

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Global Food Security and Hunger -- Integrated Pest Management

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
211	Insects, Mites, and Other Arthropods Affecting Plants			25%	
212	Pathogens and Nematodes Affecting Plants			25%	
213	Weeds Affecting Plants			10%	
215	Biological Control of Pests Affecting Plants			15%	
216	Integrated Pest Management Systems			25%	
	Total			100%	

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	65.0	0.0
Actual	0.0	0.0	55.5	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	321276	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	2340434	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	2186897	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Publications will be made available in print and online that provide pest control recommendations
- Regional management guides will be produced
- Research results will be communicated through pesticide workshops and field days
- Research results will be used to support FIFRA Section 18c products labeling requests
- Results will be used to update pesticide applicator training materials
- Training materials will be updated for private and commercial pesticide applicators

2. Brief description of the target audience

- Crop producers, dealers, distributors, and company representatives
- Crop protection companies registration and research personnel
- Montana crop advisory boards
- Private and commercial pesticide applicators
- State of Montana, Montana Department of Agriculture, BLM, USFS, and other government entities

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	350	150	0	0
Actual	1200	1500	0	0

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

Patent Applications Submitted

Year: 2010
 Plan: 1
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Plan	0	5	
Actual	12	88	100

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research citations

Year	Target	Actual
2010	10	30

Output #2

Output Measure

- Multidisciplinary journal articles published

Year	Target	Actual
2010	2	56

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Quality in-depth training programs for continuing educational on integrated approaches to pest management.
2	New IPM options discovered and evaluated per year.
3	Number of broad-ranging stewardship practices implemented.
4	Passing rate percentage for pesticide application licenses.
5	New products registered.
6	Number of potential products/practices evaluated.

Outcome #1

1. Outcome Measures

Quality in-depth training programs for continuing educational on integrated approaches to pest management.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	3	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Transitioning to reduced impact and organic agricultural systems requires that a grower develop a management system that can successfully operate by integrating knowledge of cropping systems, soil and crop nutrition, weed and disease control, and marketing. The development of reduced risk management alternatives for the key pests of forage and seed alfalfa requires the monitoring of pollinators and natural enemies. Reducing dependence on insecticides through the development of cultivars that resist damage from pests is a priority in COA projects. As the organic industry grows domestically and internationally, price premiums will be critical for producers and for all participants in the organic food industry.

What has been done

Educational programs are being developed to provide grower education for integrating biological controls with conventional disease, weed, and insect management practices in potatoes, sugar beets, and other crops. The application of pesticides in specialty crops needs to be understood by growers and applicators, especially since many of the crop protection products are relatively new and are issued under special local need or emergency exemption labels. An emphasis on pest monitoring (using decision-making parameters and determining economic injury levels) will optimize the use of pesticides for controlling pests. Foreign trade partners especially want decreased pesticide residues in the wheat and barley exports.

Results

MSU is examining the integration of natural enemies, pathogens, and chemicals for management of sawfly and is developing new sources of host plant resistance. Research is ongoing to find additional environmentally friendly solutions for the management of soil-borne plant pathogens. The deployment of bio-fungicides could provide an important crop management tool missing in organic wheat production. Implementation of research results reduces risk and increases sustainability of organic farming in the northern Great Plains. Educational programs are providing

grower education for integrating biological controls with conventional disease management practices. Research is being directed toward identifying key mortality factors which contribute to the greatest annual losses of alfalfa leaf-cutting bee pollinators in Montana. Understanding the role of weed diversity and seedbanks in Montana cropping systems will help producers develop more effective weed control programs.

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
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

New IPM options discovered and evaluated per year.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Montana's stakeholders need new and improved methods for controlling insects, weeds, and diseases that challenge producers who produce crops under less than ideal conditions. Pesticides are a major expense to producers; however delaying or eliminating pest control measures may not always be an option. An increase in public concern about food quality, natural resource biodiversity, and sustainability of the quality of soil, air, and water is mandating less reliance on traditional pesticides and more research into biological control systems and organic food production. Stakeholders across the Northern Great Plains identified wheat stem sawfly, Fusarium crown rot, and grassy weeds as major factors threatening the economic and environmental sustainability of small grains primarily due to a lack of effective chemical management options.

