

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

### **Program # 1**

#### **1. Name of the Planned Program**

Agricultural Systems

- Reporting on this Program

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

1. Program Knowledge Areas and Percentage

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
102	Soil, Plant, Water, Nutrient Relationships	5%		5%	
112	Watershed Protection and Management	5%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	5%		5%	
204	Plant Product Quality and Utility (Preharvest)	5%		5%	
205	Plant Management Systems	5%		5%	
206	Basic Plant Biology	5%		5%	
212	Pathogens and Nematodes Affecting Plants	5%		5%	
213	Weeds Affecting Plants	5%		5%	
216	Integrated Pest Management Systems	5%		5%	
302	Nutrient Utilization in Animals	5%		5%	
305	Animal Physiological Processes	5%		5%	
307	Animal Management Systems	5%		5%	
315	Animal Welfare/Well-Being and Protection	5%		5%	
501	New and Improved Food Processing Technologies	5%		5%	
601	Economics of Agricultural Production and Farm Management	5%		5%	
604	Marketing and Distribution Practices	5%		5%	
606	International Trade and Development	5%		5%	
608	Community Resource Planning and Development	5%		5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	5%		5%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	5%		5%	
	<b>Total</b>	100%		100%	

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

1. Actual amount of FTE/SYs expended this Program

<b>Year: 2012</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	103.0	0.0	93.0	0.0

Actual Paid Professional	94.8	0.0	203.4	0.0
Actual Volunteer	1.1	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
3645883	0	3204130	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
7168449	0	10228573	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
3134047	0	10557877	0

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

**1. Brief description of the Activity**

Penn State research activities in agricultural systems during the last reporting period include, among many other things, investigation of pathogen effects on plant odors to mediate vector attraction and host exposure; pioneering use of the Profitability Assessment Dairy Tool and the Income Over Feed Cost (IOFC) Tool to improve dairy farm profitability; profiles of the largest and most influential Chinese international furniture supply trade shows, to allow PA lumber exporters efficient and effective use of marketing budgets; development of new fresh-market and processing tomato breeding lines with improved resistance to early and/or late blight or high in lycopene; exploration of weed suppression measures in organic cropping systems; development of production and marketing strategies for colored potato chips; developing dairy cows that efficiently convert feed resources into milk; assessment of vaccine and antibiotic usage on PA beef farms; evaluating the benefits of humates in fruit production; and testing and optimizing high-pressure processing, a new treatment for ground beef against 6 important and virulent Shiga toxin-producing E. coli.

Extension activities in agricultural systems during the last reporting period include, among many other things, workshops on Good Agricultural Practices (GAP), requirements for the Food Safety Modernization Act, and other food safety requirements; workshops for the green industry on pest, weed, and disease identification, soil management, and environmentally sound operations; and nutrient management workshops.

**2. Brief description of the target audience**

Insect and plant scientists; crop scientists; extension educators; pest control specialists; certified crop advisors; IPM practitioners; dairy producers; ag processing industries; local governments; business development centers; academics; veterinarians; agricultural producers/farmers/landowners; agriculture services/businesses; nonprofit associations/organizations; business and Industry; community groups; education; general public; government personnel; special populations (at-risk and underserved audiences); students/youth

**3. How was eXtension used?**

The Penn State Equine Extension Stewardship Program has used the national eXtension Horse

Quest and My Horse University online sites for webinars, frequently asked questions, and as a resource for articles for their Equine PSU Horse Extension website. This and other projects have advertised programming and activities through the website's national events promotion. Team members have served on the national eXtension programming planning committee, chaired sections and communities of practice, and presented PSU research on national webinars.

Penn State Cooperative Extension supports faculty and staff use of eXtension and promotes communities of practice as a way of broadening sources of information and outreach. Penn State Cooperative Extension supports the professional development offered through eXtension.org. Pennsylvania is represented by 152 eXtension members in 47 of the 73 approved CoPs.

