PLAN OF WORK UPDATE

Federal Fiscal Years (2005-2006)

The Connecticut Agricultural Experiment Station (CONH)

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Introduction

In accordance with the Agricultural Research, Extension, and Educational Reform Act (AREERA) of 1998, CSREES guidance, and other regulations, this Plan of Work Update is submitted to extend the previous 5-year Plan of Work to cover the period federal FY2005-FY2006. Critical short-term, intermediate, and long-term agricultural issues in Connecticut are described. The Connecticut Agricultural Experiment Station (hereafter referred to as the "Station") is an independent state agency, which receives federal Hatch funds for research. No federal funds are received for extension or educational programs. Although the Station is not affiliated with the University of Connecticut, there are extensive links between Station scientists and extension personnel at the University of Connecticut and at other land grant institutions in several integrated, multi-state projects. Therefore, reporting in this Plan of Work Update mainly focuses on research in progress and planned for FY2005-FY2006, and where appropriate, descriptions are given for extension links. Many objectives listed in the FY2000-2004 Plan of Work have been met, and results and impacts have been reported in Annual Reports of Accomplishments and Results. There have been changes due to emerging agricultural problems, retirements of scientists, and state budget constraints, however, and an updated, completely revised Plan of Work is appropriate at this time.

Scientists and administrators at the Station rely heavily on stakeholder input and support. Stakeholders testify on the Station's behalf at legislative appropriation hearings. Several processes exist to consult users of agricultural research in the identification of critical issues in Connecticut and in the development of research programs to address these issues. In many instances, the agricultural problems that exist in Connecticut also

occur in several other states, and solutions require a regional approach. Efforts to reduce fertilizer and pesticide use, improve the efficiency of farm practices, promote sustainable agriculture, ensure safe food for consumers, solve immediate insect pest and plant disease problems, improve water, soil, and air quality, solve invasive plant species problems, and preserve the health of forests are national issues, which coincide with USDA/CSREES focus areas. The Station's main mission parallels that of CSREES: to advance knowledge for agriculture, the environment, human health and well being, and communities and align with the CSREES strategic plan to expand agricultural markets in a global economy, expand economic opportunities in rural America, reduce food-borne pathogens, reduce agricultural pests and diseases, and improve natural resource management. Multi-state research projects are particularly important because they encourage the blending of scientific expertise and more efficiently utilize scarce resources over broad regions to address common problems. Specific examples of how multi-state programs function and the benefits gained are described in this updated Plan of Work.

Connecticut is a small state with several physiographic regions, numerous forested areas, and a high population density (about 3,000,000 people). The Station conducts agricultural and environmental research in a setting characterized by urban sprawl, where quality of life is often defined by relatively small tracts of farmland, forests and parks in an otherwise urban/suburban setting. Larger farms still exist, however. Public drinking water is drawn exclusively from protected surface and ground water supplies and aquifers. Nearly 60% of the state is forested, and residential subdivisions have numerous trees. The Station is frequently called upon by a diverse group of

stakeholders to provide information and advice related to agricultural and forestry practices. The Connecticut Farm Bureau and Department of Agriculture estimate agriculture's total financial impact to the state's economy to be about $2.6 billion. The values of products sold are highest for the green industry ($949 million).

Although there are no formal educational or extension components, the Station disseminates new information to extension personnel at land grant institutions and to the scientific community by encouraging scientists to publish results in peer-reviewed journals and to give oral presentations at meetings and conferences. Discoveries are reported to farmers, the general public, and industry by having scientists present lectures to organized groups, releasing information to the media, and by preparing fact sheets or concise articles for distribution. Station scientists write scientific articles in laypersons' terminology for stakeholder publications. In addition, the Station holds public events, including open houses and field days, where citizens can meet scientists, see experimental plots and research laboratories, and discuss research findings. Stakeholder input is requested to assist in the research planning process and received from numerous organizations. Interactions between scientists and the public are frequent. The Experiment Station Associates, a citizen support group with a membership of about 910 persons, assist in the reporting of Station discoveries to the public and in receiving and providing stakeholder responses.

The Station's research projects are consistent with the mission of the Medium Term Strategic Plan for the State Agricultural Experiment Station system and address national issues included in all five major USDA goals. The Station's overall research program, however, is heavily weighted towards national priorities and USDA goals #1

and 4, respectively, by improving the agricultural production system to be highly competitive in the global economy and on greater harmony between agriculture and the environment, respectively. Emphasis continues to be placed on achieving economically competitive production systems, the production of value-added products, and on protecting, conserving and improving water and soil resources. Monitoring pesticides in fruits and vegetables addresses important food safety issues (USDA goal #2). The presence of bacterial, protozoan, and viral pathogens in ticks and mosquitoes require continued attention because of public concerns. Reducing the amounts of pesticides used to control insects and weeds in agricultural systems and the development of chemical and microbial methods to degrade pesticides in ground water and soil will also remain in high priority. There is also a continuing need to identify under-served and under-represented groups and to directly assist these stakeholders.

General Overview for Research Programs

Many current core research programs have been successful. Specific agricultural problems have been solved to meet several short-term and intermediate critical needs of stakeholders. In other instances, the problems are more complex, and although good progress is being made, more time is needed to meet intermediate and the long-term critical needs identified in the previous Plan of Work. Highlights of selected projects are herein described as examples of how scientists and stakeholders have interacted on different problems which include a wide range of environmental issues.

Scientists in the Department of Analytical Chemistry worked on two important problems that have national impacts. An objective was established previously to develop

chiral gas chromatography methods to quantitate chlordane residues in crops and air above contaminated soil. The new procedures incorporated ion trap mass spectrometry and were found to be sensitive and specific in detecting chlordane residues in soil where the pesticide was used 40 years ago. Chlordane residues were found in all parts of zucchini plants, the soil, and in the ambient air near the soil. These findings had impacts because it is now known that residues of this banned insecticide can persist and volatilize for many more years than previously thought. Scientists in other institutions are now using these new analytical methods in their research on related problems. For example, researchers in Hawaii are using these methods and results to determine if oriental radishes and other root crops can be grown in soils contaminated with chlorinated hydrocarbons. Some vegetable growers in Connecticut are not planting edible plants in contaminated soil. New research is being planned to determine which crops, if any, are safe to plant in these contaminated sites. In other research on chromated copper arsenate (CCA) preservative of wood products used to make picnic tables, decks, and garden borders, studies revealed that arsenic (a class A carcinogen) can be taken up by romaine lettuce and Indian mustard greens grown near the CCA-treated wood. Although reductions in arsenic leaching were observed when the wood was coated with acrylic and alkyd resins or with polyurethane, homeowners have responded by not planting vegetables near CCA-treated wood. Results of these studies were considered by Environmental Protection Agency officials in their decision to phase-out all residential uses of CCA-treated wood, effective January 1, 2004.

Entomologists and plant pathologists have found ways for nursery, vegetable, and fruit growers to reduce amounts of pesticides used and lower costs of chemical

treatments. Field tests conducted with container-grown plants, such as rhododendron, revealed that a concentration of bifenthrin at 2ppm controlled Japanese beetle larvae, a pest regulated by quarantines in several states and Canada. Growers now know that less pesticide can be used and that $6.05 per 1,000 potted plants can be saved in reduced costs of treatment. Similarly, effective methods of chemically controlling the small Japanese cedar long-horned beetle, an exotic pest of arborvitae and cedar trees, benefited nursery growers who ship plants nationally and internationally. A new species of Heterorhabditid nematode was discovered parasitizing black-vine weevil grubs, important pests of strawberries and nursery crops. These nematodes are now included in integrated pest management programs (IPM) on farms. Polynema marigold was found to be an acceptable rotation crop in potato fields to reduce prevalence of a parasitic nematode. Use of marigold increased profits by about $500 per acre because less nematicide was used. Biological information on apple tortrix, an exotic pest of apple, pear, European plum, Japanese plum, sweet cherry and 75 other species of wild and cultivated woody plants, determined that the pre-bloom sprays that growers normally apply to control a variety of other insect pests was sufficient to control apple tortrix. No additional insecticide treatments were required to control this insect, resulting in a savings of about $30 per acre. Although these problems differ in scope, there are several common features. Groups of scientists, representing different states, were working under the leadership of Station scientists and were involved in finding solutions. All projects involved integrated activities (research and extension components), had multi-disciplinary approaches, and had impact measured by the following: savings in pesticide treatment costs, increased profits resulting from the sale of agricultural products, or

changes in the behavior of growers who are now more willing to adopt IPM programs. Refinement of farm management practices is still needed to further reduce pesticide use, and there are new problems, such as invasive weeds in lakes, that need attention.

State budget deficits and reductions in numbers of scientists and other staff members at several Agricultural Experiment Stations reinforce the need for more organized multi-state efforts to leverage diminishing resources. The Station currently participates in nine USDA-approved multi-state projects. All projects have interwoven integrated activities and are making progress. The successes of multi-state project NE-183 can be described as an example of how well these joint efforts work for the benefit of stakeholders. New apple cultivars were developed at the Geneva, New York Agricultural Experiment Station. Our Station does not have plant breeders to develop new apple cultivars, but we were able to field test certain cultivars for resistance to apple scab, a major fungal problem in orchards, and to evaluate yield and fruit quality in different settings. It was important for fruit growers in New England to know how each cultivar would fare in different environmental conditions (eg. varying soil features, rainfall, and frost conditions). These long-term studies, still in progress, identified several desirable cultivars for southern New England. Some of these varieties, such as Honeycrisp, are now being planted by growers. Scientific information was given to extension agents and growers at stakeholder meetings, and scientists made visits to farms to explain the benefits of the new cultivars. The interactions of scientists on this project provided other opportunities to identify suitable grape cultivars for Connecticut. Villard Noir, Villard Blanc (a French hybrid cultivar), Seyval, and Chardonnay varieties had high yields, high sugar content, and hardiness for surviving late spring frost in Connecticut and are now

being grown in the state. The rapid advancements made were attributed to a large part to the multi-state collaborations and the close interface between scientists and fruit growers, who have interests in different crops. Further work is planned for FY2005-FY2006 to meet intermediate and long-term needs.

There are stakeholder requests for new crops, particularly those of interest to Hispanic, Brazilian, and Asian populations in Connecticut. Surveys conducted at farmers' markets indicated that consumers and growers are interested in growing new crops for local sale. Successes in growing calabaza (squash) and leeks have helped provide fresh produce to consumers, profits for vegetable growers, and have helped the Station meet the needs of under-served and under-represented groups. This program will continue to meet immediate needs.

Food safety remains a concern. A statewide program of testing food items for pesticide residues has led to the recall and destruction of contaminated products. For example, a non-permitheol pesticide residue (iprodine) was detected in quince imported from Chile. Permethrin was detected in canned mustard greens. Fortunately, most food products analyzed had no or little evidence of pesticide residues. After analyses of hundreds of items, consumers and other stakeholders (including federal and state regulatory officials) were re-assured that foods were safe to eat. The Station collaborates with the Connecticut Department of Consumer Protection, US Environmental Protection Agency, and US Food and Drug Administration in these studies. The research component of improving analytical testing procedures is planned for the future.

