# 2008 University of Massachusetts Research Annual Report of Accomplishments and Results

**Status: Accepted**
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## I. Report Overview

### 1. Executive Summary

The Massachusetts Agricultural Experiment Station (MAES) at the University of Massachusetts Amherst is currently administered through the College of Natural Resources and the Environment. The director is Dean Steve Goodwin, the Associate Dean Brenda McComb our and the Assistant Director is Patricia Cromack. The mission of the College of Natural Resources and the Environment (NRE) at the University of Massachusetts is to advance knowledge in core areas through teaching and research. To accomplish this, the College offers broad educational opportunities to a wide spectrum of public audiences, conducts applied and basic research that addresses the needs of citizens, businesses, and public agencies and makes numerous outreach opportunities accessible to its constituents. The College is uniquely qualified, equipped, and committed to fulfilling its land grant responsibilities by promoting and contributing to economic development, environmental quality and human capacity building. MAES continues with the restructured Plan of Work Process which was implemented for the FY2008 to 2012 Plan of Work and continues to explore new approaches to better meet the needs and expectations of its many constituents for our 2009 to 2013 Plan. Continued commitment to increase the scientific focus within a more limited number of projects is ongoing. Currently there are 109 distinct projects supported by MAES. This plan of work calls for projects to be gradually shifted into more clearly defined scientific foci and therefore six planned program areas are being put forward. It is anticipated that at the end of the five year period there will be approximately fifty projects within the planned programs. The six planned program areas are: Enhancing the Use of Natural Resources and Restoring Ecosystem Integrity  This planned program emphasizes the areas of urban impacts on resource conservation, management of forest and estuarine ecosystems as well as plant and animal population biology and management. Improving Animal Reproduction and Health  This planned program will exploit the overlap in techniques, approaches and knowledge base that are being used to study animal health issues (e.g. understanding zoonotic diseases and developing animal vaccines) and those that are being used to solve problems in animal reproduction. Management Practices for Sustaining Agriculture in the Northeast  The overall emphasis in this planned program is low impact, reduced risk pest and nutrient management. Improving Human Health and Wellbeing through Food Function and Food Safety  In this planned program we will focus on four areas of emphasis: physical/chemical characterization of food, food biotechnology, food safety, and health and wellness. Developing Tools for Decision Making  The major area of emphasis of this planned program will be the development of tools for decision making through the use of theoretical and empirical analysis including experiments, surveys, case studies, and other forms of data gathering and analysis. This analysis will be undertaken in the areas of incorporating sustainability into the planning and design process, development of land use planning tools, environmental and natural resource economics, industrial organization economics, and consumer economics. Center for Agriculture – The concept underlying the Center for Agriculture is a single point of entry for stakeholders and users to access the land grant resources of the University of Massachusetts, and thereby the national system. The center is a primary source of information on the state of agriculture in Massachusetts and plays a pivotal role in the integration of research and extension at the university. Stakeholders are an integral part of research and extension at the University of Massachusetts, providing input in both formal and informal ways. There is continuous input and interaction between primary stakeholders and the components of UMass Extension and the Massachusetts Agricultural Experiment Station. This continues to be true for the FY09 13 period. It should be noted that the University of Massachusetts Extension POW is built around nine critical issues that address the following topics:Natural Resource based Economic Development, Food Production, Water Resource Protection, Land Use Management, Ecosystem Management, Protection and Restoration, Food Safety, Health Promotion and Disease Prevention, Youth Development and Engagement.This is a deliberate design to insure that the issues addressed by extension cut across all of the planned research programs of the experiment station.

**Total Actual Amount of professional FTEs/SYs for this State**

| Year:2008 | Extension | | Research | |
|---|---|---|---|---|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 45.0 | 0.0 |
| Actual | 0.0 | 0.0 | 33.8 | 0.0 |

## II. Merit Review Process

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

- Internal University Panel
- Expert Peer Review

**2. Brief Explanation**

Prior to submittal, proprosed projects are reviewed by the relevant department heads for approval. Submitted projects are then evaluated by an internal university panel that consists of one faculty member active in MAES, the Associate Director of MAES, and the Assistant Director for MAES. Proposed projects are judged on their relevance to the critical issues identified in the POW. Three peer reviewers selected from amongst MAES stakeholders, at least two of whom are experts in the proposed area of research will be asked to provide written reviews of the scientific merit of the proposed project. Final approval of projects will be made by the Associate Director or Assistant Director of MAES.

## 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 non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public

**Brief Explanation**

The development of this POW has been guided by the following values respect: for people, families, and communities; respect for the diversity of people, ideas, and organizations; and a dedication to active citizen involvement. To insure that these values are upheld and that the research benefits all members of the broader community it is necessary to make sure that all citizens wishing to participate in the stakeholder process have more than ample opportunity. This requires holding stakeholder meetings, twilight meetings, and listening sessions in urban as well as rural settings. This also requires going beyond traditional outlets when advertising these opportunities. We continue to use this model of including growers and other clients in participatory research to solve problems because it strengthens the link between the University and citizens, keeps the research relevant to real problems and speeds transfer of solutions to end users.

**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
- Use External Focus Groups
- Open Listening Sessions

**Brief Explanation**

Massachusetts has several commodity based organizations which include but are not limited to, the Massachusetts Tree Fruit Growers, the Cape Cod Cranberry Growers Association, the Golf Course Superintendent's Association of New England and the Massachusetts Vegetable and Berry Growers Association provide research facilities and grants that supplement and help to direct the research activities of the MAES. Groups such as the Massachusetts Flower Growers Association, the Massachusetts Arborists Association, the New England Sports Turf Managers Association, the Massachusetts Nursery and Landscape Association, Community In Support of Agriculture (CISA), the New England Small Farms Institute, Trustees of Reservations, The Nature Conservancy, Massachusetts Division of Marine Fisheries, NOAA and the Massachusetts Natural Organic Farmers Association help to set the agenda for research and educational activities. Direct consultations with these groups provide a partnership for identifying and solving problems of mutual concern.

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

**Brief Explanation**

We attend meetings with our stakeholder groups, twilight meetings where we invite commodity groups to our research station to review our research with them and we collect information through our Extension partners.

**3. A statement of how the input was considered**

- To Identify Emerging Issues
- Redirect Research Programs
- To Set Priorities

**Brief Explanation**

Direct consultations by faculty, staff and the dean of the college along with our partners at Umass Extension with our constituents and commodity groups provide a partnership for identifying and solving problems of mutual concern. This model of including growers and other clients in participatory research to solve problems strengthens the link between the University and citizens, keeps the research relevant to real problems and speeds transfer of solutions to end users.

**Brief Explanation of what you learned from your Stakeholders**

We are using this information when we hire faculty.Our most recent hires are in Food Science and Stem Cell biology.The Governor of the state of Massachusetts has created a Life Sciences initiative which would bring a new facilities to our campus so that we could move forward in the areas of medical biotechnology and immunology for both animals and humans.In that regard we responded to his initiative by the hires we made.We are still evaluating the demographic changes in the area and are discovering a larger Brazilian population emerging in the state. With an Extension partner have spent resources on a project that helps to grow and market food that is a staple of the Brazilian diet. We have also created marketing materials and a Television commercial in Spanish and Portugese. This project will be expressly to support the close workings and collaborations of Research and Extension. This project will be at least a three year collaboration that expects to create a deliverable that will be a "whole marketing package" that can be handed over to a farmer/agribusiness group.It will contain the "who, what, where and why" of how to take their crop to market and make a profit.We are in the process of creating a new Center for Agriculture project that replaces the old Center for Agriculture project. This Center will be co Directed by the Assistant Director of MAES and the Director of the Extension Agriculture and Landscape program. Through this collaborative integration of both funds and administration we feel that we will be able to increase our stakeholder input and our research output that directly impacts the agricultural community.We have created a "Special Call" to addressusing information garnered from stakeholders to address the following issues:

- Alternative energy production and/or energy conservation
- Improved use, conservation and protection of surface and ground water
- Agricultural and/or natural resources management approaches that explicitly address effective ways of producing socially relevant resources under impending climate change.

This call asks for that there be potential for development of a highly productive team of collaborators able to compete for additional external funding; the potential for well-defined policy-relevant outcomes; innovative methods and effective use of technology (scientific, educational, informational) in proposed research and extension activities; clear integration of research and extension with potential to develop sustainable extension programs beyond the funding period; and stakeholder involvement in research and educational elements of the project.

## 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 | 2260108 | 0 |

**2. Totaled Actual dollars from Planned Programs Inputs**

| | Extension | | Research | |
|---|---|---|---|---|
| | Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| Actual Formula | 0 | 0 | 1945339 | 0 |
| Actual Matching | 0 | 0 | 2892148 | 0 |
| Actual All Other | 0 | 0 | 8771525 | 0 |
| Total Actual Expended | 0 | 0 | 13609012 | 0 |

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

| | | | | |
|---|---|---|---|---|
| Carryover | 0 | 0 | 293460 | 0 |

## V. Planned Program Table of Content

**Program #1**

## V(A). Planned Program (Summary)

**1. Name of the Planned Program**

Enhancing the Use of Natural Resources and Restoring Ecosystem Integrity

## V(B). Program Knowledge Area(s)

**1. Program Knowledge Areas and Percentage**

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---|---|---|---|---|---|
| 101 | Appraisal of Soil Resources | | | 36% | |
| 102 | Soil, Plant, Water, Nutrient Relationships | | | 29% | |
| 104 | Protect Soil from Harmful Effects of Natural Elements | | | 1% | |
| 112 | Watershed Protection and Management | | | 1% | |
| 131 | Alternative Uses of Land | | | 7% | |
| 133 | Pollution Prevention and Mitigation | | | 10% | |
| 135 | Aquatic and Terrestrial Wildlife | | | 2% | |
| 403 | Waste Disposal, Recycling, and Reuse | | | 3% | |
| 511 | New and Improved Non-Food Products and Processes | | | 11% | |
| | **Total** | | | 100% | |

## V(C). Planned Program (Inputs)

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

| Year: 2008 | Extension | | Research | |
|---|---|---|---|---|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 2.1 | 0.0 |
| Actual | 0.0 | 0.0 | 3.5 | 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 | 342626 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 382465 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 1827538 | 0 |

## V(D). Planned Program (Activity)

**1. Brief description of the Activity**

Developed a new dialysis method to study sorption of organic contaminants by disolved organic matter which can be used for various types of DOM. Species of Geobacter are known in many cases to be dominant organisms in the process of remediating metal contaminants in the subsurface for bioremediation.We found that simple in-frame deletion of pilA cannot be simply complemented by a plasmid copy of pilA.Found that aliphatic structures, particularly the paraffinic fractions tend to be less polar and more hydrophobic.As a result, they have high affinity for hydrophobic organic contaminants such as pyrene and phenanthrene. Once polar functional groups are added to aliphatic fractions via oxidation and coating, sorption of hydrophobic organic compounds are decreased due to reduced hydrophobicity and possibly the decreased accessibility.This also demonstrates the importance of the conformation of organic matter for retention of hydrophobic organic contaminants. A systems approach has been promoted to focus on and optimize planting and harvest times of corn to improve timliness of cover crop planting for increased end of season nitrogen accumulation.Runoff studies from golf greens have shown that up to 5% of the pesticides applied to greens are lost in runoff.The loss of pesticides and nutrients into surrounding bodies of water and the resulting decreases in water quality has led to the use of best management practices on golf courses.This research has identified plants that prevent pesticide losses used in turfgrass environments.

