FY2006

Annual Report of Accomplishments and Results

Kentucky

University of Kentucky
Kentucky State University

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Cooperative Extension Service (1862)
Agricultural Experiment Station (1862)
Cooperative Extension Program (1890)
Agricultural Research Programs (1890)

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Accomplishments and Results for CSREES Goal 1

Goal 1

An agricultural system that is highly competitive in the global economy. Through research and education, empower the agricultural system with knowledge that will improve competitiveness in domestic production, processing, and marketing.

Overview

The Kentucky Cooperative Extension Service made 1,741,175 contacts (including duplications) with clientele related to improving agricultural production, processing, and marketing in FY06. 60,121 of these contacts were made with clientele related to the expanding concept of 'mastery' of specific program concepts. In Kentucky we are certifying producers in the areas of Master Gardener, Master Cattlemen, and Master Grazer and have expanded that concept to include the additional programs of Advanced Master Cattlemen, the Grain Academy and Master Food Volunteers this year. We are piloting the Master Grazer Program for Horses. The 'mastery' programs offer opportunities for repeat contacts with clientele which have shown to more consistently bring about desired practice changes. 63,239 contacts were related to Farmer Markets, home- based businesses and processing, and micro- processing, reflecting the expanding agritourism industry in Kentucky. Kentucky County Extension Agents sponsored or supported 179 Farmers Markets in 94 Kentucky Counties in FY06. Contact figures also show continued and significant increases in the areas of livestock (+12.5%), Master Cattlemen (+8.5%) and Economics and Marketing (+24%) over last year's figures. This reflects targeted efforts to address the declining significance of tobacco in Kentucky's economy. Kentucky State University's Small Farm Program made 28,644 contacts with limited resource farmers (+21% over FY 05). Thirty-four percent of these contacts were with women. In part, the success of this expansion can be attributed to the success of the "Third Thursday" Programs.

These efforts resulted in 18,833 farmers adopting one or more production practices recommended by Extension while 23,409 producers adopted new resource management technologies such as IRM, IPM, and soil fertility management. Adoption of these practices resulted in $25,400,090 of additional profits to farmers. 9,446 producers utilized new marketing opportunities while 33,992 Kentuckians learned about the impact of public policy on agriculture and the environment.

The Kentucky Agricultural Experiment Station conducted the equivalent of 83 GPRA percentages related to this goal during 2005. These projects focused on such topics as developing and understanding of the genomic control of plant productivity, quality traits and adaptability of agricultural products, understanding the forage-animal interface, addressing

mechanisms of transmission and incidence of the West Nile Virus, and the role of the Eastern Tent Caterpillar in Mare Reproductive Loss Syndrome (MRLS).

External funds to support research within the University of Kentucky, College of Agriculture have more than tripled since 2001, to over $31 million. More than $7.16 million of this extramural support was secured by faculty members who have a primary appointment in Extension.

Small farm diversification and the search for alternative crops or new uses of existing crops remains the central focus of the research conducted at Kentucky State University. Seven research projects are currently supported by KSU Research and two are reported on here: Sustainable Control of Grape Black Rot, Japanese beetle and Leafhoppers in Southeastern United States; and Development of Efficient Aquaculture Technologies for the Largemouth Bass (*Micropterus salmoides*)

Expenditures	Federal Extension Funds (UK)	$2,506,872
	Federal Extension Funds (KSU)	$331,221
	Federal Research Funds (UK)	$2,564,213
	Federal Research Funds (KSU)	$742,556
FTEs	Extension (UK)	197.4
	Extension (KSU)	11.0
	Research (UK)	83.0
	Research (KSU)	11.1

Key Theme – Adding Value to New and Old Agricultural Products

Export markets for U.S. beef are demanding more detailed information about the animals from which the meat comes. The Value-Added Targeted Marketing program (VATM) was implemented by the University of Kentucky College of Agriculture supported by Tobacco Settlement Funds from the Kentucky Beef Network. The program was created to help U.S. beef producers document the source and age of cattle to make their herds ready for export markets.

