

2010 Connecticut Agricultural Experiment Station - Research Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Good progress has been made in meeting the research objectives set forth in all 4 planned programs: Global Food Security - Plant and Integrated Pest Management (IPM) Systems; Food Safety; Human and Animal Health; and Soil and Water Quality. Cooperation with extension personnel at UConn, Cornell, and other land-grant universities has helped to transfer new scientific information to a broad base of stakeholders. Collaborations exist with scientists in other states and countries.

Research on plants and IPM systems has led to improved crops and the development of a new strawberry cultivar that is resistant to pest problems. Based on results of a 4-year study, chardonnay budwood grafted onto selected rootstock reduced grapevine losses due to crown gall (a bacterial infection). The high-grafted vines saved growers about \$2,070 plus labor per acre in replacement costs. In other work, a new strawberry cultivar has been developed for resistance to root rot and black vine weevil, two important pest problems that previously required pesticide treatments. The new cultivar will increase strawberry yields and save growers about \$200 acre. In addition to increased farm income, there will be decreased pesticide exposure to people. Patent protection is being sought.

In the Food Safety Program, scientists at the Experiment Station assisted the U.S. Food and Drug Administration (FDA) by developing new assay methods to detect polycyclic aromatic hydrocarbons in seafood originating from the Gulf of Mexico. The samples submitted by the FDA were from finfish, shrimp, crabs, and oysters. Results showed that potentially harmful oil-residue contaminants were below that which would cause a health concern. These findings had impact because certain closed fishing areas off the coast of Louisiana, Florida, and Alabama were re-opened.

Progress has been made in the Human and Animal Health Research Program, and positive outcomes resulted in changes in behavior. Laboratory tests of 113,354 mosquitoes, collected throughout Connecticut, revealed widespread distribution of the West Nile encephalitis virus in the state. Press releases throughout the warmer months and the Governor's assistance on warning citizens to protect themselves from mosquito bites were important factors in preventing human cases. Based on surveys of 166 state residents, 65 (39%) protected themselves by using repellents or going indoors when mosquitoes were biting. In other work, 2,712 ticks were microscopically examined for the presence of vertebrate blood and tested for the DNA of the Lyme disease agent. Specimens had been removed from people, and results were reported to physicians or other health-care providers. Most of the ticks were negative for the Lyme disease agent (67% of 1,318 ticks tested).

In the Soil and Water Quality Program, there has been continued success in restoring water quality in lakes and ponds where invasive plants grow. Low concentrations of herbicides removed Variable water-milfoil, Eurasian water-milfoil, Minor naiad, and Curly leaf pondweed from 3 lakes and a pond. However, questions were asked about the herbicide diquat entering the wells. Analyses revealed that the amount of herbicide in treated areas of a lake was extremely low (309 parts per billion), and no herbicide was detected in well water.

Outreach programs have been active. There have been at least 36,528 direct and 121,787 indirect contacts with adults and youth in Connecticut. Staff members gave 1,050 talks and interviews, made 332 farm visits, performed about 12,245 diagnostic tests, and answered more than 26,000 citizens' inquiries. Diagnostic testing is mainly limited to Connecticut residents and businesses because of costs. However, in special cases, specimens have been analyzed from Massachusetts and New York. There are some Connecticut businesses that have branches in these states. Stakeholders have access to 38 new peer-reviewed articles or 85 other publications (book chapters, symposia proceedings,

fact sheets, newsletter articles, etc.). Assistance given to 97 reporters (representing newspapers, television, and radio) and public access to an upgraded Station website continue to be powerful methods of transferring new knowledge. There were 1,322,425 page views and 378,184 visits for publications during 2010. The average user time per visit was about 14 minutes.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	27.6	0.0
Actual	0.0	0.0	37.7	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

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

2. Brief Explanation

The review process described in the updated Plan of Work was followed during this reporting period. To evaluate project outlines for Hatch grants, an external review component has been implemented during this reporting period. All scientific proposals submitted to USDA-NIFA or other federal agencies likewise received merit and external peer-review to determine if the planned research had relevance to stakeholders' needs, met program goals, and had sufficient technical structure and resources to conduct the studies. In addition to critiques given by scientists in the discipline, Department Heads, the Vice-Director and the Director were involved in the internal review process. The Director gave final approval of all research proposals and manuscripts. In addition to meeting residents' needs, the likelihood of success and originality of the studies received careful consideration. During 2010, there were 6 Hatch and McIntire Stennis project outlines reviewed and submitted to USDA-NIFA to address state and national needs and to accomplish planned research goals in the following programs: Global Food Security and Hunger (n = 4) and Soil and Water Quality (n = 2). The approved project outlines covered work on fungi in ecosystems, invasive aquatic plants, photosynthesis, and specialty crops. Additional expert peer-review was also received on the quality of research results when manuscripts were examined by journal editorial boards and reviewers and when grant proposals submitted for competitive funds were critiqued by scientific review panels.

III. Stakeholder Input

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

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of the general public

- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public
- Other (Targeted invitations to legislators and their staff members)

Brief explanation.