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

**1. Standard output measures**

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	127371	2004503	5275	2177

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

**Patent Applications Submitted**

Year: 2012  
 Actual: 9

**Patents listed**

Serial No. 13/563,065; Filed 7/31/12; Title: Methods and Compositions for Improving the Nutritional Content of Mushrooms and Fungi

Serial No: 13/435,761; Filed: 3/30/12; Title: Compositions and Methods Relating to Continuation Transgenic Plants and Cellulosic Ethanol Production

Serial No: 61/697,400; Filed 9/6/12; Title: Activated Carbon for the Removal of Chemicals from Water

Serial No: 61/622,955; Filed 4/11/12; Title: Methods to Enhance Conversion of Cellulosic Biomass

Serial No: 61/582,703; Filed: 1/3/12; Title: Activated Carbon Material

Serial No: 61/603,580; Filed: 2/27/12; Title: Methods and Compositions Relating to Starch Fibers

Serial No: 61/618,026; Filed: 3/30/12; Title: Compositions and Methods Relating to Avocado Seed Extracts

Serial No: 13/443,339; Filed: 4/10/12; Title: Apparatus and Method for No-Till Inter-Row Simultaneous Application of Herbicide and Fertilizer, Soil, Preparation, and Seeding of a Cover Crop in a Standing Crop

Serial No: 13/574,625; Filed: 7/23/12; Title: Method of Increasing Soil Resource Capture in a Plant

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

**Number of Peer Reviewed Publications**

2012	Extension	Research	Total
Actual	0	0	422

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

**Output Target**

**Output #1**

**Output Measure**

- Number of invention disclosures submitted.  
Not reporting on this Output for this Annual Report

**Output #2**

**Output Measure**

- Number of people enrolled and/or registered in programs.  
Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- Number of invention disclosures submitted in support of all programs related to Agricultural Systems

Year	Actual
2012	11

**Output #4**

**Output Measure**

- Number of people enrolled and/or registered in all programs related to Agricultural Systems

Year	Actual
2012	124533

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

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

O. No.	OUTCOME NAME
1	Number of participants who were evaluated and demonstrated increased knowledge and skills.
2	Number of participants who were evaluated in a follow-up and who implemented/adopted practices.
3	Number of volunteers that helped with program leadership or delivery.
4	Number of participants in all programs related to Agricultural Systems who were evaluated and demonstrated increased knowledge and skills.
5	Number of participants in all programs related to Agricultural Systems who were evaluated in a follow-up and who implemented/adopted practices.
6	Investigated pathogen effects on plant odors to mediate vector attraction and host exposure
7	Number of farms that completed use of the Profitability Assessment Dairy Tool and the Income Over Feed Cost Tool to improve dairy farm profitability
8	Peer-reviewed journal article profiling the largest and most influential Chinese international furniture supply trade shows, to allow PA lumber exporters efficient and effective use of marketing budgets
9	Development of new fresh-market and processing tomato breeding lines with improved resistance to early and/or late blight or high in lycopene
10	Exploration of weed suppression measures in organic cropping systems
11	Development of production and marketing strategies for colored potato chips
12	Research aimed at developing dairy cows that efficiently convert feed resources into milk
13	Percentage of attendees at a workshop on Good Agricultural Practices (GAP) who, after completion of the workshop, said they now have adequate resources to write their own food safety plan
14	Percentage of clients who participated in Green Industry educational offerings and who, upon follow-up, had made changes and/or implemented new practices suggested by the educator
15	Percentage of nutrient management workshop participants who, on follow-up, had implemented and/or adopted practices from the workshop
16	Assessed vaccine and antibiotic usage on PA beef farms
17	Evaluating the benefits of humates in fruit production

### **Outcome #1**

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

Number of participants who were evaluated and demonstrated increased knowledge and skills.

Not Reporting on this Outcome Measure

### **Outcome #2**

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

Number of participants who were evaluated in a follow-up and who implemented/adopted practices.

Not Reporting on this Outcome Measure

### **Outcome #3**

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

Number of volunteers that helped with program leadership or delivery.

Not Reporting on this Outcome Measure

### **Outcome #4**

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

Number of participants in all programs related to Agricultural Systems who were evaluated and demonstrated increased knowledge and skills.

