2009 Connecticut Agricultural Experiment Station - Research Plan of Work

Status: Accepted
Date Accepted: 05/15/08

I. Plan Overview

1. Brief Summary about Plan Of Work

In accordance with the Agricultural Research, Extension, and Educational Reform Act (AREERA) of 1998, CSREES guidance, and other regulations, this updated Plan of Work is submitted for the period FY 2009-2013. Critical short-term, intermediate, and long-term agricultural issues in Connecticut have been identified as a result of stakeholders' input. The Connecticut Agricultural Experiment Station (CAES), hereafter referred to as the "Station", is a separate state agency, which receives federal Hatch and McIntire-Stennis funds for research. No federal funds are received for extension or educational programs. However, the Station has developed a strong outreach program to disseminate new research findings to stakeholders. Although the Station is not affiliated with the University of Connecticut or any other institution of higher learning, there are extensive links between Station scientists and personnel at the University of Connecticut, Cornell University, University of Massachusetts, and at other land-grant institutions in several integrated, multistate projects. Therefore, this updated Plan of Work has a major component for integrated activities, and where appropriate, descriptions and information on joint projects are given for research and extension links. Over the past decade, there have been changes due to emerging agricultural problems, and adjustments to existing research initiatives have been made. In other instances, there have been shifts in priorities, all of which have been based on stakeholders' concerns and input. The recent, mysterious dieback of salt marsh grasses, which occurs in coastal areas of southern New England and extends along the Atlantic seaboard west to Louisana, is an important problem. The need for testing cultivars of rapeseed and soybeans for biodiesel fuel is another new initiative that has a link with scientists at the University of Connecticut. Other links with scientists and extension specialists at the University of Connecticut include experiments on a new greenhouse that has a self-contained irrigation system and the testing of diseased plants as a part of the National Plant Diagnostic Network (NPDN). The Station is committed to facilitating equality of service and ease of access to all research and outreach programs and services. Stakeholders have testified on the Station's behalf at state legislative appropriation hearings and have sent letters of support to Congressional offices. Several processes exist to consult users of agricultural research in the identification of critical short-term, intermediate, and long-term issues in Connecticut and in the development of 4 research programs to address these issues. In most instances, the agricultural problems that exist in Connecticut are also of national significance, and solutions require a regional approach. Stakeholders' requests to reduce fertilizer and pesticide use; improve the efficiency of farm practices for sustained agriculture; ensure safe foods for consumers; detect and prevent diseases associated with ticks and mosquitoes; solve immediate insect pest and plant disease problems; improve water, soil, and air quality; solve invasive plant species problems; and to preserve the health of forests are national issues that coincide with USDA/CSREES focus areas. Moreover, the Station's main mission parallels that of USDA/CSREES: to advance knowledge for agriculture, the environment, and human health and well being. The Station's strategic plan includes broad goals to increase competitiveness of US agriculture in global and domestic markets, meet the challenges facing new farmers as they enter agriculture, promote conservation and environmental stewardship, enhance rural economic growth, and create opportunities to expand agricultural products, markets, and research. Multistate 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 multistate programs function and the benefits gained are described throughout this updated Plan of Work. Connecticut is a small state with several physiographic regions, extensive forests, and a high population of about 3,400,000 people. Scientists conduct agricultural and environmental research in settings 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. For example, there is current research on non-chemical control methods for invasive plants, such as Japanese barberry, in forests. Solving this problem is important to state forest managers and to conservation and environmental organizations. The Connecticut Farm Bureau and Department of Agriculture estimate agriculture's total annual 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). Approximately 30,000 jobs are linked to agriculture in Connecticut. The Station's outreach program is extensive. With 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 the publication of results in quality, peer-reviewed journals. Scientists give numerous presentations at stakeholders' meetings and oral presentations at public meetings and conferences. Discoveries are reported to farmers, the general public, and industry. Information is also released to the media and by preparing fact sheets or concise articles for distribution. Station scientists also write articles in laypersons' terminology for stakeholders. There have been more than 1,800,000 page views on the Station's website during 2007. Of these, about 50% extended to an average of 8

minutes and more than 300,000 files were downloaded. This website has links with the Connecticut Department of Agriculture, the University of Connecticut (including Extension), and many other institutions or organizations. In addition, the Station holds public events, including open houses and field days, where residents can meet scientists, view experimental plots and research laboratories, see demonstrations, discuss new findings, and make comments. Several Station scientists serve as officers in stakeholder organizations. Input from state residents is continually sought by different methods (including surveys/evaluations) to assist in the research planning process and is frequently received from homeowners and persons in numerous farm and environmental organizations. The Experiment Station Associates, a citizen support group (non-profit) 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 portfolio of research projects is consistent with the mission of the Medium Term Strategic Plan for the State Agricultural Experiment Station System and addresses national issues, which encompass several knowledge areas defined by CSREES. The Station's overall research programs, however, are heavily weighted towards improving plant management systems; controlling insects, mites, and other arthropods affecting plants and humans; developing and implementing integrated pest management (IPM) practices; and identifying pathogens and nematodes affecting plants. Emphasis continues to be placed on providing service, achieving economically competitive crop systems, the production of value-added products, forest health, and on protecting, conserving, and improving water and soil resources. Monitoring pesticides in fruits and vegetables addresses important food safety issues to meet short-term critical needs. The presence of bacterial, protozoan, and viral pathogens in ticks and mosquitoes require continued long-term attention. With high human population density near agricultural settings, there are problems with potential exposure to pesticides. Therefore, reducing the amounts of pesticides used to control insects, plant pathogens, 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, who represent multiple, diverse sectors of the state's population. Station scientists have been successful in solving problems that have national scope. Experience in solving problems is an important factor for meaningful outcomes, and the Station's stable workforce is expected to continue to make progress in the years ahead. There have been many noteworthy achievements. Current molecular methods have been developed to more accurately diagnose plant pathogens, such as the fungus-like organism that causes Ramorum Blight (formerly known as Sudden Oak Death). More efficient farm practices have been implemented in growing tomatoes in greenhouses, utilizing compost in vegetable plots, and in using plant products (green manure) to control nematodes that attack strawberry plants. There are demands for specialty crops, such as garlic, leeks, calabaza (squash), plums, grapes, artichokes, jilo, and sweet potatoes. Some of these crops are of value to various ethnic groups, which are under-served. Farmers have new options for continuing agriculture, consumers have fresh produce to purchase, and there is economic growth in rural communities. Moreover, open space is preserved. There have been savings in pesticide costs resulting from IPM practices. Farm profits have increased as a result of lower costs for pesticides. 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 earlier studies were considered by the US Environmental Protection Agency officials in their decision to phase out all residential uses of CCA-treated wood, effective January 1, 2004. Components of antifreeze and lead have been detected in toothpaste and toys, respectively, imported from China. Station scientists have found that volatile organic compounds are being released from "tire crumbs" being used in artificial turf for athletic fields. 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. Some specific examples of economic impacts should be mentioned. Field tests conducted with container-grown plants, such as rhododendron, revealed that a concentration of the insecticide bifenthrin at 2 ppm 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 treatment costs. This discount continues to have positive impact each year. Similarly, effective methods of chemically controlling the small Japanese cedar longhorned beetle, an exotic pest on 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 pest management programs 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, are working along with Station scientists and were involved in finding solutions. These projects involved integrated activities (research and extension components), had multi-disciplinary approaches, and had impact

measured by savings in pesticide treatment costs, increased profits resulting from the sale of quality agricultural products, or changes in the behavior of growers who are now more willing to adopt IPM programs. Refinement of IPM and other farm management practices, however, and research on new problems are still needed to further reduce pesticide use and to convince more growers to adopt new methods. New problems, such as invasive weeds in lakes, salt marsh dieback, and indoor mold problems need immediate attention. State budget problems and reductions in human resources at several Agricultural Experiment Stations reinforce the need for more organized regional multistate efforts to leverage existing resources. Although Hatch funds have been essentially flat for several years, they play an important role in multistate programs. The Station currently participates in 10 USDA-approved multistate, integrated projects. The successes of multistate project NE-183, a recently terminated project, can be described as an example of how well these joint efforts continue to work for the benefit of stakeholders. New apple cultivars were developed at the New York Agricultural Experiment Station (Geneva). 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 (e.g., 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 present in many orchards. Scientific information was given to extension agents and growers at numerous stakeholders' 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. As part of multistate NE-1020, 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. In collaboration with scientists at the University of Connecticut (including extension), the University of Massachusetts, and the University of Rhode Island, a Northeast IPM grant was awarded to reduce pesticide use in vineyards. The rapid advancements made were attributed in large part to the multistate collaborations and the close interface between scientists and fruit growers, who have interests in different crops. Further work is planned for the next five years to meet intermediate and long-term needs. There are stakeholder requests for new crops, particularly those of interest to Hispanic, Brazilian, Black, and Asian populations in Connecticut. Surveys conducted at farmers' markets indicate that consumers and farmers are interested in growing new crops for local sale. Successes in growing jilo, calabaza (squash), and leeks have helped provide fresh produce to consumers, to enhance profits for vegetable growers, and to help the Station meet the needs of under-served and under-represented groups. This program has been expanded to evaluate other crops, such as garlic, personal-sized watermelons, plums, heirloom tomatoes, and cauliflower. New research findings will be transferred to extension specialists at the University of Connecticut. Food safety remains a major public concern. A statewide program of testing food items for pesticide residues and other chemicals 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. The detection of antifreeze in toothpaste imported from China resulted in the removal of the product from state hospitals, prisons, and other institutions. Fortunately, most food products analyzed in market basket surveys had little or no evidence of pesticide residues. After analyses of several hundred items, consumers and other stakeholders (including federal and state regulatory officials) were reassured that foods were safe to eat. The Station collaborates with the Connecticut Department of Agriculture, the Connecticut Department of Consumer Protection, US Environmental Protection Agency, and the US Food and Drug Administration in these studies. A research component for improving analytical testing procedures and further developing links with other states are planned for the future. Eight years ago, a new health problem emerged, West Nile encephalitis. Stakeholders in broad regions of the US 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 anaplasmosis affect domesticated animals (horses, dogs, and cattle) as well as humans. These diseases occur throughout most of the US where tens of thousands of stakeholders are being affected. In North America, West Nile encephalitis was first reported in New York City during 1999, and human fatalities were documented in predominantly elderly residents. Fortunately, the Station had a virus isolation facility established at that time for work on eastern equine encephalitis and California group encephalitis viruses and, consequently, scientists (including those at the University of Connecticut) were the first to isolate and culture the West Nile encephalitis virus in North America. This discovery had great impact. The virus cultures were given to scientists at the Centers for Disease Control and Prevention (CDC) and Yale University, and there is current work on the development of a vaccine and molecular-based diagnostic tests. The latter is a joint project of high public interest. Other work with different scientists followed on interferon treatment of viral infections. In a collaborative effort with a veterinarian (pathobiologist) at the University of Connecticut, diagnostic assays are being developed and used experimentally as adjunct procedures to verify West Nile virus infections in horses in the state. Vaccine research is progressing, albeit slowly. Hatch funds were used initially to start research programs on mosquitoes, encephalitis viruses, ticks, and tick-borne pathogens. There have been many published contributions on the ecological studies of these diseases, including tick control; 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 by Station scientists in diagnostic tests for Lyme

