V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Global Food Security and Hunger

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	0%		4%	
102	Soil, Plant, Water, Nutrient Relationships	10%		16%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		23%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		5%	
205	Plant Management Systems	30%		12%	
307	Animal Management Systems	20%		6%	
308	Improved Animal Products (Before Harvest)	0%		11%	
603	Market Economics	40%		3%	
604	Marketing and Distribution Practices	0%		5%	
606	International Trade and Development	0%		12%	
610	Domestic Policy Analysis	0%		3%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Actual	13.5	0.0	8.0	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**
630325	0	658603	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
630325	0	657964	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	5341718	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

To meet the challenges faced in this program, activities included research to: genetically improve dry beans, rice, soybean, wheat, vegetable crops (e.g., potatoes, tomatoes) and fruits (e.g., strawberries, blueberries, tart and sweet cherries) for yield, pest resistance and food quality; better understand the processes and factors that influence the growth, meat quality and other economically important traits in food animals; increase the efficiency of milk production in dairy cattle; ensure food access and security to all; develop strategies and approaches that enhance the sustainability of vegetable production systems; and identify beneficial plant-microbe interactions and soil properties and their influence on crop yield.

Extension activities included: assist producers and processors in national and international policy issues that impacts the industry competitiveness.

2. Brief description of the target audience

Agricultural producers (crop and livestock), commodity groups, state agency representatives, food chain supply industry representatives, state and federal elected officials and policymakers, national and international policy and standards boards and councils, other researchers and academics, and the interested public.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	{NO DATA	{NO DATA	{NO DATA	{NO DATA
Actual	356	712	0	0

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

Patent Applications Submitted

Year: 2010

Plan:

Actual: 2

Patents listed
MICL01907-Elimination of airborne ascospore inoculum as a control for fungal disease of plants; TEC2009-0160-01; 12/630,244.MICL01910-Molecular biology of plant-bacterial interactions; TEC2008-0075-01; 12/695,605. In addition, one patent was awarded: MICL02145-Development of a novel planttransformation system suitable for large seeded legumes; TEC2003-0012-01US; 10/561,720; patent 7,696,406, issued 4/13/10.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	32	32

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research programs that deal with the genetic improvement of key agricultural crops related to yield, quality, drought/cold tolerance and pest resistance.

Year	Target	Actual
2010	{No Data Entered}	12

Output #2

Output Measure

- Number of research programs to understand processes and factors that influence growth, meat quality and production efficiences in food animals.

Year	Target	Actual
2010	{No Data Entered}	5

Output #3

Output Measure

- Number of programs to identify current and emerging key public policy issues on trade, environmental and agricultural food issues.

Year	Target	Actual
2010	{No Data Entered}	6

Output #4

Output Measure

- Number of research programs that enhance sustainability/reduce risk for agricultural systems.

Year	Target	Actual
2010	{No Data Entered}	7

Output #5

Output Measure

- Number of producers and processors trained in national and international policy issues that impacts the industry competitiveness.

Year	Target	Actual
2010	{No Data Entered}	356

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of research programs that deal with the genetic improvement of key agricultural crops related to yield, quality, drought/cold tolerance and pest resistance.
2	Number of research programs to understand the processes and factors that influence growth, meat quality and production efficiencies in food animals.
3	Number of research programs to identify current and emerging key public policy issues on trade, environmental and agricultural food issues.
4	Number of research programs to develop strategies and methods that enhance sustainability and reduce risk for agricultural systems.

Outcome #1

1. Outcome Measures

Number of research programs that deal with the genetic improvement of key agricultural crops related to yield, quality, drought/cold tolerance and pest resistance.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	12

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As the world population increases and the demand for food and fuel relies more heavily on agricultural products, efficient methods of plant transformation will be required. Although conventional breeding will fulfill a part of this need, these techniques are limited to the gene pool of the species involved. In contrast, the tools of genetic engineering significantly expand the sources of genes that can be used for variety improvement. Further, current transformation techniques are not applicable to all plant species.

