

College of Natural Resources and the Environment

University of Massachusetts Amherst

Safe and Secure Food and Fiber Systems

Growth potential of Community Supported Agriculture in Massachusetts

Issue

Farmers, Consumers
What has been done?
In New England there are several thousand small farmers whose viability is threatened and whose survivability would be improved by joining together to market their produce locally.

Impact

The project found that community supported agriculture (CSA) operators and potential operators should create a core group for decision making and should make use of local Brand awareness to give them some price setting ability.

Primary impact area(s)

- Research
- Education
- Extension

Topics

- Nutrition and Diet

Contacts

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College of Natural Resources and the Environment

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Competitive Agricultural Systems in a Global Economy

Sustainable Vegetable Crop Production in Massachusetts

Issue

Vegetable production in Massachusetts is a multimillion-dollar industry. Many growers operate their farms near urban areas where there are strong developmental pressures and also concerns about environmental contamination. For agriculture in Massachusetts to be continued without further relative declines in importance, its farmers must maintain or expand their production and marketing of crop products. Sustainable systems will be researched and implemented that will increase production without compromising the environment.

What has been done?

Eryngium foetidum (L.) is a popular crop among Latinos and Asians found in Massa-

chusetts. An experiment was implemented to learn basic information on this crop for production and marketing in this state. There are many brassica species that are popular among Asian populations found in Massachusetts. Information was learned on marketing and production aspects of these brassica species introduced to 30 cooperating farmers in Massachusetts.

Impact

Data suggests that producing this crop in a greenhouse and selling, as a bedding plant is the most feasible for the climate in Massachusetts.

Primary impact area(s)

- Research
- Education
- Extension

Funding sources

- Hatch Act

Topics

- Economic Response in Changing World
- Horticulture
- Precision Agriculture
- Sustainable Agriculture
- Urban Agriculture

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Competitive Agricultural Systems in a Global Economy

Maximizing Yield and Value of Muscle Tissue Foods, Especially Fish

Issue

These species would supply a valuable source of both protein and oil for consumers. We also see the use of these fish proteins as high value ingredients which would go into a wide variety of food products to improve their functional properties. Plants processing these species could be located anywhere along the Atlantic coast. However, an advantage of locating these plants in the Commonwealth of Massachusetts will be the closeness of the Department of Food Science and the Marine Station to the plants and our ability to give them technical support in their processing operations and also to continue research to improve and expand the quality and quantity of the products produced. We have been working with a local corpora-

tion, to develop an industry based on this technology in Gloucester.

What has been done?

The principal high fat fish species found on the Atlantic coast are the Atlantic menhaden, Atlantic mackerel, and Atlantic herring. The latest data indicates that the annual sustainable yield in these waters is approximately 9 billion pounds of these three species. Herring and mackerel are greatly underused and only a relatively small proportion are caught, primarily for use as bait, mink food, and fertilizers. According to FAO (1997) about 90% of the 2.5 million metric tons of herring caught world-wide is used for non-human consumption. Large amounts of menhaden are caught and processed into fish meal and fish oil. This is a lower value use

than the direct consumption of the protein portion as human food. This is, however, not true of mackerel, which is also a predator. One of the advantages of using menhaden is that it feeds almost exclusively on phytoplankton, that is, it is one of the grazing animals of the ocean and is not a carnivore like most other fish.

These fatty species have been difficult to use for human food because of their size and their high fat content, which makes them unstable to oxidation and they develop fishy, rancid odors. The bone structure of these fish makes mechanical handling of them difficult. The muscle tissue is full of bones. At the Department of Food Science, we have developed technology to separate the fat and the membrane lipid from each other and from the rest of the components including

Competitive Agricultural Systems in a Global Economy

Maximizing Yield and Value of Muscle Tissue Foods, Especially Fish

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bone. This allows a unique way of producing a concentrated protein which does not have the negative characteristics of the initial fish.

Impact

How Can This Technology Help the East Coast Fisheries?

First, it would take the pressure off the over-fished species, giving them time to recover if the fishermen could catch these fatty fish which are not now fished. When the normal commercial species are able to come back, these species will provide an additional source of marine protein to the U.S. population and will be used in products that can be exported. The world supply of fish is currently inadequate to meet the demand.