Stakeholders participated in CAES research programs and public events. Conferences and workshops were held on pests of fruit trees and vegetables (65 attendees), bed bugs (475 attendees), controlling nursery pests (56 attendees), and food safety (112 attendees). Information was disseminated to state residents living in widely separated towns and cities in the state. Press releases promoted 2 Open Houses in the spring and summer (Plant Science Day). For the latter, a one-page promotional flyer was delivered to at least 92,000 households in an edition of the New Haven Register preceding Plant Science Day. Attendance at the April event (102 persons in the main auditorium) and at the August Plant Science Day at Lockwood Farm (739 adults, 222 youths) was excellent. Connecticut Network (CT-N), a public TV station, taped the main speaker's talk and scientists' presentations at Plant Science Day for statewide telecasting. Extensive media assistance targeted the non-traditional stakeholder groups and individuals. Notices of these public events were mailed or e-mailed to 205 press contacts and 5,600 state residents on the Station's contact list to cover traditional stakeholder groups and individuals. Station displays of research, presented at 5 regional or state fairs, and invitations for high school students to tour Station laboratories, provided further opportunities to reach traditional and non-traditional stakeholders. For example, Farm/City Week is a statewide event, which provides children of urban families an opportunity to see farm research plots; 60 students (grades 3 to 7) saw Station displays. An additional 113 students toured laboratories at the Station's main campus in New Haven. At the Norwalk-Wilton Tree Festival, 1,300 adults and children saw a Station exhibit. Survey forms were distributed at both open houses plus at selected exhibits in statewide agricultural trade shows to seek written public comment on research programs and to encourage stakeholder participation. Thousands of citizens saw Station exhibits on agricultural, forestry, and public health topics and had opportunities to bring insect, plant, and soil samples for diagnostic testing. To determine if state residents were pleased with talks given at a spring Open House event, forms were distributed at the end of the event to receive input. All 40 residents who responded were pleased with the program. The stakeholders lived in at least 27 towns or cities in Connecticut. Survey forms completed by 62 attendees of Plant Science Day indicated that residents came from at least 36 towns and cities of a total of 169 municipalities. Three meetings for bedding plant growers, organized by Station scientists and UConn extension specialists, were attended by 53 persons. All individuals rated the programs as useful, whereas 60% indicated that they would benefit economically based on what they learned. Station staff members served on advisory boards and committees of at least 140 agricultural and environmental civic groups. Invasive aquatic plant problems were identified at meetings of traditional and non-traditional groups and individuals. Moreover, staff members made 332 visits to farms and other properties where pest problems occurred. In many cases, growers participated in research to find solutions for controlling insect pests and plant diseases. Finally, 5 state representatives, 3 state senators, staff in the Governor's Office of Policy and Management, State Office of Fiscal Analysis, State Attorney General's Office, and in one congressional office requested and received information following newspaper articles, other media coverage, or constituent requests.

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

1. Method to identify individuals and groups

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

Brief explanation.

Stakeholder input is a major factor in identifying projects for research. There are several mechanisms in place to identify individuals and groups of stakeholders and to collect input from them. Evaluation forms, distributed to open house, meeting, and workshops attendees, were relied on heavily for stakeholder input. Special e-mail messages and letters, written by state residents, are forwarded by Station staff members to Department Heads and the Director and are then addressed after review. Citizens received responses. A complaint requires a response and follow-up contacts by administrators. Active participation of Station staff members on 140 advisory boards of civic groups, representing different agricultural, forestry, environmental or public health interests, is an excellent way to identify users of Station research findings, receive stakeholder input, identify problems that need to be addressed, and to find solutions. A research project on chemical testing of tire crumbs used in artificial turf athletic fields was requested by state residents. Current research on detecting pesticides and pathogens in honey bees started as a result of requests from beekeepers and fruit growers who are concerned about rising honey bee mortality. Work on removing invasive plants from lakes was initiated when Station scientists attended lake association meetings. Field research on specialty crops was increased at the requests of Hispanic and Asian residents. New cultivars of grapes are being evaluated at growers' requests. Greenhouse growers requested research on ebb and flow irrigation systems. Station staff members, who were officers of civic groups, recognized the needs of the public and were able to respond. The two annual Open House events of the Station and frequent use of displays at public meetings, trade shows, and science fairs provided opportunities to meet stakeholders, who are interested in science issues, and to hear about the problems that need attention. Written survey responses obtained at special listening sessions held by CAES scientists during evenings for growers were especially useful in documenting public input. About 1,050 talks and interviews were given to civic groups and the media. Discussion during question and answer periods following the talks was an effective process in collecting input and in performing needs assessments. Major concerns are conveyed to the Director in writing. Research priorities on food safety, solving crop pest problems, providing new niche crops, biofuels, and mosquitoes and ticks as transmitters of disease organisms were set as a result of public input. Phone inquiries from the public and stakeholder access to diagnostic services also revealed important problems that needed attention. For example, pest control operators have indicated that controlling bed bugs has become very difficult. Further, frequent attendance at agricultural groups' meetings was very helpful in collecting stakeholder input. Pest problems, difficulties in receiving permits for plant shipments and pesticide treatment, and interpreting federal and state plant regulations remain common concerns expressed by meeting participants. Finally, the Science Citation Index was used to identify scientists in other institutions who were recognizing the Station's published works.

2(B). A brief statement of the process that was 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

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

Brief explanation.

Written stakeholder input was received during this reporting period. The correspondence and completed surveys, which were well designed to ask specific questions, were very effective processes in collecting public input on research programs. Emphasis is being placed on obtaining more written input so that additional in-depth evaluations of program effectiveness can be made and that objectives can be prioritized. Giving research reports, providing displays, and attending meetings of traditional stakeholder groups, such as the Connecticut (CT) Tree Protective Association, CT Nursery and Landscape Association, CT Pomological Society, CT Forest and Park Association, Federated Garden Clubs, CT Pest Control Association, CT Academy of Science and Engineering, Christmas Tree Growers, CT Greenhouse Grower Association, Northeast Organic Farmers Association, CT Beekeepers Association, Backyard Beekeepers Association, and the Experiment Station Associates, were effective in collecting direct stakeholder input. Meetings for the CT Greenhouse Growers Association were co-organized by a Station scientist and personnel in the UConn extension system. When scientists met with the general public at two Open Houses (advertised to all) and at organized events where exhibits were displayed, input was received from traditional and non-traditional stakeholders. Survey or evaluation forms, which provided for more formal written comments, were forwarded to Department Heads and the Director. All CAES staff members have been instructed to allow sufficient time following invited talks for attendees to ask questions. This process allowed traditional and non-traditional individuals to provide additional input. Inviting high school students and teachers to see CAES laboratories and hear brief presentations on research resulted in collecting written stakeholder input from teachers (mostly non-traditional individuals). The 12,245 diagnostic tests performed for traditional and non-traditional individuals also resulted in stakeholder input. Finally, meeting with specific traditional and non-traditional individuals, such as state or federal legislative leaders or staff, was another effective method of collecting stakeholder input on research results and budgetary matters. A new, formal system of evaluating the effectiveness of Station research and outreach programs has been implemented by Connecticut's General Assembly. The Appropriations Committee is requiring all state agencies to report on performance measures and accomplishments as a part of their Results-Based Accountability (RBA) program. The Station's outreach activities and stakeholder input processes are components of the RBA evaluation requirement.

3. A statement of how the input will be considered

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

Brief explanation.