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

- 1862 Extension
- 1862 Research

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

Change in Knowledge Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2012	15580

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

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

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

#### **Results**

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

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
307	Animal Management Systems
501	New and Improved Food Processing Technologies
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
606	International Trade and Development
608	Community Resource Planning and Development
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

### **Outcome #5**

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

Number of participants in all programs related to Agricultural Systems who were evaluated in a follow-up and who implemented/adopted practices.

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

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	8931

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
307	Animal Management Systems
501	New and Improved Food Processing Technologies
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
606	International Trade and Development
608	Community Resource Planning and Development
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and

## Naturally Occurring Toxins

### **Outcome #6**

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

Investigated pathogen effects on plant odors to mediate vector attraction and host exposure

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

- 1862 Research

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

Change in Knowledge Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2012	0

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

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

Pathogens can alter host phenotypes in ways that influence interactions between hosts and other organisms, including insect disease vectors. Such effects have implications for pathogen transmission, as well as host exposure to secondary pathogens, but are not well studied in natural systems, particularly for plant pathogens.

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

Determined that a bacterial pathogen of gourds changes the volatile emissions of the plant to attract vectors (beetles) for spread.

##### **Results**

The beetle-transmitted bacterial pathogen *Erwinia tracheiphila*, which causes a fatal wilt disease, alters the foliar and floral volatile emissions of its host (wild gourd, *Cucurbita pepo* ssp. *texana*) in ways that enhance both vector recruitment to infected plants and subsequent dispersal to healthy plants. Moreover, infection by zucchini yellow mosaic virus (ZYMV), which also occurs at the study sites, reduces floral volatile emissions in a manner that discourages beetle recruitment. This therefore likely reduces the exposure of virus-infected plants to the lethal bacterial pathogen, a finding consistent with our previous observation of dramatically reduced wilt disease incidence in ZYMV-infected plants.

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

<b>KA Code</b>	<b>Knowledge Area</b>
212	Pathogens and Nematodes Affecting Plants

## **Outcome #7**

### **1. Outcome Measures**

Number of farms that completed use of the Profitability Assessment Dairy Tool and the Income Over Feed Cost Tool to improve dairy farm profitability

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

- 1862 Extension
- 1862 Research

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

Change in Condition Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2012	38

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

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

Improvements in dairy farm profitability can be made through focus on increasing income over feed costs (IOFC) and by systematically identifying bottlenecks in production and financial management using benchmarking. Effective use of evaluation assessments like the Profitability Assessment Dairy Tool (PA Dairy Tool) and the IOFC Tool can help producers to target the most economically beneficial areas for changes to improve their bottom line.

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

A study used the PA Dairy Tool and IOFC Tool to (i) identify bottlenecks limiting dairy farm profitability on Pennsylvania dairy farms and (ii) show dairy producers how to make improvements to both overall profitability and IOFC. 38 farms completed both tools in year 1.

Offered Best Milking Practices workshop in Spanish and English. Said one farmer: "Our Spanish-speaking milkers [now] have a better understanding of...how to do their job."

Offered Managing Your Milk Margin to Improve Your Dairy's Cash Flow workshops.

#### **Results**

The PA Dairy Tool used year-end numbers for 2009 and showed the greatest economic losses were due to milk yield (\$296/cow/year), but the majority of farms had economic losses with replacements (age at first calving; 31 of 38 farms), udder health (somatic cell linear score >4.0; 29 of 38 farms), and reproduction (pregnancy rate; 25 of 38 farms). From January through October 2010, IOFC ranged from \$3.08 to \$10.61/lactating cow/day. A significant economic loss was from mastitis, as measured by somatic cell count (SCC).

A survey of participants of the Best Milking Practices program revealed 83% (N=17) experienced a decrease in SCC by implementing workshop recommendations. The average reduction in SCC was 162,000. This reduction from PA herd average would result in 1% less loss of production, which translates to \$4,000 increased profit per farm.

The Cash Flow Program results indicate that farms positioned to grow as much of their feed as possible stand the best chance of being sustainable over the long term, especially if they can sell the surplus.

