V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Food Safety

☑ 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
306	Environmental Stress in Animals	5%		5%	
307	Animal Management Systems	5%		5%	
311	Animal Diseases	5%		5%	
315	Animal Welfare/Well-Being and Protection	5%		5%	
402	Engineering Systems and Equipment	5%		5%	
501	New and Improved Food Processing Technologies	13%		13%	
503	Quality Maintenance in Storing and Marketing Food Products	13%		13%	
504	Home and Commercial Food Service	13%		13%	
601	Economics of Agricultural Production and Farm Management	5%		5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	13%		13%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	13%		13%	
723	Hazards to Human Health and Safety	5%		5%	
	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	17.4	0.0	12.7	0.0
Actual Paid Professional	19.1	0.0	12.8	0.0
Actual Volunteer	0.4	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**
683508	0	325185	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1529014	0	811295	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
909996	0	324775	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Food safety concerns have revealed the complex nature of the modern food system with its multifaceted distribution networks that extend from the farm-gate to the consumer's plate. Research and extension programs focus on issues of food quality and safety to address concerns of producers, processors, and consumers. Collaboration with industry partners to mitigate the risks of food safety incidents and to develop functional and improved nutritional characteristics of foods and ingredients are an important driver of food science and related research. New technologies are required for producing and processing foods that retain or enhance nutritional value, while ensuring quality and safety. Enhanced diagnostic tools are being developed to detect, identify, and track foodborne pathogenic microorganisms, with a focus on approaches that will reduce the potential of food contamination at multiple levels in the food system.

Scientists and communicators with strengths in plant and animal sciences, food science, animal and human nutrition, veterinary medicine, economics, and business contribute to research and extension on complex, interrelated aspects of food safety. Extension programming addresses food safety issues with consumers, producers, and the processing industry by providing training for certifications and informing the public and industry of food safety guidelines, policies, and recommendations. This enhances Pennsylvania's role as a reliable producer and supplier of high quality, safe, and nutritious food and food products and helps ensure Pennsylvania's economic future.

2. Brief description of the target audience

- Agricultural Producers/Farmers/Landowners
- Agriculture Services/Businesses
- Nonprofit Associations/Organizations
- Business and Industry
- Education
- General Public
- Government Personnel
- Community Groups
- Human Service Providers
- Students/Youth

- Special Populations (at-risk and underserved audiences)
- Volunteers/Extension Leaders

3. How was eXtension used?

The consumer food safety program does not use eXtension. The team, in collaboration with the food safety and quality team, has established a food safety hotline/listserv for internal customers. This hotline/listserv allows client calls to the counties to be posted to the team with an available educator responding to the call in a short time. This allows counties that do not have access to a food safety educator or who have an educator but the person is not available to respond to client needs in an efficient and timely manner.

eXtension was not used in retail manager training or wine quality.

V(E). Planned Program (Outputs)

1. Standard output measures

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

Patent Applications Submitted

Year:	2013
Actual:	2

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

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	3	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of college-initiated technology disclosures.

Year	Actual

2013	0

Output #2

Output Measure

- Number of participants in extension education classes and workshops.

Year	Actual
2013	6808

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	Food safety professionals certified in Hazard Analysis and Critical Control Points training this program year.
4	Finding that the heat generated during the traditional composting process to make mushroom growth substrate is adequate to eliminate human pathogens.
5	Percent of PA winery representatives attending a Penn State extension winery sanitation workshop that learned that a simple method adjustment would make their wine of higher quality and reduce potential costs of rebottling because of re-fermentation in the bottle.
6	Potential increase (in $) in bird quality and livability if 5% of Pennsylvania broiler farms used CUBO-S fans in poultry houses, resulting in 5% greater bird performance.
7	Work towards improved understanding of the biology and pathogenesis of mycobacterial diseases, and the development of improved diagnostic tests and new vaccine for Johne's disease.

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**

Food safety professionals certified in Hazard Analysis and Critical Control Points training this program year.

2. **Associated Institution Types**

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	165

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Food Safety Modernization Act (FSMA) has had and will have an enormous impact on the food supply chain in the coming years. It will especially affect farmers and food processors as they grapple with new regulations. Foodborne illnesses and food recalls continue to grab news headlines, with a dramatic impact on the food chain. Food producers and processors have need for improved practices under increased scrutiny from the public, law makers, and regulators.

