

**V(A). Planned Program (Summary)****Program # 6****1. Name of the Planned Program**

Plant Protection

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
123	Management and Sustainability of Forest Resources			1%	
136	Conservation of Biological Diversity			3%	
201	Plant Genome, Genetics, and Genetic Mechanisms			1%	
202	Plant Genetic Resources			3%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			1%	
205	Plant Management Systems			16%	
206	Basic Plant Biology			1%	
211	Insects, Mites, and Other Arthropods Affecting Plants			9%	
212	Pathogens and Nematodes Affecting Plants			12%	
213	Weeds Affecting Plants			18%	
214	Vertebrates, Mollusks, and Other Pests Affecting Plants			1%	
215	Biological Control of Pests Affecting Plants			5%	
216	Integrated Pest Management Systems			16%	
311	Animal Diseases			6%	
605	Natural Resource and Environmental Economics			1%	
721	Insects and Other Pests Affecting Humans			6%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

<b>Year: 2009</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	0.0	0.0	5.2	0.0
Actual	0.0	0.0	4.7	0.0

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

Extension		Research	
<b>Smith-Lever 3b &amp; 3c</b> 0	<b>1890 Extension</b> 0	<b>Hatch</b> 293050	<b>Evans-Allen</b> 0
<b>1862 Matching</b> 0	<b>1890 Matching</b> 0	<b>1862 Matching</b> 634096	<b>1890 Matching</b> 0
<b>1862 All Other</b> 0	<b>1890 All Other</b> 0	<b>1862 All Other</b> 257592	<b>1890 All Other</b> 0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

Research new ways to control diseases of potato and blueberry. Research new soil management techniques to control weeds. Research biological control of pests of potato, blueberry, other crops, and invasive ant species. Publish peer-reviewed journal articles and other publications concerning research. Present findings at professional meetings and at field days for growers and other venues.

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

Scientists, extension specialists, pest management professionals, potato, blueberry, and other crop producers in Maine

**V(E). Planned Program (Outputs)****1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	0	0	0	0
<b>Actual</b>	0	0	0	0

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

Year: 2009

Plan: 0

Actual: 0

**Patents listed****3. Publications (Standard General Output Measure)****Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>	0	10	
<b>Actual</b>	0	6	0

**V(F). State Defined Outputs****Output Target**

**Output #1****Output Measure**

- # of other types of publications

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	8	36

**Output #2****Output Measure**

- # of papers presented at professional meetings
- Not reporting on this Output for this Annual Report

**Output #3****Output Measure**

- # of research projects completed on ways to protect valuable plant/crop species

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	2	1

**Output #4****Output Measure**

- # of Youtube channels for sharing results of research on weed control

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	{No Data Entered}	1

**Output #5****Output Measure**

- # of research blogs

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	{No Data Entered}	1

## V(G). State Defined Outcomes

## V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	% of potato growers familiar with effects of soil management on populations of insect
2	# of Rhizoctonia solani genes identified that express differentially under conditions of quinate-induced hypovirulence
3	# of Rhizoctonia solani genes identified that express differentially under conditions of genetically stable hypovirulence
4	# of Rhizoctonia solani genes identified that express differentially under conditions of virulence
5	# of Maine potato growers developing a better understanding of how the use of manure soil amendments and longer crop rotations affect potato insect and weed pests, and diseases and well as potato yield, quality, and profitability
6	# of Maine potato growers learning how to integrate animal-based production systems with their potato operations
7	percentage of Maine blueberry growers adopting and maintaining integrated pest management strategies
8	% of Maine blueberry acreage treated with perimeter tactics for control of blueberry maggot fly
9	# of alternative pest and soil management systems for potato that are ready for commercial-scale evaluation
10	% of organic and diversified vegetable farmers surveyed who have adopted weed seedbank management practices
11	% reduction in the amount of damage from blueberry maggot fly in treated fields vs nontreated fields
12	% reduction in the amount of organophosphate insecticides used to treat blueberry maggot fly in Maine
13	# of commercial-scale demonstrations with significant reductions in pesticide and fertilizer use and improvements in soil quality
14	Average density of germinable weed seedbank found by Maine growers adopting ecologically based weed management practices (# of germinable seeds per square meter, 10 cm deep). Weed populations surviving cultivation will not reduce crop yield or quality and
15	Wild blueberry growers in Maine will be able to improve production by proper management of weed and disease pests
16	Wild blueberry growers in Maine will be able to properly identify and respond appropriately to weeds and diseases
17	Wild blueberry growers will make better management decisions on fertilizer and weed control
18	Integrated Pest Management for Fire Ants
19	Problems affecting honey bee health
20	Number of blueberry growers tracking mummy berry in their fields

