

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

**Program # 4**

**1. Name of the Planned Program**

Global Food Security and Hunger: Plant Breeding, Genetics and Genomics

Reporting on this Program

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms			15%	
202	Plant Genetic Resources			35%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			10%	
204	Plant Product Quality and Utility (Preharvest)			15%	
205	Plant Management Systems			10%	
502	New and Improved Food Products			5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			5%	
903	Communication, Education, and Information Delivery			5%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	40.6	0.0
Actual Paid Professional	0.0	0.0	37.3	0.0
Actual Volunteer	0.0	0.0	0.0	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	393062	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1558818	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1186656	0

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

### 1. Brief description of the Activity

- Communication of information on plant breeding and genomics advances through classroom activities, field days, cultivar trials, news releases, presentations at county and state meetings, and conventions
  - Release germplasm, new cultivars, and new genomics tools and techniques
  - Strategic planning with state agricultural groups
  - Technical and non-technical publications
  - 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 ways to enhance agricultural production practices to enhance product quality
    - Develop research summaries and fact sheets

### 2. Brief description of the target audience

- Domestic and foreign buyers of quality wheat
- Farmers, colleagues, and stakeholders
- Grain associations, Montana Department of Agriculture, Montana Wheat and Barley Committee, grain elevators, and state commodity groups
  - Seed companies
  - Crop and livestock producers in Montana
  - State agricultural advisory committees
  - Economic development groups
  - Participants in extension and commodity group meetings, conventions, and conferences, and field days
    - State of Montana, Montana Department of Agriculture, BLM, USFS, and other government entities

### 3. How was eXtension used?

eXtension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	1000	2000	0	0

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

**Patent Applications Submitted**

Year: 2013

Actual: 1

**Patents listed**

PVP App. 201300357 Application filing date: 8/01/2013 Title: Wheat, common 'SY Clearstone 2CL'

61/915,380 12/12/2014 MNR-180 Rust Resistant Mutant in Wheat

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

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
<b>Actual</b>	0	42	0

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

**Output Target**

**Output #1**

**Output Measure**

- Number of foreign trade teams in Montana

Year	Actual
2013	18

**Output #2**

**Output Measure**

- Number of foreign trade teams at MSU

<b>Year</b>	<b>Actual</b>
2013	4

**Output #3**

**Output Measure**

- Number of research citations

<b>Year</b>	<b>Actual</b>
2013	42

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

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

O. No.	OUTCOME NAME
1	Electronic documents on new cultivars and Montana district recommendations provided to Montana producers to maintain Montana producers' dominance in small grain markets
2	Integration of new molecular techniques into breeding projects to improve outcomes
3	Average per bushel yield increase of Montana grains while maintaining product quality
4	Number of elite lines of wheat and barley screened for agronomic and quality characteristics
5	Number of improved cultivar recommendations by districts across Montana
6	Planted acreage percentage increase per year of new MSU-released small grains in Montana
7	Number of programs established to enhance global food biosecurity
8	Number of new food products created from Montana crops

## **Outcome #1**

### **1. Outcome Measures**

Electronic documents on new cultivars and Montana district recommendations provided to Montana producers to maintain Montana producers' dominance in small grain markets

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	38

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

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

Grain producers in Montana rely heavily on MSU research results for the development of new genetics and cultivars adapted to Montana's climate. New disease and insect resistant wheat and barley cultivars with value-added traits are critical to producers in Montana. Disseminating timely and accurate information about crop selection and results is important in this time sensitive industry.

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

Researchers at MSU developed an online interactive tool to assist growers in selecting proper crops by district. Producers have several input options and the computer assisted program will help them select the best crops for their region. Another new agronomy decision tool assists producers in fertilizer and herbicide selection as well as proposing appropriate irrigation schedules.