To date, 81 of 98 NRCS-certified feed management planners in the U.S. have attended this nutrient management program.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management

#### Outcome #8

##### 1. Outcome Measures

Peer-reviewed journal article profiling the largest and most influential Chinese international furniture supply trade shows, to allow PA lumber exporters efficient and effective use of marketing budgets

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	1

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

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

China is now the largest furniture producer and exporter in the world and the leading importer of U.S. hardwoods. In 2011, U.S. hardwood lumber exports to China totaled \$506 million USD. At the international marketing level, firms must target their promotional mix more effectively and efficiently toward relevant buyers from around the world. Understanding of and use of international trade shows in China can make U.S. wood product exporters more competitive through cost-effective and efficient network building, market intelligence gathering, and product sales.

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

This study was conducted to increase awareness of the importance of US-Chinese hardwood trade and knowledge of Chinese international furniture supply trade shows (IFS-TSs). A total of 27 Chinese IFS-TSs were identified through a two-part process: a review of secondary sources and personal communication with key trade show informants in China.

#### **Results**

A peer-reviewed article in Forest Products Journal (2/12) profiled the largest and most influential Chinese IFS-TSs (n = 9) in terms of the number of attendees and exhibitors, and other relevant factors. A better understanding of these trade shows will help US hardwood manufacturers make show participation decisions. This information also has implications for suppliers and buyers from furniture and other related furniture supply sectors, such as woodworking machinery, wood-based panel products, hardware, etc., who may consider participation in Chinese IFS-TSs.

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

<b>KA Code</b>	<b>Knowledge Area</b>
606	International Trade and Development

#### **Outcome #9**

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

Development of new fresh-market and processing tomato breeding lines with improved resistance to early and/or late blight or high in lycopene

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

- 1862 Research

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

Change in Condition Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2012	0

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

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

Tomatoes are the 2nd most important vegetable crop in PA, with an annual farm value of \$41 million. Plant diseases are the number 1 concern to the industry. The most destructive diseases in PA and the Northeast are early blight (EB) and late blight (LB). The use of resistant cultivars will reduce fungicide use and production cost and improve environmental safety.

Consumption of lycopene, the red pigment in tomatoes, has been linked to decreased incidence of certain cancers, coronary heart diseases, and cataracts. Tomatoes are the major source of lycopene in the US diet.

**What has been done**

Researchers have identified new sources of EB/LB resistance in wild tomato, characterized the genetic basis of resistance, and transferred resistance to cultigen. They have developed fresh-market and processing tomato breeding lines with improved resistance to EB and/or LB.

Researchers have identified strong sources of lycopene in wild tomato, characterized the genetic basis of the trait, and transferred high lycopene into breeding lines. They have released several high lycopene fresh-market tomato breeding lines and more are to come.

**Results**

The new breeding lines will be used to develop tomato hybrid cultivars with resistance to EB and/or LB. The result will benefit tomato growers, processors, and consumers alike, because less fungicide would be needed to control these diseases.

The release of the high-lycopene lines will benefit the tomato industry and consumers.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)

**Outcome #10**

**1. Outcome Measures**

Exploration of weed suppression measures in organic cropping systems

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

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

**Issue (Who cares and Why)**

Problems of effective weed control emerge in organic cropping systems. Possible solutions

include cover crops, altering planting date, and supplemental control using mechanical cultivation.

**What has been done**

In an organic cropping system experiment, cover crops, planting date, and supplemental control using mechanical cultivation were evaluated for their weed management contribution in corn and soybean. Two rotations compared how to integrate winter canola; it was planted after corn silage or after alfalfa with or without tillage.

**Results**

Late cover crop termination resulted in greatest weed suppression in corn. This work has indicated that weed suppression benefits obtained from delayed cover crop termination may be achievable without yield loss.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
213	Weeds Affecting Plants

**Outcome #11**

**1. Outcome Measures**

Development of production and marketing strategies for colored potato chips

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2012	0

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

**Issue (Who cares and Why)**

Growers need to continually innovate with their vegetable offerings to ensure continued success.

**What has been done**

The research team identified potato lines that produce potatoes of deep, consistent skin and flesh color. They evaluated the lines for suitability as chips. They believe that the key to development of the colored potato chip market is to link the colors with sales at universities and/or sporting

events, especially football. Examples would be Temple University, whose school colors are red and white, or University of Pennsylvania, whose colors are red and blue.

