V(A). Planned Program (Summary)

Program # 5

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
102	Soil, Plant, Water, Nutrient Relationships	0%	40%	0%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	7%	0%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	0%	8%	0%
204	Plant Product Quality and Utility (Preharvest)	0%	0%	0%	16%
205	Plant Management Systems	56%	20%	10%	0%
206	Basic Plant Biology	0%	0%	10%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	0%	0%	14%	10%
212	Pathogens and Nematodes Affecting Plants	0%	0%	12%	0%
215	Biological Control of Pests Affecting Plants	0%	0%	7%	0%
301	Reproductive Performance of Animals	0%	5%	8%	13%
302	Nutrient Utilization in Animals	0%	0%	9%	11%
303	Genetic Improvement of Animals	0%	0%	2%	0%
304	Animal Genome	0%	0%	3%	0%
307	Animal Management Systems	39%	20%	1%	0%
308	Improved Animal Products (Before Harvest)	0%	5%	0%	18%
311	Animal Diseases	0%	0%	8%	0%
401	Structures, Facilities, and General Purpose Farm Supplies	0%	0%	0%	32%
402	Engineering Systems and Equipment	0%	0%	1%	0%
601	Economics of Agricultural Production and Farm Management	0%	10%	0%	0%
604	Marketing and Distribution Practices	5%	0%	0%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	180.0	16.0	55.0	13.5
Actual Paid Professional	168.0	7.0	41.0	20.9
Actual Volunteer	0.0	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
2485216	2173680	3240806	652079
1862 Matching	1890 Matching	1862 Matching	1890 Matching
2645653	2571901	15155094	334932
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The development and transfer of technical resources is a critical dimension of a strategy to advance agriculture and the competitiveness of the state's agricultural economy.

•Field days, demonstration programs, plotwork and hands-on training by agents and specialists will continue to be important mechanisms for disseminating technical information on production agriculture and horticulture •Printed material, mass media, Web sites, audio, and electronic communications will be employed to disseminate the latest research findings on decision-making •Featured programs for this plan of work cycle will include: Grain Crops Academy, Master Grazer Program, Horse College and the Innovative Tobacco Producer Program •Goat Production and Management Programs •Small Farm Program at KSU will focus on needs of small and limited resource farmers, •The Kentucky Fruit and Vegetable Conference plays a major role in commercial horticultural producer education •Third Thursday programs will be conducted at KSU and their research and demonstration farms will attract small and limited resource farmers and will also serve as training for County Extension Agents •Aquaculture and Fish Disease/Management Programs •Master Cattlemen and advanced Master Cattlemen programs will be conducted •Educational programs qualifying producers to receive Tobacco Settlement funds in the areas of goats, forages, bull selection and hay storage will inprove producer skills in these areas •New Research findings from KSU's Aquaculture Research center, pawpaw, goats, and honeybees will be the subject of field days and meetings to bolster the expanding alternative in Kentucky and the Southern Region Demonstration and training for appropriate production and processing of pastured poultry and honey. •Home-based processing training •On-site food demonstrations

Ongoing research at UK supporting competitive agriculture includes: •improvements in plant pest and disease resistance •optimization of cropping system inputs for maximum cost/benefit • improvements in animal reproductive efficiency •vaccine and other intervention development to improve

animal health •engineering solutions for sustainable plant and animal production •optimization of animal nutrition •interventions to improve access to healthy food in Appalachia • biological pest control

KSU has active research areas in areas of: • Aquaculture projects are concerned with the commercialization of paddlefish, nutrition and diet formulation for freshwater crustaceans, and developing technologies for raising largemouth bass. • Doe and kid production evaluation for meat goats is a relatively new research and extension thrust for KSU. • Pawpaw and primocane blackberries are under development as niche crops in Kentucky. • The control of Nosema diseases is being researched as a potential cause of colony collapse disorder (CCD) of honey bees.