What has been done
Research to: improve plant architecture, disease, stress resistance and quality traits for dry beans; develop and utilize new technologies, genes and germplasm for vegetable crop improvement and safe deployment of genetically engineered crops; breed new high quality blueberry and strawberry cultivars that are resistant to the common array of biotic and abiotic stresses; develop a model system for the genetic studies of important domestication traits in cereal; develop food-grade specialty soybean varieties; characterize and identify genes responsible for conferring mutant phenotypes during fruit development and ripening of tomato; development and release of improved soft red and soft white winter wheat varieties and germplasm; and develop and refine a novel transformation system suitable for large-seeded legumes.

Results
Results of 19 yield trials in eight market classes for dry beans identified sources of drought resistance in black, navy, pinto, red and great northern market classes, and modest levels of white mold tolerance in cranberry and kidney bean trials. A total of 2994 plots were harvested for yield in 2010, and over 2600 single plant selections were made in the early generation nurseries.

Phytopthora blight is one of the most serious diseases affecting pickling cucumbers. Research

showed that very young fruit are the most susceptible, with a transition to resistance occurring at the end of the period of rapid exponential growth. Peel studies indicated that resistance is associated with the upper 1-2 mm of the fruit surface, and preliminary results indicate that peel extracts from 12 and 16 dpp inhibit phythopthora growth and spore development relative to 4 or 8 dpp fruit or water controls.

Genetically engineered potatoes incorporating the Cry3a Bacillus thuringiensis gene were shown to be highly resistant to Colorado potato beetle in detached leaf bioassays.

Two new aphid-resistant soybean germplasm were released to the soybean industry in 2010.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems

Outcome #2

1. Outcome Measures

Number of research programs to understand the processes and factors that influence growth, meat quality and production efficiencies in food animals.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The molecular basis underpinning beef and port quality is highly complex, and continued advances in understanding the biological processes that contribute to the delivery on consistent quality meat is critical to the sustainability and security of the industry. Knowledge gained from research efforts in this area can be beneficial in defining and optimizing management systems for quality, providing assurance of meat quality and in tailoring quality to suit market needs.

What has been done

Research to: discover and evaluate genetic factors that influence growth, carcass merit and meat quality of swine and cattle; increase the efficiency of protein production and the quality of meat and milk in ruminants primarily through nutritional methods; and develop forage systems that will increase milk yield, decrease feed costs, and decrease feed resources used to meet nutritional requirements, minimizing excretion of nutrients as waste products.

Results
Supplementation of milk replacer with a blend of butyrate, coconut and flax oils improves some immune responses in calves (n=88), which may partly explain the reduction in scours and concurrent improvements in growth.

In a second study with 48 bull calves fed milk replacers based on lard and supplemented with 2 percent lard, 2 percent fish oil or 2 percent flax oil, flax oil, but not fish oil, improved body weight gain and hip width gain. Further, flax oil, but not fish oil, reduced the inflammatory response to Pasturella vaccine at 5 weeks old.

Studies evaluating the influence of development factors on longevity in sows revealed that sows that were younger than one year of age at farrowing and had larger and heavier litters at their initial farrowing had a lower culling risk. In addition, gilts that were near average for growth and backfat thickness at a constant weight had a lower subsequent culling risk than faster growing or leaner gilts.

Results of an expression eQTL study found 62 unique eQTL and three gene networks enriched with genes involved in lipid metabolism, DNA replication and cell cycle regulation. These results provide novel candidate genes for important complex pig phenotypes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)

Outcome #3

1. Outcome Measures

Number of research programs to identify current and emerging key public policy issues on trade, environmental and agricultural food issues.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Public policy has taken on considerable importance to the future of agriculture. The farmer's historic struggle was with the forces of nature and the marketplace, and government policy played a minor role. Government policy at all levels is now a major player in agriculture, especially related to agriculture as an important economic asset -- the sustainability of a productive agricultural sector balanced with the preservation of environmental quality and the importance of prime farmland with respect to the continued viability of the rural economy and of rural lifestyles.

