

Maine Agricultural and Forest Experiment Station  
Annual Report of Accomplishments and Results  
Based on the Plan of Work Report

March 2003

Hatch and Multi-state Research Funds

Maine Agricultural and Forest Experiment Station  
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## OVERVIEW OF PLANNED PROGRAM AREAS

### **Goal 1—An agricultural system that is highly competitive in the global economy**

Maine farmers are stewards of 1.42 million acres of land. The agricultural system in Maine directly contributes more than \$1 billion annually to the state's economy and further stimulates the economy by associated banking, transportation, retail, and service activity. Natural resources are central to the export-based economy. Maine's unique geographic properties with 4,500 miles of tidal coastline, glacial soils and a northern climate ideal for growing a number of plants and crops and yet containing a land base that is nearly 90 percent forested, offer unique challenges. Potatoes, blueberries, lobsters, and specialty food products are all exported to other states and throughout the world. Farming systems must meet market demands for high-quality products and allow agricultural products to be produced profitably, while preserving environmental quality and the health and safety of Maine's people.

To achieve a highly competitive agricultural system, Maine must produce high-quality crops and products. To do this, Maine's producers need better disease and pest prevention strategies, new crop varieties, new harvesting management techniques, new value-added products, and access to new markets. These are all areas in which researchers at the Maine Agricultural and Forest Experiment Station (MAFES) are working for the people of Maine. Following is a highlight of this year's accomplishments:

- In the MAFES potato-breeding program, three advanced breeding lines are being evaluated for commercial acceptance: AF1615-1, a golden nematode and corky ringspot resistant, round-white, table selection; AF1758-7, a scab resistant, round-white, table selection; and AF1753-16, a russet selection for french fry processing.
- MAFES economists surveyed rural Maine food retailers to collect descriptive data including store characteristics, perceived strengths and weaknesses, economic viability, and barriers to stocking Maine-grown or Maine-made products.
- MAFES researchers gathered information about options for efficient online promotion strategies for small producers who want to integrate online marketing with their traditional wholesale and direct marketing efforts. Training materials for designing and managing online promotions were developed and distributed to Maine specialty food producers.
- Two studies were completed assessing the ex ante economics of supplemental irrigation on wild blueberries and potatoes, and a cost of production study was conducted for the Maine dairy industry to identify cost differences between northern New England and Northern Crescent producers.
- Based on preliminary findings, MAFES researchers developed a rapid technique to measure hemolymph glucose levels in lobsters, using a hand-held glucometer that is available from any pharmacy.
- Using a laboratory assay of electrolyte leakage, MAFES scientists compared the freezing tolerance of fine roots in four deciduous tree species, *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash) and *Gleditsia triacanthos* var. *inermis* (thornless honeylocust). The differences in fine root freezing

tolerance indicate that root zone temperatures encountered during midwinter thaw freeze episodes could be lethal to fine roots of some tree species and could explain dieback in the most sensitive species.

- MAFES scientists developed PCR probes for potato mop top virus (PMTV). This recently detected virus was of some concern to the potato industry. These scientists contributed to the USDA-APHIS survey of all U.S. seed potato lots for the presence of PMTV.
- During the 2002 field season, MAFES researchers conducted a study on the vertical distribution of blueberry maggot fly adults within the forest canopy surrounding lowbush blueberry fields in Maine, with the aim of developing perimeter tactics for intercepting colonizing flies as they disperse into blueberry fields.
- MAFES entomologists investigated ability of aphids to move on the soil surface between the rows of potato plants. A better understanding of aphid movement will allow for more efficient management of viral outbreaks within potato fields.
- A MAFES study with the long-term goal to characterize the response of fish and shellfish to toxicant exposures at early developmental stages found that exposure to the herbicide 2,4-d causes increased mortality in larval clams and may affect metabolic regulation resulting in a slower growth rate in juveniles. 2,4-d is widely used as a broad-leaf herbicide.
- MAFES researchers continued work on the oyster broodstock development program, which is expected to result in a line of oysters with enhanced cold water growth performance, thus reducing the time required for oysters to reach market size under the conditions typical on the coast of Maine.
- MAFES scientists developed new, improved RT-PCR diagnostic assays for the detection and identification of several fish viruses, which are important pathogens in aquaculture.
- In a study of soil and nutrient management systems for potatoes, MAFES scientists found that blackspot bruise susceptibility has generally decreased with increasing rates of potassium fertilizer.

Scientist years:	19.1
Hatch Funds:	\$649,000
Multistate Research Funds:	\$304,000
State Funds:	\$3,385,000
Total Funds:	\$4,338,000

### **Key Theme—Adding Value to New and Old Agricultural Products**

- a) New value-added products from existing marine resources are needed to diversify the economies of Maine's coastal communities. A goal of one MAFES project is to develop several alternative income-generating methods of handling crustacean processing by-product. Crustacean processing by-product contains calcium, chitin, protein, pigments, and flavor compounds, which could be further used in the development of value-added products. The crab-picking industry doesn't bother with the invasive Green Crab (*Carcinus maenas*) because of its small size and low meat yield. MAFES research, however, is examining the feasibility of producing value-added products containing this crab.

