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,

Dr. Louis A. Magnarelli, Director
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 1983, 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.

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

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

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### Budget Summary

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**FY2008 Funding By Source**

- General Fund – 66%
- Federal Funds – 32%
- Other Funds – 2%
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 CO2. 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.
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.
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.
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 ANISOPLEA* 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 ANAPLASMSOSIS, 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.
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
Honeybees 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. Honeybees 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.
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.
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 as root stocks, pruning practices, training methods, graft union height, different spacing intervals, and application of stylet oil to harvest rows 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.
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.
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 in 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.
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 wildlife 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.
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.
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 woolly 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.
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 swallowwort, 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.


SCIENTIFIC JOURNAL ARTICLES PUBLISHED (2006-2008)


BOOK CHAPTERS PUBLISHED (2006-2008)


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

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Centers for Disease Control and Prevention
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Connecticut Christmas Tree Growers’ Association
Connecticut Department of Environmental Protection
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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
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Connecticut DEP Natural Diversity Database
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Greater Waterbury Interfaith Ministries
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International Society for Horticultural Science
Imperial Nurseries, Granby
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Kogut’s Hemlock Hill Tree Farm, Somers
Lord Creek Farm, Lyme
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Lyman’s Orchard, Middlefield
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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.

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