

2008 University of Missouri Research Annual Report of Accomplishments and Results

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2008 University of Missouri Research Annual Report of Accomplishments and Results

I. Report Overview

1. Executive Summary

The economic upheaval and chaos of 2008 will stand out as one of the most dramatic events in US economic history. Efforts to turn the economy around have emphasized the need for public investment in infrastructure to foster future growth opportunities. Basic and applied research are key building blocks to both short and long term economic growth. The University of Missouri Agricultural Experiment Station had a productive year yielding advances in plant, animal and social sciences. These advances in science and technology help provide the basis for future growth. The quantitative outputs used as markers for research productivity exceeded targets. (Upward revisions in these targets will appear in the 2010 plan of work, reflecting an updated reporting methodology.) Examples of impacts from research include improved understanding of how plants defend against pathogens, and the genetics behind the Norton grape's immunity from fungal pathogens. In animal production, researchers use beef cattle genetics to significantly improve feed efficiency and multi disciplinary teams develop an economically viable pasture based dairy system. In natural resources, investigators develop practical solutions to improving bobwhite quail populations and researchers in urban ecology examine the effect that an urban child's early interaction with wildlife has on attitudes and perceptions about nature that persist as the child grows. In food systems and bioengineering, scientists work to add new functionality to Lab on Chip nanotechnology that has wide reaching applications in scientific evaluation and medicine. Researchers use beneficial bacteria to create a novel soy protein energy bar with health benefits and without negative digestive side effects associated with soy products. In the area of improved business structures, researchers used case study analysis to determine benefits and best strategies associated with sharing equipment to improve survival of small and medium sized farms.

Total Actual Amount of professional FTEs/SYs for this State

Year:2008	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	42.0	0.0
Actual	0.0	0.0	71.0	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Other (see below)

2. Brief Explanation

Annual faculty reporting instruments, including individual report of accomplishments and the CSREES progress reports were used to evaluate the program progress. In addition, information in news releases and web publications was used to identify milestone events reported in 2008.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Other (see MU Extension Plan of Work)

Brief Explanation

MU Extension sought input from traditional and non-traditional stakeholder groups by invitation and survey processes.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees

Brief Explanation

Program administrators met with commodity groups and advisory boards to collect their input.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Other (see MU Extension Plan of Work)

Brief Explanation

3. A statement of how the input was considered

- Other (see MU Extension Plan of Work)

Brief Explanation

MU Extension personnel share results of the stakeholder input process with AES researchers. Most faculty appointments include both research and extension responsibilities, further strengthening the linkages between extension and research.

Brief Explanation of what you learned from your Stakeholders

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	4934669	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	4934669	0
Actual Matching	0	0	4934669	0
Actual All Other	0	0	54978542	0
Total Actual Expended	0	0	64847880	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous years				
Carryover	0	0	0	0

V. Planned Program Table of Content

S. NO.	PROGRAM NAME
1	Plant Biology and Biochemistry
2	Animal Biology and Production
3	Natural Resources
4	Food Systems and Biological Engineering
5	Agricultural Policy and Rural Development

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

Plant Biology and Biochemistry

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

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			7%	
201	Plant Genome, Genetics, and Genetic Mechanisms			16%	
202	Plant Genetic Resources			6%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			11%	
204	Plant Product Quality and Utility (Preharvest)			4%	
205	Plant Management Systems			13%	
206	Basic Plant Biology			17%	
211	Insects, Mites, and Other Arthropods Affecting Plants			4%	
212	Pathogens and Nematodes Affecting Plants			15%	
213	Weeds Affecting Plants			3%	
216	Integrated Pest Management Systems			4%	
	Total			100%	

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

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	15.0	0.0
Actual	0.0	0.0	24.0	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	1835121	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1835121	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	22023459	0

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

Basic and translational research will be conducted and the results disseminated via scientific publications, scientific meetings, workshops, conferences, etc.