### **Results**

The research team identified suitable potato varieties. The chips would be available during the football season, terminating at the end of the bowl games in January. This would eliminate the need for long-term storage and year-round procurement of the colored potatoes. Potato growers near Philadelphia might supply the colored potatoes to the facility.

Dialogue continued with potato chip companies on the potential of incorporating colored potato chips into their existing line of products and also with entrepreneurs in Philadelphia about setting up a facility. The research team also worked with politicians and community leaders to see if the necessary seed money to get the project underway was available. They also worked with personnel at the universities and colleges in the city that could potentially participate in the program.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
604	Marketing and Distribution Practices
608	Community Resource Planning and Development

## **Outcome #12**

### **1. Outcome Measures**

Research aimed at developing dairy cows that efficiently convert feed resources into milk

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

- 1862 Extension
- 1862 Research

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

Change in Knowledge Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2012	0

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

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

The long-term goal of this project is the development of dairy cows that efficiently convert feed resources into milk without compromising cow health and reproductive fitness.

**What has been done**

Research focused on how efficiently cows digest feed and the relationship of milk production efficiency with cow fertility, survival, and metabolic profiles. The performance of crossbred cows in grazing herds, telomere length variation among cows, and the associations of cow survival with herd management system were also evaluated.

**Results**

Cows genetically inclined toward higher levels of feed efficiency were demonstrated to have lower levels of fertility and blood glucose, higher levels of growth hormone, and longer life spans. These results emphasize the need for balanced breeding programs that consider all economically important aspects of dairy cattle production. Alternative measures of feed efficiency are needed due to the high cost of collecting feed intake data.

Telomeres have been suggested as an indicator of stress in humans and other animals. We demonstrated that telomeres shorten slightly with age and that cows with short telomeres were more likely to be culled.

Crossbred cows are popular in grazing environments that have a low level of concentrate supplementation. Our research suggests that Normande crossbreds maintain milk production levels during periods of slow pasture growth in a more stable manner than traditional dairy breeds, but their milk production levels were inferior to traditional dairy breeds during other periods of the year.

Results of the project were disseminated to dairy producers through popular press articles in Hoard's Dairyman and Farmshine.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
302	Nutrient Utilization in Animals

**Outcome #13**

**1. Outcome Measures**

Percentage of attendees at a workshop on Good Agricultural Practices (GAP) who, after completion of the workshop, said they now have adequate resources to write their own food safety plan

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
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2012

65

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

The Food Safety Modernization Act (FSMA) aims to ensure the U.S. food supply is safe by shifting the focus of federal regulators from responding to contamination to preventing it. This law will have a huge impact on the food industry in Pennsylvania. Emphasis is on training workers in safe food handling, sanitation, and production. This extension program focuses on Good Agricultural Practices (GAP), how to compare local farming practices with nationwide GAP standards, and how to start writing a farm food safety plan.

#### What has been done

An important audience is Amish and Mennonite produce growers (60% of participants). Changes in food safety standards and upcoming regulations threaten their livelihood. By offering them knowledge and skills needed to comply with GAP standards, these growers will maintain profitable operations while protecting consumer health.

We worked closely with a local foods distributor in Philadelphia to write a general food safety plan for plain sect farmers setting GAP standards for growers with mixed operations, including work horses. This plan was piloted with farmers in Lancaster County.

#### Results

~75% of respondents had never attended a farm food safety workshop, which reflects extension's effective outreach to newer grower audiences and the growing demand for this training. 72% of respondents grade and pack the produce in their own packing house, and around 33% pack their produce in the field for immediate delivery. Most respondents do not directly sell at least 50% of their produce directly to consumers, supermarkets, and/or restaurants, and around 85% sell some or all of their produce within the state. Around 25% sell their produce in other states within 275 miles of their farm. 91% of respondents reported the gross value of produce sales in 2011 as less than \$500,000.

On some knowledge-based questions, a decrease in correct response rate to the questions on FSMA requirements, safe use of manure-based compost, and USDA audit standards indicates a need for extension educators and specialists to emphasize these topics. The number of respondents reporting having adequate resources to write their own food safety plan nearly doubled after the workshops.