Stakeholder input was considered by Station scientists, and in many cases, written comments were read by the Department Heads and the Director. All written comments received in e-mail messages, letters, or survey forms were reviewed by Station staff members and considered by the appropriate Department Head in re-establishing research priorities or initiating new studies. At the requests of stakeholders, 5,462 inquiries were answered in the Department of Plant Pathology and Ecology. Fungal and bacterial infections of crops and other plants have economic impact and reporting information to the National Plant Diagnostic Network (NPDN) has relevance to other states. However, many other inquiries answered in other departments, such as Entomology and Environmental Science, are not reported to the NPDN. Chrysanthemum white rust was once again detected. Growers requested guidance in disposing of federally regulated plant waste. Despite severe budget cuts, stakeholders want the high quality diagnostic and research services continued at the present level. Growers requested information on rapeseed cultivars for control of plant-parasitic nematodes. Pest control operators notified CAES scientists that chemical control of bed bugs was ineffective. Insecticide studies continue to address the problem. Health officials asked for research on Powassan virus in ticks. Beekeepers and fruit growers expressed concern about declining honey bee populations and requested that analyses be conducted for possible pesticide contamination. Hispanics and Asians requested assistance on introducing new specialty crops. Accordingly, experiments were conducted on 9 specialty crops. At the request of stakeholders, training was given on integrated pest management practices. In nurseries, insect infestations of Christmas trees and other economically important crops are having detrimental effects on plant vigor and quality. Field tests were continued in response to stakeholder requests. In other cases, stakeholders were concerned about the following: chemical contamination of foods, forest health, ticks, mosquitoes and viruses, possible health problems associated with toxic fumes and leachates being released from "tire crumbs" used in artificial turf, and insect pests of grass turf. Based on written stakeholder responses, research priorities were re-assessed to address current and relevant problems. All written comments received by the Director were discussed with appropriate Department Heads, and in some cases, specific objectives were included in the managers' annual performance goal programs.

Brief Explanation of what you learned from your Stakeholders

Stakeholders have extensive knowledge and experience, which can aid research programs. Potential environmental, economic, or health impacts became apparent. Station scientists and administrators learned that bed bugs are resistant to pyrethroid insecticides. Members of lake associations revealed invasive plant infestations and provided feedback on effectiveness of control methods. Nursery growers enlightened Station scientists about new insect damage of Christmas trees and about the increasing problem of insect resistance to certain pesticides. The general public expressed their concerns over product and food safety. We learned that people who participate in community garden programs do not have confidence in the quality of vegetables produced on former industrial land because of the presence of heavy metals in the soil. Increased surveillance for

unwanted chemicals in foods was requested by the public and the Station responded accordingly. Physicians have alerted CAES scientists about the increase in numbers of ticks which transmit disease organism that cause Lyme disease, granulocytic anaplasmosis, and human babesiosis. These people described the impact that these diseases had on their lives and the need to develop tick control programs for homeowner properties. We learned from foresters that the Asian longhorned beetle and Emerald ash borer are spreading in Massachusetts and New York State, respectively. We learned from grape growers that fungal infections are a difficult problem to control. Fruit growers have informed CAES scientists that there are bacterial infections on peaches. Finally, CAES scientists learned that biochar might be an ideal soil amendment. Moreover, positive stakeholder input was received from growers and ethnic groups (Hispanic, Brazillian, and Asian) praising the Station's continued efforts to provide information on cultivars of specialty crops, such as jilo, calabaza, edamame, garlic, leeks, pak choi, daikon radish, and Chinese cabbage. We learned that crops evaluated by Station scientists were sold in farmers' markets.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	886498	0

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	886498	0
Actual Matching	0	0	5595864	0
Actual All Other	0	0	2387963	0
Total Actual Expended	0	0	8870325	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	0	0

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Plant and Integrated Pest Management Systems
2	Food Safety and Biosecurity
3	Human and Animal Health
4	Soil and Water Quality

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Plant and Integrated Pest Management Systems

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			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 (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	11.5	0.0
Actual	0.0	0.0	16.7	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	607354	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	2923947	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	219114	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The main research objectives are to develop methods of pest control that require less chemicals and to develop and evaluate plant cultivars that are resistant to insect and plant pathogens and are high yielding. Advances were made on these objectives during the reporting period. Several expected outputs (i.e., activities, services, events, and new crops that reach people) were designed to assist a broad, diverse group of stakeholders by transferring scientific information to stakeholders and solving problems. All activities of this planned research program will ensure that people have equality of service and access to research findings. Direct contacts were tabulated from persons served or those in attendance at meetings, workshops, etc. Numbers of indirect contacts with youth were obtained from teachers, who receive CAES assistance and incorporate informative new findings in educational curricula. The following activities were planned: (1) CAES scientists will partner with stakeholders and participate in their organizations as members or officers, (2) CAES scientists will conduct workshops or meetings for stakeholders, (3) experiments will be performed on stakeholders' properties as well as on CAES research farms, (4) diagnostic services will be provided to stakeholders (5) training on IPM practices and other methodologies will be provided to stakeholders, (6) staff members will disseminate written information on research findings by presenting scientific displays at agricultural fairs and giving talks and interviews to civic groups, (7) staff members will work with the media and provide information on scientific discoveries, and (8) staff members will educate teachers and, thereby, indirectly reach youth. Public service is an important component for all output measures. For example, all state residents were allowed to request direct assistance on diagnosing insect or plant disease problems. About 26,000 stakeholders directly received assistance from these activities annually. CAES scientists are members or officers in at least 140 stakeholder groups. This provides direct opportunities for stakeholder input on the research programs and facilitates reporting of research results. The non-traditional stakeholders were reached at agricultural fairs when they visited or inquired about CAES displays or newspaper, radio, and TV reports. Based on media statistics for viewers or readers, one can estimate indirect contacts with adults and youth who hear or read about new scientific advances made at CAES and reported by the media. Two open houses were held on CAES properties to allow the public to hear oral presentations on research results and to offer comments. Hundreds of talks and interviews were given to civic groups and the media to convey research results and to receive direct public input. Research experiments solved problems or provided information on new crops. Whenever possible, these experiments were conducted on farms or other private properties to encourage stakeholder engagement in the research. Results of these output activities led to specific outcomes, such as reducing pesticide use, controlling insects or plant disease pathogens, development of resistant cultivars, the introduction of new specialty crops, and increased farm income. Scientific publications in peer-reviewed journals or articles written for the general public reached traditional and non-traditional groups of stakeholders.