Research has been conducted to explore the idea that attachnment to rural landscapes may be a strong motivation for rural residents to support planning and conservation. There was a positive correlation between local residents' support for land preservation and their level of attachment for scenes of rural places in their area. Clostridium phytofermentans, an ethanol-producing cellulose-decomposing bacterium with exceptional nutritional versatility. C. phytofermentans is able to ferment more components of biomass than most other known microbes. Also, cellulose-fermenting cultures of this bacterium produce H2, as well as prodigious amounts of ethanol. Research described in this proposal will advance understanding of the biology of C. phytofermentans to better appreciate its potential in the development of biorefineries for the conversion of biomass to ethanol and other products. The purpose of this study is to develop industrially-useful enzymes that will enhance the cellulose conversion processes in a reactor by accessing the natural diversity of cellulases found in promising cultured microorganisms and in the DNA isolated from unculturable microorganisms in environmental samples. The development of this green technology will benefit rural life and the general public in Massachusetts if processing facilities are established within the area.

**2. Brief description of the target audience**

Environmental protection, Soils, Alternative Energy groups, Dairy Farmers, Turfgrass, Water Quality Managers, Regional Planners, Landscape Ecologists

## V(E). Planned Program (Outputs)

**1. Standard output measures**

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---|---|---|---|---|
| Year | Target | Target | Target | Target |
| Plan | 0 | 0 | 0 | 0 |
| 2008 | 0 | 0 | 0 | 0 |

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

**Patent Applications Submitted**

| Year | Target |
|---|---|
| Plan: | 1 |
| 2008 : | 5 |

**Patents listed**

US Utility & International (PCT et al.) patent applications: Leschine, S.B., and T.A. Warnick. 2008. 'Systems and methods for producing biofuels and related materials.'

Patent: US Provisional No. 61/042,657: Multiple Authors. 2008. METHOD FOR IMPROVING THE PRODUCTION OF ETHANOL IN MICROORGANISMS, filed April 4, 2008.

Patent: US Provisional No. 61/060,620: Multiple Authors. 2008. METHOD FOR IMPROVING THE BIOMASS CONVERSION OF C. PHYTOFERMENTANS THROUGH GENETIC CONTROL OF SPORULATION FACTORS, filed June 11, 2008.

Patent: US Provisional No. 61/084233: Multiple Authors. 2008. METHODS AND COMPOSITIONS FOR IMPROVING THE PRODUCTION OF ETHANOL IN MICROORGANISMS, filed July 27, 2008.

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

| | Extension | Research | Total |
|---|---|---|---|
| **Plan** | 0 | 30 | |
| 2008 | 0 | 40 | 40 |

## V(F). State Defined Outputs

**Output Target**

**Output #1**

**Output Measure**

- # of refereed manuscripts

| Year | Target | Actual |
|---|---|---|
| 2008 | 5 | 12 |

**V(G). State Defined Outcomes**

## V. State Defined Outcomes Table of Content

| O No. | OUTCOME NAME |
|---|---|
| 1 | Accurate research on wildlife management made available and shared |
| 2 | Accurate research on woodlot management made available and shared |
| 3 | Accurate research on bioremediation and nutrient runoff |
| 4 | Accurate Research on Biomass |

**Outcome #1**

1. **Outcome Measures**

Accurate research on wildlife management made available and shared

*Not reporting on this Outcome for this Annual Report*

**Outcome #2**

1. **Outcome Measures**

Accurate research on woodlot management made available and shared

*Not reporting on this Outcome for this Annual Report*

**Outcome #3**

1. **Outcome Measures**

Accurate research on bioremediation and nutrient runoff

2. **Associated Institution Types**

•1862 Research

3a. **Outcome Type:**

Change in Knowledge Outcome Measure

3b. **Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

3c. **Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Environmental protection, Soils, Agribusiness, Landscape Ecologists, Turfgrass, Dairy Farmers, Water Quality Managers

**What has been done**

Developed a new dialysis method to study sorption of organic contaminants by disolved organic mater which can be used for various types of DOM. Species of Geobacter are known in many cases to be dominant organisms in the process of remediating metal contaminants in the subsurface for bioremediattion. We found that simple in-frame deletion of pilA cannot be simply complemented by a plasmid copy of pilA. Found that aliphatic structurs, particularly the paraffinic fractions tend to be less polar and more hydrophobic. As a result, they have high affinity for hydrophobic organic contaminants such as pyrene and phenanthrene. Once polar functional groups are added to aliphatic fractions via oxidation and coating, sorption of hydrophobic organic compounds are decreased due to reduced hydrophobicity and possibly the decreased accessibility. This also demonstrates the importance of the conformation of organic matter for retention of hydrophobic organic contaminants. A systems approach has been promoted to focus on and optimize planting and harvest times of corn to improve timliness of cover crop planting for increased end of season nitrogen accumulation. Runoff studies from golf greens have shown that up to 5% of the pesticides applied to greens are lost in runoff. The loss of pesticides and nutrients into surrounding bodies of water and the resulting decreases in watr quality has led to ther use of best management practices on golf courses. This research has identified plants that prevent pesticide losses used in turfgrass environments. Research has been conducted to explore the idea that attachnment to rural landscape may be a strong motivation for rural residents to support planning and conservation. There was a positive correlation between local residents' support for land preservation and their level of attachment for scenes of rural places in their area.

**Results**

From NMR and DRIFT techniques, we observed that aromaticity increased with increasing charring temperature, and organic matter in soil humin was highly aliphatic in nature. This promotes understanding the mechanism by which organic matter sorbs organic compounds which is essential for managing soil processes to maintain and improving soil quality and productivity. Our newly developed dialysis sorption method can be used by any other scientists who are interested in studying the interactions between pollutants and dissolved organic matter. Increased understanding of DOM adsorption on minerals will help to better predict and prevent leaching of both organic contaminants and DOM in soils and is expected to help sequestrate carbon in soils.High seasonal groundwater tables negatively affect potential land use. In the case of very high water tables, regulatory agencies may use the information to decide whether or not the soil characteristics indicate the presence of wetland (hydric) soils. Current results confirmed that 90 to 110 lbs/ac of N accumulation is possible if the winter rye cover crop was planted in early September. Given that upward of 100 lb per acre of nitrogen can be recovered by seeding cover crops early this practice makes good economic sense to farmers and helps reduce N loss to the environment. Joint greenhouse and field studies have been implemented to evaluate selected plants for their effectiveness in removing pesticides and nutrients from turfgrass runoff waters that enter vegetative filter strips (VFS). Five species (big bluestem, blue flag iris, eastern gamma grass, prairie cord grass, and woolgrass) were determined to be most effective. The Adaptive Planning method has been tested in a community outreach project. In particular, the research contributed to specific recommendations to reduce impervious surface area, increase infiltration and reduce the frequency and intensity of combined sewer overflows that regularly occur in the city.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 112 | Watershed Protection and Management |
| 131 | Alternative Uses of Land |
| 102 | Soil, Plant, Water, Nutrient Relationships |
| 133 | Pollution Prevention and Mitigation |
| 101 | Appraisal of Soil Resources |
| 104 | Protect Soil from Harmful Effects of Natural Elements |

**Outcome #4**

**1. Outcome Measures**

Accurate Research on Biomass

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Alternative Energy Groups, All constituents

**What has been done**

Clostridium phytofermentans, an ethanol-producing cellulose-decomposing bacterium with exceptional nutritional versatility. C. phytofermentans is able to ferment more components of biomass than most other known microbes. Also, cellulose-fermenting cultures of this bacterium produce H2, as well as prodigious amounts of ethanol. Research described in this proposal will advance understanding of the biology of C. phytofermentans to better appreciate its potential in the development of biorefineries for the conversion of biomass to ethanol and other products. The purpose of this study is to develop industrially-useful enzymes that will enhance the cellulose conversion processes in a reactor by accessing the natural diversity of cellulases found in promising cultured microorganisms and in the DNA isolated from unculturable microorganisms in environmental samples. The development of this green technology will benefit rural life and the general public in Massachusetts if processing facilities are established within the area.

**Results**

Work currently in progress is directed toward characterizing cellulase system of C. phytofermentans using biochemical and genomics approaches. Fermentation of five-carbon sugars and five-carbon sugar polymers by C. phytofermentans: We have determined that C. phytofermentans is capable of fermenting these carbohydrates producing ethanol as the major fermentation product. Our results indicate that conjugative transposon mutagenesis may be an effective genetic tool for C. phytofermentans. 21 microorganisms with growth temperature optima between 85 and 100 degrees C were screened for their ability to grow and produce hydrogen gas on peptides each with and without the addition of elemental sulfur. This will help us to develop a model system to understand how an evolutionarily engineered consortium works to convert biomass to simple sugars. A series of incubations with a variety of sources of cellulose was initiated. Initially, growth systems were showing intense bacterial growth due to the addition of fungicide and the subsequent breakdown of fungal biomass.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 511 | New and Improved Non-Food Products and Processes |
| 403 | Waste Disposal, Recycling, and Reuse |

## V(H). Planned Program (External Factors)

**External factors which affected outcomes**

- Economy
- Public Policy changes
- Competing Public priorities

**Brief Explanation**

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

**1. Evaluation Studies Planned**

- Other (scientific peer review)

**Evaluation Results**

**Key Items of Evaluation**

**Program #2**

## V(A). Planned Program (Summary)

**1. Name of the Planned Program**

Management Practices for Sustaining Agriculture in the Northeast

## V(B). Program Knowledge Area(s)

**1. Program Knowledge Areas and Percentage**

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---|---|---|---|---|---|
| 201 | Plant Genome, Genetics, and Genetic Mechanisms | | | 3% | |
| 202 | Plant Genetic Resources | | | 7% | |
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants | | | 6% | |
| 204 | Plant Product Quality and Utility (Preharvest) | | | 6% | |
| 205 | Plant Management Systems | | | 29% | |
| 206 | Basic Plant Biology | | | 3% | |
| 211 | Insects, Mites, and Other Arthropods Affecting Plants | | | 22% | |
| 212 | Pathogens and Nematodes Affecting Plants | | | 15% | |
| 215 | Biological Control of Pests Affecting Plants | | | 2% | |
| 216 | Integrated Pest Management Systems | | | 3% | |
| 312 | External Parasites and Pests of Animals | | | 1% | |
| 601 | Economics of Agricultural Production and Farm Management | | | 2% | |
| 604 | Marketing and Distribution Practices | | | 1% | |
| | **Total** | | | 100% | |

## V(C). Planned Program (Inputs)

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

| Year: 2008 | Extension | | Research | |
|---|---|---|---|---|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 9.5 | 0.0 |
| Actual | 0.0 | 0.0 | 8.4 | 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 | 544361 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 896363 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 1829377 | 0 |

## V(D). Planned Program (Activity)

**1. Brief description of the Activity**

Conduct research and produce refereed publications in the scientific literature. Present on-site research meetings.

