

PLAN OF WORK

The Connecticut Agricultural Experiment Station
P.O. Box 1106
New Haven, CT 06504
Federal Fiscal Years (2000-2004)

Introduction

The Connecticut Agricultural Experiment Station (hereafter referred to as the “Station”) is the nation’s first Agricultural Experiment Station. As a state agency unaffiliated with a university, the Station is uniquely governed by a Board of Control comprised of the Governor, two of his or her appointees, the Commissioner of Agriculture, the Director of the Station, and appointees from the University of Connecticut, Wesleyan University, and Yale University. The Station’s mission is research. Federal Hatch funds are received for research, but no federal funds are received for extension or educational programs. Therefore, reporting in this Plan of Work focuses on research currently in progress and intended for the next five years, as required by the Agricultural Research, Extension, and Education Reform Act of 1998.

Connecticut is a small state with several physiographic regions and the highest population density in northeastern United States. 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 exist, however. Public drinking water supplies are drawn exclusively from protected surface and ground water watersheds and aquifers. Nearly 60% of the state is forested, and residential subdivisions have numerous trees. The Station is frequently called upon to provide information and advice related to agricultural and forestry practices.

Although there are no formal educational or extension components, the Station disseminates new information to extension programs 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 conferences. Integrated activities with university extension programs exist and are described in this Plan of Work. 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 strongly encouraged. The Experiment Station Associates, a citizen support group with a membership of about 650 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 three major goals of the Research, Education, and Economics Mission Area and the Cooperative State Research, Education, and Extension Service (CSREES) Agency Strategic Plans. The research program

at the Station closely follows national priorities and federal goals on improving the agricultural production system to be highly competitive in the global economy (goal #1), providing a safe and secure food and fiber system (goal #2), and on greater harmony between agriculture and the environment (goal #4). Emphasis is placed on achieving economically competitive production systems, the production of value-added products, and protecting, conserving and improving water and soil resources. New initiatives on investigating *Escherichia coli* O157:H7 in apple cider and studies on detecting and monitoring pesticides in fruits and vegetables address important food safety issues. The emergence of microbial pathogens in ticks and mosquitoes that feed on humans and of pathogenic bacteria and protozoans in food are problems that will require continued attention. 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 remain in high priority. Outreach and training programs will be conducted to address equal employment issues and to include minorities and women in the research effort. Department Heads, the Director, and the Vice Director participate in Station functions, and along with other scientific staff, have their own research programs, secure grant funds, and solicit stakeholder input.

Stakeholder Input

The Station has had and will continue to utilize different methods to identify stakeholders (i.e., customers) and receive their input on past achievements, identifying problems, and on planning research so that critical issues in Connecticut can be addressed. Stakeholders are persons who depend on the Station's research program and results to solve agriculturally related problems. Input on major problems is and will continue to be sought directly from citizens, the media, legislators, and organized groups (e.g., Connecticut Farm Bureau, Connecticut Nurserymen's 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, 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.

In addition to setting policy for the Station, board members have direct interaction with agricultural communities and solicit stakeholder input for the Station. For example, one of the Governor's appointees is a leader in the national and state farm bureaus. Serious problems in agriculture, such as house fly outbreaks in neighborhoods near poultry and dairy farms, were reported by her constituents and corrected by Station scientists. Another appointee of the Governor is a fruitgrower. Orchard-related problems, including *E. coli* in apple cider, apple scab, and a variety of insect and mite pests, are being investigated as a result of stakeholder concerns expressed to this board member and Station scientists. Moreover, there were stakeholder requests from various ethnic groups, expressed to the Commissioner of Agriculture, 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 initiating field tests of okra, jiló, artichokes, sweet potatoes, chinese cabbage and other vegetables. Finally, the board appointee from the University of Connecticut is a nurseryman. The nursery industry in Connecticut requested Station assistance on developing integrated pest management (IPM) programs and conducting research studies of major insect and mite pests. An IPM specialist was hired to help growers find ways of controlling major pests with reduced amounts of

pesticides. The nursery industry in Connecticut has asked for Station assistance on managing deer. A new position for a scientist to work on this problem will be considered.

Scientists at the Connecticut Agricultural Experiment Station view all citizens 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. Three-hundred and eighteen oral presentations were given in the state fiscal year of 1997-1998. 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 conduct or use agricultural research or who provide stakeholder input on Station programs:

- Agriculture Information Council
- Agriculture Technology Task Force
- Albertus Magnus College
- 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
- Beecher Road School
- Bishop's Orchards
- Bridgeport Aquaculture School
- Brookfield Garden Club
- Canadian Fruit Pest Management
- Canoe Brook Lake Association
- Center for Learning in Retirement (Storrs)
- Central New York Academy of Medicine
- Cheshire Garden Club
- Citizens of Groton Long Point
- Columbus House Shelter for the Homeless Community Garden volunteers
- Compost Technical Advisory Group
- Connecticut Agricultural Experiment Station Board of Control
- Connecticut Audubon Society
- Connecticut Chapter of the Society of American Foresters
- Connecticut Christmas Tree Growers
- Connecticut Department of Environmental Protection
- Connecticut Department of Transportation
- Connecticut Farm Bureau
- Connecticut Forest and Park Association
- Connecticut Greenhouse Growers Association