disease and granulocytic anaplasmosis. Commercialization of the assays is in progress. This core research initiative in medical entomology has scientists from state and federal agencies (USDA/ARS and CDC), as well as several universities and small businesses working together. An extension component (University of Connecticut) is included in the study of West Nile virus in Connecticut. The monitoring of blood-sucking insects and ticks for known and possible emerging pathogens and control of medically important arthropods are high priorities 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 in nurseries. 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 or other unwanted chemicals in biosolids present a problem. Some important publications have been prepared and released to stakeholders. The extension component at the University of Connecticut has facilitated distribution of information to a wide audience of residents. For example, 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 these publications. Planned integrated activities helped meet the objectives. All 2,000 copies of the turf manual printed, and the 12,000 copies of the "native alternatives" publication have been distributed to the public by mail upon request, at open houses, and at agricultural fairs. Future Station publications are planned on invasive aquatic plants, exotic insects, and Ramorum blight. This revised Plan of Work uses the logic model to organize each component of the overall research programs. This approach has helped to clarify goals and objectives, identify key assumptions and external factors that can influence research projects, clarify program inputs, outputs, and outcomes, and design methods of program evaluation. We expect that our application of the logic model will improve as updated Plans of Work are developed. Research initiatives on IPM practices, which are an integral part and a high priority of the planned research program, can be briefly summarized to illustrate how the logic model system was applied. The control of insects, nematodes, and fungi that cause damage to crops has traditionally relied on the heavy use of chemical pesticides. This situation has resulted in environmental pollution, rising farm costs, and increased health risks for persons who apply the pesticides. Moreover, the removal of certain organophosphate insecticides and methyl bromide from farm use to control nematodes (with the exception of emergency exemptions) has motivated stakeholders to consider alternative methods of pest control. The success of IPM practices for the control of certain insects has encouraged growers to adopt new methods. In new studies, researchers will identify the efficient uses of biological controls, develop more accurate monitoring systems for pest populations, and identify the next generation of alternative strategies, such as using cover crops to control nematodes. Results will be reported to stakeholders on the Station website, at workshops and meetings, and by distributing fact sheets and other publications. These output activities are expected to lead to short-term outcomes, such as building the knowledge base on IPM and training growers on how to implement new monitoring systems and methods of pest control. Even though there is no budget for extension, Station scientists successfully train growers, mainly by working with these people on their farms. Findings from initial research investigations on certain pests should lead to other actions, such as applications to other pest problems, thereby broadening the overall IPM effort. The expected long-term outcomes will be a cleaner environment, reduced farm costs, increased acreage in IPM, protection of crop systems, and reduced health risks to humans. The involvement of stakeholders in the design and evaluation of research experiments is of paramount importance for success. Accordingly, the experiments will be conducted on farms where pest problems occur so that growers can participate in the process of designing experiments, quickly obtain results, and acquire management skills. In summary, 4 research programs are planned: Plant and Integrated Pest Management Systems, Food Safety and Biosecurity, Human and Animal Health, and Soil and Water Quality. Each program has knowledge areas assigned and include one or more of the following National Emphasis Areas: Agriculture and Food Biosecurity; Agricultural Systems; Animals and Animal products; Biotechnology and Genomics; Food, Nutrition, and Health; Natural Resources and Environment; Pest Management; and Plants and Plant Products.

Estimated Number of Professional FTEs/SYs total in the State.

Year	Extension		Research	
	1862	1890	1862	1890
2009	0.0	0.0	27.6	0.0
2010	0.0	0.0	27.6	0.0
2011	0.0	0.0	27.6	0.0
2012	0.0	0.0	27.6	0.0
2013	0.0	0.0	27.6	0.0

II. Merit Review Process

1. The Merit Review Process that will be Employed during the 5-Year POW Cycle

- Expert Peer Review
- Other (Internal administrative and scientific review)

2. Brief Explanation

There have been no significant changes in the review processes since the previous Plan of Work was approved. As before, scientific proposals for the Station will be subjected to merit and peer review following federal register guidelines and the National Science Foundation model (http://www.eng.nsf.gov/pet/review-2.htm). Merit reviews for proposals follow criteria proposed by the National Science Foundation (NSF-99-172). All scientific proposals and experimental findings of the Station will continue to be subject to the merit and peer-review process by persons who are qualified to critique the proposed studies. The distinction between merit review (project evaluation whereby the quality and relevance to state program goals are assessed) and scientific peer review (that performed by experts with scientific knowledge and technical skills to conduct the proposed work encompassed within the program) is recognized. Research priorities are based on stakeholder input and state needs. Our priorities normally parallel 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 is of relevance sufficient for an organizational representative to make an informed decision as to whether the work is appropriate for federal support. Project outlines for Hatch, McIntire-Stennis, or multistate 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. In most cases, 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 or 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 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 multistate 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. Scientific work is held to high technical standards. Although emphasis is placed on peer-reviewed journals as the main forum for reporting scientific advancements, persons who do not have scientific backgrounds are not excluded in this reporting process. They receive non-technical summaries, regional reports, and fact sheets prepared by Scientists and other staff in the Departments of Analytical Chemistry, Entomology, Forestry and Horticulture, and Plant Pathology and Ecology. Fact sheets, pest management guides, and selected research findings are also available on the Station website.

III. Evaluation of Multis & Joint Activities

1. How will the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

During federal fiscal year 2007, there were 31 Hatch research projects at The Connecticut Agricultural Experiment Station

(CAES). Of these, 16 (52%) projects were multistate collaborations with scientists in at least 40 states, while 14 (45%) projects included jointly planned integrated activities. There are extensive external and internal linkages in staff and other resources, such as in the participation in the Food Emergency Response Network and National Plant Diagnostic Network. Stakeholders have identified the following main critical issues that need attention in the planned programs: (1) development of IPM programs to reduce amounts of pesticides used and to decrease farm costs; (2) effective immediate control of insect and plant pathogens; (3) development of efficient plant management systems that include specialty crops; (4) more efficient detection of human pathogens transmitted by ticks and mosquitoes and the transfer of new information to stakeholders; (5) ensuring that food products are free of harmful chemicals; and (6) mitigation of pollution problems such as indoor mold and invasive aquatic weeds. In some instances, immediate solutions can be found, such as finding ways of controlling insect and plant pathogen pests to reduce crop damage. However, most critical issues are complex and will require long-term research efforts in replicated field studies. Although analyses of food items for chemicals are almost entirely laboratory-based, this critical issue is considered intermediate because in some instances, analytical methods will need to be modified to improve accuracy and reduce the amount of time needed to obtain results. The multistate and integrated programs offer many advantages and enhance efforts to achieve goals. Scientists, who have different educational backgrounds in multiple disciplines, will work together in designing experiments and evaluating results. Equipment and human resources will be pooled across state lines, experiments will be conducted in different settings, and key reagents will be shared. This regional or national approach, with unique capacities of the participants, is the most efficient way of addressing all of the above-stated critical issues of strategic importance. The extension component with Cornell and the University of Connecticut is a key mechanism for transferring information and technological advances to a broad base of stakeholders. The analyses of food products for chemicals can be used as an example of how the food safety critical issue will be addressed using the multistate and integrated program approach. The Department of Analytical Chemistry receives sample food products from other Connecticut state agencies for analyses per state statute. Scientists in this department also collaborate with researchers in other states and with federal scientists and officials in the US EPA and FDA. Under FDA guidance, CAES scientists are formally participating in the Food Emergency Response Network and can officially test potentially contaminated foods and other products from other states in the event of a bioterrorist attack or other emergencies. Conversely, scientists in other states can test samples from Connecticut if necessary. Standardized equipment and reagents will be shared among collaborators.

2. How will the planned programs address the needs of under-served and under-represented populations of the State(s)?

The planned multistate and integrated programs will address the needs of under-served and under-represented populations in Connecticut. Since these research initiatives are very broad-based in approach, all persons will benefit by having (1) a cleaner environment with pesticide use reduced; (2) healthy ornamental plants and forests; (3) locally grown produce; (4) a decrease in human disease, such as Lyme disease and West Nile encephalitis; (5) safer foods to eat; and (6) by having less pollution problems due to indoor mold and invasive plants. There are specific research initiatives planned to assist the under-served and under-represented individuals in Connecticut. Over the past decade, there has been a notable increase in the Hispanic population in the state. Accordingly, there have been requests from these stakeholders to evaluate selected plant cultivars to ultimately introduce the following specialty crops: calabaza (squash), jilo (African eggplant), and artichokes. Blacks and Asians have requested that leeks, Chinese cabbage, garlic, okra, and sweet potatoes be grown and introduced to Connecticut farmers so that these produce items can be sold in local markets. These studies are in progress. In addition, assistance will continue to be given as needed to two Native American tribes (Mohegan and Pequot) in Connecticut on more efficient forest management practices. The Station has a strong outreach program, which transfers research findings and services to under-served and under-represented individuals. This is being accomplished mainly by distributing written information and by educating high school teachers and students who visit and tour the Station's facilities. Minority applicants and women are sought and trained for Postdoctoral Research Scientist and summer worker positions. The latter are recruited from inner city and suburban high schools and colleges and universities and are located by advertising in newspapers, contacting school officials, and meeting students at science fairs. Minority applicants, with an advanced or basic knowledge of science and mentoring from scientists, perform well and contribute greatly to the research programs. Spanish speaking stakeholders need assistance to improve English proficiency. Efforts will be made to have a scientist, who speaks Spanish, assist stakeholders who wish to obtain arborist certification for employment with tree companies. Results from two multistate and integrated programs (tick management and mosquito/virus studies) are printed in Spanish to reach stakeholders. Children have been identified as an under-served group. Staff members at the Station will participate in Farm/City Week and encourage hundreds of youngsters to see experimental plots and learn about science. Other children, their families, and teachers will be invited to a Station open house (Plant Science Day) in August to meet scientists and learn about research findings. Also, at harvest time, there are 8 to 10 tons of produce available at the conclusion of experiments. These food items will be donated to charities and food banks for the needy. Finally, scientists who conduct studies on crop systems assist inner city residents in the New Haven community garden program. A new program on testing soils from about 100 community gardens in Connecticut for heavy metals and pesticides is being jointly planned among Station scientists and an extension specialist at the University of Connecticut. Most of these gardens are located in urban areas. Results of multistate and integrated research programs are and will be applied in managing these and other crop systems.