**2. Brief description of the target audience**

Agriculturists, growers, viticulturists, pasture managers, tree fruit orchardists, cranberry growers, medicinal plant growers, Grape growers, ethnic vegetable growers, organic farmers,Golf course managers, Arborists, IPM

## V(E). Planned Program (Outputs)

**1. Standard output measures**

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---|---|---|---|---|
| Year | Target | Target | Target | Target |
| Plan | 0 | 0 | 0 | 0 |
| 2008 | 0 | 0 | 0 | 0 |

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

**Patent Applications Submitted**

| Year | Target |
|---|---|
| Plan: | 0 |
| 2008 : | 0 |

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

| | Extension | Research | Total |
|---|---|---|---|
| Plan | 0 | 50 | |
| 2008 | 0 | 99 | 99 |

## V(F). State Defined Outputs

**Output Target**

**Output #1**

**Output Measure**

- # of refereed manuscripts

| Year | Target | Actual |
|---|---|---|
| 2008 | 12 | 23 |

**Output #2**

**Output Measure**

- # of on-site research meetings per year

| Year | Target | Actual |
|---|---|---|
| 2008 | 9 | 14 |

**V(G). State Defined Outcomes**

## V. State Defined Outcomes Table of Content

| O No. | OUTCOME NAME |
|---|---|
| 1 | Accurate research on low impact pest and nutrient management made available and shared |
| 2 | Accurate Viticulture Research made available and shared |
| 3 | Accurate Research in Cranberry Plant Management Systems |
| 4 | Accurate Research on Tree Fruit Plant Management Systems |

**Outcome #1**

**1. Outcome Measures**

Accurate research on low impact pest and nutrient management made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | 0 | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Agriculturists, growers, viticulturists, pasture managers, tree fruit orchardists, cranberry growers, medicinal plant growers, Grape growers, ethnic vegetable growers, organic farmers, Golf course managers, Arborists, IPM

**What has been done**

Research on Diagnostic Tools to Assess Honey Bees, wine grapes research and education program for small-scale sustainable viticulture and enology in Ma as well as cultivars and clone evaluation, evaluation of pasture blends for dairy,tree-fruit production improvement,ipm and multisciplinary evaluation of cultivars,stress tolerance and quality of medicinal and aromatic plants,cranberry and cranberry pest research, understanding the mechanism of action on ozone in plants using ethylenediurea,IPM on Brassica crops, insect pathogenic viruses,Golfcourse IPM,

**Results**

1.CFW is the key insect pest in Massachusetts cranberry and is increasingly problematic in Wisconsin, the largest growing region in the US. The data provided by this project constitute some of the most significant insights into this little-studied species in cranberry, including information on mating, egglaying, female preference/larval performance on various cultivars, and diel activity patterns. Over several seasons, we showed that CFW moths move throughout the habitats surrounding commercial beds and apparently mate both off and on the bogs; these behaviors strongly suggest that mating disruption as a management tactic would likely fail. Regarding trapping to monitor flight, we showed conclusively that sex pheromone traps poorly reflect onset or intensity of oviposition activity; few females were captured in light traps and almost none were caught in sugar/other baited traps. These findings, together with results showing incompatibility of successful cultural tactics with cost, drop in yield, or labor inputs, led to our new round of work with collaborators to examine moth response to host volatiles (for trap development) and to focus on chemical management options with reduced-risk chemistries. 2.The insect virus Hz-2V is capable of infecting several species of insect and has potential to be exploited as a sterilizing agent for use in insect pest control. This insect continues to become resistant to chemical pesticides. Its host for the virus, the corn earworm is found in a variety of crops including alfalfa, corn, cotton, sourghum and soybean. Therefore successful control of this pest would prevent over $100 million of crop loss annually in the US. 3. The aims of this project were to assess cultural approaches and to integrate reduced risk (or organophosphate-replacement, if needed) chemical approaches to northeast cranberry, with an ultimate goal of ending dependence on OP/carbamates. We are close to meeting this goal. 4. Our research has found consistent differences between Chionaspis heterophyllae and Chionaspis pinifoliae across all 3 loci examined, and has found a large amount of variation at cytochrome oxidase I within presumptive Chionaspis pinifoliae. Some of this variation is congruent across all three loci, and this is the subject of ongoing analysis. Some of the divergent molecular haplotypes are associated with clear morphological differences, indicating at least a few diagnosable new species. Some of the putative new species are geographically isolated in Mexico, but one possible species pair is widely sympatric across Eastern North America. In short, Chionaspis pinifoliae is considered a polyphagous invasive pest, but may actually consist of several species, some of which are probably more specialized with respect to host and more restricted with respect to geography. 5.Several entomologists throughout the region are collaborating to refine our understanding of the ecology of ABW, particularly overwintering behavior and early spring movement. Our field trials (on golf course fairways that were at least 30% annual bluegrass) indicated that applications of pyrethroids at the traditional timing (between Forsythia and dogwood full bloom) usually reduced larval populations significantly at sites with a history of low or moderate use of pyrethroids over the previous five to ten years.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 312 | External Parasites and Pests of Animals |
| 211 | Insects, Mites, and Other Arthropods Affecting Plants |
| 212 | Pathogens and Nematodes Affecting Plants |
| 601 | Economics of Agricultural Production and Farm Management |
| 216 | Integrated Pest Management Systems |
| 215 | Biological Control of Pests Affecting Plants |
| 206 | Basic Plant Biology |

**Outcome #2**

**1. Outcome Measures**

Accurate Viticulture Research made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Agritourism industry, Viticulture
Fruit producers in MA are looking for new crops and products to improve profitability and maintain viability. In MA, winemaking serves both an end in itswelf and a large contributor to Agri-tourism. At last look, wineries were generating over $6.5 million in sales and all indications are that this is still increasing rapidly.

**What has been done**

This project completed construction of fermentation facilities at the UMass Cold Spring Orchard Research and Education Center (CSOREC) in Belchertown MA, maintained and conducted a successful harvest from the 0.5 ha demonstration wine vineyard at CSOREC, initiated fermentation cycles for 6 initial wine styles for evaluation, completed the first year of the new Massachusetts Farm Winery and Grower's Association (http://masswinery.com/), continued work on the GIS-based site assessment tool (ArcInfo) and associated manual to evaluate potential vineyard sites in the state, and assisted 3 cooperating growers with demonstration table grape vineyards planted in 2007 (Clarkdale Orchard, Apex Orchard, and Clark Bros. Orchard).
In 2008 vines were planted at the UMass Cold Spring Orchard Research and Education Center (CSOREC) in Belchertown, MA. The planting was comprised of 24 vines each of Core Varieties - Chambourcin (101-14 rootstock), Frontenac, St. Croix, Vidal (101-14 rootstock) and discretionary varieties - Corot Noir, La Crescent, Marquette, Noiret (101-14 rootstock), and Reisling.

**Results**

By establishing and managing demonstration vineyards and a fermentation facility, practical knowledge was gained on variety performance, training systems, trellising systems, insect, disease and weed management, canopy management, harvest parameters and procedures, winemaking facility design, equipment, product flow, fermentation techniques, etc. Additionally, the development of a vineyard site assessment tool and associated manual helps determine the suitability of prospective sites. Grower workshops and demonstrations have increased knowledge in the community of interest about good viticultural practices suited for the New England climate. By facilitating the establishment of the Massachusetts Farm Wineries and Growers Association, this project has helped to support established and prospective vineyard/winery operations. Indirectly, this project has contributed to a change in conditions in as much as the number of vineyard/winery operations in Massachusetts has nearly doubled to 29 from 15 in less than 10 years (1998-2007) according to the most recent MDAR survey. There are an additional 6-8 vineyard/winery establishments in development, but not yet bonded and licensed. A similar trend is seen in New England, generally. In another research project, a small number of workshops were held this season to introduce this project to interested individuals. Since this is the first year with vines in the ground, limited information and results are available for presentation. Nevertheless, growers have been interested to see the planting and discuss vineyard design, trellis construction, training systems, etc.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 601 | Economics of Agricultural Production and Farm Management |
| 205 | Plant Management Systems |
| 202 | Plant Genetic Resources |

**Outcome #3**

**1. Outcome Measures**

Accurate Research in Cranberry Plant Management Systems

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Cranberry Industry, agrotourism

**What has been done**

Interim project results have been presented to cranberry farmers at meetings. In addition, project results are being used as the basis for recommendations regarding the use of phosphorus fertilizers in cranberry production. A summary of the project results was provided to MA cranberry growers at a seminar in January 2008 and at a program sponsored by the Cape Cod Cranberry Growers Association in March 2008, this included a review of new knowledge generated in this project and recommendations for implementation. Attendance at each program was ~275.

**Results**

Management guidelines regarding nutrient management are included in the revised 'Cranberry Production Guide for Massachusetts', scheduled for publication in late 2008. Project results have provided the basis for a recommended phosphorus (P) application rate of 20 lb/a or less per season if tissue tests indicate sufficiency and the recommendation to use only moderate (20-60 lb/a) rates of seasonal nitrogen. Project results are being integrated into Best Management Practices and Nutrient Management Plans in order to reduce potential off site pollution. The UMass Cranberry Station and the Cape Cod Cranberry Growers Association have undertaken a major educational effort to encourage cranberry growers to introduce a phosphorus reduction strategy as part of cranberry nutrient management -- this initiative is supported by the change in knowledge generated in this project. Knowledge generated in this project will be used by cranberry growers as they implement management changes in response to total maximumm daily loads (TMDL) mandates from Mass. DEP under the Clean Water Act. Six growers have committed to a program of P reduction with water quality monitoring and shared record keeping. They will also serve as ambassadors to others in the community.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 205 | Plant Management Systems |

**Outcome #4**

**1. Outcome Measures**

Accurate Research on Tree Fruit Plant Management Systems

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Agrotourism, Orchardists, consumers

**What has been done**

Approximately 250 acres were planted to dwarfing rootstocks during the last year. All rootstock recommendations are based on the results of this project, and growers rely heavily on those recommendations when selecting the proper scion/rootstock combinations. These rootstocks, will reduce pruning and harvest labor by 50%, increase fruit quality, increase size by 10-20%, and enhance the economic return on this acreage by as much as 50%. Further, smaller trees require 70% less pesticide because of reduced canopy volume. The net effect of the planting in 2007 is to reduce the amount of spray material in total by about 250,000 gallons per year in Massachusetts. The beneficiaries of this year's research are tree-fruit growers and the citizens of the Commonwealth.