- b) Impact—Researchers have gathered basic information on the chemical composition and nutrient content of green crab products, by steaming 42 green crabs and picking claw and leg meat by hand. The scientists have analyzed meat from the three treatments (steamed claws, steamed legs, raw claws), and their results indicate that the invasive green crab has a nutritional profile similar to other crab species and can likely also be used in value-added products.
- c) Source of Federal Funds—Hatch
- d) Scope of Impact—State Specific

**Key Theme—Animal Health, Aquaculture**

- a) Studies at the MAFES are looking at oyster culture to help diversify the aquaculture economy. Diseases are serious threats to all aquaculture, and MAFES researchers are monitoring the status of oyster diseases throughout Maine, trying to improve detection techniques, to determine the agents that cause the disease, and to develop management tools for minimizing disease impacts.
- b) Impact—This project has resulted in positive outcomes for the shellfish culture industry of Maine. Researchers have genetically selected strains of oysters that exhibit improved growth and increased resistance to Juvenile Oyster Disease (JOD) and these oysters are currently being used by the industry. They have also found a particular bacterium that could be used to inoculate oyster seed before being placed in growing areas where JOD is common. These scientists also defined the distribution of *Bonamia ostrea*, a protistan parasite of oysters, they have demonstrated that European oysters can be cultured to market size with minimal mortalities under growing conditions normally present in the Damariscotta River, Maine. They have also developed rapid and sensitive molecular techniques to diagnose this pathogen that can be used for screening seed and broodstock, which will make production of disease-free seed a reality.
- c) Source of Federal Funds—Hatch
- d) Scope of Impact—State Specific

**Key Theme—Aquaculture**

- a) Although the lobster fishery has reported fairly consistent catches over the past few years, there is considerable concern over the ability of the population to sustain these levels of harvesting and thus there is interest in any techniques or practices that would increase the population. In the wild the survival rate from eggs to adult lobster is miniscule, with predation from many other species.
- b) Impact—Raising juvenile lobsters on-shore for reseeding has not been shown to be cost-effective, so MAFES scientists have designed and are evaluating a miniature floating lobster nursery. The nursery holds an egg-bearing female lobster and has an interior lining of small mesh fiberglass netting and an outer wire mesh cage. The concept is that the eggs will hatch and the larval lobsters will be protected from predation and feed on

their natural diet as seawater flows through. As they grow, at some point the inner lining will be removed for greater water flow. The nursery is anchored in a relatively sheltered location in about 30 feet of water. It is thought that the device might increase survival of the larval, then juvenile lobsters, by several orders of magnitude compared to the survival rate in the wild.

- c) Source of Federal Funds—Hatch
- d) Scope of Research—State Specific

### **Key Theme—Aquaculture**

- a) According to the 1998 USDA's Census of Aquaculture, Maine is the fourth largest producer of aquaculture products in the United States. Gulf of Maine aquaculture economy, however, is largely undiversified and concentrated in Atlantic salmon farming, with salmon aquaculture accounting for nearly \$60 million of the total \$70 million value of the state's harvest. Salmon aquaculture is under pressure from international competition and a federal endangered species listing of wild Atlantic salmon. MAFES researchers are developing economically and financially viable alternative aquaculture production systems by assessing technologies for larval and juvenile culture and commercial grow-out of haddock (*Melanogrammus aeglefinus*).
- b) Impact—By developing economic models of juvenile haddock hatcheries, researchers will address important uncertainties facing potential producers, including growth rates and survivability, and they will evaluate their impact on costs, returns and production decisions. So far the project has determined that haddock juveniles can be produced on average for \$1.52/fish and that this cost is sensitive to a reduction in the cost of capital.
- c) Source of Federal Funds—NRI Competitive Grant
- d) Scope of Research—State specific

### **Key Theme—Ornamental/Green Agriculture**

- a) Most wild plants have great horticultural potentials and plants currently sold in the trade are usually taken from the wild. Maine has abundant flora, which provides the source of native plants for horticultural trade. To prevent depletion and possible extinction of wild plants and produce quantities of native plants for horticultural trade, practical and commercial feasible methods of propagation are necessary.
- b) Impact—*Comptonia peregrina* (Sweet Fern), a small North American shrub having sweet-scented or aromatic leaves resembling fern leaves, is a good garden shrub because it maintains its 3- to 4-foot height for a long time without pruning. Normally, the rooting and survival rate of *Comptonia* root cuttings is less than 48%. MAFES researchers have doubled the rooting and survival rates to almost 100% by overwintering the cuttings at 2-5 C. New growth under this treatment was much more vigorous than under unfavorable overwintering temperatures. Maine propagators have implemented this finding in their daily reproduction practice. Research results also have significantly increased the sale of

this plant for the nursery industry. Following a presentation on *Comptonia peregrina* propagation, all stock rooted cuttings were sold out in Maine and 80,000 more cuttings were requested.