21	Conserving native, natural enemies of blueberry pests
22	Protecting potato crops from pink rot
23	Reduction in herbicide use among Maine blueberry growers
24	New weed control tools for small vegetable growers

**Outcome #1****1. Outcome Measures**

% of potato growers familiar with effects of soil management on populations of insect

Not Reporting on this Outcome Measure

**Outcome #2****1. Outcome Measures**

# of Rhizoctania solani genes identified that express differentially under conditions of quinate-induced hypovirulence

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	1	1

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
215	Biological Control of Pests Affecting Plants

**Outcome #3****1. Outcome Measures**

# of Rhizoctonia solani genes identified that express differentially under conditions of genetically stable hypovirulence

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
215	Biological Control of Pests Affecting Plants

**Outcome #4****1. Outcome Measures**

# of Rhizoctonia solani genes identified that express differentially under conditions of virulence

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

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

**Issue (Who cares and Why)**

**What has been done**

## Results

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
215	Biological Control of Pests Affecting Plants

### Outcome #5

#### 1. Outcome Measures

# of Maine potato growers developing a better understanding of how the use of manure soil amendments and longer crop rotations affect potato insect and weed pests, and diseases and well as potato yield, quality, and profitability

#### 2. Associated Institution Types

- 1862 Research

#### 3a. Outcome Type:

Change in Knowledge Outcome Measure

#### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	120	100

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

### Outcome #6

#### 1. Outcome Measures

# of Maine potato growers learning how to integrate animal-based production systems with their potato operations

#### 2. Associated Institution Types

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	120	100

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

**Outcome #7****1. Outcome Measures**

percentage of Maine blueberry growers adopting and maintaining integrated pest management strategies

Not Reporting on this Outcome Measure

**Outcome #8****1. Outcome Measures**

% of Maine blueberry acreage treated with perimeter tactics for control of blueberry maggot fly

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	15	87

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Lowbush (wild) blueberries are an important and unique commercial crop in Maine and the blueberry maggot, or blueberry fruit fly, is the major insect pest of blueberries in Maine.

#### What has been done

MAFES scientists have been investigating the phenomenon of vertical movement of blueberry flies into trees and determining the implications of this movement on diffusion into blueberry field interiors and subsequent potential for jump dispersal over insecticide-treated field peripheries.

#### Results

Because of the results of this project, and educational programming and publications used to disseminate these results to Maine blueberry growers, 87% of Maine blueberry growers surveyed manage blueberry flies by a perimeter spray tactic. The survey suggests that this tactic saves 80% to 90% of the cost in managing the blueberry fly. Furthermore, since application to blueberry fields is reduced by 80% to 90%, the probability of environmental contamination is also been reduced. The specific outcomes resulting from the understanding of the vertical distribution of flies in trees has provided the ability for growers to fine-tune their perimeter spray tactic by applying spray swaths in the vicinity of attractive border trees (maple and oak).

#### 4. Associated Knowledge Areas

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

#### Outcome #9

##### 1. Outcome Measures

# of alternative pest and soil management systems for potato that are ready for commercial-scale evaluation

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

**Outcome #10****1. Outcome Measures**

% of organic and diversified vegetable farmers surveyed who have adopted weed seedbank management practices

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
213	Weeds Affecting Plants

**Outcome #11****1. Outcome Measures**

% reduction in the amount of damage from blueberry maggot fly in treated fields vs nontreated fields

Not Reporting on this Outcome Measure

**Outcome #12****1. Outcome Measures**

% reduction in the amount of organophosphate insecticides used to treat blueberry maggot fly in Maine

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	10	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Lowbush (wild) blueberries are an important and unique commercial crop in Maine and the blueberry maggot, or blueberry fruit fly, is the major insect pest of blueberries in Maine.

**What has been done**

MAFES scientists have been investigating the phenomenon of vertical movement of blueberry flies into trees and determining the implications of this movement on diffusion into blueberry field interiors and subsequent potential for jump dispersal over insecticide-treated field peripheries.

**Results**

Because of the results of this project, and educational programming and publications used to disseminate these results to Maine blueberry growers, 87% of Maine blueberry growers surveyed manage blueberry flies by a perimeter spray tactic. The survey suggests that this tactic saves 80% to 90% of the cost in managing the blueberry fly. Furthermore, since application to blueberry fields is reduced by 80% to 90%, the probability of environmental contamination is also been reduced. The specific outcomes resulting from the understanding of the vertical distribution of flies in trees has provided the ability for growers to fine-tune their perimeter spray tactic by applying spray swaths in the vicinity of attractive border trees (maple and oak).

