

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

**Program # 3**

**1. Name of the Planned Program**

Food Safety -- Biobased Products and Processing

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
502	New and Improved Food Products			30%	
511	New and Improved Non-Food Products and Processes			30%	
605	Natural Resource and Environmental Economics			10%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			20%	
903	Communication, Education, and Information Delivery			10%	
	<b>Total</b>			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	8.0	0.0
Actual	0.0	0.0	7.8	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	81402	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	388155	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	277146	0

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

**1. Brief description of the Activity**

MSU research seeks to:

- Conduct outreach activities related to biobased products
- Develop systems that ensure food safety and agricultural security
- Develop value-added, agriculturally based end-use products
- Establish biobased product and food science education and research programs
- Enhance partnerships among faculty across the Montana university system, producers, agricultural industry and other educational institutions across the region
  - Provide mechanisms to enhance agricultural production practices to enhance product quality
  - Use technology and biotechnology to improve plant and animal production systems
  - Develop sustainable fuels from crops grown in Montana

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

- Alternative energy groups and state agricultural advisory committees
- Crop and livestock producers in Montana
- Economic development groups
- Participants in extension and commodity group meetings, conventions, and conferences
- State of Montana, Montana Department of Agriculture, Bureau of Land Management, 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
<b>Plan</b>	150	50	0	0
<b>Actual</b>	800	1150	0	0

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

**Patent Applications Submitted**

Year: 2010  
 Plan: 1  
 Actual: 2

**Patents listed**

Gary Strobel. #7,858,362 Use of Fusarium to Treat Human Wastes. December 28, 2010  
 Gary Strobel. #7,774,203 Muscador spp. for Use in Human Waste Remediation. July 13, 2010

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

#### Number of Peer Reviewed Publications

2010	Extension	Research	Total
Plan	0	5	
Actual	0	10	10

#### V(F). State Defined Outputs

##### Output Target

##### Output #1

###### Output Measure

- New business partnerships created

Year	Target	Actual
2010	1	1

##### Output #2

###### Output Measure

- Number of research citations

Year	Target	Actual
2010	10	9

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

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of SBIR funding proposals submitted to federal agencies.
2	Number of opportunities and value-added programs introduced in Montana through continued education, research, and partnering with non-university personnel.
3	Number of new products with value-added potential evaluated per year within Montana.
4	Number of new food safety recommendations developed for consumers, which add value and provide for new uses of Montana's agricultural products.
5	New or expanded business and/or partnerships created inside and outside of Montana.
6	Number of biofuels developed from existing crops in Montana
7	Number of new crop options introduced for biofuels in Montana

## **Outcome #1**

### **1. Outcome Measures**

Number of SBIR funding proposals submitted to federal agencies.

### **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>
2010	1	1

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

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

Small Business Innovation Research (SBIR) grant proposals are prepared by MSU-COA, university, and non-university personnel. SBIR funds early-stage R&D at small technology companies and is designed to stimulate technological innovation, increase private sector commercialization, increase small business participation in federally funded R&D, and foster participation by minority and disadvantaged firms in technological innovation. Montana companies benefit from this available funding source.

#### **What has been done**

Through efforts in the biobased products and processing programs at MSU, several companies have taken new product innovations and created viable businesses, including new value-added products, products from new crops, and other state-of-the-art research.

#### **Results**

Montanans and others have benefited from research innovation and discoveries made from new products, new markets, and new dietary products with new Montana crops (e.g. gluten-free flour) and long-established agricultural commodities. Camelina was introduced as a sustainable energy crop. Camelina oil can be used for production of biodiesel or as omega-3 oil and camelina meal can be used for production of omega-3 enriched livestock. The expansion of camelina production across Montana has driven establishment of both small and large oil extraction and biodiesel manufacturing facilities. Omega-3 enriched livestock has higher market value than traditional livestock.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
502	New and Improved Food Products

511 New and Improved Non-Food Products and Processes

**Outcome #2**

**1. Outcome Measures**

Number of opportunities and value-added programs introduced in Montana through continued education, research, and partnering with non-university personnel.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2010	2	2

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

**Issue (Who cares and Why)**

Montana stakeholders are interested in the development of new crops and new uses for crops. MSU researchers investigate new technology, new crops suitable for production in Montana's climate and soil conditions, and mechanisms to add value to existing cropping systems. Programs strive to be innovative and responsive to the developing needs of the State of Montana and the Pacific Northwest/ Northern High Plains. The primary objective of our research is to develop value-added, agriculturally based end-use products with a competitive edge in the global market that are suitable for production in rural Montana.