During the past four years, a new health problem emerged, West Nile encephalitis. Stakeholders in broad regions of the USA are now concerned about

mosquitoes as well as ticks and associated diseases. West Nile encephalitis virus or tick-borne agents that cause Lyme disease or human granulocytic ehrlichiosis affect domesticated animals (horses, dogs, and cattle) as well as humans. These diseases occur throughout most of the USA where tens of thousands of stakeholders are being affected. In North America, West Nile encephalitis was first reported in New York City during 1999. The Station had a virus isolation facility established at that time for work on eastern equine encephalitis and California group encephalitis viruses. Station scientists were the first to isolate the West Nile encephalitis virus in North America. Isolation of the West Nile virus had great impact. The virus cultures were given to scientists at Yale University, and new work started on the development of a vaccine and diagnostic test. Other work with different scientists followed on interferon treatment of viral infections. Diagnostic assays are being used experimentally as adjunct procedures to verify West Nile infections in horses in the state. Vaccine research is progressing. Hatch funds were used initially to start research programs on mosquitoes, encephalitis viruses, ticks, and tick-borne agents. There have been many published contributions on ecological studies of these diseases, and USDA Hatch funds are acknowledged in these papers. The new information gained led to the development of protective measures that stakeholders could follow to prevent being bitten by mosquitoes and ticks. In addition, there have been advancements made in diagnostic testing for Lyme disease and granulocytic ehrlichiosis that are now leading to commercialization of the assays. This core research program in medical entomology has scientists from state and federal agencies (USDA/ARS and CDC), as well as from several universities working together. An extension component is included on the study of tick-borne pathogens in Connecticut, where information is

disseminated to stakeholders. The monitoring of blood-sucking insects and ticks for known and possible emerging pathogens remains a high priority for Connecticut. Veterinarians, physicians, health officials, and the general public will be served well by research conducted on medically important arthropods.

There have been stakeholder requests to find ways to recycle plant wastes. Work thus far has shown that biosolids (sewage sludge) and mushroom waste compost can be used as a soil amendment. Chrysanthemums grown in potting media containing high and low concentrations of biosolids had satisfactory growth. Nursery and bedding plant growers are now considering the use of biosolids, but more data are needed on the growth of edible plants to determine whether heavy metals in biosolids present a problem.

Some important Station publications have been prepared and released to stakeholders. The extension component at the University of Connecticut facilitated distribution of information to a wide audience of citizens. A manual on controlling turf pests and a publication on native alternatives for invasive ornamental plant species have been well received by nursery growers, landscapers, groundskeepers, and the general public. In each case, stakeholders requested that these publications be prepared, and planned integrated activities helped meet the objectives. Of the 2,000 copies of the turf manual printed, 1,120 copies have been purchased, and 11,955 of 12,000 copies of the "native alternatives" publication have been distributed to the public.

Stakeholder Input Process

In many instances, research objectives for Hatch and McIntire Stennis programs are established as a direct result of stakeholder input. The Station has had and will

continue to utilize different methods to identify stakeholders (i.e, end users of agricultural research) and receive their input on past achievements, identifying problems, and on planning research so that critical issues in Connecticut can be addressed. In a broad sense, we consider stakeholders as those persons who are interested in and benefit directly or indirectly from agricultural research, including forestry. Scientists, legislators, business owners, farmers, administrators, forestry officials, landscapers, groundskeepers, industry personnel, state and federal workers, and homeowners are stakeholders. Public input is encouraged on all problems and issues and will be accepted by individuals or through representatives of organizations, such as the Connecticut Farm Bureau, Connecticut Nursery and Landscape Association, Connecticut Pomological Society, etc., in an open and fair process that encourages the participation of diverse groups. Participation in public meetings, giving oral presentations to citizens' groups, interaction with the media, holding open houses and other public events, responding to public inquiries, and serving on advisory boards of stakeholder organizations are effective processes for scientists to identify and meet stakeholders, foster customer engagements, and to receive citizen input on their needs. Following talks, question and answer periods are particularly useful in receiving stakeholder input.

The Station is governed by a Board of Control, which includes the Governor, Commissioner of Agriculture, two appointees of the Governor (at present, a fruit grower and a dairy farmer), and appointees of Yale University, University of Connecticut, and Wesleyan University, plus the Director of the Station. In addition to setting policy for the Station, the board members have direct interaction with agricultural communities and often solicit stakeholder input for the Station. For example, one of the Governor's

appointees is active in national and state farm bureaus. With the emergence of human granulocytic ehrlichiosis (HGE) in northeastern United States, dairy farmers were inquiring about the possibility of this tick-borne bacterium infecting cattle. Veterinarians visited farms to collect blood samples. Infection by the HGE and Lyme disease agents were confirmed in cattle by a variety of serologic tests developed at the Station to detect antibodies to these pathogens. The research team included scientists from Yale University, the University of Connecticut (research/extension appointment), and the Connecticut Department of Agriculture. There were two veterinarians in the group who knew the dairy farmers. Critical assistance was also provided by a scientist at the University of Texas (Houston); a newly developed reagent was provided for antibody tests to complete the investigation. Another appointee of the Governor is a fruit grower. Insect and plant disease problems that emerge need immediate attention. Studies on apple scab, beetle larvae, leafminers, mites, and implementing IPM programs are underway because of stakeholder concerns expressed to this board member and Station scientists. A nursery grower is also a member of the Station's board. An outbreak of pesticide-resistant pests or accidental importation of an exotic pest causing quarantines can have severe financial impacts on the nursery industry, valued at about $400 million annually. For example, during 2003, a highly infectious bacterium (*Ralstonia solanacearum* race 3 biovar 2) accidentally entered the USA from Kenya. Consequently, twenty-two greenhouse operations were quarantined in Connecticut. At the request of growers and USDA/APHIS/PPQ officials, surveys were conducted and plants having origin in Kenya were tested. No infected plants were found, quarantines were lifted, and there were no lost sales of plants worth tens of thousands of dollars. Hatch funds were

available to quickly purchase test kits, which resulted in a prompt response to the problem.

There were stakeholder requests from Hispanics and Asians to grow vegetables of interest to these persons. Station scientists considered the economic value of growing specialized crops and responded to under-served and under-represented groups by conducting field tests of calabaza, leeks, okra, jilo, artichokes, sweet potatoes, Chinese cabbage and other vegetables. Locally grown produce is now available.

Scientists at the Connecticut Agricultural Experiment Station view all persons as important stakeholders and, upon request, give oral presentations on their research findings at local meetings as well as scientific conferences. Scientists are and will continue to be receptive to stakeholder input on current research programs and new problems. Approximately 400 oral presentations were given annually. Presentations will continue to be given to numerous organizations in urban, suburban, and rural areas where there is interest in agricultural research programs and scientific advances. The following groups were identified by Station scientists as those who directly conducted or used agricultural research information or who provided stakeholder input on Station programs by contacting scientists or administrators during the period 1999 to present:

Agriculture Information Council

Agriculture Technology Task Force

Albertus Magnus College

Alice Peck School Brownie Troop (Hamden)

American Chemical Society

American Chestnut Foundation

American Lyme Disease Foundation

American Phytopathological Society

American Society for Horticultural Science

American Society for Microbiology

Amity Regional High School

Apple Valley Garden Club

Ashlar Aspetuck Lodge #142

Association of Northeastern Herbaria

Bartlett Arboretum

Beecher Road School

Bishop's Orchards

Branford High School

Branford Land Trust

Bridgeport Aquaculture School

Bridgewater Men's Fellowship Organization

Bristol Garden Club

Brookfield Garden Club

Calvin Hill School (New Haven)

Canadian Fruit Pest Management

Canoe Brook Lake Association

Center for Learning in Retirement (Storrs)

Centers for Disease Control & Prevention

Central New York Academy of Medicine

Cheshire Garden Club

Cheshire High School

Citizens of Groton Long Point

Columbus House Shelter for the Homeless Community Garden Volunteers

Community Gardens of New Haven

Compost Technical Advisory Group

Connecticut Academy of Science & Engineering

Connecticut Agricultural Experiment Station Board of Control

Connecticut Audubon Society

Connecticut Beekeepers Association

Connecticut Butterfly Associations

Connecticut Botanical Society

Connecticut Chapter of the Society of American Foresters

Connecticut Christmas Tree Growers

Connecticut Daylily Society

Connecticut Department of Agriculture

Connecticut Department of Consumer Protection

Connecticut Department of Environmental Protection

Connecticut Department of Health

Connecticut Department of Transportation

Connecticut Entomological Society

Connecticut Farm Bureau

Connecticut Farm Wine Council

Connecticut Federation of Lakes

Connecticut Federation Garden Club

Connecticut Forest and Park Association

Connecticut Gladiolus Society

Connecticut Greenhouse Growers Association

Connecticut Groundskeepers Association

Connecticut Invasive Plant Committee

Connecticut Maple Syrup Producers Association

Connecticut Master Gardeners

Connecticut Microscopy Society of Wesleyan University

Connecticut NOFA (organic farmers)

Connecticut Nursery IPM Implementation Team

Connecticut Nursery and Landscape Association

Connecticut Pomological Society

Connecticut State Environment Committee

Connecticut State Foresters

Connecticut State Office of Policy and Management

Connecticut State Public Health Officials

Connecticut State Legislative Regulations Review Committee

Connecticut Tobacco Growers

Connecticut Tree Protective Association

Connecticut Urban Forest Council

Connecticut Valley Branch of the American Society for Microbiology

Connecticut Vineyard & Winery Association

Cornell University Cooperative Extension

Cromwell Women's Garden Club

Cub Scout Pack 31, Troop 6

Doolittle School (Cheshire)

Duck River Garden Club

Dutchess County (NY) Legislature

Dwight School in New Haven

East Haven Magnet School

East Windsor Garden Club

Eastern Branch of the Entomological Society of America

Eastern Connecticut State University

Eastern Plant Board

Eastern Region International Plant Propagators Society

Edgewood Middle School

Eli Whitney Vocational School

Entomological Society of America

Environmental Compliance/Agricultural Farm Waste Advisory Committee

Environmental Industry Council

Evergreen Garden Club

Experiment Station Associates

Fairfield County Groundskeepers Association

Fairfield County Horticultural Society

Fairfield County Veterinary Medical Association

Fairfield Horticultural Society

Fairfield Woods Middle School

Farm-City Week Committee

Farmington River Watershed Association

Federated Garden Clubs of Connecticut

Florence Griswold Museum (Old Lyme)

Foote School (New Haven)

Gateway Community College

Girl Scout Troop 168 (Windsor)

Governor’s Council on Agriculture

Greenhouse Growers

Greenwich Garden Club

Guilford Garden Club

Hamden Grange

Hamden Rotary

Hartford Garden Club

Harriet Beecher Stowe Elementary School

Heritage Village Condominium Association

High School in the Community (New Haven)

Hill & Dale Garden Club

Holcomb Farm

Hopkins Vineyard

Imperial Nurseries

International Society for Interferon

James H. Moran Middle School

Johns Hopkins University

Knox Parks Foundation Community Garden Program

Lebanon Chemical

Long Hill Garden Club

Lyme Disease Foundation

Madison Beach Club

Mansfield Middle School

Maple Row Tree Farm

Massachusetts Dept. of Food and Agriculture Pesticide Subcommittee

Massachusetts Extension Service

Massachusetts Nursery & Landscape Association

Master Gardeners Planning Committee

Melissa Jones Elementary School

Men’s Breakfast Group

Metacomet Elementary School

Middlebury Garden Club

Middletown Vo-Ag Center

Milford High School teachers

Milford Middle School

Milford Middle School Teachers

Milikowski Greenhouse Supply Company

Mount Carmel Book Club

Mystic Rotary Club

Nathan Hale School

National Plant Board

Natural Resources Council

Naugatuck Valley Audubon Society

New England Christmas Tree Growers Association

New England Society of American Foresters

New England Wildflower Society

New England Vegetable and Berry Growers

New Hampshire Agricultural Extension educators

New Haven Garden Club

New Haven Parks and Recreation

Newtown Garden Club

Nichols Garden Club

Noah Wallace Elementary School

North American Maple Syrup Council

North Carolina State University (Raleigh)