#### **Results**

Producers are using the tools and researchers are sharing information about how to best use them prior to crop selection. Information is posted on the sites regarding current analysis of new cultivars and crops along with the most current information on disease and insect resistant strains. The sites provide comprehensive information about new crop recommendations by district. These tools also provide timely completion of wheat quality evaluations on breeder's samples is a priority, which leads to the timely identification of varieties suitable for desired end product quality, and for recommendations for growers to produce.

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

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms

- 202 Plant Genetic Resources
- 203 Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 Plant Product Quality and Utility (Preharvest)

## **Outcome #2**

### **1. Outcome Measures**

Integration of new molecular techniques into breeding projects to improve outcomes

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	4

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

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

Advancements in technology allow scientists to discover new genotypes and breed for favorable traits while eliminating undesirable characteristics. In particular, genetically engineered wheat varieties at MSU are geared specifically toward higher yield potential and be desirable to wheat buyers. These research goals and achievements keep Montana's producers and the Montana agricultural production economy a top priority.

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

Field selection, augmented by the use of molecular markers during the traditional plant breeding process of crossing and selection, was privileged by researchers in 2013. Several trials were conducted to identify new genes for incorporation into the breeding program, which contains experimental lines at all stages of development, from initial crosses to highly selected individual crosses made in previous years.

#### **Results**

Two new varieties underwent seed increase and purification in 2013, and they are under consideration for potential release. Dissemination of varieties has been accomplished through the established seed growers program and over one million acres were evaluated and tested. New crosses are made every year, and after several years of selection, a small subset of lines from the best crosses is ready for testing in statewide yield trails. Extensive testing for agronomic traits and end-use quality in the statewide trails provides data for the Montana Agricultural Experiment Station to consider potential release of an experimental line as a new variety.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)

#### Outcome #3

##### 1. Outcome Measures

Average per bushel yield increase of Montana grains while maintaining product quality

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	0

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

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

Montana ranks first in the production of certified organic wheat and third in the U.S. for wheat and barley production. The grain supports the livestock industry in Montana and the export market. Barley has increased in popularity with Montana producers as the cost per bushel increased for feed and malt barley. Montana produced nearly 20 percent of the barley in the U.S.

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

Investigators with the COA and MAES continued developing hard red spring wheat varieties for farmers and the wheat milling and baking industry. Montana producers planted 2.2 million acres of winter wheat in 2012, ranking fifth in the U.S. for the number of acres planted. Three of the top four varieties planted were developed by the MSU breeding program. Producers planted approximately 2.9 million acres of spring wheat in Montana in 2012.

###### **Results**

Durum, spring, and winter wheat yields dropped in 2012, and 2013 yield statistics have not been published. "Yellowstone," "Genou," and "Rampart" comprised more than half of the total winter wheat planted in 2012. Seeded acres of barley increased by 200,000 but yield dropped due to drought. Total wheat yields for 2012 totaled 34.8 bu/acre for 2011-2012. In 2012, wheat acreage

planted totaled 5,800 and the price per bushel rose 8.51, up a 6 percent increase from 2011. 2012 all wheat value of production totaled 1.6 million. Montana remains the second largest spring wheat producer in the country, according to the USDA NASS, Montana Field Office. "Vida," "Choteau," "Reeder," and "Corbin" accounted for more than 55 percent of Montana's 2012 spring wheat acreage and two of them were developed by the MAES.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

#### Outcome #4

##### 1. Outcome Measures

Number of elite lines of wheat and barley screened for agronomic and quality characteristics

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	270

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

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

The need for high quality grains increases as the world population grows, and global buyers are looking to Montana as an international leader in the development of new small grain cultivars. Global traders want high quality wheat to enhance food production in breads and noodles, and they are looking for disease and insect resistant plants with high yield potential.

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

Researchers determined the agronomic and economic impact of various crop sequences in dryland crop production in Montana and screened for key agronomic and horticultural traits such as general adaptation, phenology and growth potential. Two new varieties underwent seed increase and purification in 2013 and they are under consideration for potential release. These include CAP400 and MT1172. Data from the Northwestern Agricultural Research Center has shown superior performance of CAP400 for yield, grain protein, OWBM resistance and stripe rust

resistance. MT1172 showed very high yield potential and modest grain protein levels.