- a) Source of Federal Funds—Hatch
- b) Scope of Research—State Specific

**Key Theme—Plant Production Efficiency**

- a) MAFES researchers are investigating the occurrence of hemoglobin in Frankia. Frankia, the nitrogen-fixing microsymbiont found within the root nodules of actinorhizal plants, produces a hemoglobin when grown in pure culture. To determine whether the ability to produce hemoglobin is widespread within the genus Frankia, we assayed five Frankia strains selected for their genetic diversity for presence of hemoglobin and found that each strain produces hemoglobin. Thus production of hemoglobin is widespread within Frankia and hemoglobin may have an essential function.
- b) This project provides new information on the basic biology of Frankia. This information is needed for the creation of new nitrogen-fixing plants by genetic modification. Such plants could be used in forestry for timber and pulp, and in agriculture for food and fiber production. These new plants would improve productivity while reducing fertilizer costs and water pollution. Frankia is a good candidate for the creation of new symbioses because it is able to fix nitrogen under atmospheric conditions and so does not have to rely on the host plant to provide a low oxygen environment.
- c) Source of Federal Funds—Hatch
- d) Scope of Impact—State Specific

**Key Theme—Plant Production Efficiency**

- a) Apple production in Maine is a strong and viable industry producing a crop value of more than 11 million dollars in 2001. Increasingly the Maine apple growers are competing with foreign producers, and to stay competitive it is important to rapidly deploy new and viable apple cultivars.
- b) MAFES scientists are participating in a large, multi-year, multidisciplinary project that is evaluating the performance of new apple varieties for different growing regions within the U.S., and is developing new protocols for managing these varieties. The MAFES researchers are looking at 20 different apple varieties. In addition to yield and fruit quality, the scientists are also measuring the storability of several varieties. Two of the best-storing varieties in this study were given to growers to demonstrate their high quality after six months in storage. One grower was impressed with Honeycrisp and has since planted several acres of this variety. Many other growers have already planted this variety and can use the information to make decisions about its marketing and storage.
- c) Source of Federal Funds—Hatch

- d) Scope of Impact—Multi-state research with AR, CTH, GA, MA, ME, MI, MO, NC, NH, NJ, NYC, NYG, OH, OR, PA, VA, VT, WA, WI, WV, PA/RODALE, WV(USDA), CANADA

## **Goal 2—A safe and secure food and fiber system**

Food production and processing is important in several key sectors in Maine: dairy, fisheries, potatoes, and blueberries and other fruits and vegetables. Food safety in these areas is an important concern to producers and consumers. Researchers in the Maine Agricultural and Forest Experiment Station have continued working on food-handling and processing technologies aimed at extending shelf life of product and preventing food-borne risks. MAFES scientists have continued investigating consumer food preferences and testing crops for pesticides residues. All this work helps ensure that the people of Maine have a high-quality, safe food supply and that Maine growers and producers remain competitive in the face of changing consumer demands.

In the past year to meet Maine's performance goal to develop technologies and methods to assure access to a safe food supply for Maine people, MAFES researchers accomplished the following:

- In an effort to aid small (niche) potato growers, MAFES researchers are testing 15 novel, high-value tuber varieties for vitamin C, chlorogenic acid, mineral, and glycoalkaloid content. Preliminary results indicate that several of these varieties contain significantly higher levels of vitamin C than standard commercial varieties. The results from this study could be used to help promote the sale some of these cultivars in high-end markets.
- MAFES scientists continue to collaborate with and to support Maine industry. In co-operation with Beacon Analytical Systems (Portland, ME), the researchers developed a rapid test for capsaicinoids in salsa and other pungent foods. This assay is being marketed to major food companies, world-wide and is expected to make pungency testing of raw and processed foods much more efficient.
- MAFES researchers have found that addition of blueberry puree from two sources significantly reduced the rate of hexanal and thiobarbaturic acid reactive substances in precooked turkey patties stored at 4-5 C when compared to controls.
- Using various methods to select and detect pathogenic organisms, MAFES scientists demonstrated that filtration of pathogenic organisms is still a major issue of concern in liquid food systems. The researchers developed technologies that will enable a flow-through system to be developed for in-process-line use for identification, detection and elimination of pathogenic organisms in liquid foods.
- The MAFES analytical lab analyzed 10 samples of fruit from Maine growers and processors for the presence of pesticide residues. The scientists involved continue to develop and update methods for the determination of pesticide residues in blueberries.
- MAFES investigators worked on developing and evaluating the efficacy of "molecular padlock" probes for the detection of food-borne human pathogenic agents. Their results indicate that the molecular padlock procedure can be used for detection of pathogenic agents in crude plant extracts, without the need for nucleic acid purification.

- Using the FPE model 13500 ultraviolet unit to pasteurize juices, MAFES scientists showed that the FDA-mandated 5-log<sub>10</sub> pathogen reduction in juices can be met with multiple passes through the machine with a total exposure of just over 9 seconds.