**Results**

Cumulative (2006-08) yield per tree was not affected by rootstock. Cumulative yield efficiency was greater for trees on M.9 NAKBT337 than those on M.26 EMLA. M.9 NAKBT337 resulted in a greater spur density and a comparable percent of spurs blooming to the other two rootstocks. The result was double the blossom density of trees on M.9 NAKBT337 compared to those on G.16 or M.26 EMLA. Crop load in 2007 significantly and negatively affected blossom density in 2008, primarily by negatively affecting the percent of spurs blooming. Crop load in 2008 was positively related to blossom density and percent of spurs blooming in 2008. There was a negative correlation between crop load in 2007 and crop load in 2008. Crop load in 2007 was negatively correlated with fruit weight in 2008, even though it was negatively correlated with crop load in 2008. The result was a positive correlation between crop load in 2008 and fruit weight in 2008.Trees were stressed by the high crop loads imposed in 2007 to the point where that stress was carried into the next season.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|

203 Plant Biological Efficiency and Abiotic Stresses Affecting Plants

## V(H). Planned Program (External Factors)

**External factors which affected outcomes**

- Natural Disasters (drought,weather extremes,etc.)
- Competing Public priorities

**Brief Explanation**

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

**1. Evaluation Studies Planned**

- Other (scientrific peer review)

**Evaluation Results**

**Key Items of Evaluation**

**Program #3**

## V(A). Planned Program (Summary)

**1. Name of the Planned Program**

Improving Animal Reproduction and 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 |
|---|---|---|---|---|---|
| 301 | Reproductive Performance of Animals | | | 22% | |
| 305 | Animal Physiological Processes | | | 18% | |
| 306 | Environmental Stress in Animals | | | 5% | |
| 311 | Animal Diseases | | | 34% | |
| 312 | External Parasites and Pests of Animals | | | 3% | |
| 314 | Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals | | | 4% | |
| 315 | Animal Welfare/Well-Being and Protection | | | 4% | |
| 722 | Zoonotic Diseases and Parasites Affecting Humans | | | 10% | |
| | **Total** | | | 100% | |

## V(C). Planned Program (Inputs)

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

| Year: 2008 | Extension | | Research | |
|---|---|---|---|---|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 4.8 | 0.0 |
| Actual | 0.0 | 0.0 | 5.8 | 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 | 539776 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 402179 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 3793292 | 0 |

## V(D). Planned Program (Activity)

**1. Brief description of the Activity**

Conduct research and produce refereed publications in the scientific literature.

**2. Brief description of the target audience**

Animal producers, farmers, agritourism

## V(E). Planned Program (Outputs)

### 1. Standard output measures

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---|---|---|---|---|
| Year | Target | Target | Target | Target |
| Plan | 0 | 0 | 0 | 0 |
| 2008 | 0 | 0 | 0 | 0 |

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

**Patent Applications Submitted**

| Year | Target |
|---|---|
| Plan: | 0 |
| 2008 : | 0 |

**Patents listed**

### 3. Publications (Standard General Output Measure)

**Number of Peer Reviewed Publications**

| | Extension | Research | Total |
|---|---|---|---|
| Plan | 0 | 40 | |
| 2008 | 0 | 26 | 0 |

## V(F). State Defined Outputs

**Output Target**

**Output #1**

**Output Measure**

- # of refereed manuscripts

| Year | Target | Actual |
|---|---|---|
| 2008 | 12 | 7 |

**V(G). State Defined Outcomes**

## V. State Defined Outcomes Table of Content

| O No. | OUTCOME NAME |
|---|---|
| 1 | Accurate research on animal reproduction and health made available and shared |
| 2 | Accurate research on Equine Animal Health |
| 3 | Accurate research on Bovine Gamma-Delta T cell functions as determined by WC1 isoforms made available and shared |
| 4 | Acurate research on the mechanisms by which one protein turns genes off and on during T cell development |
| 5 | Accurate research on Zoonotic Diseases |

**Outcome #1**

**1. Outcome Measures**

Accurate research on animal reproduction and health made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | 0 | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Breeders, Dairy farmers. Today's dairy cows exhibit lower fertility, as assessed by the numbers of breedings per conception. Conversely, heifers' fertility has remained steady. Therefore, present dairy practices are affecting either oocyte quality and/or the uterine environment. We want to ascertain which one of these two possibilities or if a combination of them contributes to the deteriorating fertility in these animals. The purpose of this research is to identify the causes of decreased fertility in dairy cows with the notion to institute management changes that will alleviate this problem.

**What has been done**

The aims of this multistate project are the following: A. My laboratory will be specifically involved in Identifying genetic, morphological and physiological attributes of the ovary considered to improve fertility in ruminants and, more precisely, in conducting the following experiments in the evaluation of oocyte quality: 1) Oocyte quality in high-producing lactating dairy cows versus non-lactating dairy heifers. Do oocytes of high producing lactating dairy cows show structural differences with those of non-lactating dairy heifers? During the the last year, we have optimized the concentrations of mRNA of both mouse and bovine PLCzeta to be injected in bovine eggs to initiate fertilization-like Ca2+ oscillations. Therefore, with these at hand, we will now inject the appropriate concentrations of bovine PLCzeta to establish whether oocytes of high producing cows, and most likely with lower levels of fertility, will show reduced ability to initiate and maintain Ca2+ oscillations, which will be an indication that metabolic stress impact oocyte quality.

**Results**

The results of this proposal are expected to refine current estrous synchronization protocols and management strategies to enhance embryo survival in lactating dairy cows. In addition, the obtained results would contribute to develop herd management strategies to minimize the effects of nutritional/metabolic stress on herd fertility.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 315 | Animal Welfare/Well-Being and Protection |
| 305 | Animal Physiological Processes |
| 301 | Reproductive Performance of Animals |

**Outcome #2**

**1. Outcome Measures**

Accurate research on Equine Animal Health

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**
Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Equine industry
Immunolists
Degradation of the structures that suspend the horses skeleton in the hoof is responsible for laminitis.

**What has been done**

Firstly, neither MMP2 gene nor protein expression are elevated at the developmental (DEV) or OG1 stages of starch gruel-induced laminitis. Indeed, little or no MMP-2 activity was detected. Consequently, MMP-2 does not contribute to the developmental stages of irreversible laminitis. Secondly, neither Pro-MMP9 nor MMP9 was detected in laminae at the DEV time point but pro-MMP9 was detected at OG1. Furthermore, immigrant neutrophils were also detected in the laminae at the OG1 but not the Dev time point, determined by a neutrophil-specific antibody that reacts with a 100kDa neutrophil secondary granule protein which remains to be identified. These data show that inflammation of the laminae co-incides with lameness but is not a prelude to lameness. Thirdly, a screen of genes encoding metalloproteinases showed that expression of ADAM-TS4 was elevated by 160 fold at the Dev time point and declined thereafter although expression remained elevated relative to that in control laminae. Expression of the gene encoding ADAM-TS5 was also elevated although only 2.5 fold relative to controls. Expression of genes encoding ADAM-10, ADAM-17, MMP-9, MMP-2 and MT1-MMP did not change after administration of the starch gruel. These data suggest that ADAM-TS4, also known as aggrecanase, may be a key enzyme in pathologic remodeling of extracellular matrix leading to laminitis and that MMP-9 and MMP-2 are unlikely to contribute to developmental stages of the disease in the starch-gruel model.

**Results**

The data obtained so far strongly suggest against a role for MMP2 and MMP9 in the developmental stages of starch-induced irreversible laminitis, i.e., at a time when targeted inhibition of involved enzymes would be most likely to have an effect. Rather, they raise the possibility that ADAMTS4 may play a role in the early pathologic remodeling of the laminae and consequently that one or more substrates of ADAMTS4 may be required for integrity of the laminae. On-going studies aim to investigate this new hypothesis.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 305 | Animal Physiological Processes |

**Outcome #3**

**1. Outcome Measures**
Accurate research on Bovine Gamma-Delta T cell functions as determined by WC1 isoforms made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**
Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

A major obstacle to advances in veterinary immunology and disease control is the lack of sufficient tools specific for ruminants, swine, poultry, equine and aquaculture species. These tools are needed to study infectious and inflammatory diseases and their development will allow us to devise intervention strategies including vaccines as well as develop new diagnostic tests, which together will improve animal heath.

**What has been done**

This proposal presents a broad community plan to begin to systematically address the immunological reagent gap for the US veterinary immunology research community including for the following groups: ruminants (concentrating on cattle), swine, poultry (primarily chickens with some evaluation of reagents on turkey cells), horses and aquaculture species (concentrating on channel catfish and trout) with a goal of 20 reagents per species group. The reagents will include bioactive recombinant cytokines and chemokine proteins, expressed using mammalian, yeast, and bacterial systems, as well as antibodies to them and their receptors as well as antibodies to immunogloulin isotypes, T cell receptors and other CD molecules. The goal is to produce antibodies that function in ELISA and ELISpot assays, for intracellular staining, for blocking function and signaling, and that are useful in flow cytometric applications as well as in fixed tissue sections. Antibodies to bioactive molecules will also be tested for their ability to block the recombinant molecules as well as natural molecules if it is possible to produce cell culture systems for the later. These will be useful to research scientists for vaccine design and efficacy trials and for those evaluating pathology of important veterinary diseases.