3. How will the planned programs describe the expected outcomes and impacts?

Outcomes reflect changes in knowledge or actions that stakeholders accept based upon new knowledge, while impacts occur when a societal, economic, or an environmental condition is improved based on actions taken as a result of joint research activities and outputs. Station scientists collaborate extensively with colleagues at many other universities and state and federal agencies to enhance research expertise and support, disseminate information, or take actions, including regulatory actions, based on findings and the needs identified by stakeholders. The Station has no extension component. Therefore, the extension component is mainly linked to the University of Connecticut and Cornell University. One of the Station's mandated functions is to disseminate IPM research results to Cooperative Extension at the University of Connecticut. In addition, the Station's diagnostic services assist the University of Connecticut and are linked to Cornell University through the National Plant Diagnostic Network. During 2007, 14 growers submitted 24 samples to the University of Connecticut and were forwarded to the Station for examination or analysis. Multistate, integrated programs will: (1) secure economic benefits for farmers and other stakeholders, (2) convince stakeholders to use IPM practices, thereby reducing human exposure to pesticides and environmental contamination and solve certain pest problems, and (3) inform residents about human diseases associated with ticks and mosquitoes to help mitigate risk. The development of effective IPM programs in nurseries, greenhouses, vineyards, orchards, golf courses, and vegetable plots is a high priority and a major component of 5 integrated multistate projects. In nurseries, for example, it is expected that the implementation of monitoring systems for pests and effective use of biological controls will provide opportunities to show growers economic benefits associated with reduced costs for chemical treatment, resulting in less human exposure to pesticides, and reduced amounts of chemicals leaching into groundwater or contaminating surface waters. Similarly, new cultural, biological, and other control options for managing annual bluegrass weevil will help reduce economic and environmental costs associated with pesticides currently used on golf courses. It is expected that research will identify more efficient uses of nutrients in greenhouses and in the field and determine what new specialty crops will result in increased profits for farmers. Outreach efforts will inform under-served and under-represented residents that progress has been made on providing produce of interest to these stakeholders. Encephalitis and tick-associated diseases affect numerous stakeholders regionally and nationally. Our human and animal health planned program will monitor changes in encephalitis virus infection rates in mosquitoes, develop more sensitive and specific diagnostic assays for domesticated animals and humans, and will identify methods, particularly alternatives to area-wide chemical pesticides, for reducing vector populations on homeowners' properties.

4. How will the planned programs result in improved program effectiveness and/or efficiency?

The planned multistate and integrated programs have interdependency and will result in improved program effectiveness and efficiency. Declining financial and human resources and rising costs for research have made it difficult for a given scientist to achieve goals without collaborators. Multistate funds can leverage other grant funds to boost resources. Collaborating scientists, who also have extension appointments at Cornell or the University of Connecticut, offer added expertise and improve program efficiency by disseminating research results to a broader base of stakeholders. As examples, the following planned projects are briefly discussed to more specifically describe how there will be improved efficiency. (1) Multistate project NE-9 focuses on plant genetics resources. Cultivars of vegetable crops are developed at Cornell University for insect and plant disease resistance and are then evaluated in field tests by researchers in other states. Plant breeders are not employed at every experiment station, and a thorough evaluation of a particular cultivar must be performed and replicated in widely separated sites with different climates, soil types, insect populations, etc. The high transportation costs make it difficult for Cornell scientists to travel to field plots in New England. Accordingly, plant breeders at Cornell will work with entomologists, plant pathologists, and IPM specialists in Connecticut to identify cultivars that grow best in southern New England. Similar collaboration with scientists at the University of Connecticut, the University of Massachusetts, and at the University of Rhode Island on testing grape cultivars (NE-1020) is another example. (2) Tick-borne and mosquito-transmitted infections affect people throughout the US. Not all scientists have the laboratory facilities or access to key reagents to test ticks and mosquitoes for pathogens or to detect antibodies in serum samples. Scientists at Yale University can produce molecular-based reagents but do not have certain pathogens or reference antisera (stored at the Station) to perform certain tests. Scientists (pathobiologists) at the University of Connecticut can perform diagnostic tests not available at the other institutions. Teams of scientists from these three institutions will blend their expertise and share reagents and knowledge to determine seasonal infection rates and develop a new antibody test for West Nile virus in horses. Since Yale and the Station do not have an extension system, collaboration with a veterinarian in the University of Connecticut extension program will be used to help inform stakeholders. (3) Plant nematodes are destructive to several crops throughout the US. Strawberries and vegetable crops are affected in northern states, while peanut and other crops are damaged in the South. Multistate project (NE-1019) has 13 plant pathologists, molecular biologists, plant breeders, and extension personnel working together to find biological and cultural methods to manage nematode populations. An assay developed by biochemists and molecular biologists in Florida will be used to test for a biological control agent in soil samples from northern states, where plant pathologists are performing field studies. During federal fiscal year 2004, $199,888 in Hatch multistate funds leveraged $765,601 in state, private, and other federal funds to develop methods of nematode management. The added funds permitted the hiring of technicians and purchasing of equipment and supplies at the Station.

IV. Stakeholder Input

1. Actions taken to seek stakeholder input that encourages their participation

- Survey of selected individuals from the general public
- Survey specifically with non-traditional individuals
- Other (Targeted invitations to legislators and their staff members)
- Targeted invitation to traditional stakeholder groups
- Survey specifically with non-traditional groups
- Survey of traditional stakeholder groups
- Survey of the general public
- Use of media to announce public meetings and listening sessions
- Targeted invitation to non-traditional stakeholder individuals
- Survey of traditional stakeholder individuals
- Targeted invitation to traditional stakeholder individuals

Brief explanation.

Public input and participation are encouraged directly by inviting representatives of numerous traditional stakeholder organizations as well as the general public (non-traditional groups) to attend open houses in the spring and summer (Plant Science Day) to meet scientists and see experimental plots and laboratories. Participation in public meetings, giving oral presentations to citizens' groups, use of the media to announce Station meetings and report research findings, responding to public inquiries, and serving on advisory boards of stakeholder organizations are also effective open and fair processes for scientists to target traditional and non-traditional stakeholders, foster customer engagements, and to invite citizen input and participation. Following talks, question and answer periods are particularly useful in receiving stakeholder input on justifications for research and relevance of research findings. Insect and plant disease problems need immediate attention, and all residents of Connecticut have ease of access to diagnostic services, including the National Plant Diagnostic Network. More than 20,000 public inquiries are received directly from traditional and non-traditional stakeholders annually. Agricultural, public health, and environmental problems generate considerable stakeholder interest and, under these circumstances, it is relatively easy to encourage the public's participation in research. Many farmers allow Station scientists to perform their experiments in their fields and, thus, participate with scientists in designing experiments, obtaining data, evaluating results, and seeing progress made. Daily contact with these people allows for frank dialogue, exchange of information, and direct public input into research programs. Special contacts will be made with farm groups, civic organizations, commodity associations, and government agencies to reach under-served and under-represented groups. In the past, these actions have stimulated interest among Hispanics and Asians and resulted in requests for us to grow vegetables of interest to these persons. Station scientists considered the economic value of growing specialty crops and, in field tests, identified cultivars of calabaza, leeks, garlic, okra, jilo, artichokes, sweet potatoes, and Chinese cabbage that grew well in Connecticut. Survey (evaluation) forms designed by scientists or the Director, will be used to seek stakeholder input and participation at statewide public meetings, open houses, and at agricultural fairs. Tens of thousands of people see Station exhibits annually at major events, such as the Hartford Flower Show. Scientists and other Station staff stand by exhibits during normal working hours and receive compensatory time on weekends. Attendance at flower shows is particularly effective in attracting interest from people not in the farming community. Members of 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 and state legislators. They are also made available to the general public. Moreover, Station scientists will give research reports at an annual public meeting of ESA. Comments and questions will be encouraged from stakeholders following the talks. The Director or Vice Director of the Station will also continue to give research reports to the ESA Board of Directors at bi-monthly meetings and to seek input.

2(A). A brief statement of the process that will be used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Other (Public access to diagnostic laboratories)
- Needs Assessments
- Open Listening Sessions
- Use Surveys
- Use Advisory Committees

Brief explanation.

Several methods are used to identify individuals and groups who are stakeholders and to collect input from them. Stakeholders are defined as persons who have the opportunity to use or conduct agricultural research and outreach activities in the state or nation. Experiment Station staff members are available to give talks to agricultural and forestry groups, other civic groups, and students at all levels of education. Those persons interested in hearing about and using scientific results are stakeholders. In addition, farmers and other people who visit Experiment Station displays at agricultural fairs and other events, attend public meetings and listening sessions at Experiment Station facilities, and who request information and assistance by phone, written communication, or by visiting Experiment Station laboratories and field plots are identified as stakeholders. Although advisory committees, listening sessions, and needs assessments are important processes of identifying individuals and receiving input, the use of surveys/evaluations at public meetings and agricultural fairs will be relied on more heavily to receive stakeholder input. The Connecticut Agricultural Experiment Station is committed to facilitating equality of service and ease of access to all research, service, and outreach activities, including information generated by experimental work. This policy allows for multiple mechanisms to reach and identify non-traditional and traditional stakeholders, but direct contact with people is most effective.