Of the 176 respondents, 132 (75.0%) indicated they preferred to receive information from Penn State Extension.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

## **Outcome #14**

### **1. Outcome Measures**

Percentage of clients who participated in Green Industry educational offerings and who, upon follow-up, had made changes and/or implemented new practices suggested by the educator

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

- 1862 Extension

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

Change in Condition Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2012	100

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

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

Workers in the green industry learned to recognize plants; match plant needs with those of the habitat; identify arthropod pests, weeds, and plant pathogens; and select the most efficient and environmentally sound fertilizer and irrigation practices. Clientele learned to soil test for organic amendments and fertilizer requirements and to obtain a complete diagnosis before applying an arthropod, disease, or weed control measure. These approaches minimize the unnecessary use of fertilizers and pesticides and help minimize the cost of maintaining plant quality.

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

The Green Industry team offered to clientele single and multiday conferences, short courses, lectures, workshops, field days, webinars, pest walks, train-the-trainer events, volunteer training, and one-to-one assistance. Educational materials were made available indirectly through blogs and newsletters; sent via e-mail or posted on the web; as newspaper articles; as posters and oral presentations at professional meetings; and as fact sheets on websites or mailed directly to clientele. The Woody Ornamental Insect, Disease, and Mite manual was updated.

#### **Results**

42 visits (105 people total) were made to greenhouses, residential and commercial landscapes, nurseries, and schools. 100% of clients made changes and/or implemented new practices suggested by the educator.

Participants were better able to choose cultural rather than chemical solutions to plant problems. Participants were better able to understand pesticide resistance and to rotate chemical mode-of-action groups. Participants were better able to time pesticide applications for maximum efficacy and to reduce pesticide use overall.

The team's gardening column in the Lock Haven Express and the Williamsport Sun-Gazette was

the national winner in the National Association of County Agricultural Agents communication awards.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
216	Integrated Pest Management Systems

#### Outcome #15

##### 1. Outcome Measures

Percentage of nutrient management workshop participants who, on follow-up, had implemented and/or adopted practices from the workshop

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	72

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

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

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.

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

The Integrated Crop Management Program uses a variety of methods delivered by both specialists and educators to teach about nutrient management. These range from webinars, email, and an online newsletter to meetings, conferences, and industry update training sessions for Certified Crop Advisors, to one-on-one activities.

###### **Results**

Nutrient management planners were trained and successfully completed the requirements for certification in PA. To date >2,000 nutrient management plans have been developed and approved. As a result, the latest Chesapeake Bay report card again gave the upper Chesapeake Bay, which is dominated by the Susquehanna River flowing out of PA, the highest score. This program continued to provide educational and technical support to government agencies and

nongovernmental organizations for the development of nutrient management programs to maximize economic benefit from nutrients while minimizing the environmental impact. A critical activity has been educational support for the development of the Chesapeake Bay total maximum daily load (TMDL) by USEPA and of the Implementation Plan for Agriculture. Related to this effort, the TMDL called for revision of the Pennsylvania Manure Management Manual; this program provided educational and technical support to do so. This program is now providing educational support to farmers for implementation of these plans on an estimated 40,000 farms in PA over the next several years.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

#### Outcome #16

##### 1. Outcome Measures

Assessed vaccine and antibiotic usage on PA beef farms

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

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

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

The improper use of vaccines and/or antibiotics in livestock can result in 'super bugs' resistant to treatment.

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

A survey was conducted amount 166 beef producers in Pennsylvania to determine the extent of vaccine and antibiotic use.

###### **Results**

Nearly half of all farms either sometimes or never used vaccines, and over one-third of those using vaccines sometimes or never used a booster. Most farms (56.4%) used vaccines on the farm. A similar percentage routinely boosted the vaccines. Most diseases targeted with vaccines were the BRD complex, scours, and pinkeye. More than 40% of farms said there were

no major health problems on the farm. This would be typical of smaller, closed herds. Over 28% of farms never used a vaccine on the farm, which generally indicates there were no health problems identified that required control measures. Many beef farms are not using a comprehensive disease prevention program through correct vaccination use.