Northeast Directors Association

Northeast Integrated Pest Management Committee

Northeast Forest Pest Council

Northeast Forestry Cooperator

Northeast Regional Turf Workgroup

Northeastern Mosquito Control Association

Northeastern Weed Science Society

Northern Nut Growers Association

Northampton Massachusetts High School

Old Saybrook Garden Club

Organic Associated Growers of Connecticut

Outdoor & Environmental Education Association

Oxford Garden Club

Partnership Day Care Association

Planters' Choice Nursery

Prides Corner Farms

Quinnipiac Chapter of Sigma Xi

Quinnipiac University

Quinnipiac Valley Audubon Society

Quinnipiac College Botany Class

Regional Water Authority

River Garden Club

Rotary Club of New London

Rotary Club of Orange

Rutgers University

Saint Rita's High School

Sam Bridge Nursery

Sessions Woods Wildlife Center

Seymour Garden Club

Shoreline Garden Club

Shoreline Outdoor Education Center

Sikorski Men's Garden Club

Society of American Foresters

Society of Invertebrate Pathology

Society of Nematologists

Sound School in New Haven, CT

Southern Connecticut Alcohol and Drug Dependency Organization

Southern Connecticut Rhododendron Society

Southern Connecticut State University Chemistry Club

Southern Institute of Forest Genetics

Southington Cub Scout Pack #9

Southbury Garden Club

Southport Women's Garden Club

Spring Glen Garden Club

St. Bridgets Elementary School

Stafford Springs High School

Steep Rock Association

Suffield Garden Club

Thomas Edison Middle School

Totoket Grange

Town & Country Garden Club

Town of Guilford Maintenance Staff

Town of New Canaan Town Committee

Town of Greenwich

Trinity Academy

Trinity College (Hartford)

Trumbull Public School Building Committee

Uniroyal Chemical Company

University of Connecticut (includes Cooperative Extension)

University of Connecticut Landscape Maintenance Class

University of Delaware

University of Massachusetts (Amherst)

Urban Resources Initiative

US Forest Service

USDA/APHIS/PPQ

Vermont Christmas Tree Growers Association

Wagenengen Agricultural University, Netherlands

Wallingford Garden Club

Wallingford Senior Citizens

Waterbury Senior Citizens

West Hartford Conservation Commission

West Haven Garden Club

Westerly, RI Garden Club

Western Massachusetts Gladiolus Society

Western Chestnut Growers Association

Western Pennsylvania Society for Clinical Microbiology

Westville Garden Club

Wethersfield Garden Club

Wethersfield Nature Center

White Flower Farm

Wilbur Cross High School (New Haven)

Wilton Deer Committee

Wilton Garden Club

Windsor African Violet Society

Windsor Shade Tobacco Association

Woodbridge Rotary Club

Yale School of Forestry and Environmental Studies

Yale University (includes forestry and public health)

Diagnostic services are available for citizens to submit insect and diseased plant specimens for identification and control. Soil samples are analyzed to assist farmers, landscapers, and homeowners. There are more than 21,000 annual public inquires from stakeholders. Daily contact with these citizens allows for continued and frank dialogue, exchange of scientific information, and public input into research programs. This

customer-oriented program, which allows for immediate resolution of public concerns, will be continued.

Station scientists respond to questions from the media. There were about 350 annual interviews given to newspaper reporters and personnel from television and radio stations. Results of experiments on tick control, diseases associated with ticks, mosquitoes, West Nile encephalitis virus, Eastern equine encephalitis virus, hemlock woolly adelgids, plant diseases, composting, and general forest health problems were of high interest to reporters. The transfer of research information to stakeholders via the media allows for more informed management of natural resources and resolution of problems. The media frequently make public comments on research progress at the Station and were instrumental in helping to establish a new state-funded mosquito/virus surveillance program. This program was originally supported by Hatch funds.

Public meetings and open houses will be announced in newspapers and newsletters and held at the Station to allow stakeholders to meet scientists, see experimental plots and research laboratories, and to review and discuss research findings. Special contacts will be made with trade groups, commodity associations, and other state agencies to reach under-served populations. Public comment is and will continue to be encouraged in these important listening sessions. Each year, the Station holds special public conferences and open houses. At a public meeting on April 22, 2003, scientists reported on lawn care, growing asparagus, and issues impacting organic produce. Those attending this conference were invited to visit greenhouses and laboratories to see experiments in progress. An open house was held at the Station's main farm in Hamden, CT on August 6, 2003. More than 900 citizens attended and heard presentations on West

Nile virus, control of invasive weeds, basic techniques for propagating plants, homeowner tree care tips, arsenic phase out in pressure treated wood, and air movement of corn pollen. Scientists also described research results at various exhibits and experimental plots and received public comment on the research efforts. Moreover, during the springtime, the facilities at the Valley Laboratory (Windsor, CT) are opened for nursery growers and landscapers to see field plots and to hear research presentations. Station scientists attend growers' open houses and meetings and are available to make special visits to farms when needed.

The Experiment Station Associates (ESA) promote the scientific activities of the Station and publish a quarterly newsletter describing scientific studies and findings. This publication will continue to be sent to members of the ESA, state legislators, and be made available to the general public. In addition, scientists at the Station gave research reports at an annual public meeting of ESA. Comments and questions were received from stakeholders following the talks. The Director or Vice Director of the Station will continue to give research reports to the ESA Board of Directors at monthly meetings. These activities will provide further opportunities for stakeholder input on critical issues in Connecticut.

When Station scientists attend growers' meetings, they invite these stakeholders to participate in research programs and to provide input on experimental design. For example, multi-state research projects exist for USDA-funded SARE (Sustainable Agriculture) grants on insect pests of nursery plants and vegetable crops. Six Hatch projects include stakeholders as participants in the research efforts. Many other experiments are and will continue to be conducted on stakeholders' farms so that these

people can be directly involved with the research effort (including the planning process) and see progress being made.

Station scientists also solicit stakeholder input by serving as members of organizations or officers of board of directors. This activity provides opportunities for stakeholders to learn about Station research and to comment on the programs. This effort will be continued to receive input and to increase contacts. During the past four years, Station scientists interacted with stakeholders in the following 70 public organizations or state committees:

Advisory Board for Vocational Agriculture at Bloomfield High School

Agricultural Technology Development Advisory Board

Albert Einstein College of Medicine (Visiting Assistant Professor)

American Chestnut Foundation

American Veterinary Lyme Disease Society

American Phytopathological Society

American Society of Horticultural Science Technical Program Committee

American Society of Plant Biologists

Animal Behavior Society

Association of Northeastern Herbaria

Branford Inland Wetland Commission

Branford Land Trust

Butterfly Atlas Project

Certified Organic Associated Growers, Inc.

Chestnut Marketing Association

Clay Minerals Society

Clear Lake Improvement Association

Community Gardens, Knox Parks Foundation

Connecticut Academy of Arts and Science

Connecticut Academy of Science and Engineering

Connecticut Agriculture Science and Technology Education Advisory Committee

Connecticut Botanical Society

Connecticut Butterfly Association

Connecticut Christmas Tree Growers' Association

Connecticut Council on Soil and Water Conservation

Connecticut Endangered Species Committee

Connecticut Entomological Society

Connecticut Greenhouse Growers Association

Connecticut Invasive Plant Working Group

Connecticut Mosquito Management Program

Connecticut Nursery IPM Implementation Team

Connecticut Nursery and Landscape Association

Connecticut Pomological Society

Connecticut State Technical Committee

Connecticut Tree Protection Examining Association

Connecticut Tree Protective Board

Connecticut Urban Forestry Council

Connecticut Farm Wine Development Council

Dept. of Agriculture's Agricultural Technology Development Advisory Board

Department of Transportation Subcommittee for Compost Specifications

Department of Transportation Technical Advisory Committee

Eastern Plant Board

Environment Committee, Mill River Watershed Association

Experiment Station Associates

Goodwin Forestry Scholarship Committee

Invasive Non-Native Plant Committee

IR-4 Berry Fungicide Working Group

Loosestrife Containment Committee

Lyme Disease Foundation

Madison Land Conservation Trust

Master Gardeners of Connecticut

National Christmas Tree Growers Association

Natural Resources Council of Connecticut

New England Pest Management Network

New England Plant Conservation Program

New England Society of American Foresters (Executive Committee)

Northeast Organic Farming Association of Connecticut

Northeast Regional Committee of the Workgroup on Environmentally Acceptable Endpoints in Soil; Society for Environmental Toxicology and Chemistry

Northeast Wildlife Management and Outreach Cooperative

Northeastern Forest Pest Council

Northeastern Regional IPM Committee

Northeastern Weed Science Society

Northern Nut Growers Association

Peabody Museum of Natural History, Yale University

Plant Biology Working Group, American Society of Horticultural Science

Professional Grounds Management Society

Quinnipiac Chapter of Sigma XI

Stewart McKinney Wildlife Refuge

Urban Forestry Council

Stakeholders have identified forest health, food safety, reductions in the use of pesticides, arthropod-borne infectious agents, bioterrorism, introduction of exotic insects, plant pests and weeds, and improved quality of water, air, and soil as high priorities. Consumers also want locally grown produce. Municipal officials would like more research dedicated to composting and cleaning sites of industrial contaminants.

Merit and Peer Review Process

There have been no significant changes in the review processes since the first 5-year Plan of Work was approved. Scientific proposals for the Station are subjected to merit and peer review following federal register guidelines and the National Science Foundation model. Merit reviews for proposals closely follow criteria proposed by the National Science Foundation (NSF-99-172).

All scientific proposals and experimental findings of the Station are and will continue to be subject to thorough merit and peer review by individuals who are qualified

to critique the proposed or completed studies. The distinction between merit review (project evaluation whereby the quality and relevance to program goals are assessed) and scientific peer review (that performed by experts with scientific skills to conduct the work encompassed within the program) is recognized. Research priorities follow those outlined in the Plan of Work, are based on stakeholder input, and are consistent with national research priorities recognized by the Joint Council on Food and Agricultural Sciences, the Experiment Station Committee on Organization and Policy, and the United States Department of Agriculture. The proposed research must be of relevance sufficient for an organizational representative to make an informed decision as to whether the proposal is appropriate for federal support.

Project outlines for Hatch or multi-state research funds are prepared by scientists after consultation with the respective Department Head and are independently reviewed by other qualified scientists within or outside the Station. The reviewers are chosen by Department Heads. In addition, the project outline is reviewed by the Department Head who supervises the scientist and by at least two other Department Heads (Chief Scientists) within the Station before the Vice Director and Director of the Station review the proposals and give final approval. Copies of reviews are kept on file by Department Heads. This process evaluates the merit of the proposed scientific work to ensure that the planned research addresses established priorities that are consistent with stakeholders' needs, meets state and national USDA program criteria and goals, and has a reasonable likelihood of success. Scientific peer review of proposals focuses on the suitability and validity of methods to be used (technical quality), originality of the study, and value of the work to the scientific community and the public. Proposals for all multi-state research

projects are reviewed by at least three scientists outside the Station as well as those in the Station. The names of outside reviewers are not disclosed so that candid comments can be received.

Station scientists are encouraged to publish their results in peer-reviewed journals that have national and international audiences and to write reports for the general public. Critical scientific reviews are sought to ensure quality science and accountability. Scientific work is held to high technical standards. The promotion of a scientist depends on scientific productivity and or exceptional service to stakeholders. Emphasis is placed on peer-reviewed journals as the main forum for reporting scientific advancements. Persons who do not have scientific backgrounds, however, are not excluded in this reporting process. They receive non-technical summaries and regional reports plus fact sheets. Results of experiments are examined by the respective Department Heads and the Director of the Station in addition to journal editors and scientific reviewers chosen by the editors.

When the scientific studies are completed, Station scientists will report new discoveries to their peers at national and international conferences to receive input. The interactions among scientists at these meetings will also provide opportunities for future collaborative studies that include an expanding multi-disciplinary, multi-institutional, and multi-state approach.