2(B). A brief statement of the process that will be used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Survey of traditional Stakeholder groups
- Meeting specifically with non-traditional individuals
- Survey of the general public
- Survey of traditional Stakeholder individuals
- Survey of selected individuals from the general public
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public
- Meeting with traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)

Brief explanation

In most instances, research objectives for Hatch and McIntire-Stennis programs are established as a direct result of stakeholder input and participation. The Station utilizes 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 appropriately addressed. In a broad sense, stakeholders are those persons who are interested in and benefit directly or indirectly from agricultural research, including forestry. The Science Citation Index identifies scientists in other institutions who use the Station's published works. Scientists, legislators, business owners, municipal officials, administrators, forestry officials, landscapers, groundskeepers, industry personnel, state and federal workers, students, and homeowners are stakeholders. These persons have opportunities to use or conduct research activities. Growers, who implement IPM programs or other more efficient farming practices, are examples of primary beneficiaries because farm costs and human exposure to pesticides will be reduced. Multiple processes are used to identify individuals and groups who are stakeholders. Open house events and more formal meetings on special issues are held to allow people to hear presentations and provide comments. Those who attend are considered stakeholders. Open listening sessions are held to meet with more specialized groups (e.g., those who grow apples or Christmas trees). Individuals who visit the Station and directly use diagnostic services are stakeholders. This group represents a broad base of residents and includes many people outside agricultural communities. In addition, persons who visit Station exhibits at agricultural fairs and who receive brochures and other written or oral information on agricultural issues are stakeholders. A variety of methods will be relied on to collect stakeholder input. Survey forms will be used at public meetings, open houses, and at agricultural exhibits to receive written input. Surveys are effective tools for gathering information and will be an adjunct procedure used along with collecting verbal suggestions from traditional and non-traditional individuals. When scientists attend growers' meetings, they invite these people to participate in research programs and to provide input on experimental design. For example, 8 multistate research projects (supported by Hatch funds) are designed to investigate a variety of agricultural problems. Stakeholders are participants in these research efforts. Many other experiments will continue to be conducted on growers' farms so that these people can be directly involved with the research, including the planning process, and can receive immediate results. Station scientists also collect stakeholder input by serving as members of organizations or officers of board of directors. This activity provides additional opportunities for people 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 at least 90 public organizations or state committees.

3. A statement of how the input will be considered

- To Identify Emerging Issues
- In the Budget Process
- To Set Priorities
- In the Action Plans
- In the Staff Hiring Process
- Redirect Research Programs

Brief explanation.

Stakeholders' input must be considered in different ways to be effective. Comments from the public help identify immediate problems and facilitate the setting of research priorities. Experimental design is sometimes revised after receiving feedback from growers. Alternative methods of insect or plant pest control sometimes need to be implemented to achieve the desired results. In other instances, major shifts in the direction of the research program are required to properly address problems. Summarized below are some examples that describe how stakeholder input was considered in making programmatic decisions. Connecticut residents reported to Station scientists on salt marsh dieback. The cause(s) is unknown. Research was started to determine the factors responsible for dying grasses. Stakeholder concerns about Ramorum Blight (Sudden Oak Death) led to a special request for emergency state funds to renovate and equip a new laboratory to increase the capacity for diagnostic testing. This was later strengthened when the Station participated in the National Plant Diagnostic Network. Stakeholder support, during legislative sessions, resulted in the authorization and hiring of a full-time, state-supported technician for this laboratory. Therefore, stakeholder input was and will continue to be considered in the budget process as well as in setting research priorities. The discovery of an exotic insect pest, the small Japanese cedar longhorned beetle in Connecticut, was a direct result of stakeholder input. A person brought a dying branch from an ornamental plant into the Station's diagnostic laboratory for examination. The insect was later found to be infesting red cedar trees in coastal areas of Connecticut and other northeastern states. An urgent emerging issue was identified and an emergency action plan was implemented. Infested nursery stock then needed pesticide treatment before certain plants could be shipped to other states. In a special public meeting held with over 40 nursery growers, it became clear that research on chemical treatment was required. Studies were conducted, and a solution was found. Plants worth hundreds of thousands of dollars were shipped rather than being destroyed under quarantine regulations. Beekeepers recently requested a state action plan for Africanized honey bees. The plan was developed; and first responders (i.e., town and city emergency personnel) will be trained on how to depopulate a honey bee colony or swarm. Stakeholder attendance and participation in open house events and public meetings is essential to obtain valuable guidance on problems. Stakeholder suggestions on topics to be covered at these meetings identifies relevant issues, helps improve communication, and makes these events more meaningful for everyone. Judgment on accountability of how well state and federal funds are used for research rests with the stakeholders. Therefore, the opinions and perceptions held by these people will be considered by scientists and administrators in all aspects of research program development, execution, and the distribution of results. Once input is received in verbal or written form, the comments will be reviewed and discussed by the Director of the Experiment Station at regular administrative meetings with department heads or other staff members.

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program #1

1. Name of the Planned Program

Plant and Integrated Pest Management Systems

2. Brief summary about Planned Program

Screening cultivars for resistance to insects and plant pathogens is a major research initiative. More recent work on evaluating rapeseed as a cover crop, source of biodiesel fuel, and control of parasitic plant nematodes of fruit trees and vegetable plants demonstrates a multistate and multidisiplinary effort with an IPM component. The crops/biodiesel fuel project is a collaboration between the Station and the College of Agriculture and Natural Resources at the University of Connecticut. A grant proposal, written by a Station scientist and a chemical engineer at the University of Connecticut (not in the College of Agriculture and Natural Resources) was submitted. Another grant proposal in IPM in vineyards, which includes extension personnel at the University of Connecticut, has been awarded. Station research includes the following core areas: (1) investigations of plants and their pests; (2) development and implementation of IPM systems; and (3) enhancement of agricultural production by introducing new crops that require little or no pesticide treatments. Each core area has specific research projects that address stakeholders' concerns and needs. Stakeholder input and evaluation of this research program is of paramount importance. The Station's website, published reports of research findings in newspapers and scientific journals, scientists' presentations to and interactions with the public, and open house events are most effective in disseminating findings to stakeholders and provide evidence of the research program's success. Laboratory and field experiments are designed and conducted to solve agricultural, pest, production, and environmental problems; increase farm efficiency and income; and to protect agricultural workers and residents from pesticide exposure. Moreover, forest plots and selected trees in urban and suburban areas are monitored annually to detect emerging insect, plant disease, and invasive plant problems. The Station is the state plant regulatory agency and monitors forest health, surveys for exotic pests, and registers and inspects the State's nurseries. Finally, new crops are evaluated to increase farm income and to provide vegetables and fruits that are desired by under-represented groups. The current research program has existed for less than 5 years, and the expected future program duration is planned as long-term (more than 5 years). Although some results are obtained and goals are met in the short term, field experiments take several years to complete. Replicated trials are required in different years and on different plots to obtain statistically valid data. Shifts in priorities within each core area are anticipated as new concerns arise and as solutions are found for existing problems.

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
202	Plant Genetic Resources and Biodiversity			20%	
205	Plant Management Systems			25%	
211	Insects, Mites, and Other Arthropods Affecting Plants			15%	
216	Integrated Pest Management Systems			40%	
	Total			100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Based on stakeholder input, there are 4 important issues identified for high priority research: development of IPM programs, promptly solving emerging pest problems, growing crops for biodiesel fuel, determining the dispersal of corn pollen, and introduction of specialty crops. Development of IPM programs is particularly important because of broad-based public concern over the use of pesticides and perceived links to cancer and other diseases as well as causing pollution. Moreover, with rising food prices, there is increased interest in home gardening. People do not want to use pesticides on the foods they will consume. Growers want more efficient methods of pest control to reduce farm costs and to lessen liability due to workers' exposure to pesticides. Current work indicates that less toxic chemical pesticides can be used to solve immediate, emerging pest problems and that implementation of IPM practices over the long term can indeed be successful in decreasing pesticide use, human health risks, and farm costs. Also, there is interest among consumers and farmers for specialty crops, such as jilo, calabaza, artichokes, leeks, sweet potatoes, garlic, and Chinese cabbage. Economic development is needed in rural areas. Several factors and criteria were considered in determining research priorities. First, the problem or issue must be of national relevance. Whenever possible, research results also must ultimately have measurable economic, environmental, or health impacts. Moreover, there must be adequate financial and experienced human resources to conduct the research. Laboratories must be suitably equipped to perform the required analyses. Finally, there must be existing collaborations with scientists in other institutions to increase the likelihood of efficiently solving the problems or completing research objectives. A sufficient amount of preliminary work has been completed by scientists in the Northeast on all of the above-mentioned problems or issues. Moreover, there is a foundation of published information available. Successful IPM programs developed at Cornell University and elsewhere can be used as models. Once emerging insects or plant pathogens have been detected, there are potential remedies for immediate control. Recent success in introducing some specialty (ethnic) crops in Connecticut has heightened enthusiasm among growers and consumers. Knowing the distance corn pollen travels via wind is important in determining the buffer zone between genetically modified crops and conventional crops. There are firm collaborations between Station scientists and researchers in universities, USDA/ARS, and US EPA.

2. Scope of the Program

- Integrated Research and Extension
- Multistate Integrated Research and Extension
- In-State Research
- Multistate Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

There are several beliefs about the research initiatives and the people involved to anticipate how the program will work for each of the major priority issues discussed below. Science-based assumptions are mainly linked to past evaluations of research findings and stakeholder input. There is a stable, skilled workforce and sufficient finances currently available to perform field and

laboratory studies. There are extensive multistate collaborations to enhance research efforts. It is expected that IPM practices on farms will result in high quality nursery stock and foods, reduced health risks to the users of pesticides, and less pollution of ground and surface water and soil. Effective IPM programs have been in place for at least 10 years in Connecticut. Information gained at the University of Connecticut has been shared with Station scientists. Results of Station research are given to the university's extension specialists. A new joint project for both institutions will evaluate our ebb and flow system of irrigation in greenhouses. Experienced Station scientists have access to a substantial knowledge base and new results from other states. Farmers allow experiments to be performed on their properties. The number of acres in IPM will increase in time because stakeholders have accepted this approach. Surveillance of crops and forests for emerging pest problems allows for early detection. Scientists and other staff members work with stakeholders and are trained to diagnose problems and find solutions. Early detection of pest problems will lead to the development of efficient control practices to reduce economic losses. Based on past experience in growing specialty crops, such as jilo and calabaza, there is interest among farmers and consumers for new crops. Research in growing other crops will result in increased farm income in rural areas. The scientists performing these studies have experience in performing field trials and have contacts with several growers. It is assumed that Hatch funds will continue to leverage other financial resources. For example, in multistate project NE-1019 on plant nematode control, $199,888 in Hatch funds spent in 7 states leveraged $264,888 in state dollars and $500,713 in federal grants and industry funds in federal FY 2004.