### Results

Researchers planted the intrastate yield trial at eight locations with yields averaging 58 bu/acre. Seven hollow-stem, one solid-stem, and one "Clearfield" experimental lines were selected for further testing and seed stock purification. Twenty lines were selected for additional testing, and a 49 entry yield trial was planted and harvested and twelve solid stem lines were retained in upper level sawfly trials. 856 lines were evaluated for agronomic potential, 99 harvested, with 60 then selected for preliminary yield testing. These included four hard white and three two-gene "Clearfield" lines. They also screened for reliable grain yield and the plants ability to retain green leaves after heading. Winter wheat investigators added 284 crosses to the germplasm base, emphasizing disease resistance and adaptation traits. Extensive testing for agronomic traits and end-use quality in the statewide trails provides data for the Montana Agricultural Experiment Station to consider potential release of an experimental line as a new variety.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

### Outcome #5

#### 1. Outcome Measures

Number of improved cultivar recommendations by districts across Montana

#### 2. Associated Institution Types

- 1862 Research

#### 3a. Outcome Type:

Change in Condition Outcome Measure

#### 3b. Quantitative Outcome

Year	Actual
2013	40

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

**Issue (Who cares and Why)**

Montana crop producers want products suitable to domestic and export markets. They want wheat varieties that can thrive under harsh growing conditions and are more insect and disease resistant. As the barley industry grows researchers at MAES and the COA are introducing new varieties that will grow under dryer and warmer conditions. There are several biotic and abiotic stresses that hinder wheat production in Montana, thus, improved cultivar recommendations are immensely important to Montana producers.

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

In 2013, recommendations were made and released from the breeding program: Warhorse, a solid-stem HRW wheat resistant to wheat stem sawfly, Colter, a high-yielding HRW with strong stripe rust resistance, and WB33768, a high-yielding hard white winter wheat line was licensed to Monsanto. Leading cultivars in the state included Yellowstone (23.5%, released in 2005), Genou (14.4%, released in 2004) and Decade (6.0%, released in 2010.) Judee and Bearpaw solid stem, semi-dwarf cultivars have now entered commercial production and are expected to replace Genou. Variety performance information was disseminated to producers via internet, traditional extension bulletins, popular press articles and field day presentations.

#### **Results**

A variety is eligible for recommendation when a minimum of 16 location-years of performance data is obtained from the MAES statewide performance trials. Test results must indicate the variety is equal to or superior in overall merit to specified check cultivars and has end-use quality equal to or exceeding currently recommended varieties. Recommendations are considered on a case by case basis. Yield performance is important, but also considered are test weight, grain protein content, disease and pest resistance and end-use quality data. In general, yield needs to be at least equal to currently recommended varieties in a particular district, unless the variety is being recommended for a specific purpose; such as, sawfly resistance.

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

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems

#### **Outcome #6**

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

Planted acreage percentage increase per year of new MSU-released small grains in Montana

##### **2. Associated Institution Types**

- 1862 Research

### 3a. Outcome Type:

Change in Condition Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2013	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Montanans place a lot of trust in Montana State University as a leader in small grain agriculture, and nowhere is it more evident than in seed selection. Producers each year request the latest information and seed options available, so they remain competitive and successful in a tough global grain market.

#### What has been done

MAES and the COA released "Silver Durum," and two Clearfield hard red winter wheat varieties, "War Horse" and "Colter." In 2011 they released "Hockett" barley, three hard red winter wheat varieties ("Judee," "Bearpaw," and "Decade"), and a new red spring wheat named "Duclair." All of them were recommended in 2013 to districts throughout Montana.