Station scientists will give periodic progress reports to stakeholders at various organization meetings. Fruit growers, nursery growers, landscapers, arborists, vegetable growers, pest control operators, members of other agricultural groups, the general public, extension specialists, and the media will receive the latest information on experimental

results. Stakeholder comments are important in evaluating the usefulness of scientific work (i.e., in assessing the practical aspects of the work) and will be included along with input from scientists in changing the direction or scope of research. Written or oral comments received were important in ensuring accountability, evaluating the usefulness of scientific accomplishments, and the realignment of research programs to address changing needs and priorities.

The Station's processes of merit and peer review will be evaluated annually for effectiveness by the Vice Director.

Program: An agricultural system that is highly competitive in the global economy.

Research. Goal 1. Through research and education, empower the agricultural system with knowledge that will improve competitiveness in domestic production, processing, and marketing.

Statement of Issues. There are several short-term, intermediate, and long-term critical issues. Efforts to produce new and value-added agricultural products and commodities in Connecticut are mainly focused on protecting crops and forests from insect pests and plant diseases and on finding new and more efficient uses for plant materials. Insects, such as orange-striped oakworm, caterpillars that attack conifer trees, hemlock woolly adelgids, and soil-inhabiting grubs (Japanese beetle and black-vine weevil), impact woodlands and nurseries in Connecticut. The 400 million dollar nursery industry in the state depends on cost-effective insect and weed control programs to market quality products, such as yews and rhododendrons. Exportation of nursery plants and apples to

foreign countries requires that quarantine regulations be met and that exported products are free of diseases, nematode infestations, and insect pests. There is a pressing immediate need to utilize biological and cultural control strategies to reduce the amounts of pesticides used. Chemical pesticide applications can be hazardous to the users, add expense to crop values, and can have adverse effects on non-target species and other environmental components. The hemlock woolly adelgid is spreading northward in New England and is having a severe impact on hemlock trees in forests and nurseries. Aside from aesthetic value, hemlocks ensure diversity in forest ecosystems and prevent erosion in watershed areas. In addition, hemlock logs are exported to Canada for pulp and lumber production. Station scientists have started experiments on tree injection of chemical pesticides for their ability to keep hemlock woolly adelgids under control. The main objective is to find effective methods to save large trees on municipal or homeowner properties. In addition, new fruit and vegetable cultivars are being evaluated in multi-state research programs for resistance to plant-pathogens and insects. These efforts address intermediate and long-term critical issues. Some vegetables are being grown at the request of under-served and under-represented ethnic groups. New apple cultivars will continue to be evaluated for resistance to plant pathogens. Modeling the movement of corn pollen within and between fields is a new multi-state initiative. With the advent of genetic engineering, genetic information from other species is routinely incorporated into the maize genome. Since maize is wind pollinated, questions arise concerning the flow of genetic information between genetically modified and non-genetically modified maize. Studies on the molecular genetics and biochemistry of plants are being conducted to characterize plant nucleobase/ascorbate transporters and to

investigate genetic regulation of leaf development, and to characterize photochemical processes. Genetic engineering of crop plants is of high interest.

There are key strategies of the research program that will make this goal achievable. Collaborations with scientists in other state or federal institutions and with industry will help meet the objectives. A forest health monitoring system exists to detect emerging insect or plant disease problems. Scientists work closely with foresters, pesticide manufacturers, and crop producers to find efficient ways of controlling pests. Principles of IPM, such as pest monitoring, are applied whenever possible so that amounts of pesticides used can be reduced in nurseries and other agricultural fields. Successes in research efforts are strongly linked to a broad base of cooperation among scientists in different disciplines and the inclusion of stakeholders (i.e., crop producers, industry, and consumers) for their input. Specialty groups include fruit growers, nurseries, organic farmers, vegetable growers, pest control operators, tree-care professionals, municipal officials, and forest products companies. Ultimately, the agricultural problems being addressed affect all citizens. Therefore, participation in the multi-state research effort requires that scientists in Connecticut and other northeastern states interact with members of the agricultural community, that citizens be informed of research findings, and stakeholder input be sought and considered. In many instances, scientists work with growers in orchards, greenhouses, and other farm plots to solve immediate problems. Moreover, experiments are conducted in Station-owned farms in Hamden and Windsor, Connecticut.

Performance Goal 1. To annually increase the research and knowledge base available from CSREES partners and cooperators on new value-added commodities and products in United States agriculture and on control of insect pests and plant diseases.

Performance Goal 2. To increase market shares for targeted agricultural products of Connecticut.

Output Indicators. 1. The numbers of publications, talks, and interviews for Station scientists will be tabulated annually and reported. Officerships and memberships of scientists in stakeholder organizations and on national and state committees will also be reported to document the processes of interaction with stakeholders.

Output Indicators. 2. Value-added agricultural products.

Outcome Indicators. There are several expected outcomes and impacts, which include positive changes in behavior of stakeholders and economic benefits, associated with the performance goals listed in this updated Plan of Work. It is expected that:

(1) results of field studies on biological and cultural control of insect pests of vegetables will result in reduced pesticide use, lower costs of control, and reduced human exposure to pesticides. These outcomes also apply to USDA goal #3 (healthy, well nourished population) and goal #4 (greater harmony between agriculture and the environment.

(2) the dispersal of corn pollen will be determined, and models will be developed to aid in the establishment of effective strategies for gene flow management. Plant regulatory officials will be able to set buffer zones between genetically modified corn plantings and non-modified plants. Results will provide a basis for new federal and state permit requirements.

(3) more efficient IPM practices will lead to the reduction of pesticide use and more efficient pest control programs in nurseries to facilitate international and interstate shipments. These outcomes also apply to USDA goals #4 and #5 (enhanced economic opportunity and quality of life for Americans).

(4) commercial greenhouse production facilities will operate more efficiently to reduce environmental contamination by fertilizers and to produce quality crops.

(5) monitoring programs in orchards, nurseries, and vegetable crop production areas will detect emerging insect and plant diseases that may affect plants.

(6) field-testing of new apple cultivars will identify high-yielding, marketable crops that are genetically resistant to plant diseases. This outcome also applies to USDA goal #3.

(7) field-testing of new niche crops, such as tropical pumpkin (calabaza), jilo, maxixi, and radicchio, will provide growers added income and supply consumers with produce of high ethnic interest. These outcomes also apply to USDA goals #3 & 5.

(8) laboratory tests on the molecular genetics and biochemistry of plants will characterize nucleobase/ascorbate transporters and other processes so that new plants can be ultimately developed to use fertilizers more efficiently.

Key Program Components. Laboratory and field studies will be conducted to improve the value of agricultural products, introduce new products for market, and to increase productivity of quality crops. Emphasis will be placed on enhancing profitability of agricultural and forest production methods. Forest plots and nurseries will be monitored to detect emerging insect and plant disease problems that might also affect trees elsewhere. Economically important insect and nematode species will be studied in nurseries, vegetable and fruit producing fields to find ways of reducing infestations (i.e., biological and cultural control methods) with less pesticides. Rotation and cover crops will be evaluated for their effects on insect and nematode populations as well as soil-borne pathogens in multi-state research programs. Potential biocontrol agents will be evaluated for their ability to infect nematodes or reduce insect populations in soil. Genetic resistance will be incorporated into desired cultivars which can be integrated into long-term nematode management systems. New cultivars of apples will be field tested and evaluated for yield and resistance to plant diseases. A biophysically based computer model, using Lagrangian Stochastic simulation of pollen movement in and above corn canopies will be used to determine patterns of corn pollen dispersal. Main elements, such as the rate of production and release of corn pollen; atmospheric transport and turbulent mixing; and losses of pollen from the air due to deposition processes, will be investigated. Experiments in molecular genetics and biochemistry will be conducted to characterize nucleobase/ascorbate transporters and other key processes in plants.

Internal and External Linkages. Research programs will have a multi-disciplinary, multi-institutional, and (or) multi-state approach, and there will be

integrated activities with extension services at land grant universities. Joint efforts by international scientists who have expertise in different disciplines, will strengthen some research programs. The outcome of such synergy will be more rapid progress in meeting objectives. There are collaborative research studies underway on molecular genetics of plants with scientists at Yale University, Indiana University, University of Tartu (Estonia), and Max Planck Institute of Biophysics (Germany). Entomological studies on reducing insect pest damage on apple include inputs from scientists at the University of Connecticut and Department of Systematic Zoology (Lund, Sweden). Research on IPM for soil-inhabiting insect larvae will include both internal and external linkages; two entomologists and a plant pathologist work together at the Station. External collaborations also will include biocontrol suppliers and technical specialists at agrochemical companies, research/extension specialists at the University of Connecticut, Cornell University, Rutgers University, the University of Massachusetts, and research faculty members from the University of Rhode Island and Yale University. Research findings will be shared with extension specialists who will disseminate information to extensive groups of stakeholders in their states. Investigations on new crops will involve a group of Station scientists in the Departments of Forestry and Horticulture and Plant Pathology and Ecology working with vegetable and fruit growers. There is also a collaboration between a Station scientist and staff members at the Puerto Rico Agricultural Experiment Station.

There are extensive external linkages with researchers and extension personnel in USDA-approved multi-state projects. The evaluation of new apple cultivars (NE-183) involves scientists or extension agents in 20 states plus USDA/ARS and Canada. There

are close linkages to NC-103 (postharvest physiology of fruit). Evaluations of 25 cultivars have identified varieties that are less susceptible to insect, fungal and bacterial injury. These findings will lead to more sustainable production systems, which are less reliant on agricultural chemicals. Planned research at the Station will focus on identifying new cultivars that are resistant to fungi. Another Station plant pathologist collaborates with scientists, some of whom have extension appointments at Cornell University, Michigan State University, and the University of Massachusetts, in 8 states and USDA/ARS on NE-171 (biologically based IPM systems for plant nematode management). Significant progress has been made in the application of biologically based nematode controls, which include the use of cover crops, green manures, and (or) organic amendments. For example, rapeseed green manure was effective in controlling *Xiphinema* nematodes. Saia oat and sorgho-sudangrass rotation crops reduced *Pratylenchus* populations. Mushroom compost reduced early dying disease and increased potato yields. Although growers are accepting these practices, nematode problems are extensive in agricultural systems and more work is needed to identify new biological methods of control for species that are currently under chemical treatment. The NE-171 group now has a molecular biologist working with plant pathologists. Moreover, there is planned research to test for genetic resistance in crops, to evaluate other cover crops for effectiveness, and to explore the possibility of using *Pasteuria penetrans*, a bacterial pathogen, to control free-living nematodes. An entomologist at the Station is participating in NE-9 (conservation and cultivation of plant genetic resources) with scientists from 11 other states to identify cultivars of vegetable crops (eg., squash and cucumbers) that are resistant to powdery mildew or insects. Organic farmers have

asked for Station assistance on testing various vegetable cultivars. There is a strong extension component at Cornell University (Geneva Agricultural Experiment Station). A Station horticulturist/plant physiologist is cooperating on NE-1017 with scientists in New Jersey, New York and Michigan. Station research will be continued to develop methods of efficient use of water and plant nutrients in greenhouse tomato production systems (NE-1017). In NE-171, NE-183, and NE-1017, the collaborations of scientists on these multi-state projects extend into midwestern and southern states.

Target Audiences. There are numerous target audiences, such as vegetable growers (including organic farmers), nursery owners, fruit growers, arborists, horticulturists, forest product and seed companies, the general public, and the scientific community, which will benefit from results of scientific studies. The Station is committed to facilitating equality of service and ease of public access to all research programs and services. For example, new information on significant experimental results is and will continue to be available on the Station's internet web site (http://www.state.ct.us) for all to receive. The Station's main laboratories are located in New Haven, Connecticut. The staff serves residents of this city and other cities as well as citizens living in suburban or rural areas. There is an extensive outreach program with farmers and the general public, which allows scientists to give technical assistance to all who ask for help. Under-represented and under-served stakeholders will be included as target audiences. For example, Brazilian, Hispanic, Asian American, and African American ethnic groups asked for field tests of jilo, calabaza, radicchio, and maxixi. There are about 4,500 Brazilians and 320,000 Hispanics living in Connecticut. These stakeholders want locally grown produce that is part of their cultural backgrounds.