Connecticut Groundskeepers Association
Connecticut Invasive Plant Committee
Connecticut Maple Syrup Producers Association
Connecticut Microscopy Society of Wesleyan University
Connecticut Nursery IPM Implementation Team
Connecticut Nurserymen's Association
Connecticut Pomological Society
Connecticut State Department of Agriculture
Connecticut State Environment Committee
Connecticut State Foresters
Connecticut State Office of Policy and Management
Connecticut State Public Health Officials
Connecticut Tobacco Growers
Connecticut Tree Protective Association
Connecticut Urban Forest Council
Connecticut Valley Branch of the American Society for Microbiology
Connecticut Vineyard & Winery Association
Cromwell Women's Garden Club
Dwight School in New Haven
East Haven Magnet School
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
Experiment Station Associates
Fairfield County Groundskeepers Association
Fairfield County Veterinary Medical Association
Fairfield Horticultural Society
Farm-City Week Committee
Farmington River Watershed Association
Federated Garden Clubs of Connecticut
Gateway Community College
Girl Scout Troop 168 (Windsor)
Greenhouse Growers
Guilford Garden Club
Harriet Beecher Stowe Elementary School
Heritage Village Condominium Association
High School in the Community (New Haven)

Hill & Dale Garden Club
Holcomb Farm
Imperial Nurseries
James H. Moran Middle School
Knox Parks Foundation Community Garden Program
Lebanon Chemical
Long Hill Garden Club
Maple Row Tree Farm
Massachusetts Dept. of Food and Agriculture Pesticide Subcommittee
Massachusetts Extension Service
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
Nathan Hale School
Naugatuck Valley Audubon Society
New England Vegetable and Berry Growers
New Hampshire Agricultural Extension educators
New Haven Garden Club
New Haven Parks and Recreation
Newtown Garden Club
Noah Wallace Elementary School
North American Maple Syrup Council
North Carolina State University (Raleigh)
Northeast Directors Association
Northeast Forestry Cooperator
Northeast Regional Turf Workgroup
Northeastern Mosquito Control Association
Northeastern Weed Science Society
Northhampton Massachusetts High School
Organic Associated Growers of Connecticut
Planters' Choice Nursery
Prides Corner Farms
Quinnipiac College
Quinnipiac College Botany Class
River Garden Club

Rotary Club of New London
Rotary Club of Orange
Sam Bridge Nursery
Seymour Garden Club
Shoreline Gardeners Club
Shoreline Outdoor Education Center
Sikorski Men's Garden Club
Society of Invertebrate Pathology
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
Southport Women's Garden Club
Spring Glen Garden Club
St. Bridgets Elementary School
Steep Rock Association
Totoket Grange
Town & Country Garden Club
Town of Guilford Maintenance Staff
Town of New Canaan town committee and public
Trinity College (Hartford)
Trumbull Public School Building Committee
Uniroyal Chemical Company
University of Connecticut
University of Connecticut Landscape Maintenance Class
University of Delaware
University of Massachusetts (Amherst)
Urban Resources Initiative
US Forest Service
Wagenengen Agricultural University, Netherlands
Wallingford Garden Club
Wallingford Senior Citizens
Waterbury Senior Citizens
West Hartford Conservation Commission
West Haven Garden Club
Western Massachusetts Gladiolus Society
Western Pennsylvania Society for Clinical Microbiology
Westville Garden Club
Wetherfield Nature Center
Wilton Garden Club
Windsor African Violet Society

Windsor Shade Tobacco Association
Woodbridge Rotary Club
Yale School of Forestry and Environmental Studies
Yale University

Diagnostic services are available for citizens to submit insect and diseased plant specimens for identification and control. Soil samples are analyzed to assist farmers and homeowners. During the state fiscal year of 1997-1998, there were 24,308 public inquiries from stakeholders. Daily contact with these citizens allows for continued 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. During the state fiscal year of 1997-1998, 351 interviews were given to newspaper reporters and personnel from television and radio stations. Results of experiments on tick control, diseases associated with ticks, mosquitoes and Eastern Equine Encephalitis viruses, hemlock woolly adelgids, plant diseases, composting, and forest 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 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. During the past 2 years, the Station held special public conferences and open houses. On October 30, 1997, there was a conference on agricultural chemistry. Citizens heard talks on pesticides found in soil and produce, effect of food preparation on pesticide residues, PCB contamination of fish, and environmental issues associated with the use of pressure treated wood. At a second public meeting on April 1, 1998, scientists reported on soil preparation in the home garden, alternatives to insecticides in the vegetable garden, and growing wine grapes. 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 farm on August 5, 1998. More than 1,200 citizens attended and heard presentations on tick control and Lyme disease, managing weeds, growing vegetables by hydroponics, protecting Connecticut lakes, pruning ornamental shrubs, and growing vegetables without insecticides. Scientists also described research results at various exhibits and experimental plots and received public comment on the research efforts. On October 26, 1998, another public meeting was held on agricultural chemistry. Research findings were presented on pesticides in residential well water, fate of chlordane residues in soil and arsenic in pressure-treated wood. On December 5, 1998, a farmer/scientist conference was held on alternatives to insecticides in managing vegetable insects. This conference, organized by a Station scientist, also was attended by extension specialists. On April 7, 1999, a public meeting was held to report research findings and receive stakeholder comments on studies of a new exotic wood-boring beetle that attacks

arborvitae and cedar trees, growing raspberries, and on gardening practices.