Scientist years:	2.0
Hatch Funds:	\$66,000
Multistate Research Funds:	\$43,000
State Funds:	\$231,000
Total Funds:	\$340,000

### **Key Theme—Food Resource Management**

- a) The lowbush wild blueberry thrives in the glacial soils and northern climate found in Maine and eastern Canada. For blueberry producers to compete on national and international levels, they need information about the effectiveness of their promotion efforts and consumer perceptions of their products. As part of multi-state research project S-222, MAFES researchers are investigating the demand for wild blueberries to assess the impact of economic factors on the price of wild blueberry.
- b) Impact—The scientists have found that the demand for wild blueberries has increased steadily from 1978 to 1997, which has dampened the price effect of increasing blueberry harvest in Maine and eastern Canada. In a related study of consumer taste and preference, researchers found that, compared to cultivated blueberries, people prefer the taste and nutritional value and health aspects of wild blueberries. These same people, however, prefer the availability, convenience, and appearance of cultivated blueberries. According to the study, most consumers considered the availability and convenience of frozen wild blueberry product excellent. The challenge is to capitalize the positive consumer perception about wild blueberries in the promotion of frozen packs. The blueberry industry has been following this research and may use results to modify their marketing strategies.
- c) Source of Federal Funds—Hatch
- d) Scope of Impact—Multi-state Research with AL, CA, DE, FL, GA, ID, KY, LA, ME, MI, MS, NJ, NYC, NC, OK, TN, WA, NFAPP, USDA/ERS, PA

### **Goal 3—A healthy, well-nourished population**

Under Goal 3, the Maine Agricultural and Forest Experiment Station set for itself the performance goal of improving nutrition for all Maine people, especially the elderly and teen population. Improving the nutrition of young people is important because it is during youth that people acquire and consolidate eating patterns and develop lifelong attitudes toward food. Many diseases that affect us later in life are caused in part by poor eating habits. The nutrition of the elderly is important as Maine's population ages and more seniors are living into their eighties and beyond.



In this human nutrition program area, MAFES researchers are carrying out research projects that will lead to the development of a knowledge base that can be used by clinicians, cooperative extension, public school administrators and teachers, and social service agencies to improve the nutrition of all Maine people. Accomplishments this year include the following:

- MAFES scientists, in collaboration with Indian Meadow Herbals, are studying anthocyanin content stability in value-added wild blueberry products. Five major anthocyanins were separated and quantified from blueberry tinctures, as well as fresh-frozen, freeze-dried, and oven-dried fruit. The researchers found that the oven-dried fruit had lost almost all of its original anthocyanin content, as compared to fresh-frozen fruit, while anthocyanin content in freeze-dried samples was reduced by more than half. Blueberry tinctures retained very little anthocyanins.
- MAFES researchers found that blueberries seem to decrease vascular resistance, which may alter the response of the artery to such factors as high blood pressure or other agents that increase arterial contractility.
- As part of a study of calcium, vitamin D and seasonal bone turnover in adolescent girls, MAFES nutritionists analyzed vitamin D levels in 36 milk samples obtained at local grocery stores. Results showed a mean 384 IU vitamin D per quart, with a range of 153 to 710 IU per quart. Girls who consume milk in Maine are getting, on average, the appropriate content of vitamin D.
- In a study of the effects of manganese on arterial health, MAFES scientists demonstrated that different levels of dietary manganese influence in at least two different ways the response of the arteries to alpha-1 adrenergic receptor, by interfering in the receptor signaling pathways and/or contractile machinery for vascular smooth muscle cell.
- MAFES nutritionists have shown that continuous consumption of wild blueberries results in an improved antioxidant status in the elderly.

Scientist Years:	1.8
Hatch Funds:	\$55,000
Multistate Research Funds:	\$43,000
State Funds:	\$177,000
Total Funds:	\$275,000

### **Key Theme—Human Nutrition**

- a) Economically disadvantaged young adults often have limited physical and economic access to food and inadequate access to nutrition education and health care. As part of the multi-state research project NC-219, MAFES nutritionists investigated ways to effectively intervene to increase the amount of fruits and vegetables that these young people eat. Researchers conducted 30 telephone surveys with economically disadvantaged young adults to compare two questionnaires on diet. They also recruited economically disadvantaged young adult women and conducted in-depth interviews about the usefulness of educational newsletters.
- b) Impact—Combined with results from other states, the feedback from these interviews was used to revise the questionnaires and newsletters. The goal of this work is to perfect the intervention materials and increase the effectiveness of nutrition educational materials for limited-resource young adult audiences. Young adults who increase their

consumption of vegetables and fruits will, by virtue of being role models, transfer this food habit to their children and peers. Higher consumption of vegetables and fruits will provide an economic benefit to producers. An increased consumption of vegetables and fruits will result in increased level of dietary fiber, folic acid and other nutrients in which the typical U.S. diet tends to be inadequate as well as increasing consumption of phytochemicals with disease preventing potential. There is evidence that health habits tend to cluster, suggesting the possibility that adopting healthier eating habits may lead to other positive health habits such as increased exercise or decreased smoking. Early intervention with young adults for improvement in personal health status should lower total costs of health care for the nation over the long-term.