2. Brief description of the target audience

Researchers, scientists, extension specialists, field operation managers, agricultural producers.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2008	0	0	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2008 :	6

Patents listed

An SH, Wang SJ and Song Q (2007) Molecular cloning, developmental expression and functional analysis of bursicon gene in house fly, *Musca domestica*. Bursicon alpha mRNA, complete cds. National Center for Biotechnology Center (NCBI), Accession number EF424

An SH, Wang SJ and Song, Q. (2007) Molecular cloning, developmental expression and functional analysis of bursicon gene in the house fly, *Musca domestica*. Bursicon beta mRNA, complete cds. National Center for Biotechnology Information (NCBI), Accession n

Neelakandan AK, Valliyodan B, Song Z, Nes DW, Nguyen HT. 2007. Genes involved in phytosterol biosynthesis from soybean. Disclosure number 07UMC053.

Nguyen HT, Spollen WG, Valliyodan B, Sharp RE, and Springer GK. 2007. Genes controlling root growth under water deficits and drought tolerance in maize. Disclosure number 07UMC066.

Valliyodan B, and Nguyen HT. 2007. Gene expression profiling of soybean root and leaf tissues under water deficit conditions - Nucleic acid molecules controlling abiotic stress tolerance. Disclosure number 07UMC054.

Zhang Z, Nguyen H, Su J, Chen X. 2007. A high-frequency *Agrobacterium*-mediated transformation system for soybean [*Glycine max* (Merr.) L.]. (U.S. provisional patent).

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan	0	75	
2008	0	114	0

V(F). State Defined Outputs

Output Target

Output #1**Output Measure**

- Number of peer reviewed journal articles

Year	Target	Actual
2008	70	99

Output #2**Output Measure**

- Number of other peer reviewed publications (book chapters, proceedings, abstracts, etc.)

Year	Target	Actual
2008	9	11

Output #3**Output Measure**

- Number of invited papers and invited presentations

Year	Target	Actual
2008	2	67

Output #4**Output Measure**

- Number of graduate degrees awarded

Year	Target	Actual
2008	7	17

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	Enhanced understanding of basic aspects of plant physiology and biochemistry.
2	Development of plant varieties with improved yield, disease and insect resistance and drought tolerance.
3	Development of new plant varieties with value added traits, such as oil and protein content.
4	Translation of basic knowledge gained in model systems for the improvement of cropping systems management.

Outcome #1

1. Outcome Measures

Enhanced understanding of basic aspects of plant physiology and biochemistry.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A key to a plant's defense in defending against pathogens is its responsiveness in activating defenses. When attacked, some of the plant resources, normally devoted to growth and development, must be diverted to fighting disease.

What has been done

MU scientists conduct basic research to improve the understanding of signaling pathways in plants. The study revealed that plants first sense the attack of a pathogen, and then activate defense responses by triggering a complex signaling cascade in plants. One of the defense responses is the induction and accumulation of anti-microbial defense chemicals, known as phytoalexins.

Results

MU researchers have identified the specific signaling pathway that leads to production of camalexin, a defense chemical essential for resistance to some plant diseases. The signaling path is known as a mitogen-activated protein kinase (MAPK) cascade. By understanding- at the molecular and cellular levels- how plants protect themselves under adverse environmental conditions, such as pathogen attacks, we can eventually improve the disease resistance of crops.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants
202	Plant Genetic Resources

Outcome #2

1. Outcome Measures

Development of plant varieties with improved yield, disease and insect resistance and drought tolerance.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	0

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

Most varieties of wine grapes are susceptible to fungal pathogens. These devastating maladies limit the areas where wine varieties can be produced successfully and necessitates the use of fungicides to protect grapevines.

What has been done

The Norton grape species, native to Missouri, has the unique ability to defend itself against fungal diseases. MU researchers are investigating the genes that enable Norton grapes to both resist and defend itself against powdery mildew. The scientists use genetic techniques to understand what gives Norton an innate immune system against fungal pathogens and how it uses a combination of defense mechanisms, rather than a single immune receptor, to protect against the pathogen.

Results

Scientists hope to eventually transfer the genes that comprise these defense mechanisms in Norton into cultivated grapes to develop new disease-resistant varieties, which will be an important advance for grapevine breeding programs worldwide. By identifying the specific genes that give Norton its robust defense mechanism, the goal is to provide breeders with a way to speed up and specify the breeding process without changing the quality or taste of their grapes. This approach also will have a positive impact on the environment by reducing the use of fungicides, which breeders and vintners currently rely upon to protect their grapevines from various maladies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants
202	Plant Genetic Resources
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology

Outcome #3**1. Outcome Measures**

Development of new plant varieties with value added traits, such as oil and protein content.