**4. Associated Knowledge Areas**

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

**Outcome #13****1. Outcome Measures**

# of commercial-scale demonstrations with significant reductions in pesticide and fertilizer use and improvements in soil quality

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	1	1

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results**

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

#### Outcome #14

##### 1. Outcome Measures

Average density of germinable weed seedbank found by Maine growers adopting ecologically based weed management practices (# of germinable seeds per square meter, 10 cm deep). Weed populations surviving cultivation will not reduce crop yield or quality and

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
213	Weeds Affecting Plants

#### Outcome #15

##### 1. Outcome Measures

Wild blueberry growers in Maine will be able to improve production by proper management of weed and disease pests

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	100	100

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results****4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants

**Outcome #16****1. Outcome Measures**

Wild blueberry growers in Maine will be able to properly identify and respond appropriately to weeds and diseases

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	100	100

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results****4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants

**Outcome #17****1. Outcome Measures**

Wild blueberry growers will make better management decisions on fertilizer and weed control

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	100	100

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants

**Outcome #18****1. Outcome Measures**

Integrated Pest Management for Fire Ants

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

**Issue (Who cares and Why)**

Ants in the exterior urban/suburban landscape can cause considerable problems: stinging, homopteran-tending, and interior nuisance from invaders. The European fire ant is an invasive species that has become a serious pest in many coastal communities in northern New England over the past 10 years. Densities of this aggressive, stinging ant can average 1.4 nests/m<sup>2</sup> with 300-10,000 foragers per nest. A need exists for an effective, yet safe means for managing populations of this pest and to prevent further spread.

#### What has been done

MAFES scientists have been working to develop a least-toxic strategy for homeowners and businesses for managing European fire ants, *Myrmica rubra*, using bait station strategies.

#### Results

Their results showed that bait deployed in the field was detected in ants up to 32 m from the delivery station. Broadcast of Advion fire ant bait and Pre-Empt liquid in AntPro bait stations both resulted in the lowest number of foragers, demonstrating that either a bait station strategy or a broadcast bait strategy can work to significantly reduce activity of *M. rubra* on infested properties if the right active ingredient and product are used. The researchers have been successful raising awareness of the differences between beneficial and pestiferous ants, providing stakeholders information about ant behavior, benefits that ants provide in managed ecosystems and consequences of control actions necessary for clients to make informed decisions about controlling ants in the landscape. Among the management techniques recommended, they make sure to include both cultural methods, and chemical methods. However, much of the emphasis is focused on prevention.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems
721	Insects and Other Pests Affecting Humans

#### Outcome #19

##### 1. Outcome Measures

Problems affecting honey bee health

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

###### Issue (Who cares and Why)

The heavy reliance on insecticides for insect pest management may put honey bees at risk to exposure of harmful residues that compromise their health.

###### What has been done

MAFES entomologists designed field experiments to assess the potential of exposure to insecticide residues to honey bees for newly registered reduced risk insecticides that have low toxic effects on humans.

###### Results

Although the researchers found that there was little evidence for negative effects on honey bees when imidacloprid was applied just prior to blueberry bloom, they also made sure that honey bee keepers were aware of other studies that have shown deleterious effects of this chemical on honey bee larvae. Because of this

information, some Maine blueberry growers have decided not to use imidacloprid, a neonicotinoid insecticide, when an alternative control is available for specific insect pest outbreaks. This course of action was recommended by the University of Maine Cooperative Extension until there is more information from across the country on all life stages of honey bees.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

#### Outcome #20

##### 1. Outcome Measures

Number of blueberry growers tracking mummy berry in their fields

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	{No Data Entered}	6

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

###### Issue (Who cares and Why)

Lowbush blueberries are an important and unique commercial crop in Maine. Mummy berry disease caused by *Monilinia vaccinii-corymbosi* (Reade) Honey is the major disease problem of lowbush blueberry, but there are no studies of how the fungus progresses through the leaves and ultimately kills them.

###### What has been done

MAFES researchers have been examining the infection process of *Monilinia vaccinii-corymbosi*, the causal agent of mummy berry blight, in lowbush blueberry leaves.

###### Results

Approximately 130 growers attended meetings with the researchers and increased their knowledge about the mummy berry forecasting method and how to identify and control this disease. An informal poll showed that six growers had made mummy berry plots in their fields to track the fungus's progress in the spring.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

**Outcome #21****1. Outcome Measures**

Conserving native, natural enemies of blueberry pests

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

In Maine, lowbush blueberry is a native perennial crop. Natural enemies have evolved with the majority of insect pest species, yet insecticides are the predominant tactic used for pest management.