What has been done
Research to: investigate the causes and effects of price, yield and revenue risk in agriculture and the food system; evaluate the economics of alternative strategies for managing these risks; develop and test a theoretical model of behavioral relationships between retail buyers and suppliers to understand the distribution systems related to the entry of U.S. agribusiness products into Chinese and Indian consumer retail markets; better understand the implications of global food supply chain structure and performance; and to better understand how science and technology are used in the creation, maintenance and modification of agricultural grades and standards.

Results
A study addressing the growing connection between energy markets and food and food crop markets found that as ethanol production grows, the connections and spillovers between crude oil and corn prices increase dramatically, leading to important implications for risk management in the commodity sector.

Research exploring ways to organize food supply chains that create more effective market and communication channels found that, for fresh eggs, the individual attributes of organic, welfare-managed and nutritionally enhanced eggs carry price premiums equal to 16.5 cents, 3.57 and 2.30 cents per egg, respectively, over a base egg price of 7 cents. This type of information will help producers maximize their profits and receive the price premiums they deserve, while providing customers with the specialty products they desire.

4. Associated Knowledge Areas

KA Code	Knowledge Area
603	Market Economics
604	Marketing and Distribution Practices
606	International Trade and Development
610	Domestic Policy Analysis

Outcome #4

1. Outcome Measures

Number of research programs to develop strategies and methods that enhance sustainability and reduce risk for agricultural systems.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Globally, agriculture has performed remarkably well over the past 50 years by keeping pace with rapid population growth and delivering food at progressively lower prices. But this success has been at the expense of the natural resource base, through overuse of natural resources as inputs or through their use as a sink for pollution. To ensure sustainability of and reduced risk to the agriculture industry, research that helps develop strategies and methods related to mixed farming, mixed cropping, crop rotation, crop selection and varietal improvement is critical if agriculture is to meet future global demands without adversely affecting the resource base.

What has been done
Research to: increase our knowledge of beneficial plant-microbe interactions of agricultural importance to develop sustainable agroecosystems; develop optimal sampling schemes for accurate mapping of various soil and plant characteristics; improve the sustainability of intensive vegetable production systems through the use of cover crops, soil amendments and alternative production strategies; optimize reduced tillage production systems and evaluate their impact on pest and nutrient management, as well as yield and quality of vegetable crops; better understand micronutrients in plants; and determine the impact of alternative cropping systems and environmental conditions on weed population dynamics and weed management.

Results
A study testing the impact of cover crops and organic amendments on soil microbial activity and tomato yield under organic production systems showed that soil microbial biomass was enhanced with the combination of rye cover crop and compost application. The highest marketable tomato yield was recorded when rye and hairy vetch mixtures were followed with compost application.

Low tunnels were evaluated for frost protection and earliness in tomato and cucumber production. Both the single and the double layer low tunnels were able to protect cucumber and tomato when

the outside temperature was as low as 29 degrees F. This allowed harvesting cucumbers two to three weeks earlier than the rest of the industry.

Research showed that the clover root-nodule occupant, Rhizobium leguminosarum bv. trifolii participates in a natural, beneficial association with rice roots that can significantly improve rice growth, grain productivity and the agronomic fertilizer use efficiency with less chemical fertilizer inputs and independent of nodule formation and biological nitrogen fixation.

A methodology has been developed for best use of topographical information for predicting spatial variability in cover crop and main crop biomass and yield.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems

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.)

Brief Explanation

The economic challenges being faced by Michigan continue to affect these programs, particularly related to funding and staffing levels due to budget cuts, appropriations changes and competing public priorities. In addition, because of the inclusion of the five new national priorities in this year's reporting, many of the projected numbers in our original planned programs had to be revised. Five out of six of the original planned programs are included in the report, but a significant number (about 35 percent) were cross-walked into the new planned programs.

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

1. Evaluation Studies Planned

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}