The Experiment Station Associates (ESA) promote the scientific activities of the Connecticut Agricultural Experiment 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 Connecticut Agricultural Experiment Station gave research reports at an annual public meeting of ESA. The Director or Vice Director of the Station will 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.

Station scientists invited growers to participate in research programs and to provide input on experimental design. During the state fiscal year of 1997-1998, two research proposals were written for USDA-funded SARE (Sustainable Agriculture) grants on insect pests of nursery plants and vegetable crops. A Hatch proposal was written in collaboration with nurserymen to investigate weed control. Many other experiments are and will continue to be conducted on stakeholders' farms so that farmers can have direct involvement 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 effort will be continued to receive input and to increase contacts. During 1997-1998, Station scientists interacted with stakeholders in the following 40 public organizations or state committees:

- Advisory Board for Vocational Agriculture at Bloomfield High School
- American Chestnut Foundation
- American Veterinary Lyme Disease Society
- Association of Northeastern Herbaria
- Certified Organic Associated Growers, Inc.
- Chestnut Marketing Association
- 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 Committee
- Connecticut Nursery IPM Implementation Team
- Connecticut Nurserymen's Association
- Connecticut Pomological Society
- Connecticut State Technical Committee
- Connecticut Tree Protective Association
- 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
Experiment Station Associates
Lyme Disease Foundation
Master Gardeners of Connecticut
Natural Resources Council of Connecticut
New England Plant Conservation Program
Northeast Organic Farming Association of Connecticut
Northeast Regional Committee of the Workgroup on Environmentally Acceptable
Endpoints in Soil; Society for Environmental Toxicology and Chemistry
Northeastern Forest Pest Council
Northeastern Weed Science Society
Northern Nut Growers Association
Peabody Museum of Natural History, Yale University
Professional Grounds Management Society
Quinnipiac Chapter of Sigma XI

Merit and Peer Review

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.

Project outlines for Hatch or Multi-state Research funds are prepared by scientists and 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 respective Department Head 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. 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 program criteria, and has a reasonable likelihood of success. Scientific peer review of proposals focuses on the suitability and validity of methods to be used, 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 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. Scientific work is held to high technical standards. The promotion of a scientist depends on scientific productivity and/or service to stakeholders. Book chapters,

symposia proceedings, Station bulletins, and state and regional publications also are acceptable means of communication, but emphasis is placed on peer-reviewed journals as the main forum for reporting scientific advancements. 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 a multi-disciplinary, multi-institutional, and multi-state approach.

Station scientists will give periodic progress reports to stakeholders at various organization meetings. Fruitgrowers, nurserymen, 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. There is and will continue to be alignment and re-alignment of programs to address changing priorities.

We, the Vice Director and Director of the Connecticut Agricultural Experiment Station, certify that the above described processes of merit and peer review are being used and will continue to be used to evaluate all projects that receive federal agricultural formula funds and that the Station's processes of merit and peer review will be evaluated annually for effectiveness.

Louis A. Magnarelli, Vice Director

John F. Anderson, 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. 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 gypsy moths, 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 need to utilize biological and cultural control strategies to reduce the amounts of pesticides used. Chemical pesticide applications add expense to crop values and can have adverse effects on non-target species and other environmental components. The hemlock woolly

adelgid has had a particularly 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 are monitoring the pathogenic fungus (*Entomophaga maimaiga*) for its ability to keep gypsy moths under control. The main objective is to determine how long overwintering fungal spores remain infective to caterpillars. In addition, new fruit and vegetable cultivars are being evaluated. Some vegetables are being grown at the request of under-served and under-represented ethnic groups. To discover new uses for agricultural products, investigations are being conducted on taxane in yews growing in the northeastern United States. Taxol, a cancer-fighting drug for humans, is being produced from Pacific yews, but other species of this plant also may be suitable for extracting taxanes for commercial uses. There is ongoing research to determine the factors that influence taxane concentrations in ornamental cultivars of yews and on methods of taxane extraction. Studies on the molecular genetics and biochemistry of plants are being conducted to identify genes specific to the photoprotective response and to determine their relation to light use efficiency for photosynthesis. Genetic engineering of crop plants is a high priority.

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. Scientists in the Station's Department of Analytical Chemistry are working closely with nurseries where a variety of *Taxus* (yew) species are being cultivated. 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 fruitgrowers, 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 research effort requires that scientists 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 and other farm plots to solve immediate problems. In addition, experiments are conducted in Station-owned farms in Hamden, Connecticut 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 in a Station document- Record of the Year. Also included in this Record will be officerships and memberships of scientists in stakeholder organizations, national and state committees, excerpts of letters from stakeholders regarding services rendered, and

narratives of scientific accomplishments. The Record is a public document available to all and is and will continue to be distributed to state legislators and other elected officials who are interested in the Station's research progress and related activities.