These species would supply a valuable source of both protein and oil for consumers. Like most all animal proteins, they are highly nutritious. The oil from these species is an excellent source of the n-3

fatty acids about which we hear so much these days as being healthful food sources and important constituents of functional foods designed to improve consumers' health. The use of these fish proteins as high value ingredients which go into a wide variety of food products to improve their functional properties. Plants processing these species could be located anywhere along the Atlantic coast. However, an advantage of locating these plants in the Commonwealth of Massachusetts will be the closeness of the Department of Food Science and the Marine Station to the plants and our ability to give them technical support in their processing operations and also to continue research to improve and expand the quality and quantity of the products produced.

Primary impact area(s)

- Research
- Education
- Extension

Funding sources

- Hatch Act
- National Research Initiative
- Commodity (Fish)

Topics

- Biotechnology
- Economic Response in a Changing World
- Precision Agriculture
- Sustainable Agriculture

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Healthy, Well Nourished Population

Omega-3 Fatty Acids

Issue

Several dietary fats are essential for health including the fat-soluble vitamins (A, D, E and K) and the omega-3 fatty acids. There is strong evidence that the current level of healthy dietary fats is inadequate in many populations. These foods would be beneficial to the general population but in particular to populations at risk for coronary heart disease and pregnant and lactating women who must provide high levels of omega-3 fatty acids to their infants.

What has been done?

Our research is initially focusing on fats that are high in omega-3 fatty acids. Omega-3 fatty acids are beneficial because they lower blood lipid and cholesterol levels, are critical for infant brain and

eye development and they improve immune responses. We are developing antioxidant technologies in omega-3 oil emulsions that prevent rancidity development. These technologies utilize antioxidants in both the water and lipid phases of the emulsion. Once the omega-3 emulsion delivery system is developed, research will be conducted to develop methods to incorporate and stabilize the fatty acids in food products. Once these products are developed, they will then be tested in clinical trials at Harvard University to determine if the omega-3 fatty acids in the foods are absorbed into the blood where they can lower blood lipid and cholesterol levels.

Impact

It is essential that the consumption of healthy fats is

adequate in order to promote maintenance of good health, especially for pregnant and lactating women, and individuals with coronary heart disease, diabetes and immune response disorders. Consequently, there is an urgent need for inexpensive, desirable and convenient functional foods containing physiologically significant amounts of healthy fats. This research project will focus on the development of the emulsion delivery system containing nutritionally important fats and its subsequent incorporation and stabilization in foods, e.g., dairy, meat, dessert, beverage and condiment products.

This research will impact the citizens of Massachusetts in several ways. First, the development of foods containing omega-3 fatty acids could provide an easy vehicle to increase the incorporation of

Healthy, Well Nourished Population

Omega-3 Fatty Acids

- CONTINUED -

beneficial fatty acids into the diet. A second benefit will be to fishing communities. Underutilized fish species such as herring, mackerel and menhaden are naturally high in omega-3 fatty acids. If technologies can be developed to stabilize the oil from these fish, an increased market would be developed thus increasing the value of the fish stock which would provide new harvesting opportunities.

There is mounting evidence that increasing the amount of beneficial fats in our diet could improve health and the quality of life. Promising new technologies are currently being developed in the Department of Food Science at the University of Massachusetts, Amherst to accomplish this goal.

Primary impact area(s)

- Research
- Education
- Extension

Funding sources

- Hatch Act
- National Research Initiative
- Special Research Grants

Topics

- Nutrition and Diet

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Competitive Agricultural Systems in a Global Economy

Private Strategies, Public Policies and Food System Performance

Issue

This project is providing current analysis of the performance of the domestic and international food system. It analyzes how the system operates domestically, the prices and values it offers to consumers and producers, its competitiveness in international markets, and its ability to assure food quality, particularly food safety and nutrition. The results of this project are used in decision making by the private and public sectors.

What has been done?

Report on changes in concentration in the meat packing industry contributed to the initiation of a GAO study of oligopsony in cattle markets.
Impact

A survey to establish the situation in Massachusetts agri-

culture found that vegetable farmers who engaged in the direct marketing saw no gain in prices received compared with farmers who sold in the traditional way, compared with orchardists and maple syrup producers who gained a 25% to 30% price increase with direct marketing.