Antibiotic use on beef farms was negligible, with more than 80% of farms treating 0-5% of their cattle, and nearly 90% of farms not using any antibiotics in the feed or water at subtherapeutic levels. These results indicate that antibiotic use on beef farms in PA is very low.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
315	Animal Welfare/Well-Being and Protection

#### Outcome #17

##### 1. Outcome Measures

Evaluating the benefits of humates in fruit production

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2012	0

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

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

Healthy agricultural soil is fertile, high in organic matter, and teeming with beneficial microbes responsible for nutrient recycling and decomposition, which produces humic acids (humates). In tree fruit production, the practice of maintaining a vegetation-free zone under trees lowers soil organic matter and humic acid. This produces a less fertile and more compacted soil that can negatively affect the orchard's vigor, yield, and longevity. To counter this effect, many commercial humic acid products claim to provide the same benefits as naturally occurring humates.

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

Researchers evaluated the effect of applying supplemental humates to orchard and vineyard soils and determined what, if any, benefits may be achieved with regard to crop performance, soil health, and nematode management.

### **Results**

In the first year of testing, statistical differences in plant growth were not observed in any of the experiments. Nematodes collected at the beginning and end of the season were identified and counted. Populations of plant-parasitic and predatory nematodes increased slightly at the end of the season but showed no significant differences between treatments. However, populations of 'free-living' nematodes increased; there were an average of 23% more free-living nematodes in humate-treated soil.

These experiments were repeated with similar results, except that free-living nematodes increased an average of 18% in the second year. Although there is still much to be learned about the role of microbial life in the soil, soil ecologists are in general agreement that an abundance of free-living nematodes is considered an indicator of a 'healthy' soil environment. These data suggest that supplemental applications of humates may have some beneficial effects. This information has been presented at grower field days in Pennsylvania and published in the Pennsylvania Fruit News.

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

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
206	Basic Plant Biology

### **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
- Other (Extramural Funding)

#### **Brief Explanation**

The FDA Food Safety Modernization Act (FSMA) aims to ensure the U.S. food supply is safe by shifting the focus of federal regulators from responding to contamination to preventing it. This law will have a huge impact on the food industry in Pennsylvania, including food manufacturers, food service, wholesale, and retail, as well as food producers. A major emphasis is placed on training workers on safe food handling, sanitation, and production practices. Penn State has been working in this area for many years, but is building programming in response to these new regulations to reflect the changes.

Outcomes were affected by varying food safety documentation and training requirements among grocery chains and produce distributors. Passage of the 2011 FSMA and upcoming produce safety standards from the U. S. Food and Drug Administration is

likely to increase interest among growers and buyers. Competition for extension educator buy-in time limited Cooperative Extension involvement, although this has improved since last year. Many educators who did not formally commit buy-in time contributed by offering workshops and presenting information at regular horticulture meetings. Extramural funding remains strong and will likely be maintained or increased due to interest in how the FSMA will affect smaller growers.

Because green industry professionals are affected by weather events, program attendance is also negatively affected. Economic issues also can affect attendance as people become more selective with registrations. The economy affects program participation for fee-based programs.

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. Very dry or wet weather has had major implications for somatic cell count. This can have huge impacts on a producer's income due to decreased milk production and decrease of milk premium earned.

Because of the recession, banks are requiring a cash flow plan before considering whether to make loans. Producers need to know their breakeven income over feed cost and milk margin so they can make smart decisions. Weather extremes can have major implications in feed quality and quantity. This can have huge impacts on purchased feed costs and whether an operation can remain profitable.

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.

Nutrient management educational programming is driven largely by state and federal policies. The nutrient management extension program is involved in providing education to policy makers as they develop policies, to the agencies and nongovernmental organizations that work with the policies, and to the farmers who must ultimately implement these on their farms. In the Chesapeake Bay watershed, we are in the midst of major changes in policy, with the development of a TMDL, a presidential executive order, and renewal of the Chesapeake Bay program. All of these are having a profound impact on the extension needs of our clientele and necessitate a flexible approach to keep up with the changes.

## **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.

### **Key Items of Evaluation**

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