2. Ultimate goal(s) of this Program

The ultimate goals of the plant and IPM systems research program are to identify and address emerging pest problems by using molecular-based detection methods, develop and implement IPM systems, and to enhance agricultural and forestry production or efficiency. It is expected that this program will develop new management options, decrease chemical pesticide use and farm costs, determine buffer zones to prevent corn pollen from genetically modified plants from mixing with conventional corn crops, diversify our local food supply, and increase income options for farmers. Moreover, a database of diagnostic records will be produced on plant pests and a Plant Pest Guide will be revised for public electronic access.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2009	0.0	0.0	12.1	0.0
2010	0.0	0.0	12.1	0.0
2011	0.0	0.0	12.1	0.0
2012	0.0	0.0	12.1	0.0
2013	0.0	0.0	12.1	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Research activities will focus on the use of biological control agents, developing methods to monitor pests and the dispersal of corn pollen, the use of mulching techniques, and will evaluate cultivars of crops for productivity and resistance to pests. Service and research activities are designed to assist a broad, diverse group of stakeholders by 1) conducting research of relevance to stakeholders, 2) conducting surveillance for major pests, and 3) dissemination of research findings. Public service is an important component for all output measures. For example, all state residents are allowed to enter Station facilities and request direct assistance on diagnosing insect or plant disease problems. In this approach, at least 20,000 stakeholders are expected to request and directly benefit from these activities annually. Research experiments are designed to solve problems or to enhance agricultural production and forestry practices. Training on IPM practices and other methodologies will be provided to stakeholders. In addition to Station research farms, these experiments are conducted on stakeholders' farms or other private properties to encourage public engagement in the research. Results of these output activities lead to specific outcomes, such as developing new management options, reducing pesticide use, controlling insects or plant disease pathogens, controlling invasive plants, and the introduction of new crops or cultivars, thereby increasing farm income. Many of the new crops are of interest to minority groups and are sold at farmers' markets to diversity agricultural production and make fresh foods available to stakeholders, including under-served groups. The Station is the state plant regulatory agency whose activities include exotic plant pest detection, forest health monitoring, and nursery registration and inspection. Surveillance for existing and potential new

pests of our crops and forests permits early detection and appropriate regulatory or control activities. Surveys are conducted in cooperation with USDA/APHIS Plant Protection and Quarantine and USDA Forest Service. The plant disease and insect diagnostic laboratories are part of the National Plant Diagnostic Network (NPDN). Samples submitted by staff at the University of Connecticut will be examined at the Station. Collaborative NPDN training exercises have been held with the University of Connecticut and Cornell University. Hundreds of nursery inspections each year and phytosanitary certificates assure a quality product and facilitates commerce. Scientific publications in peer-reviewed journals, articles written for the general public, and updating of a Plant Pest Guide on the Station's website reach traditional and non-traditional groups of stakeholders. Station scientists are members or officers in dozens of stakeholders' groups. This provides opportunities for stakeholder input on the research program and facilitates reporting of research results. The non-traditional stakeholders are reached at agricultural fairs when they visit and inquire about Station displays. Two open houses are scheduled annually on Station properties to allow the public to hear oral presentations on research results and to offer comments. Hundreds of talks and interviews are given to civic groups and the media to convey research results and to receive public input. To enhance the dissemination of research and surveillance results, Station scientists will: (1) partner with stakeholders and participate in their organizations as members or officers, (2) conduct workshops or meetings for stakeholders, (3) disseminate research findings in scientific displays at agricultural fairs and by giving talks and interviews to civic groups, and (4) cooperate with the media and provide information on scientific discoveries.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• Workshop • One-on-One Intervention • Other 1 (Diagnostic services) • Group Discussion • Demonstrations	• TV Media Programs • Web sites • Newsletters • Other 1 (Radio programs)

3. Description of targeted audience

To be effective, there should be a diverse group of targeted audiences, which include under-served and under-represented stakeholders. The Connecticut Agricultural Experiment Station serves a variety of farmers who grow vegetables, fruits, nursery stock, Christmas trees, cattle, and flowers. However, the broad goals of this research program also include work on forestry and environmental problems. Accordingly, target audiences include landscapers, conservation officers, foresters, arborists, maple syrup producers, seed companies, and persons in the wood products industry. Organized environmental and conservation groups, such at The Nature Conservancy, Connecticut Forest and Park Association, and Backyard Beekeeper Association are important target audiences. Efforts are also made to reach water company officials, horticulturalists, groundskeepers, pest control operators, pesticide manufacturers and retailers, environmental regulators, extension specialists, and municipal officials. Scientists and government officials are also included as target audiences for new experimental results. This research program on plants and IPM is designed to reach the general public, which includes non-traditional stakeholder groups. Homeowners, who have interests in agriculture and forestry, have ease of access to experimental farm plots, laboratories, scientific results, as well as equality of service. Women, members of minority organizations, and children are examples of under-represented and under-served groups, important target audiences. Efforts will be made to reach Brazilian, Hispanic, Asian American, African American, and Native American populations as well as elementary and high school teachers and students.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2009	26000	90000	6500	475
2010	26000	90000	6500	475
2011	26000	90000	6500	475
2012	26000	90000	6500	475
2013	26000	90000	6500	475

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2009 :0 **2010 :**0 **2011 :** 0 **2012 :** 0 **2013 :** 0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2009	10	0	10
2010	10	0	10
2011	10	0	10
2012	10	0	10
2013	10	0	10

V(H). State Defined Outputs

1. Output Target

- Total research papers

  2009 :55 **2010 :** 55 **2011 :**55 **2012 :**55 **2013 :** 55

- # of site visits to conduct research and solve problems

  2009 :225 **2010 :** 225 **2011 :**225 **2012 :**225 **2013 :** 225

- # of talks and interviews given to stakeholders

  2009 :550 **2010 :** 550 **2011 :**550 **2012 :**550 **2013 :** 550

- # of responses to stakeholders' inquiries

  2009 :1800 **2010 :** 1800 **2011 :**1900 **2012 :**1900 **2013 :**1900

- # of diagnostic tests performed

  2009 :1300 **2010 :** 1400 **2011 :**1500 **2012 :**1500 **2013 :**1500

- # of new IPM intervention strategies judged to be effective

  2009 :5 **2010 :** 7 **2011 :**7 **2012 :**9 **2013 :** 9

- # of vegetable and fruit cultivars evaluated

2009 25 **2010** 25 **2011** 30 **2012** 30 **2013** 30

V(I). State Defined Outcome

O. No	Outcome Name
1	# of homeowners gaining knowledge on insect pests and plant pathogens
2	# of homeowners learning practices to control plant and household pests
3	# of media reporters gaining knowledge on research results
4	# of students learning agricultural skills by attending talks, courses, or training sessions
5	# growers adopting IPM practices
6	# of cultivars introduced into farming operations

Outcome #1

1. Outcome Target

# of homeowners gaining knowledge on insect pests and plant pathogens

2. Outcome Type : Change in Knowledge Outcome Measure

2009 :	**2010 :**	**2011 :**	**2012 :**	**2013 :**
9000	9000	9000	9000	9000

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants

Outcome #2

1. Outcome Target

# of homeowners learning practices to control plant and household pests

2. Outcome Type : Change in Knowledge Outcome Measure

2009 :	**2010 :**	**2011 :**	**2012 :**	**2013 :**
1500	1500	1500	1500	1500

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 205 - Plant Management Systems
- 216 - Integrated Pest Management Systems

Outcome #3

1. Outcome Target

# of media reporters gaining knowledge on research results

2. Outcome Type : Change in Knowledge Outcome Measure

2009 :	**2010 :**	**2011 :**	**2012 :**	**2013 :**
10	10	10	10	10

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity
- 205 - Plant Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 216 - Integrated Pest Management Systems

Outcome #4

1. Outcome Target

# of students learning agricultural skills by attending talks, courses, or training sessions

2. Outcome Type : Change in Knowledge Outcome Measure

2009	2010	2011	2012	2013
:500	: 500	: 500	:500	:500

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 205 - Plant Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 216 - Integrated Pest Management Systems

Outcome #5

1. Outcome Target

growers adopting IPM practices

2. Outcome Type : Change in Knowledge Outcome Measure

2009	2010	2011	2012	2013
:6	: 6	: 6	:6	:6

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 216 - Integrated Pest Management Systems

Outcome #6

1. Outcome Target

# of cultivars introduced into farming operations

2. Outcome Type : Change in Action Outcome Measure

2009	2010	2011	2012	2013
:10	: 12	: 14	:16	:18

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity
- 205 - Plant Management Systems

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Competing Public priorities
- Economy
- Natural Disasters (drought,weather extremes,etc.)
- Competing Programmatic Challenges
- Other (Media influences)
- Appropriations changes
- Public Policy changes

Description

There are several external factors that may directly affect outcomes, but financial stability and inclement weather are particularly important risk elements. The state's economy is based heavily on revenue from consumer spending and industry. Job growth, another important economic component, has seriously lagged in Connecticut. Public concerns about a possible recession and corresponding declines in certain business sectors (e.g., mortgage and housing market) can cause an economic slowdown and deficits in state appropriations, thereby resulting in reduced budgets for The Connecticut Agricultural Experiment Station. Coupled with essentially flat Hatch and McIntire-Stennis funds over several years, there can be insufficient funds for supplies and automobiles to do field studies and for technicians to assist in laboratory and field work. Without stable resources, program goals will be difficult to achieve. Moreover, weather conditions are unpredictable. Hail, wind, excessive rainfall or drought can be destructive to plants. Insect damage and plant diseases can adversely affect experimental field plots and be major setbacks for research. Without healthy plants in study plots, experiments are difficult to perform. Competing public priorities and programmatic challenges can also negatively impact outcomes. Research programs take time to design, and years may be required to properly complete experiments. Even when conditions for research are optimal, it can take years for stakeholders to accept change. When new issues arise, such as salt marsh dieback, research resources must be allocated immediately to address stakeholder concerns and to implement emergency programs. This process can divert important funds and human resources from other existing research studies. Similarly, goals of competitive grant programs can quickly change based on federal priorities and affect alternative funds that are needed to complete research studies. Moreover, competition for limited federal grants has increased in recent years, thereby decreasing the success rate for a given principal investigator to win awards. If this trend continues, it will become increasingly difficult to meet long-term research objectives.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Before-After (before and after program)
- During (during program)
- After Only (post program)
- Retrospective (post program)

Description

Several different forms of evaluation are planned to judge the effectiveness of the research program and the outreach efforts to stakeholders. Since this research program is diverse in its design to solve problems, the following methods of evaluation seem most practical depending on the research objective: after only (post-program), retrospective (post-program), before-after (before and after program), and during the program. The method of evaluation selected depends on the specific research project. For example, studies on testing tomato cultivars and nutrient solutions in greenhouses will be evaluated after tomato harvest. Retrospective evaluations of outcomes will be applied to studies that showed more cost-effective measures to control insect pests on nursery stock. For example, earlier work revealed that fewer amounts of a less toxic insecticide (bifenthrin) could control a variety of insects. It is important to determine if nursery growers have continued to adopt the new management practices and what the overall economic benefits are. Before and after program evaluations are appropriate for effectiveness of IPM programs on farms. Once again, economic benefits need to be determined to show impact. An example of during program evaluations is the field testing of alternative crops to assess plant growth problems with and without mulch. Therefore, long-term evaluations are required to determine success or failure of pest management practices. Surveys of stakeholders to determine direct benefits to these people, communities, or organizations would require post program or post services evaluations. This approach would permit assessments of short-term learning changes following public meetings or direct one-on-one services, such as the identification of insect problems and diagnosing plant diseases.