Primary impact area(s)

- Research
- Education
- Extension

Funding sources

- Hatch Act

Topics

- Economic Response in a Changing World

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Competitive Agricultural Systems in a Global Economy

Rootstock and Interstem Effects on Pome and Stone Fruit Trees

Issue

Farmers will appreciate the fact that their yield/acre will increase, as will consumers whose costs go down as a result of lower overhead. We will all be happier with less pesticides to cause environmental problems.

What has been done?

Approximately 250 acres were planted to dwarfing rootstocks during the last year.

Impact

These rootstocks, as defined and recommended by this project, 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 2001 is to reduce the amount of spray material in total by about 250,000 gallons per year in Massachusetts.

Primary impact area(s)

- Research
- Education
- Extension

Funding sources

- Hatch Act

Topics

- Economic Response in a Changing World
- Food Safety
- Horticulture
- Integrated Pest Management
- Precision Agriculture
- Sustainable Agriculture
- Urban Agriculture

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Greater Harmony Between Agriculture and the Environment

Evaluation and Development of Plant Pathogens for Biological Control of Weeds

Issue

- Cranberry Farmers
- Industry
- Consumers

What has been done?

It is important that *C. gloeosporioides* not be infective on other important horticultural and agricultural plants, and to date, this appears to be the case. This is a critical discovery in order for this fungus to be registered as a biological control agent. Furthermore, the finding that dodder seedlings are highly susceptible to the fungus even before they become attached to their hosts and produce haustoria is significant. The fungus could be used early in the growing season before fruit rot fungicides are being sprayed.

Impact

These fungicides would be roadblocks to successful establishment of infection. In addition, by killing the dodder before it parasitizes the cranberry vines, yield effects would be minimal by the parasite.

Primary impact area(s)

- Research
- Education
- Extension

Funding sources

- Hatch Act
- Special Research Grants
- Commodity (Cranberry)

Topics

- Integrated Pest Management

Contacts

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University of Massachusetts Amherst

Economic Development and Quality of Life for People and Communities

Labor Force Participation of Teenagers: Individual and Parental Perceptions

Issue

Youth, Parents, Communities

- Research
- Education
- Extension

What has been done?

Unlike other studies, in my work on youth and parents, I found many similarities in the perceptions of these two groups, especially in their views on the effects of youth employment on school performance, family and social relations, and youth character.

Funding sources

- Hatch Act

Topics

- Economic Response in Changing World
- Rural Quality of Life

Impact

My study found that the significance of this is that youth employment and spending can be planned and coordinated within the family instead of being a point of conflict as it is traditionally known.

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Primary impact area(s)

College of Natural Resources and the Environment

University of Massachusetts Amherst

Safe and Secure Food and Fiber Systems

Bacterial Adhesion and Growth at Phase interfaces

Issue

Foodborne pathogens cause approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths each year. More than 200 known diseases are transmitted through food.

Impact

Listeria monocytogenes is responsible for 61% of FDA Class 1 recalls of processed foods and the bacterial source is often established biofilms in the food-processing environment. This project will elucidate the genetic basis for adhesion and biofilm formation of Listeria monocytogenes. Knowledge of the molecular events will be used to design unique strategies for biofilm prevention and removal from processing plants, leading to large economic savings for the food

industry.

Primary impact area(s)

- Research
- Education
- Extension

Funding sources

- Hatch Act
- Special Research Grants

Topics

- Food Safety

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Safe and Secure Food and Fiber Systems

Isoflavonoid Synthesis and Pathogen Control in Soybean Sprouts

Issue

Prostate cancer is one of the leading causes for death in men.

Impact

Our work to develop a food grade process to stimulate phenolic and isoflavonoid content will increase these bioactive components in soybean to the point where we provide a key role in reducing the risk of these cancers, this is our goal and we are making great strides toward it.

Primary impact area(s)

- Research
- Education
- Extension

Funding sources

- Hatch Act

Topics

- Food Safety
- Nutrition and Diet
- Value-Added Food Products

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Competitive Agricultural Systems in a Global Economy

Genetic Improvement of Dairy Cattle Using Molecular Markers

Issue

Genetic mechanisms determining persistency of lactation are poorly understood. What has been done? These experiments have identified p19-arf, MDM-2 and Stat3 as molecular partners that interact with p53 to regulate apoptosis in response to acute interruptions in milk removal in mice.

Impact

Identifying naturally occurring polymorphisms in these genes in livestock could be exploited as a molecular method for selection of individuals for milk production.