- c) Source of Federal Funds—Hatch
- d) Scope of Project—Multi-state Research with  
IA, KS, MI, NE, SD, WI, AL, ME, NY, OR, RI

#### **Key Theme—Human Nutrition**

- a) Cardiovascular disease (CVD) still remains the leading cause of death in the adult U.S. population. One of the trace elements implicated in the development of cardiovascular disease (CVD) is manganese, but its effect on the vascular endothelium is not known.
- b) Impact—MAFES researchers have set up a unique and sensitive system to study the biophysical properties of arterial rings in tissue baths. The use of tissue baths makes it possible to study the role of nutrients on the biochemical and biophysical properties of arteries because it does not only reveal the physiologic behavior of the arteries but it also gives information on the biochemical mechanisms of the nutrient under question. During the last years they documented that dietary manganese affects the mechanical properties of aortic vessels of Sprague-Dawley rats by acting on the contractile machinery of the blood vessel. With the present set of experiments they showed that manganese enhances endothelial release of vasodilators during stimulation of an alpha 1 adrenoreceptor (AR) and it partially offsets AR-mediated contraction of the vascular smooth muscle. This may have direct implications on blood pressure regulation and thus on the process of cardiovascular disease. Results from this study will shed light on the role of manganese on the function of the vascular endothelium. Considering the high incidence of CVD in the U.S., elucidating risk factors that cause or promote its development is of utmost importance to public health.
- c) Source of Federal Funds—Hatch, NRI Competitive Grant
- d) Scope of Project—State specific

#### **Goal 4—Greater harmony between agriculture and the environment**

In many ways, Maine people define their quality of life in terms of environmental quality. Indeed, economic development strategies for Maine historically have begun from the premise that quality of life is the foundation on which all else is built. At the same time, natural resources

are the driving force behind most of Maine's export-based industries—paper, wood products, potatoes, blueberries, and seafood. The way in which these natural resources are used and conserved has a tremendous impact on the environmental quality by which Maine people measure their wellbeing.

To achieve greater harmony between agriculture and the environment, MAFES scientists are working to protect soil and water quality, to preserve wetlands, to develop ecologically friendly waste management systems, to design sustainable agricultural systems, to develop biological pest controls, and to better manage our wildlife and other natural resources. The following are highlights of this year's accomplishments:

- Best management practices adopted by wild blueberry growers such as using granular applications, alternative herbicides or not treating is resulting in fewer and lower levels of hexazinone detections in the groundwater.
- MAFES researchers are taking part in a multi-state IFAFS project that is investigating the reintegration of crop and livestock enterprises in Maine, Michigan, and Iowa. Impacts of the study to date include a greater awareness in the three regions, especially by farmers, of the potential of crop and livestock integration and an anticipation of results from the project.
- Major emphasis of one MAFES project has been on developing a model of the costs of composting dairy manure on farm for small- to medium-sized dairy farms. The model includes construction and capital costs, labor costs, and the costs of amendments, and is based primarily on milking herd size.
- MAFES scientists implemented conjoint survey to investigate how the value of conservation easements to farmland varies with the agricultural use of the land.
- Researching the economics of irrigating blueberry fields, MAFES scientists found that due to the high investment costs associated with irrigation, irrigation at the scale of 50 acres or less was not risk efficient under any scenario.
- To better assess rockweed resources in Maine, MAFES researchers tested a modified non-destructive sampling procedure for estimating biomass. The modified non-destructive sampling technique will enable rapid assessments of the rockweed resource.
- MAFES researchers conducted surveys of gray seal in Maine during the January pupping period and interviewed all site managers for the Atlantic salmon aquaculture sites in Maine regarding seal impact and damage at the pens.
- Preliminary results from research on Black Terns suggest that food resources are not limiting and that predation is the primary cause of low chick survival. Since chick survival is exceptionally low, it appears that predation of chicks is the major cause of low breeding productivity in the Black Tern population in Maine.
- MAFES scientists have continued studies on the impact of abiotic and biotic factors on secondary cycling of *Beauveria bassiana* on Colorado potato beetle populations. Results indicate that pre-diapause beetles show an increased susceptibility to *B. bassiana* when compared to post-diapause adults.
- MAFES researchers investigated inputs, storage, export potential, and system-level processing of coarse organic matter in the intermittent streams that drain the Bear Brook Watershed in Maine (BBWM).

- Working with undergraduate students, a MAFES soil scientist created seven soil monoliths. These monoliths are used as teaching tools in many classes offered by the Department of Plant, Soil and Environmental Sciences.
- In a long-term study of soil quality and nitrogen dynamics in a wheat-clover-sweet corn rotation, in its 11th year during the 2002 growing season, MAFES researchers examined the effects of continuous, residual and newly added clover to the soil physical and fertility characteristics. Early indications are that residual N effects are more apparent than other soil quality parameters.
- Precipitation collections continued on a weekly basis throughout the past year consistent with over 20 years of high-quality precipitation monitoring at Greenville, Maine, as part of the National Atmospheric Deposition/National Trends Network station.
- In a long-term evaluation of alternative pest management systems (IPM-based [IPM] vs environmentally friendly [ENV]) and soil management systems (non-amended [CHK] vs one that uses manure [AMD]), MAFES researchers found that Colorado potato beetle populations were significantly lower in ENV compared to IPM, while potato aphid populations and lady beetle populations were significantly higher in ENV.