**Results**

We have developed a web page www.vetimm.org that details the progress of the group and is updated weekly. Many of the materials referred to here are attached as PDFs to the web page and have attached posters from meeting presentations on the various web sub-pages. The gene cloning phase of the project has been virtually completed by the end of Year 2 with 145 genes cloned by Network PDs. It proved problematic to obtain whole expressed sequences from other labs in many cases and far more simple to clone them ourselves. These genes are now available to the scientific community as detailed on the website. Most are the entire coding sequence for the mature protein. FASTA files of the gene sequences are on the web page along with the primer pairs used to amplify these genes and these are available to the scientific community upon request. Those genes for which the full-length expressed sequence has been published are referenced on the website while those which are not associated with a prior publication will be published as Technical Reports in the next 2 months. Expression and assessment of bioactivity of chemokines and cytokines is set up and underway and will be the focus through Yrs 3 and 4. The Bioassay Protocols and our survey of use of these for livestock, poultry and equine species to assess their validity is on the website. Cell surface molecule expression has been underway since Year 1 and will be completed by the end of Yr 3. Generation of mAb to those cell surface molecules (and to the chemokines and cytokines selected) will continue through Yr 3 and 4. In most cases the cytokine and chemokine genes described in the following set of tables were cloned and sequenced by US-VIRN P.D.'s. Whole sequence includes signal/leader sequence while those designated as KF are ready for expression in the yeast system. They have been deposited in GenBank. All these genes are available for distribution to the scientific community upon request and we are investigating feasibility of deposition in gene banks. All sequences have been/will be deposited in Genbank. Kingfisher (KF) biotech has begun expressing these in Picchia and will be sent to the various species coordinators for biotesting beginning in Feb 2008. The bioactive proteins will be commercially available and a limited amount directly distributed to scientists. A selected number (about 30-40) will be used for producing mAbs by US-VIRN as detailed on website. These are being transfected into CHO cells at Cornell by Bettina Wagner. All these cell surface proteins will be used for producing mAbs. Transfected cell lines will also be available for testing other potential cross-reactive mAbs.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 311 | Animal Diseases |

**Outcome #4**

**1. Outcome Measures**

Acurate research on the mechanisms by which one protein turns genes off and on during T cell development

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Animal welfare
Molecular biologists
Mammals make different kind of T cells, with differing functions. It is not understood how the production of these different types of T cells is regulated. This project examines the mechanisms by which one protein turns genes off and on during T cell development, which has the potential to regulate T cell production.

**What has been done**

During the course of this project, we analyzed the activity of Runx1 protein mutants in thymocytes, myeloid cells and in hematopoietic stem cells transplanted into mice or into fetal sheep. Based on our discoveries in these systems, we generated a membrane-permeable recombinant protein produced in bacteria and have analyzed its ability to enter cells from the spleen and bone marrow and affect the transcription of two target genes. We are now working on the analysis of the stability and dose response of the protein when it is incubated with cells and the development of alternative delivery methods. The results from these studies were presented at yearly meetings of the American Association of Immunologists, seminars at The University of Massachusetts Medical School and the University of Toronto, yearly Runx conferences in Edinburgh, Scotland; Gettysburg Pennsylvania; and Provincetown, Massachusetts, and meetings of the UMass Amherst undergraduate student Animal Science/Pre-vet Club and Sheep Group. I used the research flock from this project as the source of blood samples for an undergraduate honors colloquium, in which students prepared sheep DNA from their assigned sheep, PCR amplified a fragment from the prion gene, and interpreted the sequence of this DNA fragment in reference to recent publications about prion gene sequence and scrapie susceptibility.

**Results**

This project resulted in a change in knowledge, in that the work on Runx1 mutants led to one published paper and four more submitted or in preparation. We elucidated the role of amino acids in the C-terminus and N-terminus of Runx1 in repressing CD4 in thymocytes, and in regulating genes critical in hematopoietic stem cell expansion and B and T cell development. The examination of Runx1 mutants in a murine bone marrow transplant model showed that one of these mutants expanded hematopoietic cell stem cells or their progeny. We tested the power of this expansion in a fetal sheep transplant model, a large animal model in which we injected mouse hematopoietic stem cells infected with a retrovirus encoding the Runx1 mutant into fetal sheep at approximately 55 days of gestation. At this stage of gestation, the fetal sheep will not reject transplants, as its immune system is immature. We tracked the lambs born after the transplant and analyzed their blood for the presence of blood cells from the mouse by fluorescence-assisted cell sorting (FACS) and PCR amplication of the retroviral vector marker GFP. Of the sheep showing engraftment with mouse hematopoietic stem cells, no mouse cells were detected that did not show evidence of retroviral transduction with the Runx1 mutant, indicating that the Runx1 mutant was responsible for the long-term engraftment of these hematopoietic stem cells. One sheep, euthanized at 2 years and 7 months of age (the oldest sheep in the study), still showed evidence of engraftment with mouse hematopoietic stem cells. Being able to expand hematopoietic stem cells or their progeny would be very advantageous for bone marrow transplants, a therapy whose effectiveness would be increased by increasing the number of rare stem cells transplanted. We next developed a membrane-permeable recombinant Runx1 mutant protein, since permanent genetic modification of hematopoietic stem cells via retroviral transduction leads to defects later in the development of cells of the blood and immune system and thus would not be suitable for therapy.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 315 | Animal Welfare/Well-Being and Protection |

**Outcome #5**

**1. Outcome Measures**

Accurate research on Zoonotic Diseases

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Medical Doctors
Veterinarians
650 million people worldwide (about 10% of the world population) are at risk of contracting zoonotic diseases caused by trypanosomatid organisms. Current drug treatments are toxic, there are no vaccines and drug resistance is emerging. New treatments are a necessity. With increased international travel and a growing global economy, it is highly likely that zoonotic diseases will continue to cross borders in animal reservoirs or in humans carrying disease (Chagas Disease in Southern US states is a current example).

**What has been done**

We studied four DNA polymerases (Pols) related to bacterial DNA Pol I that are involved in maintenance of the Trypanosoma brucei mitochondrial genome, known as kinetoplast DNA (kDNA). We initiated functional studies using RNA interference to study the roles of POLIA and POLID in kDNA replication or repair. In a previous progress report we noted that POLID was required for kDNA replication. The work is now published. Work on POLIA established a role as a repair protein essential during UV DNA damaging conditions. In this funding period we identified a fifth Pol I-like gene product that resembles the four mitochondrial Pol I-like proteins (e.g. it has a family A polymerase domain) and designated it POLIE. POLIE is most similar to POLIA (55% identity in the polymerase domain).

**Results**

In this funding period we expanded our understanding of the basic biology of trypanosomatid parasites and identified a new drug target, a nuclear DNA polymerase that we named POLIE. Additionally, we continued are studies on the mitochondrial DNA polymerases to evaluate their biological roles in DNA replication and repair. Currently, we have a unique opportunity to study a protein family that have specialized roles in both replication and repair processes, and to identify features in each polymerase that can be exploited for less toxic treatments. Therefore, our studies not only impact public health, but also the general fields of replication and repair.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 722 | Zoonotic Diseases and Parasites Affecting Humans |

## V(H). Planned Program (External Factors)

**External factors which affected outcomes**

- Natural Disasters (drought,weather extremes,etc.)
- Government Regulations

**Brief Explanation**

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

**1. Evaluation Studies Planned**

- Other (peer scientific review)

**Evaluation Results**

**Key Items of Evaluation**

**Program #4**

## V(A). Planned Program (Summary)

**1. Name of the Planned Program**

Improving Human Health and Wellbeing through Food Function and Food Safety

## V(B). Program Knowledge Area(s)

**1. Program Knowledge Areas and Percentage**

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---|---|---|---|---|---|
| 501 | New and Improved Food Processing Technologies | | | 20% | |
| 502 | New and Improved Food Products | | | 17% | |
| 503 | Quality Maintenance in Storing and Marketing Food Products | | | 15% | |
| 702 | Requirements and Function of Nutrients and Other Food Components | | | 24% | |
| 703 | Nutrition Education and Behavior | | | 2% | |
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources. | | | 3% | |
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins | | | 19% | |
| | **Total** | | | 100% | |

## V(C). Planned Program (Inputs)

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

| Year: 2008 | Extension | | Research | |
|---|---|---|---|---|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 7.8 | 0.0 |
| Actual | 0.0 | 0.0 | 8.7 | 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 | 357421 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 767871 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 982490 | 0 |

## V(D). Planned Program (Activity)

**1. Brief description of the Activity**

Conduct research and produce refereed publications in the scientific literature. Hold international scientific symposia

**2. Brief description of the target audience**

Healthcare professionals
Nutritionist
Food Safety industry
Food Industry

## V(E). Planned Program (Outputs)

**1. Standard output measures**

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---|---|---|---|---|
| **Year** | **Target** | **Target** | **Target** | **Target** |
| **Plan** | 0 | 0 | 0 | 0 |
| 2008 | 0 | 0 | 0 | 0 |

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

**Patent Applications Submitted**

| Year | Target |
|---|---|
| **Plan:** | 0 |
| 2008 : | 0 |

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

| | Extension | Research | Total |
|---|---|---|---|
| **Plan** | 0 | 40 | |
| 2008 | 0 | 55 | 0 |

## V(F). State Defined Outputs

**Output Target**

**Output #1**

**Output Measure**

- # of refereed publications

| Year | Target | Actual |
|---|---|---|
| 2008 | 10 | 25 |

**Output #2**

**Output Measure**

- # of international symposia

| Year | Target | Actual |
|---|---|---|
| 2008 | 1 | 1 |

**V(G). State Defined Outcomes**

## V. State Defined Outcomes Table of Content

| O No. | OUTCOME NAME |
|---|---|
| 1 | Accurate research on functional foods made available and shared |
| 2 | Accurate research on food safety made availalbe and shared |
| 3 | Accurate Research on Food Function and Nutrition |
| 4 | Accurate research in production, characterization and application of nanostructured food |
| 5 | Accurate research in food processing technologies |
| 6 | Accurate research on characterization of transfer monocytogenes between processing surfaces and food |
| 7 | Accurate research on seafood safety |

**Outcome #1**

**1. Outcome Measures**

Accurate research on functional foods made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | 0 | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Development of omega 3 fortified foods is limited because omega 3 fatty acids can undergo chemical deterioration to produce rancid aromas that lead to consumer rejection of the foods. The goal of this project is to develop a successful antioxidant strategy for food-based delivery of omega 3 fatty acids from fish oil. The antioxidant strategy will employ protein coated fish oil droplets that are resistant to rancidity development. These droplets will be incorporated into food beverages including dairy creamer and orange juice. Once incorporated into the foods, the product quality will be monitored by measuring color, texture and flavor.

**What has been done**

Omega-3 fatty acids have numerous health benefits but their addition to foods is limited by the susceptibility to oxidation which produces rancid flavors and aromas. Several different types of ingredient delivery foods systems can be used to protect omega-3 fatty acids. These protection systems must inhibit lipid oxidation while still maintaining the lipid in a nutritionally bioavailable state. The ability of an emulsion stabilized by a multilayer emulsifier systems consisting of beta-lactoglobulin and citrus or sugar beet pectin stabilize fish oil-in-water emulsions was tested since sugar beet pectin contains the known antioxidant, ferulic acid. Emulsions prepared with the multilayer system with sugar beet pectin were less stable than emulsions stabilized with protein alone despite the presence of ferulic acid in the sugar beet pectin. The lower oxidative stability of the emulsions with the sugar beet pectin could be due to its higher iron and copper concentrations which would produce oxidative stress that would overcome the antioxidant capacity of ferulic acid. Antioxidants were also tested in squid to see if they could decreased lipid oxidation however, ascorbate and erythorbate were prooxidative while EDTA and tripolyphosphate had no antioxidative effect in frozen cuttlefish.