2. Brief description of the target audience

There are many targeted audiences, which include under-served and under-represented stakeholders. CAES does not receive extension funds but, nonetheless, serves a variety of farmers who grow vegetables, fruits, nursery stock, cattle, and flowers. CAES scientists worked with the University of Connecticut extension specialists in planning growers' meetings. Progress was made in reporting new findings to the national extension service (www.extension.org) to reach stakeholders nationally. Five scientists at CAES are participating as members of communities of practice. The broad goals of the CAES research programs also include work on forestry and environmental problems. Accordingly, target audiences include landscapers, landscape architects, conservation officers, foresters, arborists, beekeepers, maple syrup producers, seed companies, and persons in the wood-products industry. Efforts were also made to reach government and 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 important target audiences for new experimental results. This research program is mainly designed to reach the general public, which includes non-traditional stakeholder groups. Homeowners, who have interests in agriculture and forestry, have access to laboratories and 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 students. New scientific information will be transferred to teachers to develop educational curricula, and, thereby, indirectly reach youth.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	13899	84062	5370	17477

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

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	9	9

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Total research papers

Year	Actual
2010	86

Output #2

Output Measure

- # of site visits to conduct research and solve problems

Year	Actual
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2010 332

Output #3

Output Measure

- # of talks and interviews given to stakeholders

Year	Actual
2010	749

Output #4

Output Measure

- # of responses to stakeholders' inquiries

Year	Actual
2010	15951

Output #5

Output Measure

- # of diagnostic tests performed

Year	Actual
2010	6227

Output #6

Output Measure

- # of new IPM intervention strategies judged to be effective

Year	Actual
2010	12

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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 Measures

of homeowners gaining knowledge on insect pests and plant pathogens

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	9000	13329

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Homeowners and farmers requested diagnostic services and sought information on how to solve plant pest problems. Food crops can suffer from a variety of fungal infections, nematode damage, and the adverse effects of insects and mites. People do not want their plants to decline or die prematurely, and they seek remedies from staff members who are knowledgeable. Scientists are likewise interested in the reasons why plants decline because the cause(s) might reflect an emerging pathogen that could negatively impact an important crop system or forests. New emerging pests or pathogens can have negative impacts internationally and cause declines in food supplies.

What has been done

Diagnoses of insect and plant disease problems were performed for 13,329 stakeholders. Results and suggestions for control were provided to these people along with written information on the pest. In about 25% of the inquiries, stakeholders visited the diagnostic laboratories to seek direct assistance from staff members.

Results

During 2009, diagnostic tests of infected tomato and potato plants revealed that *Phytophthora infestans*, a fungal pathogen, was causing plant mortality. Some people acted quickly and sprayed their crops, thereby saving tomato and potato production (valued at about \$4,000,000) in Connecticut and Massachusetts. During 2010, we learned that informing homeowners was important because their treatments prevented the spread of the fungus to nearby commercial fields. Immediate benefits are (1) a well-informed group of farmers and homeowners, who now know the early signs of "late blight" infections and what to do to save their crops and (2) ample supplies of tomatoes and potatoes for consumers.

4. Associated Knowledge Areas

KA Code **Knowledge Area**
211 Insects, Mites, and Other Arthropods Affecting Plants

Outcome #2

1. Outcome Measures

of homeowners learning practices to control plant and household pests

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1800	8257

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Homeowners (including farmers) sought information on how to control plant and household pests. Problems that occur on private and commercial properties can sometimes be solved by using biological controls, grafting techniques, insecticidal soap, horticultural oil, or crop rotation. When these alternatives are not available, the least toxic chemicals are used. People want healthy plants, a clean and comfortable indoor or outdoor environment free of pests and chemical pesticides, and high-yielding, quality crops. Crown gall, caused by a bacterium, was identified by homeowners and commercial growers as an important problem of grape vines.

What has been done

In commercial grape operations, scientists visited stakeholders' properties and conducted experiments there. Experiments were conducted with chardonnay (clone 96) budwood grafted onto rootstock (33096) to determine if grafting the vines at different heights could reduce crop losses due to crown gall. Stakeholders participated by contributing to the experimental design and allowed use of their own equipment and materials.

Results

Based on findings obtained over 4 years, high-grafted vines reduced vine losses. The short-term benefits include a savings of about \$2,070 plus labor per acre in replacement costs for vines and increased grape production in Connecticut. These advances support the grape-growing industry, valued at \$10 million in Connecticut, and have potential to reduce crown gall damage in other countries. The long-term benefits include a profitable and growing fruit juice and wine-producing industry and preservation of agricultural lands at home and abroad.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #3

1. Outcome Measures

of media reporters gaining knowledge on research results

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	35	40

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Growers and homeowners requested new knowledge on how to grow specialty crops with little or no pesticides. Farmers wanted to reduce pesticide costs and worker exposure to these chemicals and desired to have marketable crops that are in public demand. Media reporters recognized the public's interest in having a cleaner environment and, likewise, sought new knowledge on managing crop systems so that this information can be transferred to a diverse group of stakeholders.

What has been done

Reporters interviewed scientists, saw laboratories, and visited field research plots. There were at least 20 newspaper articles or other news releases on plants and IPM systems covering a wide range of topics, such as specialty crops, honey bee pollination, trees, gardening, and homeowner plantings. Station scientists gave 749 talks and interviews. At the summer Plant Science Day event, public television (CTN) taped talks given by scientists on plant systems and telecasted the presentations to state residents via a cable network.

Results

Reporters learned about a new strawberry cultivar, potential problems with the Emerald ash borer, effects of weather on plant health, effects of neonicotinoid pesticides on honey bees, plant damage caused by deer, and the introduction of new specialty crops. Nearly all (90%) reporters accurately transferred new findings in written form to stakeholders. For example, a newspaper

reporter learned that different personal-sized watermelons are high yielding and could be grown in Connecticut with little or no pesticides. Yields for the cultivar "Bravo" exceeded those of the cultivar "Vanessa" by about 10,600 watermelons per acre. At a retail price of about \$4.99 per item, the grower can gross about \$53,000 more per acre. Seeds were distributed to commercial growers. These results had impact because some growers are including this crop in their farm operations. The long-term benefits will include greater profits for growers, less pesticide use, farmland preservation, and a source of locally grown, nutritious food for consumers. Science citations = 9 for this specific program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

Outcome #4

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	375	442

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Educating youth, an under-served group, is a major outreach initiative. CAES scientists participated as judges in science fairs, showed exhibits and gave demonstrations at Farm/City Week and Plant Science Day events. Staff members organized tours of laboratories and experimental plots. Parents want their children to learn about science, including skills of growing crops. Science teachers requested assistance in promoting interests in biology and chemistry and needed material for curricula.