What has been done

Of increased importance with changing regulations, specifically FSMA, is Hazard Analysis and Critical Control Points (HACCP) training, which provides a risk-based control approach to ensuring safety in food production. This training is required for meat and poultry processors and will be required for all PA food manufacturers who fall under U.S. Food and Drug Administration jurisdiction. In this reporting period, Penn State Extension trained and certified 165 participants in HACCP.

Results
An estimated 48 million foodborne illnesses, including 3,000 deaths, occur each year in the United States (Centers for Disease Control and Prevention, 2010). Two 2012 studies estimated the costs of illnesses caused by 14 major foodborne pathogens at about $15 billion per year in the U.S. (USDA-ERS).

Fundamentals of HACCP is a 3-day course taught by certified instructors with extensive experience in food safety training. Particular emphasis is on FDA-regulated food products, including fresh-cut fruits, vegetables, and mushrooms, juice and cider, baked goods, confections, snack foods, and egg and dairy products.

More companies and industries need a HACCP-certified employee under the FSMA, so demand for the training is rising. FSMA regulations apply to smaller companies that previously were exempt from such requirements.

Penn State's HACCP training supports the economic well-being of the sizable food industry in PA and the region.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #4

1. Outcome Measures

Finding that the heat generated during the traditional composting process to make mushroom growth substrate is adequate to eliminate human pathogens.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Strict requirements on the use of animal manures in fresh produce production imposed by the new federal Food Safety Modernization Act (FSMA) threatened to adversely affect the mushroom industry, which relies on horse and poultry manure for a specialized growth substrate.

What has been done
Penn State researchers conducted studies that show the heat generated during the traditional composting process--originally developed to kill insect and fungal pests of mushrooms--is adequate to eliminate human pathogens that might be present.

As a result of these findings, there will be no restrictions on the mushroom industry composting process. More than 3.5 million cubic yards of mushroom compost are produced yearly in PA.

Results
The FSMA may be the most sweeping reform of U.S. food safety laws in more than 70 years. Its intent is to change the way we as a country ensure the safety of our food supply. Instead of responding to an occurrence of contamination or an outbreak of foodborne illness, food industries now are challenged to be proactive in recognizing potential food-safety hazards in their operations and establishing control measures to prevent them from occurring.

Mushroom shipments set record levels in 2012, and they were up another 6% in early 2013. U.S. mushroom sales totaled 900 million pounds for the 2011-12 crop, at a value of $1.10 billion. Pennsylvania accounts for 61% of total U.S. mushroom production.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #5

1. Outcome Measures

Percent of PA winery representatives attending a Penn State extension winery sanitation workshop that learned that a simple method adjustment would make their wine of higher quality and reduce potential costs of rebottling because of re-fermentation in the bottle.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Penn State's wine quality improvement series assists people with the decision to start a winery, discusses the equipment needed for safe winemaking, and assists wineries with implementing quality assurance programs based on standardized wine sensory evaluation techniques.

What has been done
In the winery sanitation workshop, 100% of the audience (41 attendees) learned that they had been making a critical error in mixing their acidulated sulfur dioxide sanitizer solutions. Instead of using hot water to make the sanitizer, cold water should be used because it more effectively retains sulfur dioxide, the antimicrobial agent, in solution. Ensuring proper sanitation helps prevent wine from re-fermenting after it is bottled, which can cause bottles to bubble through or expel the closure.

Results
If wine begins to re-ferment in storage, the winery has to collect and open each bottle to reprocess it. This could cost approximately $1,000-$3,000 or more in supplies for a batch of 500 bottles (750 mL each). This does not include the cost of the previous packaging (i.e., bottle, label, closure) that may now be useless or the labor for reprocessing.

Even greater costs are incurred when re-fermentation occurs at the consumers' residences. Then costs associated with insurance and property damage are usually involved, as well as possibly irreparable damage to the winery's brand.

The Pennsylvania Liquor Control Board reports that PA wine production increased from 560,000 gallons in 2000 to 1.8 million gallons in 2010. The state's wine, wine grape, and related industries generated about $870 million in economic value in 2007, including $32 million in retail wine sales (MKF Research, 2009).