Not reporting on this Outcome for this Annual Report

Outcome #4**1. Outcome Measures**

Translation of basic knowledge gained in model systems for the improvement of cropping systems management.

Not reporting on this Outcome for this Annual Report

V(H). Planned Program (External Factors)**External factors which affected outcomes**

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

Brief Explanation

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

1. Evaluation Studies Planned

- During (during program)

Evaluation Results

Individual faculty were reviewed by the Division Director aligned with Plant Biology and Biochemistry. Faculty submitted their research goals and accomplishments. Besides evaluating individual progress, the Division Director reviewed research progress and accomplishments in the context of the planned program. Results show continued progress in both basic and applied research.

Points of evaluation included the following:

Research focus – was it relevant and consistent with the objectives of the planned program?

Successful scholarship – were research results conveyed through peer reviewed publications?

Successful grantsmanship – was the research quality high enough to successfully compete for external grant funds?

Key Items of Evaluation

Program #2

V(A). Planned Program (Summary)

1. Name of the Planned Program

Animal Biology and Production

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals			29%	
302	Nutrient Utilization in Animals			11%	
303	Genetic Improvement of Animals			7%	
304	Animal Genome			8%	
305	Animal Physiological Processes			11%	
306	Environmental Stress in Animals			8%	
307	Animal Management Systems			4%	
308	Improved Animal Products (Before Harvest)			4%	
311	Animal Diseases			11%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals			4%	
315	Animal Welfare/Well-Being and Protection			3%	
	Total			100%	

V(C). Planned Program (Inputs)

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

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	10.0	0.0
Actual	0.0	0.0	16.0	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	816480	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	816480	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	10959940	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Basic and translational research will be conducted and the results disseminated via scientific publications, scientific meetings, workshops, conferences, etc.

2. Brief description of the target audience

Researchers, scientists, extension specialists, field operation managers, agricultural producers.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2008	0	0	0	0

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

Patent Applications Submitted

Year	Target
Plan:	1
2008 :	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan	0	150	
2008	0	185	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of peer reviewed journal articles

Year	Target	Actual
2008	80	101

Output #2

Output Measure

- Number of other peer reviewed publications (book chapters, proceedings, abstracts, etc.)

Year	Target	Actual
2008	70	79

Output #3

Output Measure

- Number of invited papers and invited presentations

Year	Target	Actual
2008	12	61

Output #4

Output Measure

- Number of graduate degrees awarded

Year	Target	Actual
2008	15	24

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	1) Pigs will be genetically modified to provide new biomedical models of human and animal diseases.
2	2) Improved and more economical protocols for fixed-time artificial insemination of cattle will be developed.
3	3) New information on measuring feed efficiency in cattle will be developed and recommendations on the incorporation of byproducts feeds into swine, poultry, and cattle rations will be determined.
4	4) Management procedures will be developed for reducing negative environmental impacts in swine, poultry, and beef confinement.
5	5) New selection tools for the genetic improvement of livestock species will be developed.

Outcome #1

1. Outcome Measures

- 1) Pigs will be genetically modified to provide new biomedical models of human and animal diseases.
Not reporting on this Outcome for this Annual Report

Outcome #2

1. Outcome Measures

- 2) Improved and more economical protocols for fixed-time artificial insemination of cattle will be developed.
Not reporting on this Outcome for this Annual Report

Outcome #3

1. Outcome Measures

- 3) New information on measuring feed efficiency in cattle will be developed and recommendations on the incorporation of byproducts feeds into swine, poultry, and cattle rations will be determined.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Over the past three years, feed prices have more than doubled. Factors contributing to the increase include the use of grains in biofuel production and an increase in export demand resulting from a weak dollar. These escalating feed prices have eroded profitability in the beef industry nationwide, and more specifically in Missouri, which accounts for the 2nd largest beef herd in the U.S.

What has been done

Feed conversion rates - the rate at which a pound of feed is converted to a pound of weight gain in a cow - is a key factor determining economic returns in beef production and is a genetically inherited trait. An efficient cow can eat up to 20% less than its inefficient counterpart and still achieve the same amount of gain. Using a sophisticated feed intake tracking system, researchers at MU have been able to identify which animals have the highest feed efficiency rates. These cattle were then bred to produce a prototype herd to make sure the efficiency benefit persisted across generations.