Scientist years:	10.9
Hatch Funds:	\$453,000
Multistate Research Funds:	\$120,000
State Funds:	\$1,567,000
Total Funds:	\$2,140,000

### **Key Theme—Hazardous Materials**

- a) Proper collection and disposal of household hazardous waste is a serious problem in Maine and in other states. MAFES scientists conducted an analysis of the economics of various collection and disposal options, and they appeared before the Maine Joint Standing Committee on Natural Resources on December 5, 2001, to testify on their findings.
- b) Impact—The Maine Department of Environmental Protection is proposing the state of Maine adopt household hazardous waste policies based to a large extent on the MAFES scientists' findings. In addition, the Maine State Planning Office has held three workshops with local municipalities to discuss household hazardous waste facility construction options. Some of the material presented at these meetings was based upon the research conducted at the University of Maine.
- c) Source of Federal Funds—Hatch
- d) Scope of Research—State Specific

### **Key Theme—Wetlands Restoration and Protection**

- a) MAFES research conducted at Acadia National Park has examined the relationships between types of wetlands and the length of time the wetlands hold water (hydroperiod) and the distribution of amphibians.

- b) **Impact**—The researchers found that wood frogs have both the greatest reproductive effort and success in short-duration pools. Spotted salamander reproductive effort, however, did not vary with hydroperiod, but they had greater success in longer hydroperiod wetlands. These findings are significant because they suggest that conserving pool-breeding amphibians will require conserving pools of varying hydroperiod. The conservation implications of these findings are that wood frogs are more specialized breeders than spotted salamanders and are much more closely associated with ephemeral pools. The researchers also found more pond-breeding amphibian species in active beaver-created wetlands. Wood frogs, however, showed a preference for short-duration wetlands that had no fish and were commonly found in abandoned beaver wetlands in the upper reaches of the watershed. This research has highlighted the importance of beaver activity in maintaining a variety of wetland types and hydroperiods in the landscape. Wetlands affected by beaver support both specialized and generalist breeders thereby increasing the overall amphibian diversity. Information on both wetland-specific and landscape-scale characteristics that affect amphibian use of wetlands can be used to predict changes in amphibian spatial and temporal distribution with modification of wetland or upland habitat characteristics.
- c) **Source of Federal Funds**—Hatch
- d) **Scope of Research**—State Specific

### **Goal 5—Enhanced economic development and quality of life for Americans**

In our original Plan of Work report, MAFES had no projects that fit under goal 5. Since that time, however, a newly hired faculty member has developed a research project entitled “Employment Change and Industry Growth in Maine.” The objectives of this project are to analyze the effects of Maine’s business-assistance programs on growth of the establishment of new businesses, to measure the seasonal aspects of jobs located in coastal areas and to analyze the effects of seasonal job reallocation on local unemployment and other measures of community well being, and to examine the factors affecting employment change in Maine businesses, industries and regions. The following are highlights of this year’s accomplishments:

- UMaine researchers are investigating economic development in Maine, examining the effects of local industry agglomeration on employment growth and employee earnings in Maine businesses. Their results indicate that a concentration of local industry encourages employment growth and enhances earnings in towns with 2,500 to 9,999 residents. Industry agglomeration, however, does not affect business growth or earnings in cities with 10,000 or more people. The results suggest that the benefits of local industry concentration evolve with the age of a cluster, from encouraging employment growth in early stages to stimulating capital investment in later stages. This project will provide information on the factors that affect business growth and new business entry in Maine. Policymakers can use this information to encourage economic growth and development in the state.

Scientist years:	0.5
Hatch Funds:	\$21,000

Multistate Research Funds:	\$0
State Funds:	\$26,000
Total Funds:	\$47,000

## Assessments of Accomplishments

As discussed in the Stakeholder Input Process section, the Maine Agricultural and Forest Experiment Station shares the preproposals for all research projects with the Board of Agriculture and the Forest Resources Advisory Committee and the Cooperative Forestry Research Unit advisory board. In addition, as discussed in the Program Review section, all MAFES research projects are peer-reviewed. We believe that these two steps ensure that our research is good science and is meeting the needs of the state.

### STAKEHOLDER INPUT PROCESS

#### **a) Actions taken to seek stakeholder input and encourage their participation:**

MAFES continued its efforts to seek stakeholder input during FY 2002. Research faculty and administrators continued their program to meet with stakeholders and seek their input on research needs. MAFES also continued its tradition of meeting monthly with the Agricultural Council of Maine and working closely with it on the key issues affecting agriculture in Maine.

For the past two years, the Maine Agricultural Center, in conjunction with the Board of Agriculture has conducted surveys of all known agricultural groups to elicit their input on research and extension education needs of their members. This year, MAFES initiated a process to better understand the research needs related to the forests of Maine. As a first step in this process, a telephone survey of Maine residents was conducted in 2002 to obtain the public's views on the current condition of Maine forests, management practices and other key issues related to the forests of Maine.