2. Data Collection Methods

- Sampling
- On-Site
- Unstructured
- Observation
- Structured

Description

Several methods of data collection are planned to evaluate outcomes and overall program effectiveness and success. The Science Citation Index will be used to assess recognition of published articles by the scientific community. On-site evaluations and observation will be relied on heavily, followed by sampling and interviews. Evaluation forms will be distributed to stakeholders after public meetings to gather input on scientific results presented or on overall program effectiveness. Similarly, stakeholders who visit Station displays at agricultural fairs will have opportunities to provide oral and written comments on scientific findings and to offer suggestions on new problems that require research as well as providing input on overall Station

performance. The on-site evaluations are particularly useful because there is opportunity for face-to-face contacts among traditional and non-traditional stakeholders and Station staff members, which would encourage open discussion of issues. When stakeholders visit Station diagnostic laboratories seeking assistance, they also will have opportunities to offer comment on the quality of services received. Observation methods and interviewing farmers on the usefulness of IPM practices, pest control initiatives, and introduction of alternative crops are also appropriate for collecting data. In many instances, experiments are conducted on farms where the problems need attention. Observation and interviewing would be ongoing processes throughout the study period. Finally, efforts will be made to periodically sample groups of stakeholders (e.g., fruit growers, nursery growers, and arborists) to seek input on outcomes. Information received from stakeholders will be used to shift research priorities or to make other programmatic changes.

V(A). Planned Program (Summary)

Program #2

1. Name of the Planned Program

Food Safety and Biosecurity

2. Brief summary about Planned Program

Under state laws, the Station must analyze foods and other products for unwanted chemicals at the request of other state agencies. This responsibility now includes federal programs, such as the FDA Food Emergency Response Network (FERN). The Station is one of 8 state laboratories selected to be funded as part of a cooperative agreement in FERN, a program designed to respond to bioterrorist activities or other emergencies. The US FDA requested Station assistance when melamine entered pet foods and caused severe illness or death in animals. In general, food items are selected by the Connecticut Department of Consumer Protection as a part of market basket surveys. Local produce and imported foods are included in routine analyses. On occasion, emergencies arise, which require immediate response. For example, flavored milk made students ill in two Connecticut schools. The Connecticut Department of Agriculture requested assistance. Sanitizing fluids were found in the milk within 4 hours of receiving the samples. These results enabled state officials to take corrective action by recalling milk from the contaminated source and by cleaning the filling lines in the milk processing plant. In another case, there was a request to test toothpaste imported from China. The product contained diethylene glycol (antifreeze). Results were promptly reported to state authorities, and the toothpaste was removed from commerce, state hospitals, and other facilities. There have been other positive outcomes when pesticides were detected in foods, and products were subsequently removed from markets. The Station has modern equipment and expertise to develop new techniques and perform scientific studies to detect chemicals in foods, soil and water. People benefit from the research program by knowing that foods are safe to consume or that tainted or adulterated products have been removed from markets. Most results are obtained and research objectives are met in the short term.

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.			100%	
	Total			100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Based on stakeholder input, food safety and security have been identified as high priority issues for research in Connecticut and nationally. People are very concerned about unwanted chemicals in food, beverages, and other products. There are perceived feelings that the consumption of pesticides or breakdown products thereof can cause cancer and that poisons (e.g., arsenic) can be deliberately introduced into the food system. Therefore, a food monitoring program and research on developing more sensitive and specific methods of chemical detection are warranted. The FERN program, in particular, allows states to participate along with federal partners in training exercises on technology in a system designed for mutual assistance in the event of bioterrorism or other emergency activities. Immediate response is of paramount importance. Scientists are well trained, there are extensive collaborations with personnel in federal and state laboratories and universities, and state-of-the-art equipment is available. Instruments can measure chemicals in parts per trillion.

2. Scope of the Program

- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

There are several beliefs about the research initiative and the people involved to anticipate how the program will work. Currrently, there is a stable workforce, and with a grant from the US FDA, a scientist and a technician were hired to build capacity. Also, FDA officials have purchased analytical equipment and have standardized testing procedures among states. There are currently sufficient state and federal funds available to perform all of the planned work. Collaborations with state and federal scientists have strengthened the monitoring and research program. Experienced scientists and technicians have access to a substantial knowledge base and use of precision instruments. It is expected that analyses of foods and beverages will result in the prompt identification of pesticides and other chemicals and in the recall of tainted or adulterated products from the market. Test results will re-assure stakeholders that foods are safe to consume and that other products, such as toys, are free from lead.

2. Ultimate goal(s) of this Program

The ultimate goals are to have safe foods and other products by analyzing produce and other items for harmful chemicals and to develop more sensitive and specific test methods to detect chemicals, including residues from agricultural and other sources. It is particularly important to improve extraction methods to reduce the amount of time to perform analyses.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2009	0.0	0.0	1.5	0.0
2010	0.0	0.0	1.5	0.0
2011	0.0	0.0	1.5	0.0
2012	0.0	0.0	1.5	0.0
2013	0.0	0.0	1.5	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Research activities will include development of more efficient methods of detecting chemicals in foods, beverages, and other products. The expected outputs (i.e., activities, services, and research results) are designed to assist a broad, diverse group of stakeholders by mainly disseminating test results to the public and state and federal regulatory agencies and by providing scientific information to scientists and other stakeholders. People will have equality of service and ease of access to scientific results. The state-generated outputs include numbers of food samples tested, scientific publications, and talks and interviews. The following activities are planned: (1) staff members will disseminate written information on test results and research findings to the media upon request, at open house events, and in scientific displays at agricultural fairs and (2) oral presentations will be given to civic groups. Direct interactions with a broad base of stakeholders will provide a mechanism for public input on the research program. Non-traditional stakeholders are reached at flower shows and agricultural fairs when they visit Station displays. Two open house events are scheduled annually on Station properties to allow the public to hear oral presentations on research results and to offer comments. Notification of state agencies with pesticide, food and health responsibilities (i.e., Department of Consumer Protection, Department of Environmental Protection, Department of Agriculture, Department of Public Health) of test results will lead to specific outcomes, such as removing tainted or adulterated food items from the markets. The expected impact is that there will be no public health event because of tainted food or hazardous products.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• Demonstrations • One-on-One Intervention • Group Discussion	• Other 2 (Youth via teachers) • Other 1 (Newsletters) • Web sites

3. Description of targeted audience

A diverse group of targeted audiences includes: state and federal public health officials and regulators, food producers, educators, extension specialists, and the general public. Women, members of minority organizations, and children are examples of under-represented and under-served groups.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2009	1000	4000	1400	1000
2010	1000	4000	1400	1500
2011	1000	4000	1400	1500
2012	1200	4000	1400	1500
2013	1200	4000	1400	1500

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2009 :0 **2010 :**0 **2011 :** 0 **2012 :**0 **2013 :**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2009	1	0	1
2010	1	0	1
2011	1	0	1
2012	1	0	1
2013	1	0	1

V(H). State Defined Outputs

1. Output Target

- Total research papers

2009 :3 **2010 :**3 **2011 :**3 **2012 :**3 **2013 :**3

- # of talks and interviews

2009	2010	2011	2012	2013
20	20	20	20	20

- # of tests performed

2009	2010	2011	2012	2013
700	700	700	700	700

V(I). State Defined Outcome

O. No	Outcome Name
1	# of stakeholders gaining knowledge of food safety
2	# state regulatory agencies applying decisions on testing results

Outcome #1

1. Outcome Target

# of stakeholders gaining knowledge of food safety

2. Outcome Type : Change in Knowledge Outcome Measure

2009 :	**2010 :**	**2011 :**	**2012 :**	**2013 :**
1500	1500	1500	1500	1500

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.

Outcome #2

1. Outcome Target

state regulatory agencies applying decisions on testing results

2. Outcome Type : Change in Action Outcome Measure

2009 :	**2010 :**	**2011 :**	**2012 :**	**2013 :**
4	4	4	4	4

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Appropriations changes
- Competing Programmatic Challenges

Description

The most important external factors that may directly affect outcomes are financial stability and competing programmatic challenges. Although the state's economy is currently stable, future budget deficits would have a direct impact because technical help could be laid off. Formula funds, which are being used to purchase supplies for analyses and research, have been essentially flat for many years. Moreover, if US FDA shifts its priorities away from food safety, there would be a loss of grant funds. This could result in the release of one scientist and a technician. The collective loss of research capacity would result in decreased output measures and outcomes.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)

Description

The most suitable form of evaluation is "during the program". Since the research effort is considered short term based on current needs and is prone to rapid shifts in priorities depending on immediate food safety issues, it is most appropriate to plan evaluations for "during the program" to assess effectiveness. Stakeholders will offer verbal and written input on how well they think the research is producing relevant findings and direct benefits. This approach provides assessment of short-term learning changes following public meetings or direct one-on-one services.

2. Data Collection Methods

- Observation
- On-Site
- Unstructured

Description

On-site evaluations and interviewing stakeholders are planned to judge outcomes and overall program efficiency. Evaluation forms will be distributed to stakeholders after public meetings to receive input. Stakeholders who visit displays at agricultural fairs will be asked to provide oral or written input on results and suggestions for new research. Face-to-face interactions and observations of stakeholders' responses are particularly effective in evaluating program effectiveness.