**What has been done**

As part of a multistate project, MAFES entomologists are assessing the natural enemy communities in blueberry production and developing pest management tactics that conserve natural enemies in blueberry fields. The researchers will also be examining the effectiveness of these natural enemies at suppressing native pest insects, focusing first on the Allegheny mound ant.

**Results**

After a presentation designed to acquaint blueberry growers with the biology and ecology of three species of mound ants that are common predators in wild blueberry fields in Maine, the researchers have seen a change in action by some organic lowbush blueberry growers. Some organic growers have begun to avoid mowing down ant mounds during their pruning operations--a conservation biocontrol management tactics that has been adopted by some of the "early adopters" in the blueberry grower community.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

**Outcome #22****1. Outcome Measures**

Protecting potato crops from pink rot

**2. Associated Institution Types**

- 1862 Research

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Pink rot losses occur in potato throughout Maine and can be severe when heavy rains occur near harvest. This disease is both a field and a storage problem. Surveys indicate that resistance to the standard fungicide used for management of pink rot, mefenoxam, is nearly universal where it has been in continuous use in Maine, and is widespread where its use for late blight was discontinued. No other fungicides have demonstrated equivalent activity

#### What has been done

MAFES scientists evaluated fluopicolide (Presidio), cyazofamid (Ranman), and a numbered compound for pink rot (*Phytophthora erythroseptica*) control in an inoculated plot at the Aroostook Research Farm in Presque Isle, ME.

#### Results

This research includes critical evaluation of assessment systems for loss to pink rot as well as varietal rankings. To augment the search for replacement pink-rot control materials, the researchers are also conducting breeding research that is intended to produce resistant lines, illustrate the patterns of resistance/susceptibility to progeny for this disease, and to provide genetic material for marker selection. Several numbered lines from Maine's potato breeding program evaluated in 2009 have resistance equivalent to Atlantic, the standard cultivar most consistently resistant to the disease.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

### Outcome #23

#### 1. Outcome Measures

Reduction in herbicide use among Maine blueberry growers

#### 2. Associated Institution Types

- 1862 Research

### 3a. Outcome Type:

Change in Condition Outcome Measure

### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

### 3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**

Weeds, diseases and vertebrate depredation reduce the yield and quality of wild blueberries.

**What has been done**

MAFES scientists conducted a spot-treatment trial assess the efficacy of a mesotrione/clethodim tank mix in controlling broadleaf weeds and grasses in wild blueberry (*Vaccinium angustifolium*) fields.

**Results**

This combination treatment allows for a postemergence application, thereby targeting the weeds as a spot treatment and combining both broadleaf and grass control with a single application. This will result in less herbicide use and a reduction in application cost for blueberry growers.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants

**Outcome #24****1. Outcome Measures**

New weed control tools for small vegetable growers

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

In 2005, there were 1.7 million small farms in the U.S. This number is likely to increase with the continued growth in demand for organic and locally produced foods. Although there is a broad array of innovative tools for tractor-mounted tool bars, many small growers do not own a tractor. Instead, they rely on walk-behind tractors or tillers, sometimes horses. Weed control is accomplished with the same tools that have been used for the past century.

**What has been done**

During the 2009 field season, MAFES researchers evaluated innovative cultivation equipment imported from Finland.

**Results**

The researchers imported from Finland the Weed Master, an innovative set of cultivation and flame-weeding equipment, designed and built by a team of Finnish small-scale organic farmers. This is the first unit to be imported to North America. Our on-farm field evaluations, along with a replicated comparison with widely available weeding tools, indicate that efficacy of weed control with the Weed Master is equal to hand weeding, hoeing or using a wheel hoe, but 60% to many times more efficient when working time is considered. The dramatically greater working speed translates directly into dollars saved weeding, and offers growers opportunity to cultivate several times to achieve a high level of weed control if necessary. The researchers also explored an innovative

mechanism for sharing results through a research blog ([gallandt.wordpress.com](http://gallandt.wordpress.com)), and have developed a new YouTube Channel, "Zeroseedrain" (<http://www.youtube.com/user/zeroseedrain>), which features our preliminary evaluations of the Weed Master.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
213	Weeds Affecting Plants

#### 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
- Populations changes (immigration, new cultural groupings, etc.)
- Other (new insect pests or diseases)

##### Brief Explanation

Certain investigators have retired or left the university. Some projects were terminated earlier than originally anticipated. University has had several years of budget cuts, affecting ability to hire new or replacement faculty.

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

##### 1. Evaluation Studies Planned

- After Only (post program)
- During (during program)
- Comparison between locales where the program operates and sites without program intervention

##### Evaluation Results

{No Data Entered}

##### Key Items of Evaluation

{No Data Entered}