#### **b) Process used to identify stakeholders and to collect input:**

For the purpose of the forest survey, resident adults were considered to be the relevant stakeholder group. It was considered important to get the views of the public, rather than the views of a narrower set of stakeholder groups that are more involved in forest-related issues. One cannot be sure that the views of these groups accurately reflect the views of the public in general. The data were collected through a random sample of adults residing in Maine households. All surveys were conducted by telephone; a professional polling firm hired by MAFES administered the survey. The data obtained from the survey are being analyzed by two groups of researchers in MAFES: one with expertise in forestry and the other with expertise in survey and public opinion research.

The process used to identify agricultural stakeholders was a continuation of the process used in previous years. A list of all known agricultural groups in Maine is maintained by the Maine Agricultural Center and these groups are contacted on a regular basis. Personal visits and telephone conversations are used most frequently to collect the input from these stakeholder groups.

**c) How collected input was considered:**

The data obtained through the forest survey are being further analyzed. However, preliminary findings have been described and shared with the Forest Resources Advisory Committee (FRAC), which advises the MAFES Director on issues related to forestry. That group has discussed the results and will discuss them further when the analysis is completed. FRAC will then assist MAFES in defining the research that should be done to address the issues raised in the survey.

The Board of Agriculture assists MAFES in setting priorities and the research agenda for agricultural issues. The Board, in preparation for a meeting with the Chancellor of the University of Maine System, assessed the current status of the MAFES research program and the Maine Agricultural Center and identified the crucial issues facing the agricultural community in Maine. Based on that assessment and the suggestions of the Chancellor, the long-range plan of the Maine Agricultural Center will be updated in FY2003 to reflect the major progress made in achieving the goals identified in the original plan, and to identify the new, emerging challenges that should be addressed over the next few years. Detailed plans to address the issues will then be developed with the input of the Board of Agriculture.

## PROGRAM REVIEW PROCESS

The external scientific peer review process used to evaluate all MAFES projects, regardless of funding source, was described in our Plan of Work. That process is still in place and is functioning as described in the Plan of Work. All research proposals developed for MAFES projects are subjected to external peer review. Preproposals are shared with the stakeholder advisory committees of MAFES. We encourage their comments and input on the relevance and the merit of the work proposed.

## EVALUATION OF THE SUCCESS OF MULTI AND INTEGRATED ACTIVITIES

This section contains an evaluation of the multi-state projects and the integrated research/extension activities in which the Maine Agricultural and Forest Experiment Station participates. Multi-state research projects are considered first.

### Multi-State Research Projects

**a) Do they address key issues, including those identified by stakeholders?**

Multi-state projects are an important part of the MAFES portfolio of research projects. In fact, multi-state projects contribute to twenty-one of the key themes identified in the first section of the report. Furthermore, these projects contribute to many of the key areas of research identified by stakeholders. For example, stakeholders identified marketing and land use measures and tax-related issues as priority needs. Two multi-state projects in the area of market and consumer economics supported by MAFES, S-222, *Fruit and Vegetable Supply-Chain Management, Innovations, and Competitiveness*, and S-278, *Food Demand, Nutrition and Consumption Behavior*, address priority marketing needs identified by stakeholders. A multi-state project in the area of natural resource and environmental economics supported by MAFES, W-133,

*Benefits and Costs of Resource Policies Affecting Public and Private Land*, addresses priority land use measures and tax-related issues identified by stakeholders.

**b) Do they address the needs of under-served and under-represented populations?**

Research results are not specific to a given population. It is the position of MAFES that all research results reside in the public domain and can be used by any individual or group. Results of MAFES projects are distributed to anyone who asks for the information. On the other hand, the two multi-state projects in the area of human nutrition supported by MAFES, NE-172, *Nutritional Risk and Antioxidant Status in the Elderly*, and NC-219, *Using Stage-Based Interventions to Increase Fruit and Vegetable Intake in Young Adults*, address nutrition needs of the elderly and young adults, both of which are non-traditional stakeholders.

**c) Do the programs describe expected outcomes and impacts?**

New multi-state research projects are written in a format that includes a listing of expected outcomes and impacts. Older multi-state projects are being revised to include expected outcomes and impacts. All of the projects contribute to the outcomes and impacts identified for a program area in the MAFES Plan of Work.

**d) Do they result in improved effectiveness/efficiency?**

Improved effectiveness/efficiency is one of the major advantages of multi-state research projects. Having faculty from different states work together generates more information than a person working alone. The information also has wider applicability as the research has been performed under different conditions, such as weather, soil type, or social institutions.

## **Integrated Research and Extension Activities**

All MAFES-supported integrated research/extension activities are managed through the Maine Agricultural Center (MAC). The Center has concentrated on creating more joint research/extension positions and supporting integrated research/extension projects. The Center has developed a process through which MAC members can request special funds for agriculture-related research projects and education programs that address high-priority needs. The funding is intended to support one-time projects that can be accomplished in approximately one year.