V(A). Planned Program (Summary)

Program #3

1. Name of the Planned Program

Human and Animal Health

2. Brief summary about Planned Program

This research program focuses on (1) testing ticks and mosquitoes for the pathogens transmitted to human beings, domesticated animals, and wildlife, (2) reducing localized populations of medically important arthropods, and (3) solving indoor mold (fungi) problems in greenhouses and other buildings. Lyme disease, tularemia, granulocytic anaplasmosis, monocytic ehrlichiosis, human babesiosis, West Nile encephalitis, and Eastern Equine Encephalitis are national problems. Tens of thousands of people are infected with the agents that cause Lyme disease and West Nile encephalitis virus annually in the United States. Stakeholders are very concerned about ticks and mosquitoes and how these arthropods affect their health by causing acute and chronic illnesses, which can result in emotional and financial burdens on families. Declining health in domesticated animals can also cause economic losses. Research on indoor mold problems is a new initiative requested by public school officials. Allergic reactions to mold spores have been documented for people who live or work in mold-infested work places. All Station scientists receive state and federal funding to support research on sampling arthropods, developing tests to detect pathogens, and on methods of pest control. Multiple methods are used to disseminate research findings: scientific publications, media reports, the Station's website, talks to civic groups, and open house events. Extensive field studies are conducted to monitor pathogens in arthropods and vertebrate reservoirs. The main objectives are to develop better diagnostic tests, more effective methods of tick and mold control, and to disseminate experimental findings to stakeholders.

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
722	Zoonotic Diseases and Parasites Affecting Humans			85%	
723	Hazards to Human Health and Safety			15%	
	Total			100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Stakeholders have requested research to develop more sensitive and specific antibody tests for arthropod-transmitted pathogens, to more efficiently monitor pathogen activity in reservoir hosts, and to reduce populations of ticks and mosquitoes. Finding solution's to indoor mold problems is another high priority. The transition of farmland to forest ecosystems has resulted in increased tick populations, primarily because white-tailed deer are the chief hosts for adult Ixodes scapularis ticks. The sharp rise in deer populations is directly correlated with increased populations of this tick, which transmits at least three different pathogens to humans, domesticated animals, and wildlife. Mosquitoes breed in stagnant water and are known to transmit West Nile, Eastern Equine, and LaCrosse encephalitis viruses to humans and other vertebrate hosts. Research on ticks, mosquitoes, and pathogens benefit a wide range of stakeholders, such as physicians, veterinarians, epidemiologists, and the general public. Advances in laboratory diagnosis, surveillance programs, and control help to prevent mammalian infections, lead to effective treatment, and can, thereby, reduce medical costs. Research results on landscape, biological, and chemical control of ticks are

included in a revised Tick Management Handbook for homeowners. This output will help homeowners' apply appropriate least-toxic methods for tick control on their properties and will decrease the risk of tick-associated diseases. The outcome of having better diagnostic tests and effective control of ticks and mosquitoes will be healthy human and domesticated animal populations. There are well established collaborations among Station scientists and researchers at universities, state and local health departments, and the Centers for Disease Control and Prevention (CDC). Laboratories are well-equipped to isolate and identify pathogens. For example, the first isolate of West Nile encephalitis virus in North America was cultured in Station laboratories, and serologic antibody tests for Lyme disease were among the first developed in the United States.

2. Scope of the Program

- Multistate Research
- In-State Research
- Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

There are several assumptions or beliefs about the research program to anticipate continued success. Strong public concern about mold in buildings, ticks, and mosquitoes encourages further investigations by justifying objectives and financial support to state and federal legislators. With adequate funding, skilled technicians can be hired. The current staff and resources available for studies on these arthropods and the pathogens they transmit are excellent. State and federal funding is sufficient to conduct field and laboratory studies, and laboratories are well equipped to complete the planned tasks. Numerous research collaborations exist among veteran scientists in the CDC, universities (including the University of Connecticut), the Connecticut Department of Public Health, the New York State Health Department, and a biotech company. Collborations speed research progress. For more than two decades, manuscripts have been published in quality, peer-reviewed journals; the scientific knowledge base is extensive. The scientists are experienced, highly motivated, and open to developing or applying new methods. Staff members can solve technical problems. It is, therefore, expected that continued research on the detection of arthropod-transmitted pathogens will result in a better understanding of Lyme disease, granulocytic anaplasmosis, and encephalitis and that the collaborative work will facilitate laboratory diagnosis and result in prompt treatment of people and domesticated animals.

2. Ultimate goal(s) of this Program

The ultimate goals of this research and surveillance program are to increase public awareness of disease and risk associated with ticks, mosquitoes, and mold; improve diagnostic tests; and to develop effective methods of vector control. It is also important to identify new (i.e., previously undiagnosed) pathogens that may be causing disease in humans, domesticated animals, and wildlife species.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2009	0.0	0.0	9.5	0.0
2010	0.0	0.0	9.5	0.0
2011	0.0	0.0	9.5	0.0
2012	0.0	0.0	9.5	0.0
2013	0.0	0.0	9.5	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Research activities will include identifying molds occuring in buildings and finding solutions for corrective action; evaluations of the use of highly specific recombinant antigens to detect mammalian antibodies to the West Nile virus and the Lyme disease agent; use of polymerase chain reaction methods to detect the DNA of the Lyme disease agent in ticks; and the use of

molecular analyses and genotyping of viral RNA to identify encephalitis viruses. The expected outputs are designed to benefit a broad base of stakeholders, such as public health officials, greenhouse growers, school administrators, veterinarians, and the general public. State-generated outputs mainly include scientific publications; talks and interviews; identifying and testing ticks for the Lyme disease agent; reports on the prevalence of ticks and mosquitoes infected with pathogens; and numbers of state residents served directly by answering inquiries. Staff members will (1) disseminate information on research findings by giving talks and media interviews, (2) analyze ticks and mosquitoes for pathogens, (3) answer public inquiries, (4) train public health officials on sanitation methods of remedying indoor mold problems and on arthropod control methods, and (5) develop more sensitive and specific antibody tests and enhance website access for stakeholders. A Tick Management Handbook and Mosquito Identification Guide will be used to train public health officials. All activities strongly emphasize research and public service and include traditional and non-traditional stakeholders. Two open houses are planned annually on Station properties to allow the public to hear oral presentations on research findings and to offer comments. Results of these activities will lead to specific outcomes, such as reducing the number of tick and mosquito bites and having mold-free work places.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• Demonstrations • One-on-One Intervention • Other 1 (TV media programs) • Group Discussion	• Other 1 (Newspaper articles) • Web sites

3. Description of targeted audience

A diverse group of stakeholders will benefit as target audiences. Research findings are directly transferred to scientists via peer-reviewed journals and conferences. The general public is reached by means of flower shows, agricultural fairs, open houses, TV, radio, and newspaper articles. Media reporters frequently request information for stories. Oral presentations will be given to public health officials in meetings and, as requested, to civic groups. Also, state residents are allowed to submit ticks through local health departments for identification and analysis for the Lyme disease agent. Results are reported to public health officials who then inform the residents. General information on tick-related research is also provided. Fact sheets and other reports will be posted on the Station's website. Although these communication venues allow for extensive contacts with the public, special efforts are made to reach under-served and under-represented groups by disseminating new findings to high school teachers and students. Information on ticks and mosquitoes is printed in Spanish, and displays at agricultural fairs and open houses are created to attract childrens' interest. Participation in agricultural fairs is particularly effective in reaching non-traditional stakeholder groups.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2009	3000	3000	1000	2700
2010	3000	3000	1000	2700
2011	3000	3000	1000	2700
2012	3000	3000	1000	2700
2013	3000	3000	1000	2700

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2009 :0 **2010 :**0 **2011 :** 0 **2012 :**0 **2013 :**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2009	8	0	8
2010	8	0	8
2011	8	0	8
2012	8	0	8
2013	8	0	8

V(H). State Defined Outputs

1. Output Target

- Total research papers

  2009 :15 **2010** :15 **2011** :15 **2012** :15 **2013** :15

- # of talks and interviews

  2009 :140 **2010** :140 **2011** :140 **2012** :140 **2013** :140

- # of responses to stakeholders' inquiries

  2009 :2500 **2010** :2500 **2011** :2500 **2012** :2500 **2013** :2500

- # of ticks identified or tested

  2009 :4500 **2010** :4500 **2011** :4500 **2012** :4500 **2013** :4500

- # mosquitoes identified and/or tested

  2009 :155000 **2010** :155000 **2011** :155000 **2012** :155000 **2013** :155000

V(I). State Defined Outcome

O. No	Outcome Name
1	# of residents gaining knowledge of ticks, mosquitoes, and mold
2	# of media reporters gaining knowledge of ticks, mosquitoes, and mold

Outcome #1

1. Outcome Target

# of residents gaining knowledge of ticks, mosquitoes, and mold

2. Outcome Type : Change in Knowledge Outcome Measure

2009 :8500 **2010 :** 8500 **2011 :** 8500 **2012 :**8500 **2013 :**8500

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 723 - Hazards to Human Health and Safety

Outcome #2

1. Outcome Target

# of media reporters gaining knowledge of ticks, mosquitoes, and mold

2. Outcome Type : Change in Knowledge Outcome Measure

2009 :30 **2010 :** 30 **2011 :** 30 **2012 :**30 **2013 :**30

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 723 - Hazards to Human Health and Safety

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Appropriations changes
- Competing Programmatic Challenges
- Economy
- Natural Disasters (drought,weather extremes,etc.)
- Competing Public priorities
- Public Policy changes

Description

Unexpected changes in appropriations, extreme weather conditions, amount of cooperation from collaborators, and competing public priorities are the most important risk factors. Cuts in the state budget, layoffs of technicians, and reduced federal formula fund and grant revenues (some of which may be dependent on economic conditions) can greatly reduce capacity and immediately affect outcomes. The research program includes laboratory studies but is strongly oriented toward field work. These investigations, which require vehicles and extra technical help, have high costs. Laboratory diagnostics are also expensive. Therefore, reduced funding and the loss of personnel can greatly impede research progress. Drought can significantly reduce numbers of mosquitoes and ticks and, consequently, greatly affect the outcomes of field research. Moreover, even though tick and mosquito research activities currently have high priority, new unrelated problems can emerge and cause important funds to be diverted to start new work. Federal priorities for grant funds can also change and affect programs.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)
- Before-After (before and after program)
- After Only (post program)

Description

Depending on the research project, different forms of evaluation will be used. Post-program evaluations are most practical to assess the impacts that new diagnostic (antibody) tests have. In tick and mold control research, before and after program evaluations seem appropriate. Assessments of tick abundance at sites before control measures and after treatments can be used to determine if certain management practices are effective. During-program evaluations will be relied on to determine if mosquito/encephalitis virus surveillance programs are effective. Effectiveness will be measured by stakeholders' response in heeding public health advisories on reducing tick and mosquito bites. In each case, public input will be considered in the evaluation process to determine if there are direct benefits to stakeholders and if there have been short-term learning changes.

