Technician I

Entomology
Stafford III, Kirby C. - Vice Director, Chief Scientist/ State Entomologist
Anderson, John F. - Distinguished Agricultural Scientist
Cheah, Carole A. - Assistant Agricultural Scientist II
Cowles, Richard S. - Agricultural Scientist
Hamid, Bonnie L. - Assistant Agricultural Scientist II
Maier, Chris T. - Agricultural Scientist
Ridge, Gale E. - Assistant Agricultural Scientist II
Rutledge, Claire E. - Assistant Agricultural Scientist II
Smith, Victoria L. - Assistant Agricultural Scientist II, Deputy State Entomologist
Stoner, Kimberly A. - Associate Agricultural Scientist
Welch, Kenneth A. - Agricultural Scientist (deceased)
Bharadwaj, Anuja - Agricultural Post Doctoral Scientist
Alves, Elizabeth - Agricultural Technician I
Blevins, Tia M. - Agricultural Research Technician II
Bonito, Rose - Secretary II
Fengler, Jeffrey - Agricultural Research Assistant III
Florek , Alyson A. - Agricultural Technician 1
Goodman, Terrill D. - Agricultural Research Technician II (retired)
Hiskes, Rose T. - Agricultural Research Technician I
Kettle, Ira - Agricultural Research Technician I
Lowry, Morgan F. - Agricultural Research Assistant III
Misencik, Michael J. - Agricultural Technician I
Penna, Angela B. - Agricultural Technician I
Petruff, Tanya A. - Agricultural Technician I
Sandrey, Stephen J. - Agricultural Research Technician II
Stuber, Heidi R. - Agricultural Research Technician I
Sturgis, Erin S. - Agricultural Research Assistant III
Trenchard, Peter W. - Agricultural Research Technician II
Vasil, Michael P. - Agricultural Research Technician II
Zarrillo, Tracy - Agricultural Research Technician I

Forestry and Horticulture
Ward, Jeffrey S. - Chief Scientist/Station Forester
Gent, Martin P.N. - Agricultural Scientist
Maynard, Abigail A. - Associate Agricultural Scientist
Nail, William R. - Assistant Agricultural Scientist II
Williams, Scott C. - Assistant Agricultural Scientist II
Hill, David E., *Emeritus*
Waggoner, Paul E., *Emeritus*
Barsky, Joseph P. - Agricultural Research Technician I
Bravo, Joan L. - Agricultural Research Technician I
Short, Michael R. - Agricultural Research Technician I

Plant Pathology and Ecology
Douglas, Sharon M. - Chief Scientist
Anagnostakis, Sandra L. - Agricultural Scientist
Aylor, Donald E. - Distinguished Agricultural Scientist, *Emeritus*
Balogh, Botond - Assistant Agricultural Scientist II
Elmer, Wade H. - Agricultural Scientist
Ferrandino, Francis J. - Associate Agricultural Scientist
Marra, Robert E. - Assistant Agricultural Scientist II
Carney, Sandra E. - Secretary II
Corwin, Jason A. - Agricultural Technician I
Inman, Mary K. - Agricultural Research Technician II
Sletten, P. - Agricultural Research Technician I
Thiel, Peter - Agricultural Research Technician II

Soil and Water
Andreadis, Theodore G. - Chief Scientist
Armstrong, Philip M. - Associate Agricultural Scientist II
Bugbee, Gregory J. - Assistant Agricultural Scientist II
Molaei, Goudarz - Assistant Agricultural Scientist II
Pignatello, Joseph J. - Senior Agricultural Scientist
Sawhney, Brij L., *Emeritus*
Shepard, John - Assistant Agricultural Scientist I
Vossbrinck, Charles R. - Associate Agricultural Scientist
White, Jason - Agricultural Scientist
Huang, Shaoming - Agricultural Post Doctoral Scientist
Marko, Michelle D. - Agricultural Post Doctoral Scientist
Deeds, Kirsten - Agricultural Research Technician I
Finan, Shannon L. - Agricultural Research Technician I
Selsky, Roslyn - Agricultural Research Technician II
Thomas, Michael - Agricultural Research Technician II

Valley Laboratory
LaMondia, James A. - Chief Scientist
Cheah, Carole A. - Assistant Agricultural Scientist II
Cowles, Richard S. - Agricultural Scientist
Li, DeWei - Associate Agricultural Scientist
Mervosh, Todd L. - Assistant Agricultural Scientist II
Rathier, Thomas M. - Assistant Agricultural Scientist II
Ahrens, John F., *Emeritus*
Canepa-Morrison, Jane - Agricultural Research Technician I
Fengler, Jeffrey - Agricultural Research Assistant III
Horvath, Richard - Farm manager (retired)
Preste, James J. - Research Farm Manager
Salvas, Michelle R. - Agricultural Research Technician I
Winiarski, John S. - Agricultural Research Technician II

MISSION STATEMENT

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," a motto as relevant today as it was at our founding in 1875.

CONTACTS

CAES Main Laboratories	P. O. Box 1106 New Haven, CT 06504-1106 (203) 974-8500 Statewide Toll Free: (877) 855-2237
Valley Laboratory	P. O. Box 248 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

Website: www.ct.gov/CAES

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