Results

In a competitive market, where producers have no control over output prices, reducing costs is the only means of improving profitability. Since feed costs are the single greatest variable cost component in beef cattle production, improving feed efficiency can have a dramatic impact on the producer's bottom line. Incorporating the efficiency trait in beef cattle genetics has the potential to decrease feed costs by up to 20%, thereby substantially improving producer returns.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
305	Animal Physiological Processes

Outcome #4

1. Outcome Measures

4) Management procedures will be developed for reducing negative environmental impacts in swine, poultry, and beef confinement.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In the nineties, more than 50 percent of Missouri's dairies had disappeared because of their inability to compete with the large dairy operations in the west. These large dairies have significantly lower costs than the small confinement dairies in Missouri.

What has been done

A team of researchers and specialists was formed at MU to develop a viable 'back to the future' approach of pasture based dairy. The strategy was to make the best use of the region's comparative advantage of climate and forage, while reducing labor demands associated with feeding and manure management in confinement operations.

Results

The multi disciplinary team, including dairy specialists, animal scientists, agronomists, economists and extension specialists developed a pasture based dairy system with production costs significantly lower than a confinement operation in the same region. A seasonal, 90-acre, 75-cow rotational grazing dairy experimental farm was established at MU's Southwest Center to fine tune the new process and try other ideas in financial management, dairy nutrition, reproduction and other production issues. The findings have been broadly disseminated through conferences and workshops, publications and extension personnel.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
302	Nutrient Utilization in Animals

Outcome #5

1. Outcome Measures

5) New selection tools for the genetic improvement of livestock species will be developed.

Not reporting on this Outcome for this Annual Report

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Public Policy changes
- Government Regulations
- Competing Public priorities

Brief Explanation

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

1. Evaluation Studies Planned

- During (during program)

Evaluation Results

Individual faculty were reviewed by the Division Director aligned with Animal Biology and Production. Faculty submitted their research goals and accomplishments. Besides evaluating individual progress, the Division Director reviewed research progress and accomplishments in the context of the planned program. Results show continued progress in both basic and applied research.

Points of evaluation included the following:

Research focus – was it relevant and consistent with the objectives of the planned program?

Successful scholarship – were research results conveyed through peer reviewed publications?

Successful grantsmanship – was the research quality high enough to successfully compete for external grant funds?

Key Items of Evaluation

Program #3

V(A). Planned Program (Summary)

1. Name of the Planned Program

Natural Resources

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			7%	
104	Protect Soil from Harmful Effects of Natural Elements			1%	
111	Conservation and Efficient Use of Water			4%	
112	Watershed Protection and Management			9%	
123	Management and Sustainability of Forest Resources			15%	
125	Agroforestry			10%	
131	Alternative Uses of Land			2%	
132	Weather and Climate			11%	
133	Pollution Prevention and Mitigation			3%	
134	Outdoor Recreation			2%	
135	Aquatic and Terrestrial Wildlife			27%	
605	Natural Resource and Environmental Economics			7%	
606	International Trade and Development			2%	
	Total			100%	

V(C). Planned Program (Inputs)

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

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	12.0	0.0
Actual	0.0	0.0	16.0	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	806784	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	806784	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	10655031	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Basic and applied research will be conducted to address elucidate underlying principles related to natural resources and to assist in the implementation of efficient, effective management actions to conserve natural resources and ensure the sustainable use of those resources. Research finds will be disseminated via appropriate scientific publications, conferences, workshops, trainings, etc.

2. Brief description of the target audience

Researchers, scientists, extension specialists, field operation managers, agricultural producers.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2008	0	0	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2008 :	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan	0	70	
2008	0	107	0

V(F). State Defined Outputs

Output Target

Output #1**Output Measure**

- Number of peer reviewed journal articles

Year	Target	Actual
2008	50	74

Output #2**Output Measure**

- Number of other peer reviewed publications (book chapters, proceedings, abstracts, etc).