2. Brief description of the target audience

• Kentucky farmer operations with agents recruiting and selecting producers for participation in Grain Academy, Master Cattlemen, Innovative Tobacco Grower Program, Horse College, and Master Grazer Programs •Farm owners, operators, absentee land owners with a variety of backgrounds and experiences •Farmers' market members and potential members •Community and farm leaders •Consumers •Extension agents

3. How was eXtension used?

Reference materials, curriculum were used

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1932562	87466	170727	7606

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

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	40	129	169

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Graduate research assistants engaged in research
  Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Published research journal articles

Year	Actual
2012	127

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of producers adopting one or more practices resulting in increased profits.
2	Economic impact of the adoption of farming practices resulting in increased profits.
3	Number of producers adopting resource management technologies (IRM, IPM, soil testing, soil fertility management, etc.).
4	Number of producers completing Grain Academy and Master Grazer Programs receiving their certification.
5	Number of individuals reporting changes in knowledge, opinions, skills and aspirations related to impact of public policies on agriculture and the environment.
6	Availability of new tools to improve profitability in reproducing swine
7	Availability of improved biological control strategies for increased crop yields
8	Availability of improved tools to manage losses from fexcue toxicosis in forage animal systems
9	Availability of methods to increase reproductive efficiency in cattle

Outcome #1

1. Outcome Measures

Number of producers adopting one or more practices resulting in increased profits.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	13611

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With the state of the economy, many of Extension's clientele are looking for ways to increase income. Kentucky Extension has implemented programs aimed to encourage producers to adopt positive practices that will hopefully increase financial stability.

What has been done
The "Got Cedar" Workshops Series was targeted at Kentucky's private landowners in central Kentucky with eastern red cedar on their property. It was designed to educate landowners about the eastern red cedar resource and provide information that will help them manage and market it. The workshop series was a partnership of the UK Forestry Extension, local county extension agents and their offices, the Kentucky Division of Forestry, Kentucky Association of Consulting Foresters, and companies in the red cedar industry.

Results
Seventy people attended the workshop impacting 3,340 acres. Exit evaluations showed that participants had a 53.83% improvement in knowledge gained and 93.2% indicated that the workshops will help them better manage their woodlands. The long-term impacts from this program will result in participants' enhanced ability to address a variety of woodland related issues, resulting in: increased revenue, increased woodland productivity, and improved woodland health.

4. Associated Knowledge Areas

KA Code	Knowledge Area

102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
402	Engineering Systems and Equipment
604	Marketing and Distribution Practices

Outcome #2

1. Outcome Measures

Economic impact of the adoption of farming practices resulting in increased profits.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1716214

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With the state of the economy, many of Extension's clientele are looking for ways to increase income. Kentucky Extension has implemented programs aimed to encourage producers to adopt positive practices that will hopefully increase financial stability.

What has been done
KSU conducted workshops to help small farmers increase their profitability. KSU and UK

collaboratively conducted trainings using web technology to address direct marketing, budgets and economics of livestock enterprises, animal health issues, crossbreeding and selection, and nutrition.

Results
KSU's Small Farm Program assisted small farmers in increasing net farm income and product diversification. Farmers averaged an estimated $4,500 increase in income, with African-American farmers averaging an estimated $5,000 increase in farm income. Also, evaluations indicated that producers are willing to utilize web capabilities to conduct producer meetings as an alternative to costly and time-consuming travel.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)
604	Marketing and Distribution Practices

Outcome #3

1. Outcome Measures

Number of producers adopting resource management technologies (IRM, IPM, soil testing, soil fertility management, etc.).

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	25978

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The key to encouraging producers to engage in new practices is to provide exposure to what can assist them in running a more effective operation. Several programs were implemented to educate producers on proper management technologies.

What has been done
The Woodland Owners Short Course (WOSC) is targeted toward Kentucky's private woodland owners and is designed to assist them in the management of their woodlands. The WOSC is the largest woodland owner educational program offered in Kentucky and is supported by more than 10 forestry and natural resource agencies and organizations. Also, KSU sought out resources to implement resource management techniques.

Results
(1) KSU was awarded a grant from the Kentucky Agricultural Development program to purchase extraction equipment, which was distributed from Graves to Pike Counties. It was documented this year, that over $1 million of honey was extracted with the equipment. KY beekeepers were allowed to use the equipment at no cost, so that their profitability was maximized. The equipment remains available for beekeepers. (2) Experienced and inexperienced woodland owners attending the advanced WOSC track reported strong indications to use the information in managing their woodlands and 100% indicated that attending the program better prepared them to manage their woodlands. The long-term impacts from this program will result in increased revenue earned from timber sales for those using a professional forester, improved wildlife habitat, increased woodland productivity, and improved woodland health.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems
304	Animal Genome
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)
311	Animal Diseases

Outcome #4

1. Outcome Measures

Number of producers completing Grain Academy and Master Grazer Programs receiving their certification.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2012	284

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Forage production has always been common throughout the state. A grazing networks of farmers are needed to increase their knowledge and understanding of managing forages and livestock under pasture based production systems.

