

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Global Food Security and Hunger

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	5%		13%	
202	Plant Genetic Resources	5%		6%	
206	Basic Plant Biology	5%		8%	
211	Insects, Mites, and Other Arthropods Affecting Plants	10%		5%	
212	Pathogens and Nematodes Affecting Plants	10%		5%	
301	Reproductive Performance of Animals	10%		5%	
302	Nutrient Utilization in Animals	5%		10%	
303	Genetic Improvement of Animals	5%		6%	
304	Animal Genome	5%		7%	
311	Animal Diseases	5%		13%	
502	New and Improved Food Products	5%		5%	
606	International Trade and Development	5%		4%	
610	Domestic Policy Analysis	5%		4%	
611	Foreign Policy and Programs	5%		5%	
704	Nutrition and Hunger in the Population	10%		0%	
722	Zoonotic Diseases and Parasites Affecting Humans	5%		4%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	8.6	0.0	202.8	0.0

Actual Paid Professional	32.9	0.0	140.8	0.0
Actual Volunteer	7.2	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
507702	0	1126589	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1081281	0	6853350	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1610461	0	12355489	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Work in this area focuses on and captures the efforts of multidisciplinary program teams across the system to provide the science and outreach required to boost U.S. agricultural production, improve global capacity to meet the growing food demand, and foster innovation in fighting hunger by addressing food security for everyone, but especially for vulnerable populations. Research and extension program areas addressing agriculture productivity are rooted in an understanding of the underlying genetic mechanisms as they relate to the fundamental biology of plants and animals and translating that information into practice. Improving the productivity of plant and animal systems is a balance between maximizing the genetic potential of organisms and minimizing losses due to pests and poor agricultural practices. Programs help producers increase production, while improving sustainability. New discoveries in biotechnology add value as exports to developing nations.

Research and extension continues to provide growers with science-based information to enhance production without negative environmental impact. As world populations increase, U.S. food production capability will become instrumental in addressing the need for more food. Penn State-developed technology and modern science-based resources can be a solution to help solve world hunger when exported and adopted by food-producing nations around the world. Hunger is real, but can be minimized, if not eliminated, by adoption of sustainable food production methods based on research and extension programs that focus on efficiently increased production with a sustainability and environmental stewardship focus.

Processing and manufacturing of food products is a major economic contributor for local, state, regional, and national food sectors. Pennsylvania is a leader in the industry. Research and extension programs continue to partner with the food manufacturing and processing industries to ensure safe, wholesome products entering the food chain from Pennsylvania growers and processors.

2. Brief description of the target audience

- Agricultural Producers/Farmers/Landowners
- Agriculture Services/Businesses
- Nonprofit Associations/Organizations
- Business and Industry
- Community Groups
- Education
- General Public
- Special Populations (at-risk and underserved audiences)
- Government Personnel
- Human Service Providers
- Military
- Students/Youth
- Volunteers/Extension Leaders

3. How was eXtension used?

Several Extension team members in dairy, equine, livestock, poultry, family consumer sciences, and veterinary medicine are topic experts for eXtension.org, and have answered questions from participants of the ask-the-expert program.

Two members of the equine team participate in the Horsequest community of practices. They have conducted national webinars dealing with equine environmental stewardship through MyHorseUniversity and HorseQuest eXtension. They have answered 69 questions dealing with equine health and management and have hosted meetings. They have added content for the HorseQuest eXtension Facebook and Twitter accounts. The Penn State Extension Equine website (<http://extension.psu.edu/animals/equine>) and on-line materials (newsletter, events, fact sheets, PowerPoints, etc.) were developed to provide educational opportunities for managers of equine operations. From our site they have shared articles and releases with eXtension on Facebook and off the national site to supplement the PSU equine programming.

eXtension's Extension Alliance for Better Child Care is cross-referenced on our website as a means of providing additional resources for early learning and school-age practitioners.

eXtension was not used by every team, but at least one indicated intentions to begin using it next year.

V(E). Planned Program (Outputs)

1. Standard output measures

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

Patent Applications Submitted

Year: 2013

Actual: 3

Patents listed

Serial No. 11/060,136; Filed 2/17/2005; Title: Gas Treatment Chamber

Serial No. 13/563,065; Filed 7/31/2012; Title: Methods and Compositions for Improving the Nutritional Content of Mushrooms and Fungi

Serial No. 13/668,859; Filed 11/5/2012; Title: High Lycopene Content Tomato Plants and Markers for Use in Breeding for Same

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	27	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of college-initiated technology disclosures.

Year	Actual
2013	2

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2013	33675

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)
2	Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)
3	Genes sequenced on the bovine Y chromosome.
4	Species of fusaria fungi associated with invasive, nonnative ambrosia beetles described.

Outcome #1

1. Outcome Measures

Percentage of extension class/workshop participants who expect to implement/adopt practices. (This is a short-term outcome measure.)

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Percentage of extension class/workshop participants who respond to a follow-up survey with a self-report that they have implemented/adopted practices. (This is a medium-term outcome measure.)

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Genes sequenced on the bovine Y chromosome.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1274

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

For 60 years, cattle breeders selected for milk or beef production, but animal fertility dropped concurrently. U.S. farmers measure cow fertility by daughter pregnancy rate (DPR)--the percentage of nonpregnant cows that become pregnant during a 21-day period. DPR of Holsteins declined by about 7% (28 days open) from 1960-2000. Every 1% increase in DPR is likely worth at least \$8-10/U.S. dairy cow/year. A lack of knowledge about genes on the male Y chromosome contributed to low fertility.