**Results**

Producing foods fortified with omega-3 fatty acids could be an effective method to increase the consumption of omega-3 fatty acids which could decrease the incidence of cardiovascular disease, mental illness and immune response disorders. This work continues to show that encapsulation of omega-3 fatty acid oils into emulsion systems can be an effective method at controlling lipid oxidation while leaving the omega-3 fatty acid highly bioavailable. Delivery of omega-3 fatty acid into foods without effecting food quality could help people significantly decrease their risk of premature death by heart failure.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 502 | New and Improved Food Products |

**Outcome #2**

**1. Outcome Measures**

Accurate research on food safety made availalbe and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | 0 | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Food antimicrobials are compounds that can greatly improve the safety of foods, but their activity in foods is very low and large concentrations are required which impacts flavor and taste. The purpose of this study is to develop new encapsulation methods based on modern nanotechnology approaches to improve the effectiveness of food antimicrobials and to ultimately improve the safety of the US food supply

**What has been done**

The information obtained in this grant was disseminated via presentations at a variety of conferences including the 2008 American Oil Chemists' Society Annual Meeting, the 2008 Annual Meeting of the Institute of Food Technologists (IFT), and the 2008 Surfactants in Solution Meeting. Results were transferred to industry via consulting. Companies included, Pepsico, Oceanspray, Harris Acoustics, Nestle, Sensient Technologies, Wrigleys, and Vedeqsa, Inc. In addition, information was presented in two workshops to industrial, academic and governmental audiences, one workshop on 'Health Benefits of Omega-3 Fatty Acids' organized by Dr. Eric Decker was held in Shanghai, China, the second workshop was held in conjunction with the IFT Annual Meeting and involved topics on Food NanotechnologyThis reporting period, significant progress was made on two key subjects: the development of solid lipid nanoparticles as novel nutraceutical carriers and the development and functionalization of nanofibers from food biopolymers. (1) Solid Lipid Nanoparticles: We successfully produced for the first time stable solid lipid nanoparticles using tripalmitin and a variety of foodgrade surfactant that were resistant to previously observed recrystallization phenomena that eventually led to a breakdown of the particle suspension.

**Results**

We found that the recrystallization process as well as the stability of the solid lipid nanoparticle suspension can be improved by selecting surfactants that have lipid tails that crystallize prior to the lipid matrix. In this case, crystallization becomes 'surface-initiated' resulting in morphologically stable alpha-beta crystal mixtures that are extremely promising as carrier systems for lipophilic bioactives such as e.g. w-3 fatty acids and carotenoids. This is a dramatic step forward and we expect by next year to have developed a stable formula which prevents chemical degradation of bioactives and essential lipid nutrients in complex food systems.

Electrospinning of nanofibers: we demonstrated for the first time, that fibers can be produced with diameters of 100-200 nm, that contain particulate carrier systems such as microemulsions or emulsions. By inclusion of these structures, the fibers become highly functional, as for example antimicrobial compounds can be added to the nanofibers rendering them antimicrobially active. The fibers become of great interest to food manufacturers wishing to improve food quality and personal care industries. Moreover, we found that the fibers can be manufactured (albeit with some difficulty) from pure food biopolymers in the absence of organic harsh solvents to yield truly food grade components. With this, we have overcome the major obstacle that prevented a subsequent commercialization by the food industry.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 501 | New and Improved Food Processing Technologies |

**Outcome #3**

**1. Outcome Measures**

Accurate Research on Food Function and Nutrition

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

It is estimated that approximately 10 million people in the US suffer from osteoporosis, and 44 million or 55% of people 50 years of age and older are at risk for developing osteoporosis. Osteoporosis is one of the major diseases in the elderly and can affect the quality of life. Thus the prevention of osteoporosis is of interest and conjugated linoleic acid may help to reduce its incidence. This proposal will help to understand how and under what conditions CLA may be beneficial, looking toward an eventual use in helping to control osteoporosis. The purpose of this proposal is to study CLA's effects on bone metabolism by two separate approaches; first, to identify the conditions under which CLA can improve bone mineral mass, and second, to clarify the effect of CLA on differentiation of bone marrow mesenchymal stem cell into adipocytes, osteoblasts, or chondrocytes. The purpose of this proposal was to 1) investigate the correlation between calcium levels and CLA's effect on bone mineral content and 2) investigate CLA's effects on bone marrow stromal stem cell differentiation.

**What has been done**

During the last year, the focus was on the second part of the proposal, using bone marrow stromal stem cells to investigate CLA's effect on adipogenesis. Mouse bone marrow stromal stem cells were differentiated into adipocytes cells over a 8-10 day while CLA (mixed isomer, cis-9,trans-11, trans-10,cis-12), linoleic acid, and control (albumin) were treated during the same time period. First, total triacylglyceride deposition in these cells was measured as an indicator of adipocyte differentiation.

**Results**

Since the treatment of osteoporosis has had either limited success or adverse effects, it is generally recommended that prevention may be the best choice for avoiding osteoporosis. Among prevention strategies, the main emphasis has been on dietary calcium intake, however, calcium by itself has limited efficacy on prevention of osteoporosis. Thus, any component that can improve calcium's effect on bone mass may potentially improve bone health significantly. The link between adipogenesis and osteogenesis has been reported, where low bone mass is positively linked with high adiposity in bone marrow. Thus, increasing osteogenesis with decreased adipogenesis may provide the mechanism by which CLA controls bone formation. In addition this observation will assist in understanding not only the mechanism of CLA's benefit on bone mass, but may also be extended for discovery of other components for bone health. It has been proposed that we will test effects of CLA on older animals to compare the effects of CLA on bone loss vs. bone formation in young animals. Since bone loss in the elderly is a relatively slow process, we will use an ovariectomized animal model. This model is an established bone loss model. Currently we are setting up experiments with CLA in this model.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 702 | Requirements and Function of Nutrients and Other Food Components |

**Outcome #4**

**1. Outcome Measures**

Accurate research in production, characterization and application of nanostructured food

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Food Processors
Consumers
This project will develop a new method of improving the stability of food emulsions to environmental stresses. This project will develop a new method of creating novel delivery systems. This project will increase the utilization of underutilized components, such as proteins and polysaccharides

**What has been done**

The overall objective of this project was to develop new strategies for improving food emulsion stability and extending food emulsion performance based on engineering the interfacial membrane surrounding the droplets. The specific outputs that were carried out in this reporting period to attain this objective were: (1) We examined the influence of protein type, polysaccharide type, and preparation conditions on the formation and stability of multilayer emulsions. (2) We characterized the properties of the interfacial layers surrounding lipid droplets in multilayer emulsions, and examined how these properties could be controlled. (3) We examined the relationship between the interfacial properties of multilayer emulsions and their stability to various environmental stresses: pH extremes, high mineral contents, thermal processing, freeze-thaw cycling, drying and mechanical agitation. The knowledge gained from this project has been disseminated through scientific publications, reports in trade journals, presentations at scientific meetings and consulting with the food industry.

**Results**

The outcomes of the research project are listed below: (1) We have shown that a wide range of proteins and polysaccharides can be used to form stable multilayer emulsions, provided that the preparation conditions are carefully controlled. (2) We have shown that the electrical charge, thickness and environmental responsiveness of the interfacial layer surrounding lipid droplets in multilayer emulsions can be rationally controlled by selecting appropriate proteins, polysaccharides and preparation conditions. (3) We have shown that the stability of emulsions to environmental stresses (temperature, pH, salt, freezing, drying, enzyme hydrolysis) could be controlled by carefully designing the interfacial membranes using the electrostatic deposition method. (4) We developed a mathematical model to predict the impact of interfacial properties on multilayer emulsion stability. This model can be used to theoretically predict how specific interfacial properties impact the stability of multilayer emulsions. The knowledge gained from this study has important consequences for the practical application of this technology by the food industry. In particular, it enables food manufacturers to select the most appropriate ingredients and processing operations to produce products with improved stability and performance. We have had great interest from the pharmaceutical, food and cosmetic industries in utilizing this technology in their products. The project will also improve the competitiveness of the US food industry by leading to the development of novel encapsulation technologies for use in functional food applications.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 501 | New and Improved Food Processing Technologies |

**Outcome #5**

**1. Outcome Measures**

Accurate research in food processing technologies

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

According to recent estimates, there are more than 1 billion overweight and obese adults on earth today. Since 2001, this figure has surpassed the number of people (0.8 Billion) who are mal-nourished. Obesity-related diseases seriously contribute to chronic disease and disability. Major challenges facing the world today are not just food production and quality for meeting protein, calorie, vitamin and mineral requirements but also better health for those whose basic nutritional needs are met, for which additional disease protective food ingredients are essential.

**What has been done**

Dietary phenolics from legumes and cereals in combinations with fermented organic acids have potential for chemoprevention of ulcer causing bacteria, Helicobacter pylori. To enhance chemoprevention we have developed combinations of phenolics and organic acids by natural fermentation and bioprocessing by enhancement of sprouting-linked protective phenolics from legumes such as soybean. Many of these phenolics and organic acid have been targeted for disruption of energy pathways of Helicobacter pylori, specifically targeting proline oxidation. During past year we have continued to develop natural soy fermented systems using novel lactic acid bacteria and developed combinations of phenolics and lactic acid to inhibit Helicobacter pylori by inhibition of proline dehydrogenase to reduce energy generation of this microaerophillic bacteria and also targeted the inhibition of catalase that this critical to combat toxicity from higher oxygen. Specifically we have found a natural strain of Lactobacillus bulgaricus found in commercial yogurt and a strain of probiotic lactic acid bacteria, Lactobacillus acidophilus that can enhance phenolic and lactic acid profiles in fermented soymilk for the above critical inhibitory targets of Helicobacter pylori. Additionally we have now initiated studies to explore how other legumes and cereal phenolics also have potential for inhibition of Helicobacter pylori and whether such phenolic profiles can also inhibit glucose absorption in the gut that could have relevance for management of other chronic disease such as hyperglycemia linked to type 2 diabetes. Such a strategy can be have double benefits of controlling Helicobacter pylori and also combating specific pathways associated with better management of soluble carbohydrates linked to obesity and type 2 diabetes.