Output Indicators. 2. Value-added agricultural products.

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

(1) results of field studies on biological and cultural control of insect pests of vegetables will be reported to organic farmers during a farmer/scientist workshop.

(2) a written record of proceedings of a farmer/scientist workshop on control of insect pests of vegetables will be prepared, including stakeholder discussions, and given to interested parties.

(3) appropriate technology will be developed for users of the food and fiber system.

(4) field trials of six cultivars of sweetcorn will reveal a cultivar that is suitable for growing in northeastern United States and will have high yields and maintain sweetness and flavor of the product.

(5) field and laboratory investigations of a pathogenic fungus, *Entomophaga maimaiga*, of gypsy moth caterpillars will determine whether or not this pathogen has the ability to infect caterpillars after several years of dormancy.

(6) field experiments on the fungus that causes apple scab will indicate more precisely when ascospores are released in orchards so that more timely fungicide applications can be made, amounts of chemical pesticide used in apple orchards can be reduced, and yields and quality maintained or increased.

(7) laboratory experiments on enzymes in plants will reveal which enzyme protects plants from photooxidative damage.

(8) field and laboratory experiments on wood preservatives will determine if surface soil becomes contaminated.

(9) forest health monitoring programs will detect emerging insect and plant diseases that may affect nursery-grown plants.

(10) laboratory and field experiments on chemical control of soil-inhabiting beetle larvae in container-grown nursery stock will reveal a more cost-effective and efficient method of treating nursery stock for national and international shipments.

(11) field and laboratory tests will reveal new methods of managing plant nematode, insect, and soil-borne pathogen infestations with reduction in pesticide usage on vegetable and fruit crops.

(12) field-testing of apples, grapes, raspberries, okra, leeks, and sweet potato cultivars will identify high-yielding, marketable crops that are genetically resistant to plant diseases.

(13) field-testing of flax cultivars will reveal which varieties are most suitable for growth in Connecticut.

(14) laboratory tests will identify more efficient methods of extracting taxanes from *Taxus* plants.

(15) laboratory tests will identify key genes involved with photoprotective response and photosynthesis.

Key Program Components. Laboratory and field studies will be conducted to improve the value of agricultural products, produce new products for market, and to increase productivity of quality

crops. An emphasis will be placed on enhancing profitability of agricultural and forest production methods. Forest plots will be monitored to detect emerging insect and plant disease problems that might also affect nursery trees. 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 nematode populations and soil-borne pathogens. 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 sweetcorn, apples, grapes, raspberries, okra, leeks, and sweet potatoes will be field tested and evaluated for yield and resistance to plant diseases. In studies of fiber flax, replicated field trials of available cultivars coupled with laboratory processing experiments will be conducted to determine which cultivars are most suitable for farming in Connecticut and for foreign markets. Alternative harvesting methods (mowing and combining) for flax will be evaluated and compared to conventional harvesting methods (pulling and turning) relative to cost and efficiency. Tests will be conducted on developing more efficient methods of extracting taxanes from *Taxus* plants. Using *Arabidopsis* as a higher plant model, molecular experiments will be conducted to identify key genes involved with photoprotective response and photosynthesis.

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 research programs. The outcome of such synergistic activity will be more rapid progress in meeting objectives. There are collaborative research studies underway on molecular genetics of plants with scientists at Yale University, the University of Massachusetts, Rutgers University, the University of Edinburgh, Scotland, the University of Ghent, Belgium, and the University of Oxford, United Kingdom. Entomological studies on reducing leafminer and leafroller damage on apple include input from biochemists and organic chemists at Otis Methods Development Center (Otis, MA) and Simon Fraser University (Burnaby, British Columbia). Research on IPM for soil-inhabiting insect larvae will include both internal and external linkages; two entomologists and a plant pathologist work with analytical chemists at the Station. External collaborations also will include biocontrol suppliers and technical specialists at agrochemical companies, extension specialists at the University of Connecticut, Cornell University, and the University of Massachusetts and other 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 Station scientists in the Departments of Soil and Water, Forestry and Horticulture, and Plant Pathology working with vegetable and fruit growers. Scientists at the Station, University of Georgia, and Clemson University will evaluate cultivars of fiber flax. Efforts to control apple scab fungal infections include external linkages with scientists at Yale University, the University of Connecticut, Cornell University, and Wageningen Agricultural University in the Netherlands. Finally, the evaluation of new apple cultivars (NE-183) and the biological and cultural management of nematodes (NE-171) are multi-state research efforts which include collaborators from several northeastern, midwestern, and southern states.