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and

Naturally Occurring Toxins

Outcome #6

1. Outcome Measures

Potential increase (in $) in bird quality and livability if 5% of Pennsylvania broiler farms used CUBO-S fans in poultry houses, resulting in 5% greater bird performance.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1080000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Air and litter quality are critical for bird health and performance. Investing in technologies that enhance poultry house environmental quality must also improve bird performance to be economically viable. Some undesirable conditions in a poultry house include cooler temperatures for chick brooding and high litter moisture and ammonia release. CUBO-S fans may reduce the concentration of noxious gases, improve temperature uniformity, enhance bird performance, and reduce energy expenditures.

What has been done
The objective of this research was to evaluate the impact of CUBO-S fans, which mix air and eliminate temperature and noxious gas stratification, in commercial broiler housing on the bird performance, poultry house environmental conditions, and energy consumption. Use of these fans resulted in greater bird performance and revenue in two field evaluations.

Results
Results of two trials indicated that CUBO air mixing equipment consistently resulted in a warmer environment at bird level and reduced temperature stratification at the ceiling. Propane consumption declined by 6.6 and 13.0% in trials I and II, respectively, and body weight and feed:gain ratio consistently improved. Other significant observations included lower house ammonia levels, higher litter temperature, better litter scores and livability, and fewer carcass condemnations at processing. These findings indicate the potential for CUBO fans to improve energy consumption, poultry house environmental conditions, and broiler performance on commercial farms.

The Pennsylvania broiler industry is worth about $432 million per year. If 5% of the industry used these fans and obtained a 5% improvement in bird quality and livability, that would equal $1.08 million annually. Increased farm profitability preserves farmland and ecosystem services, and helps maintain rural community life.

4. Associated Knowledge Areas

KA Code	Knowledge Area
306	Environmental Stress in Animals
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection
402	Engineering Systems and Equipment
601	Economics of Agricultural Production and Farm Management

Outcome #7

1. Outcome Measures

Work towards improved understanding of the biology and pathogenesis of mycobacterial diseases, and the development of improved diagnostic tests and new vaccine for Johne's disease.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Johne's disease (pronounced "yo-knees") (JD) is a contagious, chronic, inflammatory intestinal disease to which all ruminants are susceptible. JD, which is usually fatal, is caused by Mycobacterium avium subspecies paratuberculosis, a hardy bacteria related to the agents of leprosy and tuberculosis. The disease occurs worldwide. Recent evidence of the presence of M. paratuberculosis in retail milk sources is of concern from a milk quality and potential food safety standpoint.

What has been done
Penn State researchers are working to improve our understanding of the biology and pathogenesis of mycobacterial diseases and the host response to infection, and to develop and

implement new generations of diagnostic tests and a vaccine for JD.

Results

JD remains a major concern for producers. There are very high prevalence rates: 68% of all U.S. dairy herds and 95% of those with more than 500 cows have at least one JD-positive animal. A national study of US dairies (Dairy NAHMS 96) found that on approximately 22% of U.S. dairy farms at least 10% of the herd is infected with JD.

JD results in more than $200 million in annual losses to the U.S. dairy industry each year. This loss reflects reduced milk production, early culling, and poor conditioning at culling. The cost of JD in beef herds and other species is still to be determined.

Understanding more about the biology and pathogenesis of the disease and the development of efficient and effective diagnostic tests and vaccines could help cut down these economic losses and potentially make the milk supply safer.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

· The widespread late-season frost in late May hindered attendance for our annual research symposium.

Economy

· Most of the information obtained from people who did not attend workshops for this reporting period indicated that cost and time were the greatest hindering factors.

· Increasing public awareness of food safety and potential economic impact of a foodborne illness outbreak on an organization have led nonprofit organizations that depend on food fundraisers for financial survival to seek food safety training for their volunteers.

· There has been a renewed interest is gardening, which has led to more inquiries about how to preserve fruits and vegetables.
· The availability of the Internet has allowed the home consumer to access a lot of information. However, much of the information on preserving food available via the Internet is often biased, lacking evidence-based research and safety information.

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.

Government Regulations
· Public awareness of foodborne illness has been enhanced by the ability to view restaurant health inspections online.

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.)
· The workforce in restaurants and food service operations is diverse, including many people with limited English speaking and reading skills.

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.