**Results**

The impact of our research is that by natural fermentation of soybean products such as soymilk and stress elicitation linked with the sprouting of commonly consumed legumes and cereals we can enhance bioactive phenolics and organic acids in a food background to inhibit ulcer-linked Helicobacter pylori. This provides an exciting food-based strategy to safely compliment other pharmaceutical-based strategies to combat ulcer-linked Helicobacter pylori that affects 50% of the global population. A second exciting offshoot of this research is that same phenolic and organic acid profiles have relevance for inhibiting pathways linked to hyperglycemia that is linked to management of type 2 diabetes. Therefore naturally enriching soybean and legumes as well as cereal food systems with these critical natural bioactives using biological and biochemical approaches many disease pathways have the potential to be continuously managed from moving towards deleterious cellular breakdowns causing eventual disease states, whether ulcers linked to Helicobacter pylori or hyperglycemia linked to type 2 diabetes.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 501 | New and Improved Food Processing Technologies |

**Outcome #6**

**1. Outcome Measures**

Accurate research on characterization of transfer monocytogenes between processing surfaces and food

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Biofilms growing within processing plants can be a source of pathogenic and spoilage bacteria in foods. Knowledge of the genetics, growth within mixed systems and the influence of spore formation during the biofilm growth cycle can be applied to cleaning and sanitation of the food environment to produce safer foods with longer shelf-life.

**What has been done**

Listeria monocytogenes contamination is responsible for the majority of Class I recalls of processed foods due to post-processing contamination of this organism surviving on food processing surfaces. Although the biofilm formation of L. monocytogenes has been studied, only a few genes have been identified as necessary for biofilm formation to date. Over the past year, a mariner-based transposition system (pAM38) was used to generate mutants of L. monocytogenes LM21. A total of 6500 colonies were screened for reduced surface growth (RSG) characteristics in a microtiter plate assay in modified Welshimer's broth at 32C for 48h. The RSG phenotype was defined as a strain that exhibited normal growth density at 48h, but had a biofilm level three or more standard deviations below the wild type surface growth. A total of 43 RSG phenotype mutants were confirmed and the location the disrupted genes were identified by sequencing PCR reactions performed with a combination of primers specific to the transposon and an arbitrary primer. Thirty different genes involved in biofilm formation were identified, which included genes previously characterized (flagella and the agr quarum-sensing system). New genes identified include surface proteins (LPXTG containing genes), genes involved in surface modification, and genes of unknown function. Currently, we are performing complementation experiments and are continuing characterization of reduced surface growth phenotypes by monitoring biofilm morphology via confocal microscopy and gene expression. Previously in this project we used transposon mutagenesis to generate 36 random mutants within L. innocua LCDC 81-861with reduced surface growth (RSG) characteristics in a microtiter plate assay. However, despite years of work, we were only able to identify the location of one of the transposon insertion sites. This past year, the mutagenesis was started from scratch with a new mariner-based transposition system (pAM38) and we were able to identify the location of 42/43 RSG mutants, a significant leap forward for this project.

**Results**

This research on basic science behind biofilm production of L. monocytogenes has identified many unique genes that are utilized by this organism for biofilm formation. This knowledge will be the basis for new biofilm control strategies based upon the biological survival mechanisms.

**4. Associated Knowledge Areas**

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

**Outcome #7**

**1. Outcome Measures**

Accurate research on seafood safety

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**
Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Seafood products still pose a significant public health risk from infectious bacteria. This project proposes the development of rapid real-time PCR methodology for the quantitative assessment of both viable bacteria and gamma radiation killed cells of V. vulnificus in shellfish tissue. The state of sanitation in seafood processing plants poses a continual public health risk. This study will optimize methodology for destruction of biofilms in processing plant drain systems for elimination of Listeria monocytogenes. The purpose of this project is to enhance the public health safety of seafood products with respect to human infectious agents.

**What has been done**

The effects of irradiation on the destruction of Vibrio vulnificus by real-time PCR were studied. Irradiation was found to result in extensive reduction in the molecular size of DNA. Irradiation of viable cells (1 x 106 CFU/ml) at 1.08 KGy resulted in 100% destruction determined by plate counts, with most of the DNA from the irradiated cells having a bp-length of less than 1000. The use of a pair of primers to amplify a 1000-bp sequence of DNA from cells exposed to 1.08 KGy failed to yield amplification. In contrast, primers designed to amplify sequences of 700, 300, and 70-bp yielded amplification with Ct values resulting in 13.4, 27.6, and 45.4% detection of genomic targets. When viable cells of V. vulnificus were exposed to 1.08, 3.0, and 5.0 kGY, the average molecular size of genomic DNA visualized in an agarose gel decreased with increasing dose, corresponding to an increased probability of amplification with primers targeting sequences of decreasing size

**Results**

These results make it possible to determine if certain human infectious bacteria in irradiated shellfish have been destroyed in terms of enhanced seafood safety

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins |

## V(H). Planned Program (External Factors)

**External factors which affected outcomes**

- Economy
- Competing Public priorities

**Brief Explanation**

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

**1. Evaluation Studies Planned**

- Other (scientific peer review)

**Evaluation Results**

**Key Items of Evaluation**

**Program #5**

## V(A). Planned Program (Summary)

**1. Name of the Planned Program**

Developing Tools for Decision-Making

## V(B). Program Knowledge Area(s)

**1. Program Knowledge Areas and Percentage**

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---|---|---|---|---|---|
| 123 | Management and Sustainability of Forest Resources | | | 11% | |
| 603 | Market Economics | | | 20% | |
| 605 | Natural Resource and Environmental Economics | | | 22% | |
| 606 | International Trade and Development | | | 5% | |
| 607 | Consumer Economics | | | 4% | |
| 610 | Domestic Policy Analysis | | | 6% | |
| 801 | Individual and Family Resource Management | | | 4% | |
| 804 | Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures | | | 3% | |
| 901 | Program and Project Design, and Statistics | | | 25% | |
| | **Total** | | | 100% | |

## V(C). Planned Program (Inputs)

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

| Year: 2008 | Extension | | Research | |
|---|---|---|---|---|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 1.7 | 0.0 |
| Actual | 0.0 | 0.0 | 3.4 | 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 | 96578 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 401822 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 338828 | 0 |

## V(D). Planned Program (Activity)

**1. Brief description of the Activity**

Conduct research and produce refereed publications in the scientific literature.

**2. Brief description of the target audience**

Policy makers

## V(E). Planned Program (Outputs)

### 1. Standard output measures

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---|---|---|---|---|
| Year | Target | Target | Target | Target |
| Plan | 0 | 0 | 0 | 0 |
| 2008 | 0 | 0 | 0 | 0 |

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

**Patent Applications Submitted**

| Year | Target |
|---|---|
| Plan: | 0 |
| 2008 : | 0 |

**Patents listed**

### 3. Publications (Standard General Output Measure)

**Number of Peer Reviewed Publications**

| | Extension | Research | Total |
|---|---|---|---|
| Plan | 0 | 45 | |
| 2008 | 0 | 36 | 0 |

## V(F). State Defined Outputs

**Output Target**

**Output #1**

**Output Measure**

- # of refereed manuscripts

| Year | Target | Actual |
|---|---|---|
| 2008 | 4 | 2 |

**V(G). State Defined Outcomes**

## V. State Defined Outcomes Table of Content

| O No. | OUTCOME NAME |
|---|---|
| 1 | Accurate research made available and shared |
| 2 | Accurate research to promote Ecosystem-Level Cooperation among Non Industrial Private Forest Owners |
| 3 | Accurate Research on determinants of Food System Performance |
| 4 | Accurate Research on Economic Issues in Biosecurity were made available and shared |

**Outcome #1**

**1. Outcome Measures**

Accurate research made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | 0 | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 607 | Consumer Economics |
| 610 | Domestic Policy Analysis |
| 605 | Natural Resource and Environmental Economics |
| 804 | Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures |
| 801 | Individual and Family Resource Management |
| 901 | Program and Project Design, and Statistics |
| 606 | International Trade and Development |
| 603 | Market Economics |

**Outcome #2**

**1. Outcome Measures**

Accurate research to promote Ecosystem-Level Cooperation among Non Industrial Private Forest Owners

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Private woodland ownership dominates ecosystems in many eastern states, yet the majority of owners do not have management plans or seek professional advice before making decisions. The importance of greater public benefits from these lands warrants improved methods to appeal to a larger segment of the landowner population than has been heretofore 'reached' with a conservation message through traditional means such as county foresters, conventional extension programming, and promotional means such as Tree Farm. This study will assess the potential use of a locally relevant and interactive Internet tool (with interactive spatial information, links to other sources of information, and opportunities to submit questions, and read the answers and discussion of others) to reach woodland owners with information about forest management and the potential for cooperation at scales greater than their own properties, which is important for ecosystem function and resulting greater public services.

**What has been done**

MassACORN is an interactive web site (massacorn.net) designed for private woodland owners in the target areas of the Westfield and Deerfield river watersheds. It has online simple mapping and spatial data viewing capacity, contacts for additional information, as well as a threaded discussion tool to allow for exchange of information between owners. We have used a wide variety of marketing approaches to make the target audience of woodland owners aware of its existence and promote its use. Ads have appeared in local and regional newspapers, letters to the editor of similar papers have been published, posters in locally important places have been posted, direct mail postcards to owners of woodland > 10 acres have been sent, town clerks and other local officials and conservation leaders have been notified, and we have placed an announcement on local public radio. We continue to update and maintain the site on a monthly basis, and notify visitors who have subscribed to our monthly email update notice list.

**Results**

We designed an online survey instrument on MassACORN, and have implemented it between April 2008 and November 2008. We have had a response rate of 1.7% (representing a so-called survey of convenience; i.e., 55 responses out of 3,236). On this basis, we estimate that 82% of respondents are landowners with following characteristics: Most visitors are owners of land in western Massachusetts. Roughly a third of the landowner visitors own more than 50 acres; 70% own 10 or more acres. There is an even distribution of ownership tenure; we're not just catching the new owners, but 38% of visiting landowners have held their land for 20 years or more. Most ACORN visiting landowners live on their land; few live great distances from their land (i.e., we're not catching an abundance of absentee owners). Although often thought of as an activity or tool for young people, the age distribution of massACORN users tracks well with the overall age distribution known overall for woodland owners - i.e., 2/3rds are over 50 years of age. Interestingly, gender distribution of landowner massacorn visits does not follow the general gender distribution of owners. E.g., Butler (2008) estimated that 81% of family forest decision makers are male, responsible for 84% of family forest land, yet we estimate as many as 40% of massACORN visiting landowners are female. Are women more likely to visit an online site for information about their land, than get it from a male dominated profession? These ownership interests in nature, privacy, and scenery are in line with what we know about owners in general; timber products/income is a distant low level of interest. Direct mail post cards are the most effective way to elevate awareness, though importantly the second most important method is word of mouth. Landowner visitors are favorably impressed with the site. Roughly a third have considered cooperation; though few claim to have made an actual management decision. (how often are they in the position to make an actual management decision) Importantly: more than half of the massACORN landowner visitors [53%] have had no prior contact or experience with traditional activities or sources of information, management plans pr consulting foresters. Our marketing campaign has been very active since August 2008. In the 4 months since then, compared to the previous 4-month period, the number of visits has increased by 126%; page views on the site are increased by 160%; pages/visit are at 5.02, up 15%; time spent on the site (3:50 minutes) is up 15%; proportion of new visits (71%) is up 14%; and the bounce rate is at 42%, down 23%. Based on our online visitor surveys and monitoring site visitation, it seems direct mail postcards are most effective means to market/ heighten awareness of the existence of the site.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 123 | Management and Sustainability of Forest Resources |

**Outcome #3**

**1. Outcome Measures**

Accurate Research on determinants of Food System Performance

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The combinations of quality attributes and prices offered to consumers in food products are changing, affecting the performance of the food system. This project uses case studies to examine the factors the influence the quality and price combinations offered to food consumers.