Native Americans in the Mohegan and Pequot Tribes asked for and are receiving Station assistance on wetland and forest maintenance practices. Assistance is given to the community gardens program in New Haven, where minorities grow vegetables. Scientists will continue to provide assistance on insect pest problems and plant diseases to all who need information. Career specialists in New Haven high schools assist the Station in locating minority students for summer research apprenticeship programs. This mentorship program is successful. All research programs at the Station focus on the needs of all citizens in diverse audiences including the poor. In addition to information and technical assistance given, the Station donates about 8 tons of produce, which is grown on its farms, to charities. School children of diverse ethnic backgrounds will continue to be invited to Station farm plots to learn about agricultural research programs and will be allowed to pick fruits and vegetables for their own use. The Station participates in Farm/City Week each year. This organized event introduces hundreds of children to agricultural topics. Finally, Station policies exist to correct any disparities identified in its research programs. When scientific studies are completed, results will be presented to stakeholders at organizational meetings and published in peer-reviewed journals. Stakeholder acceptance of research findings and reviewer approvals of the scientific results are and will continue to be major indicators of success and play an important part in changing the direction and scope of research.

Program Duration. All research projects listed under USDA goal #1 are planned for 2 years.

Allocated Resources. Estimated allocated resources for fiscal and human (expressed as Scientist Years) components are listed for 2005 and 2006, as covered by this updated Plan of Work. Resource information in the form of scientific publications and fact sheets will be distributed to stakeholders regularly.

	Fiscal Resources		Human Resources
			SY
	Federal*	State	
Years	Target	Target	Target
2005	$360,000	$1,724,422	12.1
2006	$360,000	$1,724,422	12.1

* Federal Hatch funds only (based on FY 1999 formula funds).

Program: A safe and secure food and fiber system.

Research Goal 2. To ensure an adequate food and fiber supply and food safety through improved science based on detection, surveillance, prevention, and education.

Statement of Issues. There is a need to supply nutritious and safe food for all Americans. The Station has research and testing programs to ensure a safe, secure food and fiber system and participates in state-operated market basket surveys. Surveys of

fresh fruits and vegetables sold in Connecticut, using current multi-residue procedures show that as much as 40% of this produce has contained detectable pesticide residues. The public is very concerned about food safety. This is evident from discussions held at Station-sponsored open houses, media reports, and public inquiries made to Station scientists. Other stakeholders, such as fruit growers, also have requested more information on pesticide residues in produce. Many of the newer pesticides are not amenable to current multi-residue procedures because they are either non-volatile, thermally labile, or water soluble. Therefore, there is an intermediate need to apply highly sensitive and specific analytical methods to detect a broad range of agricultural chemicals in food and to work more closely with other state and federal agencies.

Performance Goal(s). (1) To annually increase the research and knowledge-base available from CSREES partners and cooperators on food safety and food-borne risks and illnesses. (2) Increased consumer access to selected agricultural products of Connecticut that provide greater assurances for safety.

Output Indicators. (1) The numbers of publications, talks, and interviews for Station scientists will be tabulated annually and, along with narratives on research accomplishments, will be reported. Interactions between Station scientists and stakeholders' organizations (i.e., officerships held) also will be documented.

Output Indicators. (2) The numbers of agricultural products and drinking water analyzed for pesticide residues will be recorded along with results of assays. Findings will be reported to appropriate state or federal agencies and the public.

Outcome Indicators. There are two major expected outcomes and impacts associated with the performance goal(s) listed in this section of the updated Plan of Work. It is expected that:

(1) there will be greater consumer access to safe foods grown in Connecticut or produced elsewhere. This outcome also applies to USDA goal #3.

(2) results of laboratory investigations with state-of-the-art equipment will lead to the development of new procedures to detect pesticides in plants, soil, and air. This outcome also applies to USDA goal #4.

Key Program Components. Scientists in the Department of Analytical Chemistry will test fresh fruits and vegetables and canned and frozen vegetables for pesticide residues at the request of other state agencies, such as the Department of Consumer Protection, and for municipalities and growers in Connecticut. The Station's research goals will focus on improving food safety by detecting, controlling, or eliminating food-borne risks. There is flexibility in research programs to allow for immediate responses to emerging problems on food safety. Projects are underway to analyze for chiral components or metabolites of technical chlordane, such as heptachlor, heptachlor epoxide, and oxychlordane. A multi-residue screening method and state-of-the-art analytical equipment, including liquid chromatography and atmospheric pressure ionization mass spectrometry, exist to identify and quantitate pesticides in foods. The research program will continue to include protocols for developing new sample

preparation and cleanup procedures for the analyses of pesticides in produce, focusing on those pesticides and pesticide metabolites not covered with current procedures. Scientists will work along with technicians in performing laboratory analyses. The Food and Drug Administration (FDA) acknowledged that the Department of Analytical Chemistry at the Station is the only facility in the New England states that has an ongoing and viable pesticide monitoring program. Research findings, obtained by Station scientists, will benefit stakeholders nationally. The expected outcomes and impacts of this work will result in more efficient detection of pesticides in food and safer food products.

Internal and External Linkages. Research programs will have multi-disciplinary and multi-institutional components. Station scientists who have expertise in different methods of chemical extraction and detection will work together to ensure accuracy of results. There are frequent interactions with inspectors and officials in the Department of Agriculture and Department of Consumer Protection in Connecticut, which will continue in the future.

Target Audiences. Results of analyses are of interest to commercial growers, especially those who wish to sell organic produce, and to the general public. Connecticut consumers are the ultimate main target audience, but food safety is an issue for all Americans. Stakeholders will promptly receive information (via telephone inquiries, the media, and Station scientist reports) on the presence or absence of pesticide residues in fruits and vegetables. The Station is committed to facilitating equality of service and ease of access to all research programs and services. Significant research findings will be

made available on the Station's website for all to receive. The following state agencies, which submit samples for analyses, will receive test results: Department of Agriculture, Department of Consumer Protection (Food Division and Product Safety Division), and the Department of Revenue Services. Local health departments, growers, businesses in the food processing industry, federal agencies, and the scientific community will also benefit. The Station's research results will be made available to all primarily through the media, including under-represented communities and under-served customers. Scientists will publish their findings in peer-reviewed journals or Station publications to reach a broad professional audience. Stakeholder acceptance of research results and reviewer approval of scientific data are major indicators used to judge success and are important in deciding the direction and scope of future work. Station policies exist to encourage the participation of diverse audiences.

Program Duration. All research projects listed under USDA goal #2 are planned for 2 years.

Allocated Resources. Estimated allocated resources for fiscal and human (expressed as Scientist Years) components are listed for 2005 and 2006, as covered by this updated Plan of Work. Resources information, presented in the form of scientific publications or updated fact sheets, will be distributed to stakeholders upon request annually.

	Fiscal Resources		Human Resources
			SY
	Federal*	State	
Years	Target	Target	Target
2005	$121,400	$244,510	2.6
2006	$121,400	$244,510	2.6

* Federal Hatch funds only (based on FY 1999 formula funds).

Program: Greater harmony between agriculture and the environment.

Research Goal #4. Enhance the quality of the environment through better understanding of and building on agriculture's and forestry's complex links with soil, water, air, and biotic resources.

Statement of Issues. Agricultural systems must be in harmony with other components of the environment. The short-term and long-term critical issues of protecting our soil and water from weeds, pesticides and other chemical contamination, reducing pesticide use and fertilizers in agricultural systems, managing deer populations, finding ways to utilize farm wastes (i.e., composting plant materials), and of the emergence of human and veterinary pathogens transmitted by ticks (eg., bacteria and protozoans) and mosquitoes (eg., encephalitis viruses) in or near farms and forested areas

are of major importance to citizens in Connecticut and many other states. There is a need to develop, as an intermediate-term need, a productive greenhouse growing system for tomatoes and other vegetables where the use of plant nutrients is efficient. Marketing greenhouse tomatoes during the colder months is of great interest to about 40 growers in the state. Investigations also are needed on finding methods of detecting and degrading pesticides and other agricultural compounds that have contaminated soil and water. These studies are designed to meet long-term needs to clean up contaminated sites. There is public concern over pesticides in residential well water and the fate of chlordane and other banned pesticides in soil. Sorption of chemicals to soil particles is a fundamental process governing the fate of organic chemicals in soil and ground water. This process needs further investigation as a long-term need. Composting, a sustainable method of recycling plant materials in agroecosystems, is a priority among farmers, municipalities, and the general public and represents short-term and intermediate critical issues. The emergence of tick-borne pathogens, such as the agents of human Lyme disease, babesiosis, and ehrlichiosis, in or near farms and woodlands and transmission of encephalitis viruses by mosquitoes in similar habitats where deer, mice, birds, and other wildlife are abundant has become a major public concern. With abandonment of small farms, subsequent reforestation has resulted in a rise in ticks and related illnesses. Efforts are needed to reduce tick and mosquito populations in areas where people live or work without adversely impacting natural resources. Finally, it has become apparent that invasive plants, such as water lily, milfoil, cabomba, and coontail, are invading lakes and ponds. Stakeholders have requested Station assistance on finding ways to remove the invasive plants.

Performance Goal 1. To annually increase the research and knowledge-base available from CSREES partners and cooperators on environmental sciences and agriculture, including conserving, maintaining, and protecting ecosystem integrity and biodiversity.

Performance Goal 2. To increase technology options available to agricultural producers to enhance profitability without damaging the environment.

Output Indicators. (1) The numbers of publications, talks, and interviews for Station scientists will be summarized and reported annually. Moreover, the number of interactions between Station scientists and stakeholders' organizations (i.e., officerships held) will be recorded.

(2) Production practices options for reducing over-reliance on chemicals.

(3) Methods for plant waste management that protect the environment.

(4) Methods for removing chemicals from soil and water.

(5) Methods for removing invasive plants from lakes and ponds.

Outcome Indicators. There are several expected outcomes and impacts associated with the above mentioned performance goals listed in this updated Plan of Work. It is expected that:

(1) laboratory experiments will reveal more efficient, cost-effective methods of applying nutrients to greenhouse-grown tomatoes and other crops. This outcome also applies to USDA goals #3 and 5.

(2) laboratory tests will improve methods of detecting and degrading pesticides and other agricultural compounds that have contaminated soil and water.

(3) results of field experiments will lead to more efficient production and use of compost in agroecosytems, including stakeholders' gardens.

(4) laboratory analyses will identify which mosquito species are important in the transmission of West Nile, eastern equine encephalitis, and California group encephalitis viruses in forested areas so that there will be a minimal use of pesticides for control and a more precise time interval defined for application of pesticides. There will be rapid notification of virus isolation results to the public so that precautions on reducing mosquito bites can be taken.

(5) new antibody tests will be developed for the laboratory diagnosis of Lyme disease, granulocytic ehrlichiosis, babesiosis, and tularemia in human beings, domesticated animals, and wildlife species (such as deer and mice) to determine specific localities where there is risk of infection and a need to control ticks.

(6) field experiments will reveal prevalence of infected ticks near human dwellings and effective methods of controlling ticks that transmit pathogens to mammalian hosts.

(7) laboratory analyses will determine concentrations of pesticide residues in air, water, or soil samples submitted by state regulatory agencies.

(8) laboratory and field studies will identify species of entomopathic microsporidia that may be used to control mosquito larvae in wetland habitats and thereby reduce chemical control.

(9) field experiments will be conducted to find environmentally safe methods of removing invasive weeds from lakes and ponds.

(10) IPM programs will be developed for nurseries to reduce the amount of pesticides used, which will result in more efficient uses of agricultural chemicals by producers.