Through the VATM program, calves are identified through electronic ear tags and are sold in trackable lots of 50 to 80 calves that move through the feedlot as a group. The development of the calves is monitored. When they are harvested, a grader is sent into the plant to collect detailed information about the quality of the beef. These data are returned to cattle managers to improve management practices. It only costs about $10 per head for the electronic ID and the cost of the grader. At least some carcass data have been collected on over 8,000 cattle, with full data on 4,553 animals. As a result of the VATM program, Kentucky producers are exposed to the use of electronic identification of their cattle and better prepared for the National Animal Identification System. Data also demonstrated that the VATM cattle are above national standards for carcass quality and helped identify carcass yield as an area to target for improvement. Sickness and death loss in VATM cattle is about one-fourth the level of a USDA cattle survey. Likewise, quality is very high. 10 percent more VATM cattle graded choice than the U.S. average. This data provides Kentucky feeder cattle producers with information to make genetic and management decisions required for improvements and enhanced profitability. In addition to assisting producers directly involved in the program, the results have been used to develop case studies and other education materials. These have been used extensively in Kentucky, presented nationally, and will be shared at the European Precision Livestock Farming conference in FY2007.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Themes – Organic Agriculture

With over 500 acres of vineyards now planted in 2006, grape production for fresh market and wine production has almost doubled in the last five years in Kentucky. Unfortunately, Japanese beetles are a voracious pest of grape vines in the SE United States and reduce crop size and quality for growers. Research at Kentucky State University has identified a white wine and table grape variety, Edelweiss, which showed about half the leaf damage by Japanese beetles compared to other varieties tested; therefore, growers can now plant this variety and use less insecticide during production. An organically approved kaolin clay product (Surround) reduced Japanese beetle feeding by 60% on a range of grape varieties.

Source of Federal Funds: 1890 Evans-Allen and USDA Capacity Building
Scope of Impact: Regional

Key Theme – Small Farm Viability

Small Farm Program and 2501 OASDFR Project. - Kentucky's 80,000 small farmers are not only as risk due to the weather (drought, flooding, hail, ice, and storm damage), health of an aging population, and a fluctuating downward economy; most have lost federal support for tobacco, a primary farm income source. The majority of Kentucky's small farmers, tenant farmers, and nearly all of Kentucky's African American farmers are in transition - they need assistance and information as they make decisions concerning their enterprise mixes, alternative sources of income, retirement, and their farming systems.

The KSU Small Farm Program and 2501 Project utilizes Extension agents and paraprofessionals to provide one-on-one education to limited-resource cooperators in targeted counties to help them to better manage their farms, to incorporate new enterprises, to make their farms more sustainable, and to strengthen their financial position.

The Small Farm Program had nearly 12,000 contacts with farm families with over 5,800 contacts through the OASDFR 2501 Project. Some 250 families enrolled in the one-on-one program show average increases in annual farm income of $9,000 - $12,000.

Source of Federal Funds: 1890 Extension Funds
Scope of Impact: State

Key Theme –Managing Change in Agriculture

Kentucky agriculture is in the midst of a major structural change as a more concentrated tobacco sector adjusts to a very different marketing and economic environment. Demand opportunities are present for tobacco farmers to expand production, but the remaining tobacco producers must improve their management skills to survive in today's competitive environment which no longer provides the support-price safety net producers have been accustomed to for the past 60 years. Developing and interpreting budgets, conducting investment analyses, and presenting economic evaluations on means to improve labor efficiency are vital in assuring success in this post-buyout era. Various workshops, educational handouts and web materials have been developed as a part of the University of Kentucky Extension program to assist tobacco farmers in Kentucky and surrounding states during this transition period.

Extension Agents have responded through such programs as the Innovative Tobacco Grower Program (ITGP). This satellite-based program was the first of its kind in Kentucky. Annual Extension Tobacco Growers Meetings have continued with renewed focus, along with innovative newsletters, continued use of plotwork, method demonatrations and now computer-based management programs. In addition, a lot of individual grower advice is given by extension agents on soil testing and fertility management, disease diagnosis, pest control, and market preparation. The yields and quality seen in the 2006 crop show that the growers are using Extension recommendations more than ever before and this has allowed tobacco to continue, at least at the present time, as a profitable income-producing enterprise for Kentucky and burley belt farmers.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Animal Production Efficiency

Goat Production and Management Program - The number of new goat producers with little or no livestock production knowledge has increased – creating a need for basic Goat Production and management programs, while more advanced producers want more in-depth training and research-based information to solve problems and improve profitability. There is also a need to increase the knowledge-base of Extension personnel and associated agricultural industry representatives in the area of goat production and management practices

The Kentucky State University Goat Production and Management program involves basic goat production research to provide answers to the most common concerns related to profitability, production practices, and health concerns with goats and extension outreach that focuses on getting the newer producers educated in the differences and problems associated with goat production while providing the more experienced producers an opportunity to receive resources that meet their production needs. The program also includes a training component for Extension personnel statewide.