What has been done
Components of the Master Grazer Educational program were conducted across the state of Kentucky. These educational programs included Kentucky Grazing Schools, an Advanced Grazing School and regional grazing networks to help producers implement and more effectively manage grazing systems.

Results
After attending the Grazing schools, over 80% of the participants plan to make the following changes: Renovate pastures with legumes, increase use or start using stockpiled fescue, design a watering system to provide ready access to any grazing paddock, use temporary electric fence to create more grazing paddocks, and to use additional high tensile electric fencing. When surveyed, the majority of attendees increased their knowledge of the presented topics.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
307	Animal Management Systems

Outcome #5

1. Outcome Measures

Number of individuals reporting changes in knowledge, opinions, skills and aspirations related to impact of public policies on agriculture and the environment.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2012	23931

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The USDA and the Kentucky Agricultural Development Board have made cost share funds available for energy efficiency improvements in the past few years. Both programs require an energy assessment or audit as part of the application. The UK Biosystems and Agricultural Engineering Department was asked to help support the programs by providing technical assistance for potential program applicants.

What has been done
Subsequently, energy assessments were provided for 18 grain farms that applied for cost share funds from one or both programs. Projects evaluated in the assessments included both in-bin and stand-alone dryers. Upgraded systems included improved electronic controls and technology that manipulates grain flow through the dryer or employs heat recovery technology to improve fuel efficiency.

Results
Energy assessments provided the following estimate of benefits for the 18 projects: Avg. annual savings per grower: $4,800 per farm; Annual energy savings (%): 26% (total BTU basis)

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #6

1. Outcome Measures

Availability of new tools to improve profitability in reproducing swine

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)
A primary factor affecting profitability of swine production is sow productivity, and optimum nutrition of the sow is essential to maximizing sow productivity. An ideal nutrition program should provide adequate nutrients to maximize sow productivity while minimizing excreted nutrients and feed costs. An increase in the number of pigs marketed per sow per year, through improved sow nutrition, would result in increased profitability by allocating the fixed sow costs over more pigs. Although progress has been made in sow nutrition in the last 30 years, there is still a dearth of information relative to specific nutrient requirements of sows during gestation and lactation, especially the high milk-producing sows used today. Further research is greatly needed to completely define the levels of various nutrients necessary for optimizing reproduction and lactation, and for minimizing nutrient excretion.

What has been done
A study was completed with a new commercial form of phytase fed to sows. It's supplementation to the growing animal has a large market adoption; however, its relative value in the reproducing animal has been debated because of differences in feeding management compared to the growing animal. The product resulted in no change in reproductive performance of the sow, as would be expected, but increased digestibility of phosphorus, calcium, and total ash. Further, the increased digestibility of phosphorus resulted in less phosphorus excretion in the waste.

Results
Phytase is undoubtedly the supplemental enzyme that has brought the most value to the livestock producers and to reducing the environmental footprint of the livestock industry. Our demonstration of efficacy in sows should increase market adoption for use in reproducing animals. Assuming a dietary cost savings of $1.00/ton of feed by using phytase rather than supplemental phosphorus and an increase in market adoption by 20% of the U.S. sow herd results in a $1,200,000 savings for U.S. producers along with an expected reduction in phosphorus excretion of 15% from those sows while the phytase is being fed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals

Outcome #7

1. Outcome Measures

Availability of improved biological control strategies for increased crop yields

2. Associated Institution Types

- 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)
Characterizing the function of generalist predator food webs is important for promoting biological control solutions because understanding what predators consume in relation to food availability reveals subtle, but often important, shifts in dietary preference that can affect pest density and crop yield. Integrating natural enemy solutions into agriculture forms an opportunity to facilitate yield enhancement and economically important increases in agricultural revenue.

What has been done
Field experiments were conducted to examine the effect of habitat manipulation on the abundance and efficacy of key predators in agroecosystems. In Kentucky, a study was conducted to determine the role of weed strips on biological control in winter wheat agroecosystems.