Year	Target	Actual
2008	30	30

Output #3**Output Measure**

- Number of invited papers and invited presentations

Year	Target	Actual
2008	3	46

Output #4**Output Measure**

- Number of graduate degrees awarded

Year	Target	Actual
2008	15	25

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	Development of new, more efficient strategies to manage renewable natural resources.
2	Develop new economic opportunities related to the sustainable use of natural resources.
3	Enhanced understanding of people's attitudes toward, perceptions of, and use of natural resources.
4	Develop direct solutions to problems related to the human-natural resource interactions.
5	Enhanced understanding of the basic functioning of ecosystems and their constituent communities and species.

Outcome #1

1. Outcome Measures

Development of new, more efficient strategies to manage renewable natural resources.
Not reporting on this Outcome for this Annual Report

Outcome #2

1. Outcome Measures

Develop new economic opportunities related to the sustainable use of natural resources.
Not reporting on this Outcome for this Annual Report

Outcome #3

1. Outcome Measures

Enhanced understanding of people's attitudes toward, perceptions of, and use of natural resources.
Not reporting on this Outcome for this Annual Report

Outcome #4

1. Outcome Measures

Develop direct solutions to problems related to the human-natural resource interactions.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Bobwhite quail numbers decreased drastically in the 1950s when intensive 'fence row to fence row' farming destroyed much of their habitat. Today's quail population is about one-fifth of what it was prior to that period. Knowledge and cooperation between farmers and conservationists holds the key to help these bird populations come back.

What has been done

Ongoing research is conducted at MU to develop and test practical ways that farmers can maintain crop productivity while leaving enough habitat for the bobwhite to thrive. The project integrates quail management into modern agriculture. Allowing shrubs and annual plants to grow around the relatively unproductive crop field borders and corners provides immediate cover and a food source for bobwhite with little impact on crop yields.

Results

Conservationists consider bobwhite a significant barometer of a local ecosystem's health. Improving bobwhite habitat not only helps the quail, but also a host of other wildlife in the ecosystem. Techniques being developed at the demonstration farm are simple to implement and require little financial outlay by the farmer. Information and awareness are disseminated through demonstration, workshops and extension efforts.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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135	Aquatic and Terrestrial Wildlife
111	Conservation and Efficient Use of Water

Outcome #5

1. Outcome Measures

Enhanced understanding of the basic functioning of ecosystems and their constituent communities and species.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The interest in urban ecology is increasing and is recognized as an important venue in which many people observe wildlife. The future of wildlife conservation in the city depends on the next generation, but there is concern urban children may not be in touch with wildlife.

What has been done

With ethnic minority groups making up a large portion of city populations, researchers at MU investigated the experiences that urban minority kids have with wildlife. The study involved African-American and Latino students and found that negative experience with wildlife around a child's home could limit that individual's future interest or appreciation in nature.

Results

Results of the study suggest that it is important to foster an appreciation of wildlife at a very young age. According to data from the MU study, it doesn't matter what kind of nature activity takes place as long as it's safe, positive and happens on a frequent basis. Parents and teachers support of wildlife involvement is very important and programs that promote this involvement are helpful in engaging children's interest. Ultimately these early positive experiences help children develop positive attitudes about nature and the importance of conversation and those attitudes are likely to persist.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
134	Outdoor Recreation
135	Aquatic and Terrestrial Wildlife

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Public Policy changes
- Competing Public priorities

Brief Explanation

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

1. Evaluation Studies Planned

- During (during program)

Evaluation Results

Individual faculty were reviewed by the Division Director aligned with Natural Resources. Faculty submitted their research goals and accomplishments. Besides evaluating individual progress, the Division Director reviewed research progress and accomplishments in the context of the planned program. Results show continued progress in both basic and applied research.

Points of evaluation included the following:

Research focus – was it relevant and consistent with the objectives of the planned program?

Successful scholarship – were research results conveyed through peer reviewed publications?

Successful grantsmanship – was the research quality high enough to successfully compete for external grant funds?

Key Items of Evaluation

Program #4

V(A). Planned Program (Summary)

1. Name of the Planned Program

Food Systems and Biological Engineering

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
402	Engineering Systems and Equipment			4%	
404	Instrumentation and Control Systems			17%	
405	Drainage and Irrigation Systems and Facilities			3%	
501	New and Improved Food Processing Technologies			18%	
502	New and Improved Food Products			16%	
504	Home and Commercial Food Service			2%	
511	New and Improved Non-Food Products and Processes			8%	
702	Requirements and Function of Nutrients and Other Food Components			9%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.			5%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			18%	
Total				100%	

V(C). Planned Program (Inputs)

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

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	2.0	0.0
Actual	0.0	0.0	6.0	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	222003	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	222003	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	5280612	0

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

Basic and applied research will be conducted and the results disseminated via scientific publications, scientific meetings, workshops, conferences, etc.