What has been done

MSU researchers are examining the integration of natural enemies, pathogens, and chemicals for management of sawfly and are developing new sources of host plant resistance. Research is ongoing to find additional environmentally friendly solutions for the management of soil-borne plant pathogens. Projects evaluate natural enemies, pathogens, and the chemical ecology of wheat stem sawfly and its host plants and seek new sources of host plant resistance as tools for integrated pest management. Several fungal pathogens have been found that cause high levels of mortality in sawfly larvae and are being further developed for potential commercial uses. Research continues in the development of wheat cultivars that are less susceptible to damage from wheat stem sawfly.

Results

Novel sources of host plant resistance and promising agrochemical inducers may be incorporated into wheat stem sawfly IPM and plant breeding programs. For heavy infestations, biological control with parasitoids and pathogens is being developed for integration with the planting of partially-resistant solid-stem varieties. Research is being directed toward identifying key mortality factors which contribute to the greatest annual losses of alfalfa leafcutter bee pollinators in Montana. Additional work investigates colony collapse disorder (CCD) of honeybees, especially determining the role that *Nosema ceranae* infections may have in honeybee colonies.

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
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #3

1. Outcome Measures

Number of broad-ranging stewardship practices implemented.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The increase in public concern about food safety, food quality, cost, natural resource biodiversity, and sustainability of the quality of soil, air, and water is mandating less reliance on traditional pesticides and research into more environmentally friendly systems, including biological controls and organic production. The management of diseases in potatoes and sugar beets is becoming increasingly difficult according to growers who participated in MSU sponsored meetings. Tribal members who are involved in agriculture need an awareness of how to be environmental stewards and preserve natural resources, particularly in irrigated systems.

What has been done

Programs have been established to investigate low impact control options and promote sustainable practices utilizing biological controls. Difficult-to-control pests require producers and researchers to evaluate new IPM methodologies in order to maintain a competitive position while helping to alleviate global hunger. Integrated disease management programs are in place for potatoes and sugar beets that profitably provide growers with management programs using biological, chemical, and host plant resistance options. MSU projects have identified effective and economical biological controls that will help growers manage plant diseases using methods that are safer to humans and the environment. An MSU program provides programming in sustainable agricultural practices combining grazing intensity with preservation of water, native plants, fisheries and wildlife.

Results

Workshops in forest management and stewardship have been completed. Surveys of participants indicated that the majority took home new ideas and tools that helped them better meet their property objectives. Owners had their stewardship plans reviewed and updated through this process. We have demonstrated that mycofumigation using *Muscodor albus*, or synthetic gases that mimic the natural gases, provides excellent control for a wide range of fungal, bacterial, and nematode pathogens, especially in potatoes and sugar beets. The research provides a basis for organic and other growers to control soilborne plant pathogens. The development of a quick and accurate electronic field identification system will aid growers, crop advisors, extension agents, diagnosticians, and others associated with crop production with a multi-entry, multi-media, commodity-based electronic key to aid in the identification and management of pests of small grains, including weeds. To promote good forest stewardship and healthy forests across Montana we have established a program to recruit, train, and maintain forest landowners who will actively manage their forested lands for multiple resource conservation objectives that are sound and scientifically based.

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
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #4

1. Outcome Measures

Passing rate percentage for pesticide application licenses.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	70	90

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

As a minimum requirement for certification, private applicators must show that they possess a practical knowledge of the pest problems and pest control practices associated with their agricultural operations. Also they must be familiar with proper storage, use, handling, and disposal of pesticides and containers use them legally and responsibly.

What has been done

Training programs are available to private and commercial applicators who wish to become certified. A private applicator applicant needs to complete the 50 question open book Montana Private Applicator Certification Exam at their local extension office and pass it with a grade of 70% or better. The Montana Department of Agriculture (MDA) oversees a wide variety of pesticide programs ranging from pesticide education, pesticides, and groundwater to licensing pesticide products and commercial pesticide applicators.