The Extension Specialist has conducted over 30 of these meetings in the past year. Topics have included health care, nutrition, genetics, selection, records, marketing, and predator control. These outreach opportunities have resulted in over 2000 contacts in the past year related to goats and goat production.

Source of Federal Funds: 1890 Extension Funds
Scope of Impact: State

Key Themes – Aquaculture

Production of feed-trained large mouth bass (LMB) fingerlings normally involves extensive pond rearing of fingerlings which are subsequently feed trained. Unpredictability in weather patterns and depletion of natural forage can dramatically affect nursery pond survival and production. Survival through the fingerling production phase of production is normally estimated at 10-20%, resulting in high production and stocking costs. Research at Kentucky State University has determined that LMB fry could be transitioned to prepared diets using a combination of live and prepared diets with survival rates of 50-70%. Implementation will improve the reliability and dramatically reduce costs of largemouth bass fingerling production. High feed and fingerling costs are the major impediments to increases in production and profitability of largemouth bass production. Commercial production has historically relied on trout diets, which are expensive, require expensive transport, and contain high levels of fish meal (> 30%). Due to its relatively high cost, cost variability, and growing environmental concerns about harvesting wild fish to produce fish meal, it is desirable to replace fish meal with less expensive protein sources. The results of this research could lead to the development and commercial adoption of more environmentally sustainable and cost effective diet formulations. This work demonstrated a 50% reduction in feed costs without decreasing growth. The largest largemouth bass producer in the state is cooperating in an on-farm field trail of these diets.

Source of Federal Funds: 1890 Evans-Allen
Scope of Impact: Regional

Key Theme: Diversified/Alternative Agriculture – Risk Management

Kentucky State University "Third Thursday Thing" – The "Third Thursday Thing" is a hands-on monthly workshop series focusing on full-scale research in sustainable agriculture, farm profitability, marketing and agricultural risk management.

Kentucky State University's "Third Thursdays" had 935 participants in 2006, including farmers, Extension state and county staff, researchers, USDA and state agencies, state legislators, non-profits, state and private universities, consumers, vocational agriculture teachers, students and representatives from eleven states and three nations. Some impacts of implementation of the Third Thursday series include:

- 40 farms were registered with the Farm Identification Program
- Three "Third Thursday" program regular participants enrolled in a Regional Agricultural Leadership Program
- 50 producers adopted new farming enterprises
- 125 producers utilized the information learned to improve their operations

Source of Federal Funds: 1890 Extension Funds
Scope of Impact: State

Key Theme: Organic Agriculture

The Organic Agriculture Program at Kentucky State University uses workshops, conferences, farm tours, online presentations, and demonstrations to give farmers and gardeners the training they need to take advantage of the growing demand and premium prices for organically-grown products. Training sessions are also provided to Extension agents so that they are better able to assist such farmers**.**

In 2006 the number of certified organic farms in Kentucky tripled, from 12 to 36. In its first year, the KSU Organic Working Group website has attracted more than 3,000 page views from more than 1,000 unique visitors. The GardenData.org FAQ, to which the extension specialist contributes organic gardening answers, has attracted more than 50,000 page views from more than 10,000 visitors. Both sites have seen user numbers increase steadily since their launch. GardenData.org was originally conceived as a project to serve Kentucky, but is now slated to become part of a national eXtension project in 2007. KSU's new Organic Working Group has succeeded in strengthening collaboration between its members, offering a unified source for the considerable organic agriculture information being generated at KSU.

Source of Federal Funds: 1890 Extension Funds
Scope of Impact: State

Key Themes – Niche Markets

A collaborative pilot program has been developed between University of Kentucky Food Services, the Department of Horticulture, and the Agricultural Economics Department to establish protocols for purchasing local farm products for use at the University of Kentucky. Two farms participated in the pilot in fall 2006 in order to work out issues of delivery, insurance, purchasing, and quality. The success of the pilot program brought about an expansion which includes the Kentucky Department of Agriculture and interactions with other farmers and food service providers. UK Food Service is now exploring the possibility of sourcing meat products and other Kentucky grown or processed products in several additional venues on campus. The program is positioned to continue this spring and will be used as a model framework for encouraging other Kentucky universities to follow suit.