#### Results

Field crop revenue for Montana in 2012 totaled \$2.1 billion with wheat being the most significant. Montana producers seeded 2.1 million acres of winter wheat last fall for the 2013 crop year, down 200,000 acres or nine percent below the 2012 winter wheat planting of 2.3 million acres. The MSU variety "Yellowstone" continues as the highest yielding winter wheat line ever developed at MSU. "Judee" and "Bearpaw" solid stem semi-dwarf cultivars were released in the fall of 2011 and are expected to soon replace "Genou." "Genou" and "Yellowstone" have increased their yield per acres by 2.8 bu/acre and 6.7 bu/acre since 2007. Spring and durum wheat production were both up as was barley.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

## **Outcome #7**

### **1. Outcome Measures**

Number of programs established to enhance global food biosecurity

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

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

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

Discovering new ways to use products increases global food security and keeps consumers engaged. Consumers continue to want more local food options, and they are more interested in how and where it was grown. COA/MAES researchers prioritize providing the most accurate and reliable data to Montana breeders, to ensure breeders will continue using the best lines. The COA/MAES breeding and genetics programs develop and releases crop and plant varieties that are more profitable for Montana growers. The programs identify genes and genetic mechanisms that promote improved plant productivity and plant health, and ultimately provide more profit and confidence for Montana producers.

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

MSU researchers processed samples submitted by the wheat and barely breeding programs in a timely mannner to allow the breeding programs to continue their selection programs without incurring delays. MSU researchers also conducted studies on genes important to cereal grain quality and agronomic traits. In 2013, they completed five refereed journal articles with three appearing online and in press. These manuscripts covered three main topics: plant productivity, grain hardness, and starch quality.

#### **Results**

The primary output of MSU research breeding programs is the completion of crop quality evaluations on breeders samples, and the results of which continue to be featured in journals and publications throughout Montana and beyond enhancing knowledge for producers and consumers alike. This then leads to the identification of varieties for desired end product quality and to recommend for growers to produce.

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

<b>KA Code</b>	<b>Knowledge Area</b>
205	Plant Management Systems
502	New and Improved Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
903	Communication, Education, and Information Delivery

## **Outcome #8**

### **1. Outcome Measures**

Number of new food products created from Montana crops

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	2

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

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

Discovering new ways to use products increases global food security and keeps consumers engaged. Consumers continue to want more local food options, and they are more interested in how and where it was grown.

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

MSU researchers conducted studies on genes important to cereal grain quality and agronomic traits. In 2012, three new germplasms were released; WB9879CLP, MSUPBLB10-10, and another on behalf of faculty member Michael Grioux. In 2013, gene tagging and identification efforts was focused specifically on three pea varieties, as the gene originally proposed to investigate was identified by others. Dry peas, following a newly released food product, are demonstrative of a crop well suited to the agricultural practices common in Montana and neighboring states. Dry peas are an economically viable alternative to wheat, barely and canola, and the crop also helps to condition the soil through its ability to add nitrogen, low water use, and alternate pests, weeds and diseases.

#### **Results**

A new product type, a new germplasm, was released in 2013: MSUPBLB10-10, a yellow, high-amylase dry pea suitable for conditions on the northern Great Plains. This is new product registry

provides a new food product tailored for the economic gain and surrounding bio region for a large percentage of Montana producers. A second new germplasm that included the variety WB9879CLP, was also released. The germplasm is resistant to the imidazolinone herbicides and has solid stems for wheat stem sawfly resistance. A set of near-isogenic lines with all combinations of the R genes were developed and submitted to the National Small Grains Collection. Montana received 462 germplasm accessions during 2012. Of those accessions 384 (75%) were Triticum species. Seventeen individuals received germplasm during 2012, and eight were associated with Montana State University.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
502	New and Improved Food Products
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
- Government Regulations
- Other (Funding)

##### Brief Explanation

Montana experienced one of the driest growing seasons on record in much of Southern Montana, but overall had a successful year with the value of all wheat crops up 24 percent from 2011 to \$1.7 billion, according to USDA NASS, Montana Field Office. The all wheat season average price increased \$0.77 per bushel to \$8.45 per bushel.