Results

Extension publications, training programs, and application clinics are supported by MSU staff and faculty for private and commercial applicators. To become certified for the first time, private applicators must either attend an approved training program or pass an exam administered by an authorized representative of the MSU Pesticide Education Program, usually the local County Extension Agent. Materials are continually updated to ensure that producers and applicators understand the latest innovations in integrated pest management systems and equipment.

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
- 215 Biological Control of Pests Affecting Plants
- 216 Integrated Pest Management Systems

Outcome #5

1. Outcome Measures

New products registered.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Stakeholders are interested in new and innovative ways to control pests in crops and rangeland. Manufacturers of pesticides and biocontrols must often wait several years before their products can be used on Montana farms. An active monitoring and testing program at MSU ensures that all available control methods are made available to producers in the state via requests for federal, state, or emergency labeling.

What has been done

MSU research and extension personnel cooperate with the Montana Department of Agriculture and manufacturers to support the registration of new products via Section 3, Section 18(c), and Section 24(c) guidelines of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) administered by the USEPA.

Results

Products under development by chemical manufacturers are routinely included in herbicide, insecticide, and fungicide screening trials across the state. Results are used in developing pesticide labels, fine-tuning rate structures, and obtaining emergency labeling as appropriate.

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
- 215 Biological Control of Pests Affecting Plants
- 216 Integrated Pest Management Systems

Outcome #6

1. Outcome Measures

Number of potential products/practices evaluated.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	3	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Comparing biological and agricultural risk assessment from biotechnology crops, pesticides, and invasive species allows producers to selectively use a variety of management systems. Risk assessment is an important discipline to provide a better understanding to producers of the ecological and human-health risks associated with pest management options. Incorporating biopesticides into insect management plans can conserve natural enemies and pollinators. Preserving the quality of grain during storage includes the management and control of insect pests. Management of weeds in rangeland includes research in several management areas, including prevention, chemical, mechanical, and biological control, prescribed burning, and revegetation.

What has been done

The purpose of one study is to examine the impact of several reduced-risk biopesticides on alfalfa insect pests, natural enemies, and pollinators, while assessing alfalfa seed damage and seed yield. The research provides growers with information on the efficacy of alternative pesticides to be used in seed alfalfa for control of lygus bugs, aphids, and alfalfa weevils, while minimizing impacts on natural enemies of these insects and on pollinators, both managed and native. Researchers are also determining factors that favor soil-inhabiting forage pests on alfalfa stand longevity. A multistate partnership focuses on insecticidal and non-insecticidal approaches in laboratory and large-scale field trials. The primary focus of entomological research will be to ensure reduction of grain storage losses at a lower cost than conventional chemical methods with less reliance on chemicals.

Results

Educational outreach programs for adoption of reduced-risk insecticides in the seed alfalfa production system are being established. Ecological and human-health risk assessments of emerging infectious diseases and insecticides used to control disease vectors have revealed science-based risks and the uncertainty and variability associated with each risk type.

Lepidopterous insects represent one of the largest insect pest groups of food and fiber crops worldwide. Sex pheromones have been identified from hundreds of moth species and are used in IPM programs as lures to monitor and trap pest species and to disrupt mating.

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
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes
- Public Policy changes
- Government Regulations

Brief Explanation

Demanding government regulations on the approval of new pest control options continue to be a challenge for manufacturers and researchers to obtain registrations for new products. The demands of producers who grow crops organically require innovative pest and fertility solutions often requiring the use of biocontrols and alternative nitrogen sources. Organic farming and the introduction of non-traditional crops create a need for MSU researchers to delve into new non-traditional approaches to managing crop production.

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

1. Evaluation Studies Planned

- After Only (post program)
- Retrospective (post program)

Evaluation Results

Evaluation studies are in progress.

Key Items of Evaluation

Evaluation studies are in progress.