2. Data Collection Methods

- Structured
- Unstructured
- Observation
- On-Site

Description

Different methods of data collection will be used to evaluate outcomes and research progress. On-site evaluations after talks have been given to stakeholders are appropriate. The use of evaluation forms in the past has been an effective means of gaining stakeholder input. Oral and written comments from the public are also received by less-structured means when these people visit diagnostic laboratories or see displays at agricultural fairs. Face-to-face interactions and interviewing are the most desired means of input because the ensuing discussions allow for more in-depth examination of issues. However, completion of evaluation forms, anonymously, provides opportunities for stakeholders to offer critical comments on research programs or services received. Finally, direct observation of stakeholders' reactions during oral presentations by scientists can also be helpful in judging whether or not reports are being well received. The Science Citation Index will be relied on to assess recognition of published articles by the scientific community. Regardless of the methods used, the input received will be used to shift research priorities and to make appropriate programmatic changes as needed.

V(A). Planned Program (Summary)

Program #4

1. Name of the Planned Program

Soil and Water Quality

2. Brief summary about Planned Program

Soil and water quality is a major concern of stakeholders. Farmers need good soil for optimal crop production, and homeowners want non-contaminated soil for gardens. Water quality ranks very high, along with food safety and public health, as concerns that need attention. The presence of heavy metals (eg., arsenic, lead, and mercury) in soil and pesticides in soil and water, in particular, have reduced the value of these water resources and have raised concerns about human and domesticated animal health. The presence of heavy metals and persistent organic pesticides (e.g., chlordane and DDE) in soil and water has been a major focus of intensive field and laboratory research. The use of certain plants (phytoremediation) show promise in removing some pesticides from soil. Moreover, surveys of lakes and ponds for invasive weeds (considered pollutants) are being conducted throughout the state to determine presence of invasive plants and the water conditions which favor their establishment. Consistent with stakeholders' requests, pollution prevention and mitigation are the primary focus areas for research in this planned program. The current research program is heavily field oriented, has existed for less than 5 years, and is expected to extend for more than 5 years.

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
133	Pollution Prevention and Mitigation			100%	
	Total			100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Persistent organic pollutants or their degradation products and heavy metals are found in many ecosystems. The problem is extensive in the United States. Chlorinated hydrocarbons, such as chlordane, were banned many years ago but continue to persist in the soil, herbicides (e.g., atrazine) have entered groundwater systems, heavy metals are present at industrial sites, and invasive aquatic plants are spreading and choking lakes and ponds. Since chlorinated hydrocarbon pesticides accumulate in animal tissues, this issue is a problem for many stakeholders. Skin contact with or accidental consumption of these chemicals may have public health importance by being linked to cancer and other diseases. Therefore, detection and removal of pollutants (including invasive plants) from soil and water is a high priority for research. Cucurbits (zucchini and pumpkins) have been found to remove chlordane and other persistent organic pesticides from soil; phytoremediation methods have been effective in improving soil quality. Moreover, chemical methods have been developed to speed the decomposition of certain pesticides in well water. Experiments are planned for minimizing amounts of herbicides used to control aquatic weeds and for biological control of invasive aquatic plants by using beetles. Future work is urgently needed to increase the efficiency of removing pollutants from the environment, reduce amounts of fertilizer used, develop more sensitive detection methods, and to determine the sources of heavy metal and other forms of contamination. It is expected that results of this research program will improve soil and water quality, may also help reclaim contaminated, industrial sites as well as agricultural fields, and prevent the movement of pollutants into crops and eventually into human foods. Collaborations with scientists in other states and past successes increase the likelihood of future progress. There is also an excellent knowledge base on published information and

state-of-the-art instrumentation available to support the research program. State and federal funds are in place to continue the research.

2. Scope of the Program

- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

There are several assumptions about the program and the people involved to predict how the program will work. Stakeholders believe that the research initiatives are important, are of national relevance, and should be supported by state and federal funds. There currently is a stable workforce of experienced scientists and technicians and strong collaborations with experts in universities. Past successes indicate that the research approaches are valid, and published findings by other scientists support the overall research strategies. Moreover, the practices being used by our research team are being used by other scientists. It is expected that continued studies of lakes and ponds, using current methods, will be as effective in detecting and removing invasive aquatic plants to improve water quality. Volunteers in lake associations will monitor boats for invasive plant parts attached to propellers and remove debris. It is also assumed that federal Hatch funds, used to start research programs, will continue to leverage federal and private grant funds.

2. Ultimate goal(s) of this Program

The ultimate goals of this research program are greater public awareness, pollution prevention and mitigation, knowledge of the presence and fate of specific pollutants in soil and water, and reducing environmental pollution caused by pesticides and invasive aquatic plants.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2009	0.0	0.0	4.5	0.0
2010	0.0	0.0	4.5	0.0
2011	0.0	0.0	4.5	0.0
2012	0.0	0.0	4.5	0.0
2013	0.0	0.0	4.5	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Research activities will include the use of chemical procedures and selected plants to remove pollutants from soil and water, chemical analyses to determine the need for fertilizers, the use of herbicides to remove invasive plants from lakes, and application of DNA procedures to identify aquatic weeds. The expected outputs are scientific publications, newsletters, and fact sheets; talks and interviews; and numbers of state residents served directly by analyzing soil samples or identifying invasive aquatic weeds. All activities, services, or events are designed to disseminate new information to stakeholders and to seek their input on the research program. Interactions with members of lake associations in group discussion, workshops, and one-on-one interventions are particularly important because permission must be granted to perform experiments on removing aquatic weeds from lakes. Limited diagnostic services are available to determine the extent of pollution problems and to determine the success of field experiments. Information will also be made available to all stakeholders on the Station’s website, in newsletters and fact sheets, and in displays at the agency’s open houses or at agricultural fairs. It is also expected that there will be interest from reporters to write articles on the research, thereby enhancing the educational process. Results of these output activities will lead to specific outcomes, such as increased knowledge of pesticide pollution and prevention, clearing lakes and ponds of invasive aquatic plants, and preventing pollution.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• Demonstrations • Group Discussion • One-on-One Intervention • Workshop	• Web sites • Newsletters

3. Description of targeted audience

A diverse group of stakeholders, including under-represented and under-served persons, is targeted. It is expected that the following stakeholder groups will directly benefit from the research: farmers, lake associations, homeowners, water company officials, environmentalists, extension specialists, corporate and municipal officials, participants of urban community garden programs, and pesticide producers. Special efforts will be made to contact and include members of minority organizations, women, and children to provide information and to participate in open house events.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2009	7000	9000	185	500
2010	7000	9000	185	500
2011	7000	9000	185	500
2012	7000	9000	185	500
2013	7000	9000	185	500

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2009 :0 **2010 :**0 **2011 :** 0 **2012 :**0 **2013 :**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2009	2	0	2
2010	2	0	2
2011	2	0	2
2012	2	0	2
2013	2	0	2

V(H). State Defined Outputs

1. Output Target

- Total research papers

2009 5 **2010** 5 **2011** :5 **2012** 5 **2013** :5

- # of talks and interviews given to stakeholders

2009 90 **2010** 90 **2011** :90 **2012** 90 **2013** :90

- # of diagnostic tests performed

2009 2700 **2010** 2700 **2011** :2700 **2012** 2700 **2013** :2700

V(I). State Defined Outcome

O. No	Outcome Name
1	# of homeowners gaining knowledge on pesticide pollution and invasive aquatic plants
2	# of homeowners gaining knowledge on soil and water quality
3	# of lakes and ponds surveyed and/or cleared of invasive aquatic plants

Outcome #1

1. Outcome Target

# of homeowners gaining knowledge on pesticide pollution and invasive aquatic plants

2. Outcome Type : Change in Knowledge Outcome Measure

2009 :	**2010 :**	**2011 :**	**2012 :**	**2013 :**
80	85	100	100	100

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation

Outcome #2

1. Outcome Target

# of homeowners gaining knowledge on soil and water quality

2. Outcome Type : Change in Knowledge Outcome Measure

2009 :	**2010 :**	**2011 :**	**2012 :**	**2013 :**
1500	1500	1500	1500	1500

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation

Outcome #3

1. Outcome Target

# of lakes and ponds surveyed and/or cleared of invasive aquatic plants

2. Outcome Type : Change in Action Outcome Measure

2009 :	**2010 :**	**2011 :**	**2012 :**	**2013 :**
4	7	10	10	10

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Economy
- Other (Unexpected changes in workforce)
- Appropriations changes

Description

The external factors that may directly affect outcomes are financial stability and unexpected changes in the workforce. With declining economic conditions, state appropriations might be lowered. This could decrease funds for technical help, automobiles, and supplies. Consequently, reduced research capacity would greatly impact the progress of field and laboratory studies. Also, Postdoctoral Research Scientists assigned to this research program eventually leave for better jobs regardless of available federal grant funds. Although the Hatch funds are helpful in supporting this research, these funds might not be sufficient to sustain research activities over the long term. Also, compared to the other three research programs, there have been relatively higher turnover rates for employees in this research program.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)
- Before-After (before and after program)

Description

Two forms of evaluations seem most appropriate for this research program: "during program" and "before and after" program. For example, assessments of research progress and seeking stakeholder input on analyses of contaminated soil before and after experiments, when phytoremediation methods will be used, is expected to show improvement in soil quality and customer satisfaction. Studies on invasive aquatic plants will also include this type of evaluation, but during program assessments are also applicable. Participating stakeholders will be able to see progressive improvements in water quality. Depending on the local situation, retrospective evaluations of lakes and ponds with repeated surveys and receiving stakeholders' concerns on water quality might also be applied because invasive plants may re-invade bodies of water over time. Also, residents who request soil analyses will receive results and, with the help of scientists, will be able to make decisions on whether soil is suitable for garden use or in need of nutrients and organic matter to grow crops.

2. Data Collection Methods

- Observation
- Structured
- Unstructured
- On-Site

Description

The Science Citation Index will be used to assess recognition of published articles by the scientific community. On-site evaluations by stakeholders at meetings and observations will be relied on heavily, followed by interviews to determine program success. Evaluation forms will be distributed to stakeholders requesting input on the research and to determine if changes in behavior have occurred. Face-to-face interactions with stakeholders at agricultural fairs and open house events also are excellent means of communication for traditional and non-traditional stakeholders. Diagnostic services (soil analyses) help attract stakeholders to laboratories and provide opportunities for input on scientific progress. Observation and interviewing would be on-going processes. The input received will help judge customer satisfaction and permit shifts in priorities and programmatic changes.