What has been done

Scientists contacted career specialists in high schools in Bloomfield, New Haven, and Waterbury and invited students to see CAES facilities. Scientists also served as judges in science fairs, displayed exhibits at public events where youth of mixed racial and ethnic backgrounds attended, and gave 10 presentations to hundreds of elementary and high school students and 70 teachers. Students toured chemistry and mosquito laboratories and saw demonstrations on the use of analytical equipment. Students from the Sound School in New Haven and from Waterbury, Connecticut learned how to grow vegetables in community gardens. They grew vegetables for their own use at the research farms and were taught good farming practices.

Results

Minority students living in two cities saw experimental field plots and learned how to grow vegetables, to control plant pests by using mulching practices, and how to fertilize and rotate crops. Elementary and high school students learned about the biology and importance of honey bees. High school students learned about research on testing different cultivars and about chemical analyses used to ensure food safety. These efforts to change knowledge in students about agriculture had impact. The students, who learned how to grow vegetables, shared their knowledge with family members and neighbors, who were participating in urban community garden programs. Students learned about food banks and donated surplus produce. Based on feedback from teachers, there was increased interest among students in science. New knowledge on gardening was incorporated in science programs in elementary schools and helped to reach other students (e.g., indirect contacts with youth). The expected long-term benefits are a better educated youth population and increased interests in science.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

Outcome #5

1. Outcome Measures

growers adopting IPM practices

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	12	12

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Farm costs rise when pesticides are over used. These chemicals can cause toxic effects on users, consumers and beneficial insects, and can pollute soil and surface and ground water. Christmas tree growers requested assistance on how to reduce amounts of pesticides used and exposure to chemicals. The adoption of IPM practices benefits farmers, consumers, golf course managers, landscapers, and the environment. Annual gross revenue for 440,000 harvested Christmas trees, representing 6% of the total 7.7 million trees in Connecticut, is valued at about \$9 million. Most growers include food crops on their farms to diversify operations and ensure sufficient income to keep the entire farm financially solvent. Christmas trees are normally grown relatively close together on 6,000 acres in Connecticut. Under these conditions, insect pest problems can emerge and cause immediate economic losses. Armored scales cause discoloration of the tree needles, which decreases market value.

What has been done

Experiments were conducted with the insecticide dinotefuran as a basal trunk spray of Christmas trees 6 feet taller or shorter.

Results

Field tests revealed that dinotefuran effectively suppressed armored scales without negatively impacting biological control. Properly timed treatments avoided losses ranging from \$20,000 to \$50,000 per acre. These results had impact because growers in Connecticut, Pennsylvania, and Rhode Island have adopted the use of dinotefuran as a trunk spray in IPM programs, and the increased profits from Christmas tree sales helped support the production of fruits and vegetables on these farms.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

Outcome #6

1. Outcome Measures

of cultivars introduced into farming operations

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	14

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Growers want cultivars of crops that are resistant to plant pests and are high yielding. Strawberries are grown on about 206 acres in Connecticut. "Pick your own" farm operations are very popular with the public. With average yields of 4,100 pounds per acre and a retail value of \$5.00 per pound, there is an overall annual statewide crop value of about \$4,223,000. However, pest problems caused by black vine weevil and black root rot can greatly decrease crop yields. Pesticide treatments are required to save crops. Growers requested assistance on trying to find remedies for the pest problems, with minimal use of pesticides.

What has been done

In a breeding program, using conventional-pollination techniques, new strawberry cultivars were produced and evaluated for resistance to black vine weevil and root rot.

Results

A new cultivar has been discovered that has resistance to black vine weevil and root rot. The plant has excellent vigor with high yield, resistance to foliar disease, antifeedent properties to prevent beetle damage, and impressive high quality berries. Patent protection is being sought for future commercialization. This discovery will have immediate impact when the plant is introduced to grower's fields. There will be increased strawberry yields and a savings of about \$200 per acre in pesticide costs. Expected long-term benefits will include increased farm income, a quality product for consumers, royalty income to re-invest into research programs, and decreased pesticide exposure to farm workers and the public, thereby reducing human health risks.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

The loss of an IPM specialist in a prior reporting period and recent resignation of a scientist hired about 2 years ago, adversely affected outcomes because the new knowledge could not be effectively transferred to more growers. It is questionable if this vacancy will be refilled because of a large state budget deficit. Nonetheless, the actual quantitative target outcome for growers adopting IPM practices was met.

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

Evaluation Results

Planned evaluation studies were conducted during this reporting period. "After only" evaluations verified that there were knowledge changes in reporters. "During program" evaluations showed that there were knowledge changes in 442 students, whereas "before and after" program on-site evaluations and observations indicated that there were positive outcomes in more effective control of a Christmas tree pest.

Key Items of Evaluation

The Science Citation Index verified recognition of published articles on plant systems written by 20 scientists. There were 453 citations for this entire planned program during this reporting period. Thirty-six of 40 published news articles showed that substantial knowledge changes had occurred in reporters. The remaining 4 news articles had minor misquotes of information. Likewise, feedback from teachers verified knowledge changes in youth. On-site observations and evaluations verified success in improved IPM monitoring and control methods.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Food Safety and Biosecurity

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 (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.5	0.0
Actual	0.0	0.0	4.8	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	135523	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	520921	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	661127	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The main research objectives are to develop more efficient analytical methods to detect toxic chemicals in food and other consumer products, to determine if consumer products are safe, and to determine if pesticides are causing honey bee mortality. Good progress was made on the first two objectives. The activities, services, and events that reach people are designed to assist a broad, diverse

group of stakeholders by mainly disseminating scientific information to the public through the media, publications, and exhibits. People will have equality of service, ease of access to scientific results, and the ability to see laboratories and field plots. The state-generated outputs include numbers of food samples tested, scientific publications, and talks and interviews. The following activities are planned: (1) new analytical chemistry procedures will be developed, (2) staff members will disseminate new information on analytical test results to visitors at open house events and in scientific displays at agricultural fairs, (3) oral presentations will be given to civic groups, and (4) laboratories will be opened to allow adults and youth to meet staff members and see analytical equipment. Direct interactions with a broad base of stakeholders provide a mechanism for public input on the research program. Non-traditional stakeholders are reached at agricultural fairs when they visit 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. Results of these activities will lead to specific outcomes, such as removing tainted or adulterated food items from the markets and greater public awareness of research on food safety.