What has been done

Penn State researchers identified 1,274 genes on the bovine Y chromosome, significantly more than that of other mammals. This discovery may help biologists better understand how cattle and other mammals evolved, and help animal breeders better maintain and enhance cattle fertility. We can now better understand how to maintain male genetic diversity, particularly in a breed such as Holsteins that has been extensively selected and whose breeding is almost all based on artificial insemination.

Results

Understanding genetic diversity may give farmers another tool for managing their herds to improve male fertility. Cows bred to high-fertility bulls yield more profit, because they bear more calves earlier in the season who can gain more weight before weaning and marketing. Fertility issues occur in 15-20% of beef bulls. A 1% increase in fertility in the U.S. beef industry equals a net profit of \$55-60 million. The ability to understand factors affecting higher fertility in bulls and other livestock species could help feed millions of food-insecure people and would be worth billions of dollars globally.

The female bovine genome sequence was published in 2009. The findings of the bovine Y chromosome study are a significant contribution to the completion of the bovine genome project.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
304	Animal Genome

Outcome #4

1. Outcome Measures

Species of fusaria fungi associated with invasive, nonnative ambrosia beetles described.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	9

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Ambrosia beetles, which first appeared in the U.S. in CA in 2011, bore into trees and cultivate Fusarium fungi as food. The fungi carried by the ambrosia beetle damage or kill trees, including avocado crops in the U.S., Israel, and Australia. Avocado sales in 2011 were \$2.9 billion, up 11% from 2010. Sales in the first half of 2012 were 30% greater than in the same period of 2011. Ambrosia beetle infestation is also a global concern because they can be transported worldwide in wood pallets.

What has been done

Penn State researchers published an article describing the diversity of 9 fusaria fungi associated with ambrosia beetles. The fungi include 4 lineages that currently threaten avocado crops. The beetle threatening avocado crops is similar to many others, including one that attacks Ailanthus trees. The researchers are studying this system to see how the beetles and fungi interact.

Results

Over the past 4 or 5 years, ambrosia beetle populations have increased, and there is evidence that the fungi associated with the beetles easily form hybrids. Researchers are worried that hybrid versions of either the beetle or fungus could pose a larger threat to farms and forests. Understanding the molecular phylogeny of the genus Fusarium and characterizing new and emerging lineages will help researchers guard against the possibility of more virulent hybrids able to infest more species of plants. It may also help control the spread of the beetles and/or the fungi.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants

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.)
- Other (Extramural Funding)

Brief Explanation

Natural Disasters (drought, weather extremes, etc.)

· There have been weather extremes with too wet or too dry conditions that had major implications for somatic cell count and feed quality and quantity. This can have huge impacts on a producer's income, due to decreased milk production and milk premium earned, and increased feed costs.

- Floods and droughts create issues with needing to reseed experimental plots and adapt plans in other ways.
- Circumstances resulting from natural disasters require more of our time to serve a limited amount of people.

Economy

- The volatility of the grain and milk markets has forced dairy producers to be more involved in how to use risk management to cover their margin and produce an increased amount of high quality milk.
- Because of the recession, banks are requiring a cash flow plan before any consideration will be given to making loans, so our programs are popular.
- Increase in expense of grains made profitability of operations decrease, and therefore, many producers were unable to attend meetings or afford suggested changes in production techniques.
- Economy continues to increase pest problems due to abandoned properties from bank foreclosures.

Appropriations changes

- Appropriation Changes affected both the research and extension functions of the College of Agricultural Sciences and resulted in fewer faculty and staff across all areas of the college.

Public Policy changes

- Public Policy Changes continue to meet the public health need related to Lyme Disease and other vectored diseases.

Government Regulations

- The Chesapeake Bay is under the microscope for improving impaired watersheds for nitrogen and phosphorus. Feed management is being recognized as an important means of reducing the nutrients before being excreted. It also allows improvements in feed efficiency and reductions in manure volume.
- Because of the new Pennsylvania state regulation, the equine team took this opportunity to reach horse farm managers with writing manure management plans. We began advertising the Equine Environmental Stewardship course as a workshop to help with the development of a farm's manure management. This increased our participation in the program.
- Government Regulations are counterintuitive to following IPM. An NPDES permit is now needed for mosquito control.

Competing Public priorities

- Competing Public Priorities force us to continually align our program priorities with budget realities.

Competing Programmatic Challenges

- The College of Agricultural Sciences' restructuring process allowed for continued focus on cost-effective program deliverables and strategic elimination of programs.

Populations changes (immigration, new cultural groupings, etc.)

- Population Changes continue to create new pest concerns, from bed bugs to introducing dengue fever.

Other - Extramural Funding

- Extramural Funding continues to decline.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The generation of outcomes from existing programs and the development of new programs require improved evaluation that identifies pre- and post- responses to information and monitoring for long-term behavioral changes that result in improved environmental outcomes. The evaluations conducted thus far provide initial measures of implementation, but long-term monitoring is needed to ensure that the practices are successfully managed over time. We are attempting to incorporate more economic valuations of the results of our research and extension work.

Key Items of Evaluation

See highlights of state-defined outcomes in this planned program.