Target Audiences. There are numerous target audiences, such as vegetable growers (including organic farmers), nursery owners, fruitgrowers, owners of wineries, arborists, horticulturists, forest product and seed companies, pharmaceutical companies, the general public, and the scientific community, which will benefit from results of scientific studies. The Connecticut Agricultural Experiment Station is committed to facilitating equality of service and ease of 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/caes>) for all to receive. The Station is located in New Haven, Connecticut and 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 communities and under-served customers will be included as target audiences. For example, Brazilian, Asian American, and African American ethnic groups asked for field tests of okra, jilo, artichokes, sweet potatoes, and chinese cabbage. Native Americans in the Pequot Tribe asked for and are receiving Station assistance on wetland and forest maintenance practices. Community gardens in New Haven are plowed by Station staff. A scientist assists homeless citizens in New Haven with growing vegetables in community gardens. Scientists will provide assistance on insect pest problems and plant diseases. Career counselors in New Haven high schools have asked the Station to place minority students in summer research apprenticeship programs. This mentorship program is successful. All research programs of the Connecticut Agricultural Experiment 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 tons of produce grown on its farms to charities. School children of diverse ethnic backgrounds will be invited to Station farm plots to learn about agricultural research programs and are allowed to pick fruits and vegetables for their own use. The Station hosted Farm/City Week in 1997 and 1998. This organized event introduced hundreds of children to agricultural studies. 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 main goal #1 are intermediate term (1 to 5 years) in duration.

Allocated Resources. Estimated allocated resources for fiscal and human (expressed as Scientist Years) components are listed for 1999 and each of the five years covered by this Plan of Work. Resource information in the form of scientific publications and fact sheets will be distributed to stakeholders each year. The Station's Record of the Year will be produced annually to tabulate and report activities.

Years	Fiscal Resources		Human Resources
	Federal*	State	SY
	Target	Target	Target
1999	\$447,704	\$2,417,000	17.8

2000	447,704	2,417,000	17.8
2001	447,704	2,417,000	17.8
2002	447,704	2,417,000	17.8
2003	447,704	2,417,000	17.8
2004	447,704	2,417,000	17.8

* Federal Hatch funds only.

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 for a supply of 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 contains 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 fruitgrowers, also have requested more information on pesticide residues in produce and answers on how *E. coli* enters cider production. 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 a need to develop 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 targeted 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 in a Station publication - Record of the Year. Interactions between Station scientists and stakeholders' organizations (i.e., officerships held) also will be documented along with excerpts of letters from stakeholders regarding services rendered and newspaper articles. The Record is a public document available to all upon request.

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 six major expected outcomes and impacts associated

with the performance goal(s) listed in this section of the Plan of Work. It is expected that:

- (1) there will be greater consumer access to safe Connecticut produced foods.
- (2) laboratory studies will determine how maple syrup becomes contaminated with lead.
- (3) in cooperation with maple syrup producers, guidelines will be developed to lower or eliminate lead content in finished maple syrup.
- (4) results of laboratory investigations with state-of-the-art equipment will lead to the development of new procedures to detect pesticides in produce and drinking water.
- (5) field and laboratory studies will reveal when *E. coli* enters cider production during the fall and will clarify the natural history of *E. coli* in orchards.

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 detect lead in maple syrup and to determine potential sources of lead contamination in syrup. 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 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. Another scientist at the Station is investigating the natural history of *E. coli* in orchards and is in the process of determining when this bacterium enters cider production. Research findings obtained by Station scientists, benefit citizens in several states. The expected outcomes and impacts of this work will focus on 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 is substantial interaction with inspectors and officials in the Department of Agriculture and Department of Consumer Protection in Connecticut, which will continue in the future.

Target Audiences. Connecticut consumers are the ultimate target audience. Food safety is an issue for all citizens. 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 Connecticut Agricultural Experiment 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 web site 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. Also benefited will be local health departments, growers, businesses in the food processing industry, federal agencies, and the scientific community. The Station's research results will be made available to all primarily through the media, including under-represented communities and under-served customers. In addition, the staff in the Department of Analytical Chemistry organizes a community internship program, an outreach effort initiated in 1995. College students of different ethnic groups work with scientists during the summer in a mentorship program to learn new skills. Minority students have participated in this program and will continue to be recruited. Agricultural Chemistry Night, an open house event, will be open to all citizens who wish to hear informative talks on research in progress, see analytical laboratories and to make public comment on research being conducted. 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 main goal #2 are intermediate term (1 to 5 years) in duration.

Allocated Resources. Estimated allocated resources for fiscal and human (expressed as Scientist Years) components are listed for 1999 and each of the five years covered by this Plan of Work. Resources information, presented in the form of scientific publications or updated fact sheets, will be distributed to stakeholders upon request each year. The Station's Record of the Year will be produced annually to report key activities.

Years	Fiscal Resources		Human Resources
	Federal*	State	SY
	Target	Target	Target
1999	\$114,550	\$341,700	2.6
2000	114,550	341,700	3.0
2001	114,550	341,700	3.0
2002	114,550	341,700	3.1
2003	114,550	341,700	3.1
2004	114,550	341,700	3.1

* 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 issues of protecting our soil and water from pesticide and other chemical contamination, reducing pesticide use and fertilizers in agricultural systems, finding ways to utilize farm wastes (i.e., plant materials), and 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. There is a need to develop 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 growers. Investigations also are needed on finding methods of detecting and degrading pesticides and other agricultural compounds that have contaminated soil and water. 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. Composting, a sustainable method of recycling plant materials in agroecosystems, is a priority among farmers, municipalities, and the general public. 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 have become 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.