**a) Do they address key issues, including those identified by stakeholders?**

All of the joint research/extension positions created and the MAC-funded projects are strongly supported by the stakeholders. In terms of the joint positions, the university is responding to a stakeholder recommendation that more joint appointments be created to help develop a more seamless delivery of services to the agricultural community.

All MAC-funded projects must have letters of support from stakeholder groups showing that they address key issues to be eligible for funding. To date MAC has supported 36 projects that address priority issues facing Maine agriculture.

**b) Do they address the needs of under-served and under-represented populations?**

All of the joint appointments created have allowed the university to serve groups that were not being served before. For example, creating a joint research/extension position for a food science and human nutrition faculty member has allowed MAFES to better serve the home-based food



processors, an industry that does not have many places to turn for assistance. Small food processors have a continuous need for product testing and education. A good percentage of the industry is comprised of women living in counties with higher unemployment levels. Projects supported by MAC have also broadened the scope of groups served. For example, one project supports the Maine sheep industry, an industry that was not well served in the past by MAFES or University of Maine Cooperative Extension (UMCE).

**c) Do the programs describe expected outcomes and impacts?**

Integrated research and extension projects developed by faculty with joint appointments must go through the same program review process used to evaluate all MAFES projects, which was described in our Plan of Work. All research proposals developed for MAFES projects discuss the expected outcomes and impacts of the proposed research. These expected outcomes and impacts are submitted with their CRIS forms and are available on the CRIS web site.

Project proposals submitted for MAC funding must show that the research addresses a priority need of Maine agriculture and must include both a research and extension education component, expected outcomes and the method for sharing the outcomes of the project, and proof of industry support for the project. The final result will be a report, product, or finding that can be shared with Maine agriculture and will have a measurable impact.

Examples of outcomes and impacts reported in the termination reports for MAC-funded projects FY2002 are listed below.

- In a study to determine species composition of wireworms in northern Maine, scientists discovered wireworm complex that was very different from that generally known to attack potato crops in other areas of North America. An improved understanding of the wireworm complex proved to be extremely valuable at the beginning of the growing season, when UMCE was receiving up to 20 complaints per day from commercial growers about wireworm infestation. This highlights the necessity of developing management recommendations specifically for Maine potato growers.
- In a study dealing with blueberry spanworm, an important spring caterpillar pest of lowbush blueberry, a UMaine scientist developed a user-friendly computer program that will aid blueberry growers in predicting the time of egg hatch in the spring based upon soil temperatures.
- In a trial dealing with pickling cucumber variety performance in Maine, scientists evaluated seven different pickling cucumber varieties. The results of this trial were presented to the annual meeting of the Maine Vegetable and Small Fruit Growers Association. Of the approximately 100 growers in the audience, it is estimated that 50% will try at least one of the varieties in this trial as a result of the scientists' recommendations. If so, nearly 25% of Maine retail vegetable growers will have been impacted by this trial within one year, significantly improving the market quality and profitability of this crop.
- In a project to determine if wood pellet bedding is suitable for horses and to estimate the reduction in volume of waste that can result from its use, scientists determined that wood pellet use would lower the volume by 36% and would reduce the amount generated per animal by 5.4 cubic yards per year.

- In a project to determine the usefulness of using *Muscidifurax raptor*, a parasitic wasp, to control flies on Maine organic dairy farms, early results show that farmers can save \$250 in reduced pesticide costs. All producers who participated in this demonstration project will continue to use parasites as part of their integrated pest management plan.

**d) Do they result in improved effectiveness/efficiency?**

We believe that joint appointments are the most efficient way to ensure that research and extension programs are meaningfully integrated. Furthermore, joint appointments allow researchers to get credit for the extension work they perform as well as giving extension personnel credit for the applied research they often perform. Projects that have co-principal investigators (a researcher and an extension educator), such as those funded by MAC, are also an effective way to integrate research and extension activities.

## MULTISTATE EXTENSION ACTIVITIES

Not Applicable

## INTEGRATED RESEARCH AND EXTENSION ACTIVITIES

The Maine Agricultural and Forest Experiment Station has continued to increase its participation in integrated research and extension activities through the Maine Agricultural Center (MAC). MAC has funded 36 projects over the last three years, most of which include both a research and extension component. Many of the projects have both research and extension faculty working together. MAC will fund additional projects in FY2003.

The Maine Agricultural Center also manages all joint research/extension faculty positions. In FY2002, one faculty member was hired on joint appointment to replace a person who resigned. Therefore, the total number of faculty with joint appointments continues to be nine and a search is underway for a tenth position, a joint extension/research food science position.

The Maine Agricultural and Forest Experiment Station has met its requirement to spend at least 12.8 percent of its Hatch allocation on integrated research and extension activities. Based on FY 2002 Hatch allocations, our target was about \$231,534. We are certifying a total of \$284,702 expended on integrated research and extension activities for FY 2002. Form CSREES-REPT (2/00) is attached.

27 Feb 03  
Date