Source of Federal Funds: Smith Lever
Scope of Impact: State Specific

Key Theme – Grazing

As tobacco income has become less dependable, farm operators are looking to forage and hay production for more of their farm income. Farmers will receive more net income from forage related enterprises by more efficiently utilizing forages, grazing more animals, and marketing the forages they would have lost through less efficient farm operations. The University of Kentucky Master Grazer Educational program consists of a series of educational meetings and demonstration farms to illustrate how to implement key grazing concepts for beef and dairy cattle, sheep and goats.

In this first year of programming, 301 producers representing 45 Kentucky counties participated in 8 multi-county Master Grazer Educational Programs. At the conclusion of these programs, participants were asked to identify those areas they planned to change or implement on their individual operations. The five areas were (1) decrease the amount of hay fed by extending the grazing season, (2) design a water system to provide water in each grazing paddock, (3) increase use of temporary electric fence to increase number of paddocks, (4) renovate pastures with legumes, and (5) improve management practices of animals grazing, i.e. feed better mineral, control parasites. Ten Master Grazing Demonstration farms are currently modifying their grazing system to improve or incorporate water systems, use of temporary fencing, and forages utilized to extend the grazing season.

By utilizing practices identified above by program graduates, Kentucky will be on its way to increasing the pasture utilization rate by 15% which will allow Kentucky's pastures to carry an additional 500,000 cattle and result in $276 million more gross revenue from the sale of cattle and milk.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Plant Production Efficiency

Seed germination can be erratic in species with dormancy. Although moist chilling stratification is an effective treatment for dormancy release, its effects are not often retained in dry seeds. Currently, growers must accept erratic germination and poor seedling stands in perennial species with seed dormancy or employ a dormancy release treatment. The industry could benefit from a seed pretreatment that would relieve dormancy yet be retained in seeds after subsequent drying. Dormant Echinacea seeds respond to ethylene releasing compounds for improved germination and it was hypothesized that loading seeds with ethylene precursors might provide a suitable pretreatment. Germination was compared to seeds receiving 60 days of moist chilling stratification. With this treatment, germination was improved in all species compared to untreated seeds and reached the level observed in stratified seeds using either ACC or ethephon, depending on the species. This research demonstrates that seeds can be loaded with plant growth regulators and their effects on satisfying seed dormancy retained in dry seeds that can be commercially distributed. This will allow greenhouse producers to handle dry seeds with currently available mechanical seeders reducing overall production costs and improving seedling quality.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State

Key Theme – Plant Production Efficiency

In 1996, two blueberry plantings were established at the University of Kentucky Robinson Station. One was placed on a heavy silt loam, the other on a disturbed strip mine site owned by the University. At the time these plantings were made, Kentucky had a total of ten acres of commercial blueberry production. Over the next 10 years, 20 cultivars have been evaluated for hardiness, disease resistance, yield, size and berry quality. Best production methods for the two drastically different sites have been examined. Each year, educational programs have been conducted and prospective growers come to the research plots to visit our plantings to look at cultivars, irrigation methods, bed preparation and netting. As a result, Kentucky blueberry production has increased to over 140 acres of commercial production.

University of Kentucky Agricultural Economists' analysis show that blueberries are one of the most profitable small acreage crops for Kentucky producers willing to invest the capital and time a new enterprise requires. Third-year yield on well-maintained blueberries is 500 pints/ ½ acre for a gross return of $2,000 - $2,500/ ½ acre. By full production in the fifth or sixth year ½ acre of blueberries should yield 3,000 – 4,000 pints /year for a potential income of $12,000 - $20,000. For small growers on limited acreage this represents a significant income source for years to come.

Source of Federal Funds: Smith Lever
Scope of Impact: State Specific

Key Theme – Agricultural Profitability

The Beef Extension Group at the University of Kentucky has been instrumental in the development of guidelines and educational programs to support the Kentucky Cattle Genetic Improvement Program. This program is funded through the State Agricultural Development Board as a Model Program. The beef Extension group has been instrumental in developing guidelines and delivering educational programs to support the program. As of October 2006, $13,016,808 has been distributed as 50% cost-share dollars. This represents over $25 million dollars in bull purchases in 104 Kentucky Counties to date. This program facilitates better selection and performance recording for seedstock producers, resulting in better genetic evaluations, and improved selection and crossbreeding for commercial producers. Approximately 12,000 bulls have been purchased through the program. With each bull siring 60 calves with an increased value of $25/head, an additional $18 million of additional income has been realized. Additionally, producers are developing a genetic base and production skills that they will utilize for years to come.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Animal Health – Pasture/Rangeland Management

The per annum impact of the horse industry to the gross domestic product of the United States is approximately $112.1 billion, with $7.4 billion of that attributed to the horse breeding industry. There are approximately 30 million acres of fescue in the United States and approximately 80% of that estimated is to be endophyte fungus infected (E+) tall fescue. Although 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. Pregnant mares grazing endophyte-infected (E+) tall fescue frequently incur reproductive problems which potentially can end with the death of the foal and/or mare.