2. Brief description of the target audience

Researchers, scientists, extension specialists, field operation managers, agricultural producers.

V(E). Planned Program (Outputs)**1. Standard output measures****Target for the number of persons (contacts) reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2008	0	0	0	0

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

Year	Target
Plan:	0
2008 :	1

Patents listed

Suppes, G.; Hsieh, F.; Tu, Y.; Kiatsimkul, P. Soy-based polyols. 2007. U.S. Provisional Patent Applications 20070265459, November 15.

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

	Extension	Research	Total
Plan	0	20	
2008	0	64	0

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

Output #1**Output Measure**

- Number of peer reviewed journal articles

Year	Target	Actual
2008	10	34

Output #2**Output Measure**

- Number of other peer reviewed publications (book chapters, proceedings, abstracts, etc.)

Year	Target	Actual
2008	12	27

Output #3**Output Measure**

- Number of invited papers and invited presentations

Year	Target	Actual
2008	3	33

Output #4**Output Measure**

- Number of graduate degrees awarded

Year	Target	Actual
2008	4	15

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	Develop new uses and products from biomass - food and nonfood (fuels, plastics, acids, etc).
2	Improve efficiency in conversion processes.
3	Food and water quality – develop sensing tools and assurance systems.
4	Food safety and health – develop biosensing and microbiological technologies.

Outcome #1

1. Outcome Measures

Develop new uses and products from biomass - food and nonfood (fuels, plastics, acids, etc).
Not reporting on this Outcome for this Annual Report

Outcome #2

1. Outcome Measures

Improve efficiency in conversion processes.
Not reporting on this Outcome for this Annual Report

Outcome #3

1. Outcome Measures

Food and water quality – develop sensing tools and assurance systems.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Laboratory equipment for scientific evaluation and medical diagnoses can fill a room and cost a small fortune. Using nanotechnology advances, scientists across the world are looking to shrink such machines down to something that can reside on a computer chip.

What has been done

Lab on Chip (LOC), is a new technology capable of analyzing extremely small volumes of fluid and is a device of only millimeters to a few square centimeters in size. MU researchers are working to enhance the technology by combining micro fluidics and sensing technology into one function on a single LOC. Combining these now separate functions will even further reduce the already small fluid levels needed to perform a scientific evaluation, thereby lowering the cost of the test and shortening detection time.

Results

The most immediate application for the LOC device will provide less expensive and easier blood analysis, vapor analysis and cancer detection. The technology has several other applications, including environmental testing and new kinds of lasers as well as detection of cancer, other diseases and improved explosives.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
404	Instrumentation and Control Systems
511	New and Improved Non-Food Products and Processes

Outcome #4

1. Outcome Measures

Food safety and health – develop biosensing and microbiological technologies.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	0

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

Soy is considered a healthy addition to a human diet. However, intestinal bloating and cramping can occur after consuming soy products.

What has been done

Beneficial bacteria, known as probiotics, are effective in reducing the adverse intestinal symptoms associated with soy. Food scientists at MU have developed a method of encapsulating probiotics in a gel and then freeze drying the material to produce a powdery ingredient that contains live bacteria. This dry ingredient has a relatively long shelf life in which the beneficial bacteria remain preserved.

Results

The encapsulated bacteria product was added to soy protein energy bars and evaluated. Taste testers detected no taste difference between soy bars with and with out the probiotic additive. The result is a soy protein energy bar with the desirable health benefits but free of the negative digestive side effects associated with soy. This is a novel functional food since there are no soy energy bars on the market today that contain probiotics.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products

V(H). Planned Program (External Factors)**External factors which affected outcomes**

- Public Policy changes
- Government Regulations
- Competing Public priorities

Brief Explanation**V(I). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

- During (during program)

Evaluation Results

Individual faculty were reviewed by the Division Director aligned with Food Systems and Biological Engineering. Faculty submitted their research goals and accomplishments. Besides evaluating individual progress, the Division Director reviewed research progress and accomplishments in the context of the planned program. Results show continued progress in both basic and applied research.