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 annually and reported in a formal institutional document, Record of the Year, which will be made available to all upon request. In addition, the number of interactions between Station scientists and stakeholders' organizations (i.e., officerships held) will be recorded in the Record along with narratives on scientific advances made and excerpts of stakeholder letters commenting on services rendered and research findings.

(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.

Outcome Indicators. There are several expected outcomes and impacts associated with the above mentioned performance goals listed in this 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.

(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 agroecosystems, including stakeholder gardens.

(4) laboratory analyses will identify which mosquito species are important in the transmission of 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.

(5) new antibody tests will be developed for the laboratory diagnosis of Lyme disease and granulocytic ehrlichiosis 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 and laboratory experiments will determine the growth of woody and herbaceous nursery crops in media amended with biosolids compost and if this nutrient source is suitable for commercial use.

(10) IPM programs developed for nurseries will reduce the amount of pesticides used and 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 or 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. Air samples in retail establishments, which sell pesticides, will be analyzed to determine if there is a release of harmful chemicals into the air near storage areas. 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 and on monitoring mosquitoes living in wetlands and forests for encephalitis viruses. 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 to it. Leaf compost and varying amounts of fertilizer will be tested on sweetcorn to increase yield. There will be additional field experiments on determining the growth of many woody and herbaceous nursery crops in media amended with biosolids compost. 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 collaborators. 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, Michigan State University, Rutgers University, and Washington State University and extension specialists at all of these institutions 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-265) and involves a coalition of several states and the USDA/ARS Center for Medical Agriculture and Veterinary Entomology (Gainesville, Florida). 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 TRI, Princeton (Princeton, New Jersey). Research on composted biosolids will involve collaborators within the Station (Departments of Analytical Chemistry and Soil and Water) and outside the Station: the University of Connecticut, Metropolitan District Corporation (Hartford, CT), Connecticut Mulch Inc. (Suffield, CT), Bakers Nursery (West Suffield, CT) and Sunny Border Nursery (Kensington, CT). 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), Johns Hopkins Medical Institutions (Baltimore, MD), the University of Connecticut Medical School (Farmington, CT), National Institutes of Health (Bethesda, MD), 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 stakeholders.

Target Audiences. Homeowners, physicians, veterinarians, forest workers, landscapers, arborists, pest control operators, pesticide retailers, operators of composting facilities, environmental regulators, farmers (vegetable growers and nurseries), and 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 and 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 web site (<http://www.state.ct.us/caes>). By these methods and scientist participation in community events, outreach efforts will provide technical assistance to under-represented and under-served customers. The Station's presence in New Haven provides opportunities for citizens in an urban setting as well as those in rural and suburban areas to receive information and services from the institution. 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 articles. Results of mosquito analyses for encephalitis viruses will be posted weekly during the warmer months on the Station's web site. 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. All research projects listed under main goal #4 are intermediate term (1 to 5 years) in duration.

Allocated Resources. Estimated allocated resources for fiscal and human (expressed as Scientist Years) components are listed for 1999 and each of the five years covered by this 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. The Station's Record of the Year will be produced annually to report activities. In addition, a video will be produced on ticks, tick pathogens, and related diseases for national public television broadcasts.

Years	Fiscal Resources		Human Resources
	Federal*	State	SY
	Target	Target	Target
1999	\$205,373	1,310,000	15.5
2000	205,373	1,410,000	16.0
2001	205,373	1,410,000	16.0
2002	205,373	1,410,000	16.5
2003	205,373	1,410,000	16.5
2004	205,373	1,410,000	16.5

* Federal Hatch funds only (FY 1999 formula funds baseline).

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 reports projected distributions of Hatch and State matching funds for federal fiscal years 2000-2004. The CRIS code for The Connecticut Agricultural Experiment Station is CONH.

Table 1. Multi-Institutional
CRIS

Hatch	Project	Access.#	Collaborating institutions and businesses (direct interactions)
CONH	130	0172279	CT Dept. of Agriculture, N. American Maple Syrup Council
	131	0173195	None
	132	0177218	CT Dept. of Consumer Protection
	237	0174732	Yale University (New Haven, CT)
	238	0174788	Rutgers Univ., University of Gent (Belgium)
	239	0177684	Yale University (New Haven, CT) University of Oxford (UK)
	344	0078445	Centers for Disease Control (Atlanta, GA), Georgia Southern Univ. (Statesboro), Yale University, Univ. of Connecticut (Farmington), Johns Hopkins Univ. (MD), Nat. Inst. of Health (MD), L ² Diagnostics, Bronx Lebanon Hospital Center (NJ)
	358	0133614	Yale University (New Haven, CT)
	359	0133609	CT Dept. of Environmental Protection, Centers for Disease Control (Fort Collins, CO).
	360	0133932	Dept. of Agriculture (MD and NJ)
	365*	0163201	Cornell Univ., Geneva Experiment Station (Geneva, NY)
	369	0177208	Otis, Massachusetts Development Center, Simon Frasier University (British Columbia, Canada)
	371	0179183	Univ. of Connecticut (Storrs), Cornell Univ. Cooperative Extension (NY)
	372	0179689	University of Connecticut (Storrs), Cornell Univ. (NY), Univ. of Rhode Island, Yale University (New Haven, CT)
	546	0157556	Hopkins and Stonington (Connecticut Vineyards)
	548	0163925	University of Georgia, Clemson Univ., Center for Amer. Fiber Flax
	551*	0167653	Cornell University (NY), W. Virginia Univ. (WV), Univ. of Georgia (GA), Univ. of Arkansas (AR), Virginia Tech Univ. (VA), Michigan State Univ. (MI)
	555	0177791	CT. Dept. of Agriculture
	556	0178482	Univ. of Connecticut (Storrs)