Key Program Components. Laboratory and field studies will be conducted to utilize IPM practices; develop more efficient and productive greenhouse operations; monitor and detect pesticides in air, water and soil; find efficient methods of composting and uses for composted products in farming; control ticks; and to monitor ticks and mosquitoes for human pathogens. A scientist in the Department of Forestry and Horticulture will investigate the optimal supply of nutrients to individual tomato plants in a greenhouse. The Station assists the Department of Environmental Protection (DEP), which is charged with compliance monitoring within Connecticut for the Federal Insecticide, Fungicide, and Rodenticide Act. Samples, including foliage, water, and air, will be submitted to the Department of Analytical Chemistry for analyses of pesticide residues. The Station also interacts with DEP on surveys of surface waters and mosquito/encephalitis surveys. Soil samples will be analyzed for polychlorinated biphenyls. Research underway in the Department of Soil and Water focuses on developing methods of degrading pesticides that have entered soil and water, on monitoring mosquitoes living in wetlands and forests for encephalitis viruses, and on chemical control of invasive weeds in lakes and ponds. Entomopathic microsporidia are being studied to control medically important mosquitoes. Studies also will be conducted on the structure of soil organic matter and the sorption of organic compounds. Leaf compost and varying amounts of fertilizer will be tested on various vegetable crops to

increase yield. There will be additional field experiments on determining the growth of many woody and herbaceous nursery crops in media amended with composted materials. In the Departments of Entomology and Forestry and Horticulture, there are joint research programs on monitoring human pathogens in ticks and wildlife, such as deer and mice; assessing the extent of bacterial, viral, and protozoan infections in humans, wildlife, and domesticated animals (dogs and horses); and on the control of ticks. Scientists in the Department of Plant Pathology are searching for alternative methods of controlling soil-borne plant pathogens so that amounts of fungicides can be reduced on high value vegetable and ornamental crops and on strawberries. There are excellent laboratory facilities for all research projects in this program and a high degree of multi-disciplinary and multi-institutional collaborations. Interest among stakeholders is likewise high.

Internal and External Linkages. There are joint research efforts among scientists who are experts in different disciplines (i.e., soil chemists, pesticide chemists, ecologists, environmental scientists, microbiologists, entomologists, physicians, immunologists, veterinarians and extension specialists) at land grant universities. Research studies on IPM in nurseries include external linkages with the University of Connecticut and Cornell Cooperative Extension Services. Integrated research efforts on control of plant pathogens rely on collaborations among scientists at the Station, the University of Connecticut, Pennsylvania State University, and the University of Massachusetts. Information gained in joint research studies is and will continue to be shared with extension specialists and transferred to stakeholders in numerous states. The development and integration of entomopathogens into pest management systems is linked to a USDA multi-state research

project (S-301) and involves a coalition of 70 scientists in 22 states plus the USDA/ARS Center for Medical Agriculture and Veterinary Entomology (Gainesville, Florida). Although this group of scientists is working on a wide range of economic pests, such as Colorado potato beetles, lepidopteran (caterpillar) pests, and grasshoppers, there is a component to develop biological controls for mosquitoes. In Connecticut, there are stakeholder concerns about pesticides used to control mosquito larvae in catch basins and tidal salt meadows entering sensitive ecosystems near and in Long Island Sound. There is a need to further explore microsporidians as a biological control for target mosquito species found to be important transmitters of encephalitis viruses or identified as major nuisances to humans. Station research is planned to continue to investigate the natural occurrence of microsporidia in mosquitoes and to elucidate the natural history of these parasites so that the long-term need for biological control of mosquitoes can be achieved. Field and laboratory investigations on sorption of organic compounds to natural organic matter and mineral particles will be performed by scientists at the Station, the University of Connecticut, the University of Massachusetts, Cornell University, and in 22 states in multi-state project W-082. The main goal of Station research is to develop efficient and comparatively inexpensive strategies for remediating contaminated environments in agro-ecosystems or urban systems. This group of scientists has a unique blend of expertise and includes experts in the fields of soil chemistry, microbiology, industrial and pesticide chemistry, and environmental pollution. Another Station scientist is participating in multi-state research project NE-1005 on deer management. White-tailed deer cause damage to nursery stock and other crops, saplings in forests, and to homeowners' shrubs. Deer also can cause automobile accidents and are important hosts for ticks that transmit

the agents of Lyme disease, human babesiosis, and human granulocytic or monocytic ehrlichiosis. Nursery growers asked for Station assistance in conducting field studies on methods of humane sterilization of male deer. Station research is planned to further test an injection of a sterilizing agent into male reproductive tissues of deer to determine the feasibility of reducing populations in limited areas. There are 13 scientists from 9 states working together to assess the impact of deer damage, evaluate and improve techniques for estimating deer abundance, and evaluate various methods of deer management. The main extension component is at Cornell University. Research on composted materials will involve collaborators within the Station (Departments of Analytical Chemistry and Soil and Water) and outside the Station: the University of Connecticut, the Connecticut Department of Environmental Protection and municipal officials. Collaborations exist within the Station and with scientists in other institutions on tick-borne infections and efforts to control ticks: Yale University (New Haven, CT), University of Texas (Houston), the University of Connecticut (Storrs), and The Centers for Disease Control and Prevention (Atlanta, GA and Fort Collins, CO). Information on tick pathogens, related human diseases, and tick control will be given to extension specialists at the University of Connecticut for dissemination to broad audiences of stakeholders.

Target Audiences. Homeowners, physicians, veterinarians, forest workers, groundskeepers, public trust and turf managers, landscapers, arborists, conservation officers, pest control operators, pesticide retailers, operators of composting facilities, environmental regulators, extension specialists, water company officials, farmers (vegetable, fruit, and nursery products), soil scientists, other members of the scientific

community are the main target audiences. State and federal regulatory agencies (eg., Department of Environmental Protection and the Environmental Protection Agency) will benefit by receiving data on pesticide contamination and related research. State and local health departments are eager to receive new information on prevalence of infected ticks and mosquitoes and on advances made in the development of more accurate antibody tests for tick-associated illnesses, such as Lyme disease, human babesiosis, and human granulocytic ehrlichiosis. The Station is committed to facilitating equality of service, and ease of access to research programs and services. New findings will be made available to all citizens. Large target audiences are reached by news releases, media coverage of breaking stories, and by providing information on the Station's website (http://www.state.ct.us). By these methods and scientist participation in community events, outreach efforts will provide technical assistance to under-represented and under-served stakeholders. The Station's presence in New Haven provides opportunities for citizens in an urban setting, but efforts are made to reach people in rural and suburban areas so that they can receive information and services. The main objective of the Station's outreach program is, however, much broader in scope and is directed toward state and national stakeholder audiences both within and outside scientific communities.

When experiments and surveys have been completed, results will be published in peer-reviewed journals or Station publications. Results of mosquito analyses for encephalitis viruses will be posted weekly during the warmer months on the Station's website. The media will be informed of significant findings, and oral reports will be given to stakeholder groups. State and federal agencies will be promptly informed of new discoveries. In some cases, when federal grants have supported research, periodic

progress reports will be given to update federal officials on accomplishments. By these diversified methods, there is cross-sectional evaluation of the scientific program which allows for a broad base of stakeholder input and approval and a means to re-direct research efforts.

Program Duration. The research projects listed under USDA goal #4 are planned for 2 years.

Allocated Resources. Estimated allocated resources for fiscal and human (expressed as Scientist Years) components are listed for 2005 and 2006, as covered by this updated Plan of Work. Resource information, presented in the form of scientific publications or updated fact sheets, will be produced and distributed to stakeholders each year.

			Human Resources
	Fiscal Resources		SY
	Federal*	State	
Years	Target	Target	Target
2005	$286,227	$1,945,864	18.6
2006	$286,227	$1,945,864	18.6

* Federal Hatch funds only (based on FY 1999 formula funds).

Multi-Institutional, Multi-Disciplinary, and Multi-State Programs

The Station's Hatch projects, CRIS/CSREES accession numbers, and state and federal Hatch funds are listed in separate tables to document multi-institutional, multi-disciplinary, and multi-state programs (Tables 1-3). Table 4 shows a distribution of funds for this part of the research program and the ≥ 25% required amounts for formula funds. Table 5 shows integrated activities with extension systems in land grant universities, while Table 6 lists separate planned integrated projects showing projected allocated resources (SY values) and estimated costs for FY 2005 and 2006. Table 7 reports projected distributions of Hatch and State matching funds for federal fiscal years 2005-2006. The CRIS code for The Connecticut Agricultural Experiment Station is CONH.

Table 1. Multi-Institutional

Hatch	Project	CRIS Access.#	Primary Collaborating institutions and businesses
CONH	135	0187947	CT Dept. of Environmental Protection
	136	0188720	CT Dept. of Environmental Protection
	137	0177218	CT Dept. of Consumer Protection, US Food & Drug Administration
	138		US Environmental Protection Agency, CT Dept. of Consumer Protection
	139		US Environmental Protection Agency

140		US Environmental Protection Agency
240	0188383	Yale University (New Haven, CT)
241	0191156	Rutgers University
242	0191890	Yale University (New Haven, CT) University of Oxford (UK)
243		None (state specific)
344	0078445	Centers for Disease Control (Atlanta, GA), University of Texas (Houston), Yale University, Univ. of Connecticut (Storrs), L^2 Diagnostics
371	0179183	Univ. of Connecticut (Storrs), Cornell Univ. Cooperative Extension (NY)
375*	0183834	University of Connecticut (Storrs), Cornell Univ. (NY), Univ. of Rhode Island, Rutgers University (NJ)
377	0191684	University of Connecticut (Storrs)
378	0195135	University of Connecticut (Storrs), University of Massachusetts, Cornell University
380	0163201	Cornell Univ., Geneva Experiment Station (Geneva, NY)
551*	0167653	Cornell University (NY), W. Virginia Univ. (WV), Univ. of Georgia (GA), Michigan State Univ. (MI)
559	0186018	Cornell University (NY), Rutgers Univ. (NJ), University of Maryland (MD)
560*	0190494	Cornell University (NY), Rutgers Univ. (NJ), University of Massachusetts (MA), Penn. State Univ. (PA)
561	0191645	CT. Dept. of Agriculture

563	0193029	Cornell University (NY), Rutgers Univ. (NJ)
565*	0198286	Cornell University (NY), Rutgers Univ.
625	0178255	Yale University, Univ. of Connecticut (Storrs), Cornell Univ. (NY), Pioneer Hy/Bred Corp.
628	0187597	None (state specific)
630	0195468	Penn. State University (PA), Univ. of Massachusetts (MA), Univ. of Connecticut
695*	0139748	Univ. of Massachusetts (MA), Cornell Univ. (Ithaca & Geneva, NY), Penn. State University (PA)
768*	0187398	USDA/ARS, Rutgers University (NJ), Cornell Univ. (NY)
769	0187670	CT. Dept. of Environmental Protection, Univ. of Connecticut (Storrs, CT)
770*	0190791	USDA/ARS, University of California (CA), Penn. State Univ. (PA)
771	0188384	Western Connecticut State University, CT. Dept. of Environmental Protection
772	0192464	Western Connecticut State University, CT. Dept. of Environmental Protection
805	0198560	Univ. of Connecticut (Storrs, CT)

*USDA approved Multi-state Research Project.