**What has been done**

Efforts in the biobased products and processing programs support cutting-edge research and outreach to improve the profitability of Montana agricultural through enhancement of current production and development of new value-added applications and products.

**Results**

Current value-added products being evaluated include biocontrol agents on plant diseases, biobased highway de-icer, biodiesel, biofuel pellets, cellulosic ethanol, and gluten-free crops. OmegaMontana eggs are commercially available across Montana. Direct return to the producer is 50% higher for these eggs than traditional eggs. Wheat Montana LLC has evaluated camelina oil in bread that will have a higher return per loaf than their existing products. Several new cultivars of camelina have been developed, and new uses for camelina oil and meal are being evaluated. As camelina acreage grows, the need for new varieties becomes apparent in order to meet the need for renewable and clean sources of industrial lubricants. Additional new crops or varieties developed by MSU include high protein oat (PrOatina), gluten-free Teff, high-yielding soybean, fenugreek, and gluten-free timothy. The development of value-added high oleic and high linoleic

safflower varieties is a current project that will increase crop sustainability and provide new products to commercial producers of edible oil, cosmetics, biofuel, birdseed, supplemental fat for livestock rations, and other end-use U.S. and foreign markets.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
511	New and Improved Non-Food Products and Processes

#### Outcome #3

##### 1. Outcome Measures

Number of new products with value-added potential evaluated per year within Montana.

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	1

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

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

Producers are attracted to new innovations that can better utilize their farming operations and provide additional profits. Start-up industries in Montana often rely on MSU research to develop ideas for new products that can be marketed from crops grown in the State.

###### **What has been done**

Research projects have been funded that strive to increase the profitability of Montana agriculture, enhance the health of the human population, and reduce our reliance on non-renewable energy product development activities.

###### **Results**

One project has successfully produced alternatives to solid wood (log and chip) using agricultural crop residue in making biobased pellet fuels for residential stove and commercial boiler burning. Biobased processed engineered fuels can be manufactured to take advantage of materials that are common to Montana agricultural areas. The oilseed crop, camelina, can be added to boost the BTU output. Research conducted at the Western Agricultural Research Center (WARC) is investigating production methods for specialty crops that can be used in value-added biobased

products. The production of essential oils, culinary and medicinal herbs, and spice crops provides an opportunity for Montana farmers to diversify their agricultural operations particularly with small acreage landowners in western Montana. Research is impacting rural Montana. Several products are being produced and marketed by private industry or grower cooperatives, including PrOatina gluten-free oats to the celiac community and beta-glucan barley to the nutraceutical industry. The Great Northern Grower Cooperative has established an oatmeal processing facility and is distributing high-protein, gluten-free oatmeal.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
511	New and Improved Non-Food Products and Processes

#### Outcome #4

##### 1. Outcome Measures

Number of new food safety recommendations developed for consumers, which add value and provide for new uses of Montana's agricultural products.

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	2	2

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

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

A major goal of the projects in biobased products and processing programs at MSU is to develop systems that enhance food safety and agricultural security for U.S. and global consumers. Food safety has also become a concern for the beef industry at all production levels. Beef producers must address methods to improve and document ranch biosecurity and biocontainment protocols to prevent food safety events.

###### **What has been done**

Recommendations for food safety are made available to food processors, schools, consumers through different departments at MSU. Using the processes and organizational structure developed by the sustainable beef supply (SBS) program, research and educational programs continue to develop an animal identification and traceability system to address the animal health, biosecurity, and food safety concerns expressed by producers and consumers.

### Results

In addition to publications, researchers have developed food products for individuals who may not be able to consume traditional grains. Flour developed from Indian ricegrass (Montina flour) at MSU is now produced and distributed by a Montana cooperative. The development of gluten-free crops, such as high-protein oat and timothy grass, provides food options for those sensitive to gluten. Timothy flour is highly nutritious, gluten-free and can be used to produce a variety of baked products. Research-based information on food safety and other food management principles are made to producers through conferences and producer meetings. Research in organic farming is aimed at promoting economic and environmental sustainability. Research is providing producers with value-added high oleic and high linoleic safflower cultivars for commercial production of edible oils, cosmetics, biofuel, birdseed, and supplemental fat for livestock rations.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

### Outcome #5

#### 1. Outcome Measures

New or expanded business and/or partnerships created inside and outside of Montana.

#### 2. Associated Institution Types

- 1862 Research

#### 3a. Outcome Type:

Change in Condition Outcome Measure

#### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	1

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

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

Montana and neighboring state industries are seeking innovative markets for new biocontrol tools and new crops, such as camelina, that have been catalyzed by MSU. These industries work directly with the MSU to explore potential licensing for various products.