557	0180059	None
622	0168962	Univ. of Connecticut (Storrs), Michigan State Univ. (MI), Washington State Univ. (WA)
623	0170500	CT. Dept. of Environmental Protection, USDA Forest Service
624	0171998	Univ. of Connecticut (Storrs)
625	0178255	Yale University, Univ. of Connecticut (Storrs), Cornell Univ. (NY), Wageningen Agric. Univ. (Netherlands)
695*	0139748	Univ. of Massachusetts (MA), Cornell Univ. (Ithaca & Geneva, NY), Pennsylvania State Univ. (PA)
762	0168386	Univ. of Massachusetts (MA), Univ. of Connecticut (CT), Cornell Univ. (Ithaca, NY), TRI/Princeton (NJ)
763*	0170382	USDA/ARS Center for Med. Agric. and Vet. entomology
764	0173196	State of CT. Dept. of Transportation
765	0173197	Univ. of Connecticut (Storrs, CT)
804	0179283	Univ. of Connecticut (Storrs, CT)

*USDA approved Multi-state Research Project.

Table 2. Multi-Disciplinary

Hatch Project	Scientific Disciplines
CONH 130	analytical chemistry, food production systems
131	analytical chemistry, horticulture
132	analytical chemistry, food production systems
237	plant biochemistry, molecular genetics
238	plant biochemistry, molecular genetics, plant physiology
239	plant biochemistry, molecular genetics, plant physiology, immunology
344	acarology, microbiology, immunology, molecular biology, epidemiology, human and veterinary medicine
358	insect pathology, molecular biology
359	acarology, ecology, insect pathology
360	entomology, horticulture, integrated pest management
365*	plant genetics, entomology
369	plant biochemistry, organic chemistry, surveillance technology
371	acarology, entomology, integrated pest management
372	agronomy, analytical chemistry, economics, entomology, insect pathology, integrated pest management, plant pathology
546	horticulture, food production systems
548	horticulture, fiber production systems
551*	horticulture, plant pathology, plant genetics, entomology
555	horticulture, waste management systems
556	horticulture, plant genetics
557	horticulture, plant physiology
622	plant pathology, mycology, horticulture, soil bacteriology, agronomy, plant biochemistry
623	virology, plant pathology, mycology, nematology
624	plant pathology, biological control
625	meteorology, plant pathology, epidemiology, biophysics, biological control
695*	nematology, plant pathology, entomology
762	organic chemistry, environmental toxicology, environmental engineering, soil microbiology, and soil chemistry
763	protozoology, invertebrate pathology, entomology
764	soil microbiology, horticulture, soil and water chemistry
765	soil chemistry, environmental toxicology
804	analytical chemistry, horticulture, weed management

*USDA approved Multi-state Research Project.

Table 3. Multi-State Collaborations

		CSREES Regional Research	
Hatch Project	Project Number		Participating states in research efforts
CONH	130		
	131		
	132		
	237		
	238		CT, NJ
	239		
	344		CT, MD, GA
	358		
	359		CO, CT
	360		MD, NJ
	365*	NE-9	CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, VT, WV
	369		CT, MA
	371		CT, NY
	372		CT, NY, RI
	546		
	548		CT, GA, SC
	551*	NE-183	AR, CT, GA, ME, MI, MO, NC, NH, NJ, NY, OH, OR, PA, VA, VT, WA, WI, WV
	555		
	556		
	622		CT, MI, NJ, WA
	623		
	624		
	625		CT, NY
	695*	NE-171	CT, FL, MA, MD, MI, NJ, NY, PA, WV
	762		CT, MA, NY
	763*	S-265	AL, AR, CA, CT, FL, GA, ID, IL, KY, LA, ME, MN, MS, NJ, NY, NC, SC, TN
	764		
	765		
	804		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 at The Connecticut Agricultural Experiment Station (C.A.E.S.). 1998 Fiscal Data for Multi-institutional, Multi-disciplinary, and Multi-state Projects with several states.

Fed. Hatch Funds	Connecticut		SY units	
	State Funds	Total	Multi-categories	Total Hatch Program
\$381,484	1,320,001	1,701,485	13.4	35.9
Total funds available for entire Hatch program (FY 98) at C.A.E.S.				\$720,833
% dedicated to multi-institutional, multi-disciplinary, and multi-state programs				52.9%

Table 5. Integrated research activities between The Connecticut Agricultural Experiment Station (C.A.E.S.) and extension programs in Land Grant Universities during 1998.