Table 2. Multi-Disciplinary

Hatch Project	Scientific Disciplines
CONH 135	analytical chemistry, pesticide technology
136	analytical chemistry, soil chemistry
137	analytical chemistry, food production systems
138	analytical chemistry, pesticide technology
139	analytical chemistry, pesticide technology
140	analytical chemistry, horticulture, soil chemistry
240	plant biochemistry, molecular genetics
241	plant biochemistry, molecular genetics, plant physiology
242	plant biochemistry, molecular genetics, plant physiology, immunology
344	acarology, microbiology, immunology, molecular biology, epidemiology, human and veterinary medicine
371	acarology, entomology, integrated pest management
375*	agronomy, analytical chemistry, entomology, insect pathology, integrated pest management, plant pathology
377	entomology, pomology, integrated pest management
378	entomology, plant physiology, integrated pest management
380*	plant genetics, entomology
551*	horticulture, plant pathology
559	deer management, animal physiology, animal behavior

560*	deer management, animal physiology, animal behavior
561	horticulture, composting
563	plant physiology, plant biochemistry, food production systems
565*	plant physiology, food production systems, horticulture
625	meteorology, plant pathology, epidemiology, biophysics
628	plant physiology, epidemiology, biological control
630	mycology, plant physiology, horticulture
695*	nematology, plant pathology, mycology
768*	protozoology, invertebrate pathology, entomology
769	soil microbiology, horticulture, composting
770*	soil chemistry, environmental toxicology
771	weed management, analytical chemistry
772	weed management, analytical chemistry
805	horticulture, weed management

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* USDA approved multi-state research project.

Table 3. Multi-State Collaborations

Hatch Project	CSREES Regional Research Project Number	Participating states in research efforts
CONH 135		
136		
137		
138		
139		
140		
240		
241		
242		
243		
344		CT, CO, TX
371		CT, NY
375*	NE-187	CT, FL, ME, MD, MA, NJ, NY, PA, RI
377		CT, MA
378		CT, MA, NJ, NY
380*	NE-9	CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, VT, WV
551*	NE-183	AL, AR, CT, ID, IN, MA, MI, NC, NH, NJ,

		NY, OH, OR, PA, UT, VA, VT, WA, WI,
559		CT, DE, MA, MD, NJ, NY, PA, VA, WV
560*		CT, DE, MA, MD, NJ, NY, PA, VA, WV
561		
563		
565*	NE-1017	AZ, CT, KY, MI, NJ, NH, NY, OH
625		CT, NY
628		
630		CT, MA, PA
695*	NE-171	CT, FL, MA, MD, MI, NY, PA, RI, WV
768*	S-301	AL, AR, AZ, CA, CT, FL, GA, ID, IL, KY, LA, ME, MN, NJ, NY, NC, OH, SC, TN, TX, VA, DE, PA
769		
770*		AL, AR, AZ, CA, CT, CO, DE, FL, HI, IN, IL, IA, LA, KS, MI, MN, MT, PA, SD, WA, TN, GA
771		
772		
805		CT, MA

* USDA approved Multi-state Research Project.

CT= University of Connecticut (unaffiliated with the Connecticut Agricultural Experiment Station).

Table 4. Distribution of Hatch and State Matching Funds and allocated resources (SY) at The Connecticut Agricultural Experiment Station (C.A.E.S.). 2003 Fiscal Data for Multi-institutional, Multi-disciplinary, and Multi-state projects.

Connecticut			SY units	
Fed. Hatch Funds	State Funds	Total	Multi-categories	Total Hatch Program
$351,342	$1,598,218	$1,949,560	17.1	39.2

Total funds available for entire Hatch program (FY 03) at C.A.E.S.	$760,541
% dedicated to multi-institutional, multi-disciplinary, and multi-state programs	46.2 %

Table 5. Distribution of Hatch and State Matching Funds and allocated resources (SY) for integrated research activities between The Connecticut Agricultural Experiment Station (C.A.E.S.) and extension programs in land grant universities during 2003.

Connecticut			SY units	
Fed. Hatch Funds*	State Funds	Total	Integrated only	Total Hatch Program
$309,537	$1,453,215	$1,762,752	14.4	39.2

Total funds allocated to entire Hatch program at C.A.E.S. in FY 03	$760,541
% dedicated to all multi-categories and integrated activities in Connecticut only	35 %
% dedicated to all multi-categories and integrated activities with CT and other states	40.7%

***The Connecticut Agricultural Experiment Station receives no Smith-Lever funds but dedicated Hatch funds for integrated activities with extension services in land grant universities in different states. In Connecticut, $265,898 was dedicated to integrated activities with extension at the University of Connecticut, an institution which is unaffiliated with The Connecticut Agricultural Experiment Station. Amounts for FY2005 and 2006 integrated activities will exceed the required 25% target value.**

Table 6. Separate listing of planned programs for integrated research and extension activities with projected allocated resources (SY values) and estimated costs for federal FY 2005 and 2006.

	Projected SY		Estimated Costs*	
Title of planned program activities	2005	2006	2005	2006
Tick-borne infections	2.3	2.3	$34,000	$34,000
Managing insects on vegetable crops	0.4	0.4	6,500	6,500
Plant genetic resources (NE-9)	0.1	0.1	4,000	4,000
Greenhouse production (NE-1017)	1.0	1.0	5,000	5,000
Managing insects in apple orchards	0.5	0.5	45,000	45,000
IPM for Connecticut nurseries	0.8	0.8	5,000	5,000
Management of insects in soil (NE-187)	0.2	0.2	5,000	5,000
Evaluation of new apple cultivars (NE-183)	1.0	1.0	4,500	4,500
Suppression of soil-borne fungal infections	1.0	1.0	40,000	40,000
Wildlife Management (NE-1005)	0.8	0.8	5,000	5,000
Dispersal of corn pollen	0.6	0.6	10,000	10,000
IPM for plant nematodes (NE-171)	1.0	1.0	65,000	65,000
Herbicides/weed control	1.0	1.0	9,500	9,500
Totals	10.7	10.7	$238,500	$238,500

*Projected distribution of Hatch funds. A minimum of 25% of total Hatch funds will be dedicated to integrated activities.

Table 7. Projected distributions of Hatch and state matching funds at The Connecticut Agricultural Experiment Station (C.A.E.S.) for Multi-institutional, Multi-disciplinary, Multi-state, and integrated activities for federal fiscal years 2005-2006.

Years	Federal Hatch Funds	%*	Total State Funds	Total Matching funds**	Total SY units
2005	$238,500	31	$1,453,215	$1,691,715	14.4
2006	$238,500	31	$1,453,215	$1,691,715	14.4

*% = Amounts of Hatch and state funds projected for all “multi” categories and integrated activities at C.A.E.S. divided by total Hatch funds allocated to C.A.E.S. in 2003 ($760,541).

**Federal Hatch funds for all “multi” categories and integrated activities plus state match.

Projected Resources for The Connecticut Agricultural Experiment Station

The following is a projection of financial and human (Scientist Years) resources for the entire Hatch research program and related state projects (excluding federal and non-federal grants) for federal FY 2005-2006. Federal dollars include the Multi-state research allocations. The baseline for the formula funds was taken from the 1999 appropriated levels. The state matching funds are based on 2003 final figures.

Year	Projected Federal Hatch Funds *	Projected State Matching Funds	Projected SY
2005	$767,627	$4,483,825	39.2
2006	$767,627	$4,483,825	39.2

*Baseline FY 1999 appropriations for The Connecticut Agricultural Experiment Station.

Descriptions of integrated programs (jointly planned, funded, and interwoven projects)

Tick-borne infections. At the request of veterinarians and pet owners, laboratory studies will be conducted to develop or refine serum antibody-detection assays for the diagnosis of Lyme borreliosis, tularemia, babesiosis, and granulocytic ehrlichiosis in mammals to meet short-term and intermediate critical needs. A veterinarian, who has a research/extension appointment at the University of Connecticut, is collaborating on this research by performing immunoblotting methods and supplying key positive and negative controls.

Managing insects on vegetable crops. There is increased interest in organic farming. Consumers want to buy locally grown produce that has not been treated with pesticides. Alternatives to insecticides will be investigated in field plots of cucurbits, eggplants, beans, and *Brassica* greens and will include evaluations of insect resistant plant cultivars, various mulches, cover crops, and of predators and parasites of major insect pests to meet intermediate needs of stakeholders. Extension agents at the University of Massachusetts are collaborating on the project by enlisting organic farmers to participate in the research.

Plant genetic resources. Plant breeders at land grant universities and scientists in businesses are developing new cultivars of vegetable plants that are resistant to insects. Selected plant cultivars will be evaluated in field plots for resistance to flea beetles, caterpillars, and other insects to meet long-term critical needs of organic farmers. The main extension component is in the Geneva Agricultural

Experiment Station (Cornell University), where new plant cultivars are developed.

Greenhouse production. Greenhouse-grown tomatoes are an important commodity during colder months in northeastern United States. Experiments will be conducted to evaluate new cultivars for yield and fruit quality and to determine minimal amounts of plant nutrients needed to produce acceptable crop yields. Researchers, who also have extension appointments at Rutgers University and Ohio State University, will determine which cultivars are best for greenhouse systems that use minimal amounts of plant nutrients.

Managing insects in apple orchards. Leafminer, leafrollers, and other insect pests of apple trees reduce fruit quality and yield. Insecticides are needed to control these pests, but such treatments reduce populations of natural parasites and predators. Studies will be conducted to monitor orchards for the introduction of exotic pests, to determine specific periods when insecticidal sprays will be effective without negatively impacting parasites and predators of target pest species, and to further develop IPM programs to meet intermediate and long-term critical needs of fruit growers. The extension component is in the University of Connecticut and University of Massachusetts, where staff members disseminate research findings to growers.

IPM for Connecticut nurseries. Intensive production of nursery plants requires pesticide treatments to ensure quality plants for wholesale and retail establishments. In some cases, large nurseries are situated over aquifers or located near residential areas. Efforts to establish IPM programs have been successful. Some growers

are convinced that the IPM approach is sound and that there can be reductions in the use of pesticides with substantial cost savings. Research efforts to control mites and select target insects will continue in nurseries where IPM programs exist. The goal is to establish IPM programs in more nurseries statewide to meet intermediate and long-term critical needs of nursery growers. Extension agents at the University of Connecticut and Cornell University are collaborating on the project by informing nursery growers of the latest results.

Management of insects in soil (NE-187). Great progress has been made in controlling various beetle grubs in turf, Christmas tree farms, and container-grown nursery stock to meet short-term critical needs of groundskeepers, golf course managers, and growers. Additional experiments are required, however, to establish more specific guidelines for the treatment of different beetle species under different growing conditions. Scientists with extension appointments at Rutgers University, the University of Massachusetts, and Cornell University are collaborating on this project by informing stakeholders of new results.

Evaluation of new apple cultivars (NE-183). Fruitgrowers need new apple cultivars that are resistant to apple scab and other fungal infections. Field evaluations will be conducted to determine if new cultivars do indeed have resistance to fungi and are acceptable in fruit quality and yield. The main extension component is in the Geneva Agricultural Experiment Station (Cornell University), where new cultivars are developed and evaluated.

Suppression of soil-borne fungal infections. *Fusarium* infections of asparagus,

pumpkins, and other crops decrease yield and profitability for growers. Field and laboratory experiments will be continued to develop methods of suppressing these pathogens by utilizing mineral nutrition (fertilizers) and chloride salts (cultural practices) to meet intermediate and long-term critical needs of growers. Scientists, who have extension appointments at Cornell University, Rutgers University, University of Connecticut, and University of Massachusetts are collaborating on the research by performing parallel experiments in different settings.

Wildlife management. Deer cause damage to nursery and food crops. Their involvement in automobile accidents and increasing tick population also results in financial losses or emergence of human diseases. Experiments will be conducted to find ways of sterilizing male deer so that populations will decrease. The main extension component is at Cornell University.

Dispersal of corn pollen. With the development of genetically engineered corn plants to develop high-yielding cultivars that are resistant to insects and plant diseases, questions are being asked about the range of corn pollen dispersal by wind. Agrobusinesses are requesting permits to grow genetically modified corn in isolated open plots. Therefore, experiments are needed to determine patterns of corn pollen dispersal to better define buffer zones for the growth of genetically modified plants to meet short-term critical needs. The extension component is in Cornell University where a scientist overseeing some field experiments has an extension responsibility to inform growers of test results.