**What has been done**

Differentiated products: a paper on the incidence of taxation when products are differentiated has been finished (Rojas and Shi, 2008); this paper is currently under review at a major journal. Another paper on the estimation of demand for differentiated products using discrete choice models is currently being finished (Rojas and Huang, 2008). Wal-Mart Impacts: an article on the impact of Wal-Mart Supercenters on grocery prices in New England was published in the Review of Agricultural Economics. The article drew attention from the media. Articles about the study were written in the Daily Hampshire Gazette and In the Loop, a publication of the University of Massachusetts Amherst. One of the authors was interviewed on the radio (WFCR). Mainstreaming of organic produce: a Master's thesis was completed on the mainstreaming of organic products and the impact of Wal-Mart presence on organic pricing. Fisheries Industry: An article on the effects of individual transferable quota (ITQ) management on fishermen's welfare in the presence of an imperfectly competitive processing sector has been accepted for publication in Land Economics. COOL: A doctoral dissertation is nearing completion on the effectiveness of the Country-of-Origin Law (COOL). A working paper was presented at two conferences - the joint conference of the Canadian Agricultural Economics Association and Northeastern Agricultural and Resource Economics Association (Quebec City, June 2008) and the annual conference of the American Agricultural Economics Association (Orlando, FL, July 2008). Public and Private Incentives for Food Quality Assurance: An article was published on consumer demand for quality in the Journal of International Agricultural Trade and Development, a book chapter on import safety was published, and a chapter on innovation in the meat industry was published. In addition, two working papers were completed on the effect of new HACCP regulations on seafood imports into the United States and the impact of geographical labeling on developing countries. PARTICIPANTS: Not relevant to this project.

**Results**

Differentiated products: the work on taxation informs our limited knowledge of tax incidence when products are not homogeneous; our empirical work suggests that consumers tend to switch to brands of higher quality when the same per unit tax is imposed on brands of varying quality. Our work on demand estimation makes a significant methodological contribution to the literature by suggesting a new method of how to estimate the potential market (which prior work assumes is an 'ad-hoc' given value). Wal-Mart: Our research quantifies the impact of Wal-Mart Supercenters on the price of groceries at competing supermarkets in New England. We show that taking into account demographics, store characteristics, and market conditions, Wal-Mart decreases prices by 6 to 7 percent for national brand goods and by 3 to 8 percent for private label goods. Price decreases are most significant in the dry grocery and dairy departments. Mainstreaming of Organic Products: Organic products are becoming widely marketed across different retail formats. Analysis of pricing and product availability in a sample of seventeen New England micro-markets shows that product pricing for thirteen fresh produce items is affected by product, store, community, and market (presence of competitors of different store types) characteristics. Fisheries: Our research shows that although fishermen should expect to gain from ITQs under perfect competition, they may suffer welfare losses if the processing sector is imperfectly competitive. Quality Assurance: Our research shows that safety and quality attributes have important impacts on demand for food products, particularly for imported products. HACCP adoption for the seafood industry had uneven impacts on importers into the United States, with countries with higher levels of imports gaining ground relative to those with lower levels of imports. Change in Actions: Wal-Mart: Our research is helping the general public understand how the arrival of a new Wal-Mart Supercenter will affect their grocery bill and prices of organic products. Fisheries: Our research is helping fishermen understand the impact of potential new regulation.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 606 | International Trade and Development |
| 603 | Market Economics |

**Outcome #4**

**1. Outcome Measures**

Accurate Research on Economic Issues in Biosecurity were made available and shared

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | {No Data Entered} | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The efforts to create a secure food system in reaction to the terrorist attacks of the past and potential attacks of the future.

**What has been done**

Several workshop presentations on surveillance for biosecurity purposes were given during this project. Presentations were given at the University of Massachusetts, at a workshop at Wageningen University in the Netherlands, at the Rochester Institute of Technology, and at a workshop in Hobart, Tasmania, Australia. Three separate presentations were given at workshops attended by USDA personnel in Washington, DC.

**Results**

Project participants have developed new research methods for decision making under severe uncertainty and have applied these methods to study the character of efficient surveillance techniques. The techniques have garnered interest from research sponsors resulting in support for further research in the direction indicated by this project. The original publication associated with this project has experienced (to this date) 367 full-text downloads. Downloads have occurred in every month since the publication appeared. Publications and workshop presentations associated with this project have made the surveillance techniques used known to many researchers in this field.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 901 | Program and Project Design, and Statistics |

## V(H). Planned Program (External Factors)

**External factors which affected outcomes**

- Natural Disasters (drought,weather extremes,etc.)
- Economy
- Public Policy changes

**Brief Explanation**

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

**1. Evaluation Studies Planned**

- Other (scientific peer review)

**Evaluation Results**

**Key Items of Evaluation**

**Program #6**

## V(A). Planned Program (Summary)

**1. Name of the Planned Program**

Center for Agriculture

## V(B). Program Knowledge Area(s)

**1. Program Knowledge Areas and Percentage**

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---|---|---|---|---|---|
| 902 | Administration of Projects and Programs | | | 55% | |
| 903 | Communication, Education, and Information Delivery | | | 45% | |
| | **Total** | | | 100% | |

## V(C). Planned Program (Inputs)

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

| Year: 2008 | Extension | | Research | |
|---|---|---|---|---|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 0.2 | 0.0 |
| Actual | 0.0 | 0.0 | 0.3 | 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 | 64577 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 41448 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 0 | 0 |

## V(D). Planned Program (Activity)

**1. Brief description of the Activity**

Maintain website for stakeholder information and feed back and an electronic forum for agricultural leaders. Hold three coordination meetings with MAES, UMass Extension and Massachusetts Department of Agricultural Resources yearly. Hold one yearly public forum on a critical issue to agriculture in Massachusetts.

**2. Brief description of the target audience**

Consumers, Agricultural Commodity Groups including Orchards, parks, Turf, Cranberry, Floral and Landscape Plants

## V(E). Planned Program (Outputs)

### 1. Standard output measures

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---|---|---|---|---|
| Year | Target | Target | Target | Target |
| Plan | 0 | 0 | 0 | 0 |
| 2008 | 0 | 0 | 0 | 0 |

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

**Patent Applications Submitted**

| Year | Target |
|---|---|
| Plan: | 0 |
| 2008 : | 0 |

**Patents listed**

### 3. Publications (Standard General Output Measure)

**Number of Peer Reviewed Publications**

| | Extension | Research | Total |
|---|---|---|---|
| Plan | 0 | 0 | |
| 2008 | 0 | 0 | 0 |

## V(F). State Defined Outputs

**Output Target**

**Output #1**

**Output Measure**

- # of stakeholders using Center for Agriculature website

| Year | Target | Actual |
|---|---|---|
| 2008 | 250 | 0 |

**Output #2**

**Output Measure**

- # of participants in critical issues for agriculture in Massachusetts forum

*Not reporting on this Output for this Annual Report*

**V(G). State Defined Outcomes**

## V. State Defined Outcomes Table of Content

| O No. | OUTCOME NAME |
|---|---|
| 1 | # of new stakeholders participating in the activities of MAES |

**Outcome #1**

**1. Outcome Measures**

# of new stakeholders participating in the activities of MAES

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| Year | Quantitative Target | Actual |
|---|---|---|
| 2008 | 25 | 0 |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Consumers, Agricultural Commodity Groups including Orchards, parks, Turf, Cranberry, Floral and Landscape Plants
The Massachusetts Center for Agriculture is the primary vehicle for integrating the applied research activities of the Massachusetts Agricultural Experiment Station with the outreach activities of UMass Extension. The coordination provided by the Center allows for rapid responses to immediate crises in the agricultural community. The specific research goals change as issues important to our agricultural stakeholders change but the Center provides the framework for providing consistent and integrated responses.

**What has been done**

The Center for Agriculture was created to deliver a consistent and timely evaluation of the state of agriculture within Massachusetts, to share this information with agricultural stakeholders from around the state, and to use stakeholder input to design and carry out applied research that directly targets stakeholder concerns. The specific objectives that flow from this goal are: - To be a source of information on the state of agriculture in Massachusetts - To provide all constituencies within the state access to agricultural resources and to allow for direct stakeholder feedback through electronic communications - To facilitate continuous identification and discussion of the issues critical to agriculture in Massachusetts - To provide agricultural leaders a direct electronic communication forum for the timely exchange of information on activities and issues - To insure that the research performed by MAES actively addresses the needs of under-served and under-represented populations of the state - To coordinate research on six agricultural research facilities around the state. These include the Cold Spring Orchard, the Hadley Equine Center, the Troll Turf Facility, the South Deerfield Agronomy and Animal Research Centers, and the Wareham Cranberry Bog.

**Results**

The first output from this project is a study that utilizes The Census for Agriculture to evaluate the status of agriculture within Massachusetts. The study is updated yearly on the Massachusetts Center for Agriculture Web site (http://www.masscenterforag.org/) and is published in print form once every five years. The first study was initiated in 1999 and a major update occurred in 2003. A second output from this project is the website itself which in addition to the study contains a forum for electronic exchange of ideas among agriculture stakeholders from around the state and an on-line feedback system which can be utilized by anyone accessing the question and answer portion of the site. The third output is a set of targeted projects that address the immediate stakeholder concerns. These are projects that integrate research and extension activities. It is not possible to predict the specific projects but topics that might be appropriate based on preliminary analysis of stakeholder input would include analysis of native pollinators, evolution from integrated pest management to low impact management, exploration of diversification options for dairy farms, and population dynamics of deer ticks within the state.

**4. Associated Knowledge Areas**

| KA Code | Knowledge Area |
|---|---|
| 902 | Administration of Projects and Programs |
| 903 | Communication, Education, and Information Delivery |

## V(H). Planned Program (External Factors)

**External factors which affected outcomes**

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

**Brief Explanation**

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

**1. Evaluation Studies Planned**

- Before-After (before and after program)

**Evaluation Results**

**Key Items of Evaluation**