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

The development of improved winter wheat lines and cultivars continues with improvements in yield, disease resistance, and tolerance advances, combined with improved stem solidness to combat sawfly. New challenges arrive, or former pests mutate to circumvent the remedies developed to thwart their damage and renew their attack on wheat and other crop species.

Montana's spring wheat acreage during the past five years has ranged from 44 to 55 percent of the total wheat acreage planted. In 2012, spring wheat accounted for 48 percent and durum 7.8 percent of the total wheat acreages. In 2012, Montana ranked second among the wheat and durum producing states. The wheat stem sawfly, wheat rust diseases and leaf diseases including Septoria, remain threats to wheat growers in areas across Montana, and require the planting of resistant varieties.

Hard red spring wheat is grown in all areas of the state, with more than 97 percent of the acreage on dryland. The largest concentration of acreage is east of the Continental Divide along the northern tier of counties. The highest producing counties in 2012 were Roosevelt, Valley, and Toole. More than 98 percent of durum wheat is also grown on dryland, and in 2012 the highest producing counties were Sheridan, Daniels, and Roosevelt in northeastern Montana.

"Yellowstone" and "Genou" (cultivars developed by the MSU research program) are the top two planted cultivars in Montana, accounting for about one million acres in 2012. Adoption of these cultivars by Montana wheat growers has resulted in harvest of an additional 21.5 million bushels of winter wheat over the past six crop years (2007-2012) based on production acreage and estimated yield gains over previously deployed cultivars.

Scientists developed improved winter wheat cultivars adapted to Montana cropping systems and climatic conditions. Through molecular and genetic research they discovered plants more resistant to the wheat stem sawfly and made significant strides toward introducing new rust resistant genes into Montana cultivars.

Researchers focused efforts on sugar beet and potato production and discovered biocontrol agents for different disease affecting these crops. The value of the canola crops and safflower increased significantly and producers ranked number one in the U.S. for the production of pulse crops.

The COA and MAES will continue to research and publish results for the agricultural community. New online tools provide immediate information regarding crop and seed recommendations, and researchers are working relentlessly to improve production and profitability of Montana crops.

## Key Items of Evaluation

- A new germplasm, "MSUPBLB 101-10", a yellow, high-amylose dry pea suitable for conditions found on the northern Great Plains was released
- An organized collection of more than 9,000 photographs of plants, including more than 2,000 photos of grasses are maintained at [www.flickr.com/photos/plant\\_diversity/collections](http://www.flickr.com/photos/plant_diversity/collections). All photographs are georeferenced and tagged with taxonomic, ecological, and morphological information for ease of retrieval and use as primarily an educational tool and secondarily to document study sites
- Three winter wheat cultivars were released: Warhorse, Colter HRW wheat, WB3768 HWW wheat
- Several new low glycemic lines of potato, one low glycemic line of naked oats, and one low glucosinolate *Camelina sativa* line for microgreens were developed
- A set of guidelines for dryland crop rotation for Montana producers is currently being developed
  - "Yellowstone" and "Genou" (cultivars developed by MSU) continued to be the top two planted cultivars in Montana, accounting for about 0.934 million acres in 2012. Adoption of these cultivars by Montana wheat growers has resulted in harvest of an additional 21.5 million bushels of winter wheat over the past six crop years (2007-2012) based on production acreage and estimated yield gains over previously deployed cultivars.
  - Completed complex field research experiments with nearly 1,000 experimental lines of dryland and irrigated barley.
  - MAES researchers developed and reported a new high throughput molecular marker

for leaf rust resistance breeding and a new strategy for studying genes in wheat seed development.

- Researchers demonstrated two important mechanisms in plant triacylglycerol biosynthesis pathway that were published.
- Spring wheat varieties developed by the COA/MAES program were grown on more than one million acres. The two most widely grown varieties in the state, "Vida" and "Choteau," were developed at MSU. In addition, two varieties developed by marker-assisted selection were marketed for the first time in 2012.