##### What has been done

Over 150 available accessions of camelina have been screened for fatty acid profile, total oil content, and total glucosinolate content. Oilseed crops continue to represent important new sources of income for farmers and provide opportunities for increasing crop diversity. The development of value-added high oleic and high linoleic safflower varieties is a current project that will increase crop sustainability and provide new products to commercial producers of edible oil, cosmetics, biofuel, birdseed, supplemental fat for livestock rations, and other end-use U.S. and foreign markets.

### Results

Public policy survey results suggest that producers preferred policies that promised to support agriculture and agriculture's opportunity to grow within a changing environment. Producers' preferences for pursuing new forms of support for specialty crops and creating new risk management tools shows a general preference for policies that focus on addressing emerging issues.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
605	Natural Resource and Environmental Economics
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

## Outcome #6

### 1. Outcome Measures

Number of biofuels developed from existing crops in Montana

### 2. Associated Institution Types

- 1862 Research

### 3a. Outcome Type:

Change in Action Outcome Measure

### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	1

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

The development of bioenergy alternatives will provide opportunities for renewable biobased products and will help to reduce the current dependence on fossil fuels. Consumers are looking for alternatives to fossil fuels in order to reduce our dependence on those fuels and to reduce the

potential greenhouse gases associated with them.

#### **What has been done**

MSU projects are evaluating various cool and warm season cereal crops for yield potentials in Montana with the intent of maximizing biomass production for the production of ethanol. Crops designated for biodiesel production include canola, camelina, and mustard. A significant potential exists in the Pacific Northwest for the production of canola seed and its use as a biolubricant. Additional initiatives will provide new insights into food safety and risk assessment, including the use of vegetable oils as feedstock for fuel cells, the development of new wheat varieties, non-corrosive biobased de-icers, and the optimization of ethanol production from various feedstocks.

#### **Results**

Biobased processed engineered fuels (typically in pellets, briquettes, or logs) can be manufactured to take advantage of materials that are common to local Montana areas.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
511	New and Improved Non-Food Products and Processes
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

#### **Outcome #7**

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

Number of new crop options introduced for biofuels in Montana

##### **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>
2010	{No Data Entered}	1

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

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

Goals are to improve the quality and diversity of agricultural commodities, expand production and pest management strategies with reduced inputs, identify and develop new Montana crops, and develop biofuels and energy alternatives. By increasing productivity in a biobased economy, there

is positive effect on manufacturing, product development, rural development, job opportunities, and farm and ranch incomes.

#### **What has been done**

Initiatives provide new insights into the use of vegetable oils as feedstock for fuel cells, the development of new wheat cultivars for the production of ethanol, non-corrosive biobased de-icers, and the optimization of ethanol production from other feedstocks. We have been instrumental in identifying potential oilseed crops suitable for production in Montana for use as culinary oils, biolubricants, omega-3 oils, feeds, and production of biodiesel and bioenergy products.

#### **Results**

Research projects strive to increase the profitability of Montana agriculture, enhance the health of the human population, and reduce our reliance on non renewable energy. A prime emphasis is to add value to existing Montana products and to commercialize new products, while maximizing our limited resources and reducing reliance on commodity agriculture.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
511	New and Improved Non-Food Products and Processes
605	Natural Resource and Environmental Economics
903	Communication, Education, and Information Delivery

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

##### **External factors which affected outcomes**

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

##### **Brief Explanation**

Normal delays in the development of biocontrol products and the challenges needed to obtain product registrations at the USEPA extend the time needed for innovative research to become commercially viable products. With the granting of emergency uses for biocontrol products, the time to market has been substantially reduced.

- Inadequate moisture (rainfall, irrigation, snowpack) for consistent crop production
- Inadequate funding and technical support from partnering institutions and cooperators
- Major interruptions in program development
- Lack of full-time staff and part time assistants for the projects
- Reduced support from Montana crop and animal agricultural groups, conservation and wildlife groups, private industry, private donations, and other agencies

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

## **1. Evaluation Studies Planned**

- Retrospective (post program)
- During (during program)

## **Evaluation Results**

The success of the biobased products and processing projects has been demonstrated in the substantial and growing interest from agricultural producers and consumers. The general acceptance of ethanol-based biofuels has increased the interest in the production of camelina and other feedstocks. Growers are adjusting acres of small grains to accommodate this new crop. A major challenge at this juncture is the lack of chemical products labeled for use on alternative crops and the fluctuating prices offered for small grains. Montana is collaborating with other states through the IR-4 program to obtain labels for pesticides used in camelina.

## **Key Items of Evaluation**

Evaluations are on-going through interactions at winter meetings.