2. Brief description of the target audience

A diverse group of targeted audiences includes: state and federal public health officials and regulators, state and federal legislators and their staff members, food producers and importers, managers of supermarkets, educators, extension specialists, researchers in the food sciences, beekeepers, and the general public. Women, members of minority organizations, and children are examples of under-represented and under-served groups who are expected to receive benefits.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	205	7513	136	1569

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

Patent Applications Submitted

Year: 2010
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	2	2

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Total research papers

Year	Actual
2010	4

Output #2

Output Measure

- # of talks and interviews

Year	Actual
2010	45

Output #3

Output Measure

- # of tests performed

Year	Actual
2010	1056

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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 Measures

of stakeholders gaining knowledge of food safety

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1500	1025

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

On April 20, 2010, an accident occurred in an off-shore, oil-drilling facility in the Gulf of Mexico. For at least 100 days, millions of gallons of oil leaked from the underwater well structure. The Deepwater Horizon oil spill covered vast areas of the Gulf, causing the closing of waters to fishing. With the eventual capping of the underwater wellhead, there were questions about when the waters would be re-opened for fishing and if the seafood was safe for human consumption. Seafood obtained from the Gulf area is shipped to many locations in the United States and elsewhere. Consumers, members of the fishing and oil industries, and state and federal government officials were concerned about the adverse economic and environmental effects of the oil spill. The US Food and Drug Administration (FDA) has regulatory authority for food safety and requested assistance from Experiment Station chemists.

What has been done

Conventional methods for detecting petroleum-related contaminants (polycyclic aromatic hydrocarbons) were not suitable for analyzing large numbers of seafood samples. Moreover, only a few state and federal laboratories have the required equipment to perform these tests. As part of the Food Emergency Response Network of the US FDA, chemists at The Connecticut Agricultural Experiment Station worked with scientists at the US FDA Forensic Chemistry Center in Cincinnati, Ohio and the Department of Agriculture in Minnesota, to develop highly sensitive and specific analytical methods (liquid chromatography with a fluorescence detection system) to test seafood samples for unwanted chemicals. In addition, seafood samples were tested for the dispersant chemicals used to control the oil-polluted areas.

Results

The newer, alternative analytical methods were developed and used to screen shrimp, oysters, crabs, and finfish samples for petroleum-related chemicals. Analyses of samples from areas off the coasts of Alabama, Louisiana, and Florida revealed that potentially harmful oil-residue

contaminants in shrimp, finfish, and other seafood samples were below that which would cause a human health concern. These findings had impact because certain areas off the coasts of Alabama, Louisiana, and Florida were re-opened to commercial fishing. Also, the new chemical methods are being used by scientists in other state and federal laboratories. The short-term benefits included re-opening of fishing areas and assurance that seafood entering domestic and international commerce is safe. A long-term benefit will be the continued use of more efficient analytical test procedures and the return of economically important fishing industries in the Gulf coast states.

4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

Outcome #2

1. Outcome Measures

state regulatory agencies applying decisions on testing results

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	4	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Foods and beverages are tested for unwanted chemicals and to determine if products are in compliance with labels. Consumers are concerned about potentially contaminated products. State and federal regulatory officials are mandated to enforce consumer protection laws.

What has been done

As a part of routine analyses of foods requested by the CT Department of Consumer Protection, wine sorbet ice cream was tested for alcohol content. The product label lists the item as "non-alcoholic", which must have an ethanol content of less than 0.5%.

Results

Analyses revealed an ethanol content of 1%, a clear label violation. Findings were reported to officials in the CT Department of Consumer Protection who then notified the manufacturer and

requested that changes be made to comply with the product label. Additional samples, collected one month after notification, revealed that the ethanol content was less than 0.5%. These outcomes had immediate impacts because manufacturers learned that a food and beverage monitoring system existed and that violations would be acted upon to correct problems and change conditions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Appropriations changes
- Competing Programmatic Challenges
- Other (Staff changes)

Brief Explanation

One scientist retired on August 1, 2008, and with the current hiring freeze in place for state-funded positions and continued budget cuts, this vacancy was not filled. This is a critical position because the discipline requires the testing of toxic heavy metals (e.g., lead, arsenic, cadmium, and mercury). In addition, the Chief Scientist took advantage of an early retirement program offered by the state. This management position was filled by promotion within the agency. Work continues in the Department of Analytical Chemistry and planned program objectives were met. Grant-funded positions can still be filled.

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

Evaluation Results

Information on research and service results was obtained "during the program" evaluations at public meetings (1 Open House), civic groups' meetings, and at Station exhibits. Positive feedback was received from stakeholders. There was sufficient interest among media reporters, and at least 5 articles were written on the testing of seafood from the Gulf of Mexico. Observations made during interviews with stakeholders revealed positive stakeholder sentiment about program effectiveness and value.

Key Items of Evaluation

The key items of evaluation and data collection were as follows: Media reporters' responses upon learning about seafood testing and written responses from stakeholders who sent electronic messages to the newspaper website. The Citation Index indicated that articles written in previous years by 3 scientists were recognized and cited by scientists in this field (total citations = 58 during the reporting period).

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Human and Animal Health

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 (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	9.6	0.0
Actual	0.0	0.0	11.4	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	98770	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1452394	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1175821	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The main research objectives are to determine the chief mosquito vectors of encephalitis viruses, if biological control agents can control ticks, and to determine which vertebrate hosts are reservoirs for arthropod-transmitted pathogens. Major advancements have been made on the first two objectives. The expected outputs are designed to benefit federal, state, and local public health officials, physicians,

veterinarians, and the general public. State-generated outputs mainly include scientific publications, talks and interviews, identifying and testing ticks for the Lyme disease agent, and numbers of state residents served directly by answering inquiries. For activities, staff members will (1) conduct research on tick and mosquito control and disseminate information on research findings by giving talks and media interviews, (2) analyze ticks and mosquitoes for disease agents, (3) answer public inquiries, and (4) inform public health officials on control methods. All activities strongly emphasize 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 more efficient or environmentally sound methods of tick and mosquito control and prevention of human illnesses.