Fed. Hatch Funds*	Connecticut		SY units	
	State Funds	Total	Integrated only	Total Hatch Program
\$197,093	708,808	902,641	6.2	35.9
Total funds allocated to entire Hatch program at C.A.E.S. in FY 98				\$720,833
% dedicated to all multi-categories and integrated activities in Connecticut only				26.6%
% dedicated to all multi-categories and integrated activities with CT and other states				27.3%

***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, \$191,810 was dedicated to integrated activities with extension at the University of Connecticut, an institution which is unaffiliated with The Connecticut Agricultural Experiment Station.**

Table 6. 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 2000-2004.

Years	Federal Hatch		Total	Total State	Total	Total
	Funds	%*	Hatch Funds	Matching Funds	funds**	SY units
2000	260,360	33.9	767,627	845,500	1,105,860	10.0
2001	262,000	34.1	767,627	850,000	1,112,000	10.5
2002	264,000	34.4	767,627	875,000	1,139,000	10.5
2003	265,500	34.6	767,627	875,000	1,140,500	11.0
2004	265,500	34.6	767,627	875,000	1,140,500	11.0

*% = Amounts of Hatch funds dedicated to all “multi” categories and integrated activities at C.A.E.S. divided by total Hatch funds allocated to C.A.E.S.

**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 the period 1999-2004. 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 1998 final figures.

Year	Projected Federal Hatch Funds *	Projected State Matching Funds	Projected SY
1999	\$767,627	\$4,068,700	35.9
2000	767,627	4,168,700	36.8
2001	767,627	4,168,700	36.8
2002	767,627	4,168,700	37.4
2003	767,627	4,168,700	37.4
2004	767,627	4,168,700	37.4

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

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. Highlights of activities for the past 2 years are described in this Plan of Work. Future accomplishment reports will include similar results.

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. Assistance has been given on forest and wetlands management to members of the Pequot Tribe in Ledyard, 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 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. Station personnel plow inner city garden plots, help urban as well as suburban gardeners solve agricultural pest problems, and explain how to produce and use compost. 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 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 in accordance with state regulations (46a-68-31 to 46a-68-74).

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 Day, Agricultural Chemistry Night, and Farm/City Week. 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.

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

Procedures: The following events will be scheduled annually during the spring, summer, and fall: Plant Science Days and Agricultural Chemistry Night. The Station will participate in Farm/City Week. 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.

Results: Major public events occurred during 1998 and 1999 to invite citizens who live in urban, rural, and suburban areas to see Station experimental plots and to hear oral presentations on research. More than 2,000 persons attended these events. Minority students from area high schools participated in Farm/City Week, which was held at the Station's Lockwood Farm in Hamden, Connecticut.

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 with 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.

Results: Station staff assisted New Haven residents with plowing community garden plots, answering questions on insect pest problems and plant diseases, and in securing grant funds for a community project. Residents from urban, suburban, and rural communities attended Station open

houses and other public events.

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.

Results: Produce from plots at both of the Station's farm locations were donated to charities, including food-sharing programs.

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 posted in public areas and is 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 is given annually to all employees. Union groups and Station employees are invited annually to review the Station's Affirmative Action Plan. All job notices include statements that the Station is an Affirmative Action/Equal Employment Opportunity Employer. Job notices are published in newspapers, sent to colleges and universities, and mailed to organizations representing minorities in the state. Policies regarding discrimination and equal opportunity are 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, 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.

Results: 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. 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.

Highlights of Past Performance and Accomplishments

The Station has an outreach program to increase minority applicant flow and 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. The Private Industry Council in New Haven has been responsive. They provided funds for a Black female to work at the Station during the summer of 1997. Two other Black females worked in the same capacity during 1998. These persons learned new skills. A teacher at the Sound School in New Haven assisted the Station in finding minority high school students to help improve the Station grounds during 1998. The goal of these initiatives is to help find jobs for high school minority students and to provide a mentorship program. The Station's Chief of Services and Director were instrumental in facilitating the hiring of these students.

The Station is committed to making every good faith effort to award a fair proportion of its contracts to Minority Business Enterprises (MBE). During 1998, there were 12 MBE set-aside purchases and contracts awarded to business owners who are Asian American (n=3), women (n=4), and to MBE where categories were uncertified (n=5). In addition, there were five MBE "good faith effort" purchases/contracts awarded to business owners who are Asian American (n=3) and to MBE where categories are uncertified (n=2). There has been marked improvement in the number of contracts awarded to these groups in 1999. These results will be reported in a future accomplishment report.

Certification

This Plan of Work was prepared by Dr. Louis A. Magnarelli, Vice Director at the Connecticut Agricultural Experiment Station. Input was received from Station scientists and stakeholders in the development of research programs and review of the Plan of Work. This document 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's "Guidelines for Land Grant Institution Plan of Work".

Director _____ Dr. John F. Anderson Date _____