IPM for plant nematodes and fungi control. Scientists from 9 institutions are working

together (NE-171) to develop methods to reduce nematode and fungal infections in nursery, strawberry, and potato crops. Use of certain rotation crops has had limited success. Additional experiments are planned to continue this research effort so that more efficient IPM programs can be implemented on farms to reduce pesticide use. The major extension components are in the following institutions: University of Massachusetts, Cornell University, and Michigan State University. Joint publications for growers are planned.

Herbicides/Weed control. Weeds are a major problem in nurseries, vegetable production sites, and Christmas tree farms. Growers have asked for assistance on finding acceptable chemical and non-chemical methods of weed control. Experiments will be conducted to develop workable management programs so that herbicide use and costs can be reduced. The extension component is the University of Connecticut.

Assistance to the Under-Served and Under-Represented / Equal Employment Opportunity

The Station has formal policy statements and a written plan, revised annually, that address equal access and nondiscrimination in all terms and conditions of research programs including employment, work assignments, educational and training opportunities, research opportunities, use of facilities, and opportunities for employees to serve on committees for Station activities. There also are efforts to increase purchases of items from businesses owned by women and minorities. A brief summary of activities and plans for the federal FY 2005 and 2006 are described below.

The Station's main laboratories are located in New Haven, Connecticut. Consequently, the institution has strong ties to urban residents of varied ethnic backgrounds (eg., African Americans, Hispanics, and Asian Americans) as well as residents living in rural or suburban settings. In addition, assistance has been given on forest and wetlands management to members of the Mohegan and Pequot Tribes in Connecticut at the request of these stakeholders. Ethnic crops are being grown at the request of other minority stakeholders. With the current outreach programs and goals to extend service to broad populations of Connecticut citizens, the Station has been and will continue to be in an excellent position to connect persons of different economic, racial, ethnic, and educational backgrounds in the state.

Innovative programs exist to further develop and sustain a diverse workforce that includes minorities and women, to train high school and college students in science, provide opportunities for Postdoctoral Research Scientists to conduct higher-level experiments, and to encourage participation of all citizens in public events, such as lecture programs, field days, tours of laboratories and field plots, and other research-related events. Station employees have opportunities to further their education by taking courses in area colleges and universities. Moreover, the Station is strongly community oriented. Produce from its farm plots is donated to charitable organizations, including food-sharing programs, to assist those in need. The Station assists the homeless and poor in urban settings with community garden programs. Soil samples from existing and planned gardens are analyzed for heavy metals, such as lead and arsenic, because these

plots are sometimes located on old industrial sites. Station personnel help urban as well as suburban gardeners solve agricultural pest problems, and explain how to produce and use compost. Minority and other students, who visit farm plots and learn about scientific work, are allowed to pick fruits and vegetables for their own use. The Station's auditorium and conference rooms are available free of charge.

Administrators and staff members at the Station are committed to equal employment, affirmative action, and addressing underutilization of minorities and women in the workforce. The Vice Director, who is also the institution's Affirmative Action Officer, reviews civil rights program initiatives, employment records and personnel policies, identifies nonquantifiable aspects of the employment process which may impede or prevent the full and fair participation of protected race/sex group members, and prepares documents annually for review by the State Commission on Human Rights and Opportunities (CHRO) in accordance with state regulations (46a-68-31 to 46a-68-74). The Director and Vice Director appeared before the CHRO annually to answer questions about progress being made to address underutilizations in the Station's workforce.

Goals & Procedures: Program Delivery

The Station's research program and activities benefit the needs of all citizens. Nonetheless, efforts are made to reach under-served and under-represented groups in the hopes of cultivating their interest in agriculture and of increasing their participation in Station events that are open to the public, such as

Plant Science Days in the spring and summer, open houses at the Valley Laboratory in Windsor, CT, Farm/City Week, and other events. The Station's staff includes minorities and women who participate in these and other events. Research exists to benefit under-served and under-represented groups. For example, crops are being grown at the request of ethnic groups, and assistance is being given to native American stakeholders. A mentorship program exists to train minority high school and college students.

Goal 1: Annual public events will be scheduled to meet the needs and interests of all citizens, including those of under-represented groups as a means of increasing their participation and inviting stakeholder input.

Procedures: Plant Science Days will be scheduled annually during the spring and summer. The Station will participate in Farm/City Week and have displays at other agricultural fairs and events. Notification of Station events will be published in the Experiment Station Associate's Bulletin and announced through the media. Efforts will be made to invite minority students. Tours of Station facilities will be planned.

Past Performance and Expected Impact: Major public events occurred each year to invite citizens who live in urban, rural, and suburban areas to see Station experimental plots and to hear oral presentations on research. About 1,000 persons attend these events. Stakeholders saw experimental plots, reviewed and commented on results, and were able to apply new information to farm management programs or to homeowner needs. Efforts to implement IPM programs on farms have been successful and have resulted in savings on pesticide

costs. Grower acceptance of IPM principles has increased. Stakeholder input was considered in re-alignment of research programs. It is expected that more nurseries will establish IPM programs and that there will be increased stakeholder participation in Station programs.

Goal 2: The Station will work closely with inner city garden communities and encourage good agricultural practices.

Procedures: Station personnel will aid inner city residents by plowing garden plots and assisting on solving insect and plant disease problems. Groups of citizens will be invited to see experimental plots on Station-owned farms.

Past Performance and Expected Impact: Station staff assisted New Haven residents by plowing community garden plots, answering questions on insect pest problems and plant diseases, and by securing grant funds for a community project. Stakeholders had good yields of nutritious vegetable crops, which helps meet USDA goal #3: to have a healthy, well-nourished population. Residents from urban communities attended Station open houses and other public events, met scientists, received answers to their questions, and saw minorities and women working. Input was received to help re-align research programs. It is expected that there will be continued users in the community gardens program and increased Station involvement.

Goal 3: The Station will donate produce to charitable organizations in food-sharing programs to meet the needs of the poor.

Procedures: Station personnel will make and maintain contacts with charities and coordinate the harvest and distribution of produce to organizations in food-sharing programs.

Past Performance and Expected Impact: Fruits and vegetables from plots at both of the Station's farm locations were donated to charities, including food-sharing programs. There were no costs for these foods. Hundreds of needy stakeholders received the donated foods. These efforts support USDA goal #3: to have a healthy well-nourished population. It is expected that farm produce from Station research plots will continue to improve diets for under-represented and under-served stakeholders.

Goals & Procedures: Public Notification

The Station confirms its continuing policy of commitment to affirmative action and equal employment as immediate and necessary objectives of the Station. A policy statement, signed by the Director, is and will be posted in public areas and has been given annually to all employees and their labor unions. This document covers research programs and all aspects of the employment process, such as employment applications, job qualifications and specifications, recruitment, hiring, promotion, personnel policies, and notification of the general public of all bidders, contractors, subcontractors, and suppliers of material that the Station will not knowingly provide services and programs for or do business with anyone who discriminates against protected persons. A list of objectives for affirmative action has been given annually to all employees. Union groups and Station employees have been invited annually to review the Station's Affirmative Action Plan. All job notices have included statements that the Station is an Affirmative

Action/Equal Employment Opportunity Employer. Job notices have been published in newspapers, sent to colleges and universities, and mailed to organizations representing minorities in the state. Policies regarding discrimination and equal opportunity have been and will be clearly stated or expressed in official station documents or as a part of various program activities, such as contract compliance. Station policies on discrimination and equal employment are consistent with those of the United States Department of Agriculture outlined in memos on Departmental Regulations dated February 25, 1998 and March 16, 1998 from the Office of Civil Rights and the Office of the Secretary, respectively. If violations of state and federal laws on discrimination and sexual harassment occur at the Station, procedures are established to correct problems.

Goal 1: Job candidates will be notified of program availability and requirements of nondiscrimination on the basis of race, color, national origin, sex, sexual orientation, disability, and other categories covered by state and federal laws.

Procedures: Job notices will be posted on the Station's web site, published in newspapers, and distributed to colleges, universities, and members of protected organizations to announce vacancies. All notices will have statements on equal employment opportunity and affirmative action. The policy statement on employment processes will be given to employees annually and will be posted along with USDA notices against discrimination in public areas to reaffirm nondiscriminatory policies based on race, color, national origin, sex, sexual orientation, disability and other categories covered by state and federal laws.

Past Performance and Expected Impact: Job notices were posted on the Station's web site, published in newspapers and distributed to other media (e.g., scientific job

placement offices, colleges, universities, and members of organizations for protected groups) to announce vacancies. All notices had statements on equal employment and affirmative action. This effort resulted in the hiring of minorities for Postdoctoral Research Scientist and Summer Research Assistant positions. A policy statement on employment processes has been posted in public areas at the Station and includes anti-discrimination statements. Similarly, non-discrimination clauses have been included in bidding forms sent to bidders and contractors who do business with the Station and on official state requisition forms. Minorities were hired for Postdoctoral research positions and the summer intern program. There have been no complaints filed on discrimination issues during the period covered by the current Plan of Work. It is expected that workforce diversity will be improved.

Special Program Initiatives

The Station has an outreach program initiative to increase minority applicant flow and to continue a mentorship program to train young adults interested in science careers. This program is designed to increase workforce diversity and to provide opportunities for promising students. In a continued effort to reach minorities in urban settings, Station staff members have met with community leaders. Career specialists at colleges, universities, and in the New Haven School System have been responsive. For example, seven minority high school and college students were hired to assist scientists during the summer of 2003. Included were one Black male, two Black females, two Hispanic females, and two Other females. A teacher at the Sound School in New Haven, with

outside funding from a special USDA grant, assisted the Station in finding two minority high school students (one Black female and one Hispanic female) to help improve the Station grounds during 2003. These initiatives will be extended to help find jobs for high school minority students and to provide a mentorship program so that students can learn new skills.

A new initiative focuses on helping Hispanic stakeholders further their education. In recent years, there has been a marked increase in numbers of people entering the USA from Central and South America. A White male forester at the Station taught short courses on tree biology and health in Spanish to employees of tree companies. This program helped Hispanic workers to receive state certification as licensed arborists. This outreach effort has brought the Station closer to an expanding and previously under-served population of minorities and will continue in the future.

The Station is committed to making every good faith effort to award a fair proportion of its contracts to Minority Business Enterprises (MBE). During 2003, there were 25 MBE set-aside purchases and contracts awarded to business owners who are Black, were from the Iberian Peninsula, or are women. There has been marked improvement in the number of contracts awarded to these groups since 1999. Minority and women-owned businesses are receiving a better share of state contracts allowed under the Station's budget and will continue to have access to state contracts the future.

Certification

This new updated Plan of Work was prepared by Dr. Louis A. Magnarelli, Vice Director at the Connecticut Agricultural Experiment Station. Input was received from

Station scientists for the development of this document. This plan is submitted as a part of specified reporting requirements, as mandated by the Agricultural Research, Extension, and Education Reform Act of 1998 and as allowed under the USDA/CSREES guidelines for preparing a Plan of Work.

Dr. John F. Anderson, Director

Appendix 1

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(brief summaries on pages 72-76 precede this page)

Institution The Connecticut Agricultural Experiment Station (New Haven)
State Connecticut

Check one: ___ Multistate Extension Activities
_X Integrated Activities (Hatch Act Funds)
___ Integrated Activities (Smith-Lever Act Funds)

Title of Planned Program/Activity	Actual Expenditures FY 2005	FY 2006
Tick-borne infections		
Managing insects on vegetable crops		
Plant genetic resources (NE-9)		
Greenhouse production		
Managing insects in apple orchards		
IPM for Connecticut nurseries		
Management of insects in soil (NE-187)		
Evaluation of new apple cultivars (NE-183)		
Suppression of soil-borne diseases		
Wildlife management		
Dispersal of corn pollen		
IPM for management of plant nematodes (NE-171)		
Herbicides/weed control		
Total		

_____ _____
Director Date

Form CSREES-REPT (2/00)