2. Brief description of the target audience

Research on human and animal health benefits a broad range of stakeholders. Research findings were directly transferred to scientists via peer-reviewed journals and conferences. The general public was reached and participated in events by means of agricultural fairs, open houses, TV, radio, and newspaper articles. Media reporters frequently requested information for stories. Oral presentations were given to public health officials in meetings and, as requested, to civic groups. Also, state residents were allowed to submit ticks through local health departments for identification and analysis for the Lyme disease agent. Results were reported to public health officials, who then informed the residents. General information on tick-related research was also provided. Fact sheets and other information were posted on the CAES website and made available to everyone. Although these communication venues allowed for extensive contacts with the public, special efforts were made to reach underserved and under-represented groups. Information on ticks and mosquitoes was printed in Spanish. A fact sheet on bed bugs was printed in Spanish, Chinese, and French. Displays at agricultural fairs and open houses were designed to interest children as well as adults. Public participation in agricultural fairs was particularly effective in reaching non-traditional stakeholder groups.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2759	10291	666	2125

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

Patent Applications Submitted

Year: 2010
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
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Actual	0	22	22
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V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Total research papers

Year	Actual
2010	23

Output #2

Output Measure

- # of talks and interviews

Year	Actual
2010	155

Output #3

Output Measure

- # of responses to stakeholders' inquiries

Year	Actual
2010	4205

Output #4

Output Measure

- # of ticks identified or tested

Year	Actual
2010	2712

Output #5

Output Measure

- # mosquitoes identified and/or tested

Year	Actual
2010	113354

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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 Measures

of residents gaining knowledge of ticks, mosquitoes, and mold

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	4550	4655

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Lyme disease and other tick-associated human diseases continue to increase in the United States and Eurasia. There were 38,468 confirmed and probable cases of Lyme disease reported to the Centers for Disease Control and Prevention in 2009. Without antibiotic treatment, persons can suffer from dermatologic, joint, cardiac, or neurological disorders. The mean cost per Lyme disease patient is about \$1,965 (in year 2000 dollars). The application of pesticides remains one of the primary methods for tick control in the residential landscape, and there is growing interest in biological, natural, and cultural methods to reduce the risk of tick bite and disease. Only 22% of residents in one knowledge, attitudes and behavior Lyme disease survey indicated that they would use or consider using synthetic pesticides.

What has been done

Scientists at The Connecticut Agricultural Experiment Station (CAES) conducted the first field trials in the United States with the entomopathogenic fungus, *Metarhizium anisopliae* Strain F52 against the Lyme disease tick vector, *Ixodes scapularis*. Subsequent field trials with this fungus against the tick in Connecticut and additional trials arranged with some researchers in other states were also conducted. A tick management handbook was updated, printed, and placed on the CAES website.

Results

The initial field trials with *M. anisopliae* F52 resulted in 56% and 85% control of the tick in lawn and woodland plots, respectively, at treated homes. Based on these results, a provisional registration for the fungus for tick control was obtained by the manufacturer from the U.S. Environmental Protection Agency (EPA). The subsequent field trials resulted in full EPA and individual state registrations, allowing investment and development of the commercial end product containing spores of *M. anisopliae*, currently on tract to be available in 2011. The availability of a biopesticide will result in less exposure to toxic pesticides, reduced health risks,

and provide another tool for integrated tick management. There have been 15,350 tick handbooks distributed and over 117,000 downloads of the handbook from the CAES website indicating a strong interest in the management of ticks in the residential landscape. Long-term benefits will be fewer tick-associated illnesses in people and domestic animals. Science citations = 39 for the tick control program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

Outcome #2

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	30	49

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Reporters frequently sought information on mosquitoes, ticks, human pathogens, and associated diseases and were interested in new information gained from research on the spread of disease organisms in nature and the status of tick and mosquito population densities. West Nile and Eastern Equine Encephalitis (EEE) viruses constitute ongoing threats to human health by causing severe illness or death. Since its introduction into the United States in 1999, West Nile virus has sickened nearly 30,000 people resulting in over 1,500 deaths. Public health officials have requested studies on the ecology of mosquitoes and viruses.

What has been done

There were at least 31 reporters who sought information on mosquitoes and encephalitis viruses. More than 2 million mosquitoes were tested for viruses over 11 years. By interviewing scientists conducting field and laboratory investigations, the reporters gained new knowledge of mosquitoes and 7 viruses identified by RNA analyses and transferred this information to the general public. Tens of thousands of stakeholders were kept informed of recent research findings and the significance of new scientific advances as they relate to the geographic areas they live in.

Results

There were more than 43 news stories on mosquitoes and viruses. Articles written by 29 (94%) of 31 reporters accurately transferred results to stakeholders. Reporters and stakeholders learned that La Crosse and Potosi viruses (not previously recognized in Connecticut) were present, that West Nile and EEE were active in certain towns, and that the American robin was the chief natural reservoir for West Nile virus. Analyses of blood-engorged mosquitoes using molecular markers for the cytochrome b gene, revealed that *Culex pipiens* was a primary vector in amplifying the West Nile virus in bird populations. Field studies identified two exotic mosquito species, *Ochlerotatus japonicus* and *Aedes albopictus*, in Connecticut; both mosquitoes species have potential for transmitting encephalitis viruses, such as Rift Valley fever and chikungunya, which are common in African, mideastern, and Asian countries. These results had impact because mosquito control programs targeted the most important mosquito species, and state residents took precautions to avoid mosquito bites. The long-term benefit is healthy human and domestic animal populations. Science citations = 104 for this specific program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Because of budget cuts, the number of available vehicles for field visits was reduced. This factor made it difficult to collect specimens. There were no changes in public policy, competing priorities, amounts of grant funding, or competing programmatic challenges. Although there is a hiring freeze on state-supported positions, grant-funded positions can be filled.

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

Evaluation Results

"During program" and "after only" evaluations were conducted to assess program effectiveness. The treatment of mosquito larval habitats, following news releases of West Nile and EEE virus infections in mosquitoes, successfully reduced mosquito populations at selected, key sites. Surveys of stakeholders revealed positive responses to news releases to warn the public about infected mosquitoes, at least 39% of 166 persons surveyed indicate that they followed advice to reduce exposure to mosquitoes.