Primary impact area(s)

- Research

- Education
- Extension

Funding sources

- Hatch Act

Topics

- Biotechnology

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Safe and Secure Food and Fiber Systems

PCR Detection of *L. monocytogenes* & *E. coli*

Issue

Foodborne pathogens cause approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths each year. More than 200 known diseases are transmitted through food.

Impact

In order to combat these outbreaks of food poisoning, rapid and inexpensive methods of detection using the agglutination procedures described in this project will increase the number of assays performed on *Listeria monocytogenes* by a factor of 20.

Primary impact area(s)

- Research
- Education
- Extension

Funding sources

- Hatch Act

Topics

- Food Safety

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Competitive Agricultural Systems in a Global Economy

Regulation of Feeding and Mating Behavior in the Blowfly, *Phormia regina*, and the House Fly, *Musca Domestica*

Issue

It has been projected that the poultry industry spends \$20 million dollars/year on fly control while the dairy industry has losses of \$100 million annually due to house fly control. One of the major problems concerning fly control in either industry is the development of resistance by house flies to conventional pesticides. Thus, to achieve control, farmers must not only use more pesticides but, many of these may not be effective control chemicals. The house fly is resistant to most pesticides and alternate strategies of control are essential.

What has been done?

Non-pesticidal control is not only appealing but essential. Many agricultural pests, which are flies, are not

attracted to baits like the house fly is. This permits the addition of non-pesticidal materials into its food. Using non-peptidal mimics, like benzethonium chloride, our goal is to interfere with both feeding and crop emptying

Impact

Distruption of these two events will lead to death of the fly. Benzethonium chloride is an inexpensive material compared to a conventional pesticide. Thus, if effective, it will be more than cost effective for farmers.

Primary impact area(s)

- Research
- Education
- Extension

Funding sources

- Hatch Act

Topics

- Integrated Pest Management

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Competitive Agricultural Systems in a Global Economy

Modeling the Fate of Genetically Engineered Baculoviruses

Issue

The development of genetically modified organisms (GMOs) that express insecticidal proteins has provided useful tools for use in controlling insect pests. Predicting the environmental fate of these organisms provides an additional measure of safety necessary for the further development of GMOs, including recombinant baculoviruses as efficacious agents do for controlling insects

What has been done?

Many of these GMO including plants with enhanced pest resistance and recombinant insect viruses expressing insecticidal proteins have increased efficacy but could upset natural ecosystems. We have developed a model that can predict the fate and

ultimately the environmental impact of genetically modified insect viruses.

Impact

Predicting the environmental fate of these organisms provides an additional measure of safety necessary for the further development of GMOs

Primary impact area(s)

- Research
- Education
- Extension

Funding sources

- National Research Initiative

Topics

- Integrated Pest Management

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Competitive Agricultural Systems in a Global Economy

Introgressive hybridization between *Colias* butterflies and their mutual adaptation to forage Crops

Issue

Pest control strategies affect everyone. The project will assess whether we need to study these butterflies as one ecological species in order to develop one control strategy, or as two separate pest species in order to develop two (perhaps coordinated) control strategies.

What has been done?

Our theoretical and statistical work is the first for measuring the rate that genes are shared between sympatric, hybridizing species. This measure is fundamental to any strategy to manage the spread of adaptations (for example, resistance to pesticides or herbicides) between species. Our genetic marker data will be helping us progress toward the development of the one of the first

fine scale maps of any butterfly genome, and among the first to assess the long-suspected role of sex-chromosome differences in blocking the spread of genes between species.

Impact

The project will assess whether we need to study these pest butterflies as one ecological species in order to develop one control strategy, or as two separate pest species in order to develop two (perhaps coordinated) control strategies

Primary impact area(s)

- Research
- Education
- Extension

Funding sources

- Hatch Act

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Competitive Agricultural Systems in a Global Economy

Endocrine regulation of reproduction in higher dipterans

Issue

It is known that life span of flies can be extended up to 400% experimentally.

What has been done?

My lab helped to show that nutrition, reproduction and longevity of flies are controlled by endocrine mechanisms involving insulin-like hormone and steroid hormones.

Impact

With these findings, we are one step further to our goal which is to greatly extend human life span using hormone treatment.

Primary impact area(s)

- Research
- Education

- Extension

Funding sources

- Hatch Act

Topics

- Biotechnology

Contacts

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