Points of evaluation included the following:

Research focus – was it relevant and consistent with the objectives of the planned program?

Successful scholarship – were research results conveyed through peer reviewed publications?

Successful grantsmanship – was the research quality high enough to successfully compete for external grant funds?

Key Items of Evaluation

Program #5

V(A). Planned Program (Summary)

1. Name of the Planned Program

Agricultural Policy and Rural Development

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
601	Economics of Agricultural Production and Farm Management			14%	
602	Business Management, Finance, and Taxation			6%	
603	Market Economics			3%	
604	Marketing and Distribution Practices			2%	
608	Community Resource Planning and Development			9%	
609	Economic Theory and Methods			2%	
610	Domestic Policy Analysis			23%	
611	Foreign Policy and Programs			7%	
801	Individual and Family Resource Management			5%	
802	Human Development and Family Well-Being			6%	
803	Sociological and Technological Change Affecting Individuals, Families and Communities			18%	
903	Communication, Education, and Information Delivery			5%	
	Total			100%	

V(C). Planned Program (Inputs)

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

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	3.0	0.0
Actual	0.0	0.0	9.0	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	1254281	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1254281	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	6059500	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Public policy analysis will be conducted and provided to public agencies at the regional, state and national levels.

Research will be conducted and the results disseminated via scientific publications, scientific meetings, workshops, conferences, etc.

2. Brief description of the target audience

Researchers, scientists, extension specialists, field operation managers, agricultural producers.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2008	0	0	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2008 :	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan	0	8	
2008	0	33	0

V(F). State Defined Outputs

Output Target

Output #1**Output Measure**

- Number of peer reviewed journal articles

Year	Target	Actual
2008	5	14

Output #2**Output Measure**

- Number of other peer reviewed publications (book chapters, proceedings, abstracts, etc.)

Year	Target	Actual
2008	4	17

Output #3**Output Measure**

- Number of invited papers and invited presentations

Year	Target	Actual
2008	1	18

Output #4**Output Measure**

- Number of graduate degrees awarded

Year	Target	Actual
2008	2	8

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	Improve the understanding of potential consequences of alternative policies under consideration.
2	Policy impacts that are more consistent with intended objectives.
3	Improved business structures or organizations.

Outcome #1**1. Outcome Measures**

Improve the understanding of potential consequences of alternative policies under consideration.

Not reporting on this Outcome for this Annual Report

Outcome #2**1. Outcome Measures**

Policy impacts that are more consistent with intended objectives.

Not reporting on this Outcome for this Annual Report

Outcome #3**1. Outcome Measures**

Improved business structures or organizations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	0

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

Business survival of small- and medium- sized farmers.

What has been done

Researchers conducted a series of case study analyses of small- and medium-sized Midwestern grain farmers who are sharing equipment and labor in their farming operations. The research identified motivations, benefits and challenges associated with forming sharing arrangements as well as key factors for success.

Results

Key factors identified for successful cooperative agreements include compatibility of operations and members' willingness to communicate and adapt. Sharing resources is found to improve farm profitability, efficiency and farmers' quality of life. The findings of this research provided the knowledge base for producer workshops designed to create awareness about the potential for sharing equipment and labor as well as some of the challenges. Eight workshops held in Iowa and Missouri in 2007 and 2008 were attended by 165 participants. Follow-up surveys with workshop participants estimated an average financial impact of over \$7,000 over the past year or a total of \$265,000 for all producers who responded to the survey.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
803	Sociological and Technological Change Affecting Individuals, Families and Communities

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

Brief Explanation

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

1. Evaluation Studies Planned

- During (during program)

Evaluation Results

Individual faculty were reviewed by the Division Director aligned with Agricultural Policy and Rural Development. Faculty submitted their research goals and accomplishments. Besides evaluating individual progress, the Division Director reviewed research progress and accomplishments in the context of the planned program. Results show continued progress in both basic and applied research.

Points of evaluation included the following:

Research focus – was it relevant and consistent with the objectives of the planned program?

Successful scholarship – were research results conveyed through peer reviewed publications?

Successful grantsmanship – was the research quality high enough to successfully compete for external grant funds?

Key Items of Evaluation