Results
The primary yield losses in winter wheat are caused by the aphid-vectored Barley Yellow Dwarf Virus and this virus causes 17% yield loss worldwide and $31 million in annual yield losses in Kentucky alone. This research project revealed that the utilization of weed strips in Kentucky wheat not only increased the number of natural enemies, but resulted in a 10% increase in overall yield in the experimental fields. Such an increase in yield has the potential to produce significant economic benefits to winter wheat producers if results are replicated over multiple years and field sites.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants

Outcome #8

1. Outcome Measures

Availability of improved tools to manage losses from fexcue toxicosis in forage animal systems

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)
Pregnant mares grazing endophyte infected (E+) tall fescue frequently incur problems in late pregnancy such as extended gestation, thickened placenta, difficult births, lack of milk production, and potentially death of the foal and/or mare at parturition. Responses of individual mares grazing the same pastures are variable, and currently there are no convenient premonitory physiological measurements to determine which mares may experience problems of fescue toxicosis. This project investigated whether changes in vasoconstriction and blood flow parameters, as measured with Doppler ultrasonography, are satisfactory response variables to indicate which animals are consuming potentially detrimental levels of E+ fescue.

What has been done
An initial set of experiments performed in nonpregnant mares or geldings determined optimal blood vessels for study, determined the ability to detect changes in vessel and blood flow characteristics using a pharmacological agent known to cause vasoconstriction in horses, and compared manual vs. automated trace measurements. The second set of experiments determined which vessel and blood flow parameters are most affected when horses consume E+ fescue seed, the duration of feeding E+ seed necessary to induce vascular effects, and the duration after cessation of feeding for the effects to return to pre-treatment levels. The amount of seed being fed was determined by animal body weight, ergot alkaloid concentrations in the seed, and the amount the animals were willing to consume. The third set of experiments determined if uterine/placental vessels behave in the same manner as peripheral vessels when animals consume E+ fescue seed, if placental thickening can be induced in mid-gestation mares by feeding them E+ fescue seed, and, if so, correlated changes in uterine/placental blood flow with the pathology of placental thickening.

Results
There are approximately 9.2 million horses in the United States and the horse industry sustains approximately 1.4 million full-time jobs annually. The overall value of the horse industry, including goods and services in approximately $102 billion per annum. There are approximately 30 million acres of fescue in the United States and approximately 80% of that estimated is to be E+ tall fescue. Although currently there is no estimate of the economic impact of grazing E+ fescue in horses, in cattle the economic impact is reported to be approximately $600 million annually, so it is easy to understand that the economic impact of fescue toxicosis in horses could be of considerable significance. These appear to be the first experiments demonstrating that endophyte

infected fescue causes vasoconstriction in horses in vivo, and that blood flow to the reproductive tract is altered. This new knowledge and technology, may, for the first time, provide veterinarians, farm manages, and research scientists with a convenient and satisfactory response variable to determine premonitory signs of fescue toxicosis in broodmares.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
307	Animal Management Systems

Outcome #9

1. Outcome Measures

Availability of methods to increase reproductive efficiency in cattle

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)
Reproductive efficiency continues to be a major problem in lactating dairy cows. Improved procedures for estrous synchronization in heifers and lactating dairy cows are needed to increase farm income by increasing milk production, through reduced days open and genetic improvement (widespread use of artificial insemination). Early pregnancy detection is essential for the application of modern timed artificial insemination (TAI) protocols such as RESYNCH. Many producers do not have regular access to ultrasound and must rely on other methods of early pregnancy detection. A limitation to the use of blood- based detection procedures by producers is the difficulty in obtaining the blood sample. On dairy farms, it may be easier to obtain milk samples.

What has been done
Experiments were conducted to compare the accuracy of the IDEXX pregnancy detection assay after modification for the use of milk samples to the established, blood-based assay system.

Lactating Holstein dairy cows (n=19) were bred by artificial insemination and assessed for pregnancy by transrectal ultrasonography. Milk and blood plasma samples were analyzed for pregnancy associated glycoproteins (PAGs) using the IDEXX proprietary, enzyme-linked immunosorbent assay (ELISA). Results indicated that the milk PAG ELISA identifies pregnant and nonpregnant cows with a high degree of accuracy as early as 30 days after insemination and is comparable to the established, blood-based assay system.

Results

This study has identified a new, potentially more convenient tool for dairy producers to improve estrous synchronization and increase milk production. Successful implementation of RESYNCH protocols can be expected to shorten the average days open by 5-10 days (average cost of $5.00/cow/day open), saving American dairy farmers about $300 million per year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals

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 Programmatic Challenges

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

See outcomes 1-5 for results

Key Items of Evaluation

Surveys, observations, one-on-one interviews