Key Items of Evaluation

Data were collected mainly by on-site evaluations conducted following talks to civic groups. A survey was conducted to assess changes in behavior regarding prevention of mosquito and tick bites, and there were face-to-face interactions with reporters and other stakeholders. During this reporting period, there was a total of 318 citations for scientific articles written by 6 scientists on ticks and mosquitoes for the entire program.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Soil and Water Quality

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 (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	5.0	0.0
Actual	0.0	0.0	4.8	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	44851	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	698602	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	331901	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The main research objectives are to develop chemical, biological, and mechanical methods of controlling invasive plants and to develop procedures to detect herbicides in water. Good progress has been made on these objectives. The expected outputs are new scientific findings; scientific publications, newsletters, and fact sheets; talks and interviews; and numbers of state residents served directly by analyzing soil samples, identifying invasive aquatic or terrestrial weeds, or controlling these pest plants. These activities, services, or events are designed to disseminate new information to stakeholders

and to seek their input on the research program and findings. Participation by members of lake associations in group discussions and workshops are particularly important because these stakeholders must agree on how to remove aquatic weeds from lakes. Options are limited to herbicide treatment and mechanical methods, which can vary in effectiveness depending on the extent of invasive weed infestations. 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 CAES website, in newsletters and fact sheets, and in displays at the open house events or at agricultural fairs. It is also expected that there will be interest from reporters to write articles on the research, thereby enhancing awareness of invasive plant infestations. Results of these output activities will lead to specific outcomes, such as removing pesticides from soil and water, clearing lakes and ponds of invasive aquatic plants, and preventing loss of water quality.

2. Brief description of the target audience

A broad base 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, boaters, homeowners, water company officials, environmentalists, extension specialists, corporate and municipal officials, 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(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1060	4552	56	1575

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

Patent Applications Submitted

Year: 2010
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	5	5

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Total research papers

Year	Actual
2010	8

Output #2

Output Measure

- # of talks and interviews given to stakeholders

Year	Actual
2010	101

Output #3

Output Measure

- # of diagnostic tests performed

Year	Actual
2010	9971

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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 Measures

of homeowners gaining knowledge on pesticide pollution and invasive aquatic plants

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1000	757

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Members of lake associations see extensive growths of aquatic weeds and are concerned about the loss of water quality. Homeowners also are concerned about the over use of herbicides for weed control in lakes and possible contamination of ground water. Diquat is used extensively to control invasive aquatic plants. If excessive amounts of fertilizers leach into lakes and ponds, aquatic weeds can significantly reduce water quality and alter wildlife habitats on different continents. Clean water is required for agricultural production. Municipal officials and property owners, living adjacent to lakes and ponds in Connecticut, were concerned about aquatic weeds, and possible herbicide contamination of wells and asked for field studies to be conducted.

What has been done

Per aqueous liquid chromatography (PALC) methods were used to analyze water samples "spiked" with various concentrations of diquat (i.e., standards) or collected from lakes where diquat was used. These methods are particularly advantageous when testing compounds that have a polarity that makes organic-based extraction process unfeasible. Chromatographic parameters of the selected analytes were enhanced by using high water content mobile phases.

Results

PALC methods accurately detected diquat at 7 parts per billion (ppb) in the water samples used as standards in laboratory analyses and at 309 ppb in water samples taken from a treated lake one day after dilute concentrations of the herbicide were applied. Tests revealed that the amount of herbicide present in lake water was extremely low. No herbicide was detected in well water. These results had impact because sensitive and specific chemical methods are available for long-term monitoring of lakes and wells for diquat and the low concentrations of the herbicide detected were not considered a human health concern. Long-term benefits include improved water quality after weed removal.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

Outcome #2

1. Outcome Measures

of homeowners gaining knowledge on soil and water quality

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	3000	1850

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Homeowners, landscapers, golf course managers, and farmers frequently use fertilizers. In many cases, these chemicals are applied without knowledge of soil quality. This practice can lead to polluted surface and ground water and encourage rapid growth of algae and other invasive aquatic plants. People who own or rent lake-front properties have expressed concern over reduced water quality and the inability to navigate boats in areas where aquatic weed populations are dense.

What has been done

At the request of stakeholders, 3,817 soil tests were performed at our research laboratories in Windsor, CT to determine nitrogen and phosphorous concentrations, acidity, and amounts of organic matter present. Specific results were provided on soil quality, and, as a part of an educational program, written suggestions were made concerning the application of fertilizers and lime to improve soil quality, or a statement was provided that no fertilizers were needed.

Results

Analyses revealed that 859 (22.5% of 3,816 samples) were considered adequate for plant growth and did not require fertilizer applications. These stakeholders, mainly homeowners who submitted soil samples collected from their lawns or gardens, learned that they did not need to purchase fertilizers and, collectively, saved about \$17,180. Another short-term benefit is less fertilizer leaching into surface and ground water. The long-term benefit is a cleaner environment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

Outcome #3

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	3	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Invasive aquatic plants reduce public access to water, restrict boat navigation, decrease water quality by increasing sedimentation and eutrofication rates, and alter wildlife habitats. People who own or rent lake-front properties have requested assistance on the control of aquatic weeds, such as Eurasian water-milfoil, variable water-milfoil, curly leaf pondweed, fanwort, common water-hyacinth, yellow iris, and watercress.

What has been done

In cooperation with the CT Department of Environmental Protection, experiments were conducted with the herbicides triclopyr and glyphosate to control a massive yellow floating heart (*Nymphoides palntata*) infestation in a pond. Having origins in Europe, Japan, China, and India, it is unknown how this invasive plant entered Connecticut. Survey records indicate that there are only two infestations of this plant in the state.

Results

The application of both herbicides removed most of the invasive plant from the pond. Continued treatments are required. These results had immediate impacts because water quality was partially restored, and the control methods are suitable for future remediation of the infestation. Science citations = 12 for this specific program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Other (Staff changes)

Brief Explanation

While there were no external factors that immediately affected outcomes during this reporting period, the current economy, changes in state or federal appropriations, and resulting staff changes remain the primary external factors that could affect outcomes.

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

Evaluation Results

"Before and after" and "during" evaluations were conducted to document increased knowledge of aquatic plants, whereas "during" evaluations were most helpful in assessing advanced knowledge of stakeholders on soil and water quality issues. More than 120 stakeholders participated in the aquatic weed abatement programs and in town meetings. They followed progress as treatments cleared the weeds from targeted areas.

Key Items of Evaluation

Written information on survey forms following workshops (on-site) was an important information collection method for program assessments. During this reporting period, there were 280 citations for scientific articles written by 3 scientists for the entire program.