Horse farm managers seek to reduce/eliminate the amount of E+ fescue in their pastures, and many are currently using the selective herbicides for that purpose. However, the potentially harmful or endocrine disruptive effects of these herbicides to grazing broodmares and their fetuses are unknown. Ongoing is a two-year project testing the hypothesis that broodmares grazing pastures treated with herbicides will have increased incidence of fetal loss or newborn foal morbidity/mortality when compared with broodmares grazing untreated pastures. Pregnant mares are placed on the plots immediately after treatment, and then examined regularly for general health. Foals born to the mares will be examined for general health and well-being, and blood samples will be obtained for clinical chemistries and complete blood counts. In the first year of the project mares lost pregnancies at three, six and seven months after herbicide treatment. Year two of the project and statistical analysis from year one is ongoing.

Adopting the practice of selective removal of fescue from pastures will provide more usable pasture acreage, will provide a more palatable and nutritious forage to livestock, and will reduce health risks and financial loss associated with animals grazing E+ tall fescue.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State

Key Theme – Animal Health

Internal parasites pose an ever-present, worldwide threat to the health and economic prosperity of the equid and ruminant sectors of animal production agriculture. Most producers are aware of the problems that worms cause, which range from decreased productivity of their animals to death. Animals are usually routinely dewormed with different commercial chemicals, by owners using a variety of deworming schedules. Every dewormer on the market has had some resistance built up to it by the internal parasites that infest livestock. This resistance means that not all the worms are killed during deworming. The surviving worms pass that genetic resistance on to offspring. University of Kentucky Researchers are gathering further information on the prevalence, ecology, and molecular mechanisms of drug-resistance of intestinal nematode parasites.

The long-term research continues on drug resistance of internal parasites in horses on commercial farms and the UK research farms. It is evident that these parasites are resistant to most compounds on the market and constant surveillance needs to be done to find the best usage of the remaining effective compounds. One recent finding is that in one group of horses naturally infected with drug (benzimidazole)- resistant small strongyles, even though the horses were not treated with this class of compounds for over 20 years---resistance still prevailed.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State

Key Theme – Changes in Agriculture

With changes in the tobacco industry, Kentucky has under-utilized controlled environment resources- i.e., high tunnels and greenhouses, which could be used for producing vegetables and ornamentals, among other crops. Growers face numerous operational changes in order to produce these new crops and the infrastructure needed to address those needs is both on-going and coming on-line.

Hypoxia, or low-oxygen, fumigation has been shown to be an effective method against greenhouse pests. Initial studies focused on the pests, but now, as researchers look at scaling up for possible commercial applications, the impact that hypoxia has on the plants themselves is a priority.

Researchers have surveyed the responses of 72 different ornamental plants and found that hypoxia fumigation has the potential to be an effective biosecurity measure with minimal environmental impact.

A set of high tunnels are now available to develop thermal control strategies. The goal of this project is to develop a model which will predict the interior conditions of the "greenhouse" along with an economical thermal control system to maintain acceptable growing conditions for plants, thus opening the door for the production of bedding plants, vegetables, nursery stock and other revenue generating opportunities for Kentucky farmers

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme – Ag Profitability

The University of Kentucky Beef Extension Group offers numerous programs to improve beef cattle production and profitability. Through the Allied Inputs and Marketing Program (AIM), livestock producers learn about group purchasing and marketing and how small and medium-sized producers are able to take advantage of economies of size. The AIM concept encourages producers to form local alliances or cooperatives to enable producers to lower input costs of production and create a greater demand for their product as well as to help them organize and develop collective production and marketing plans.

Currently, six AIM alliances are functioning in Kentucky. Together they encompass 378 producers who own approximately 21,000 cows. Purchased costs of these products were from 20-30% lower than available through traditional markets. Financial analyses have indicated that production costs were reduced $45 per cow in the first year alone. Cooperative marketing efforts have also been successful. Feeder calf sales have generated a $5-12 / cwt. premium over other cattle sold in Kentucky that same day. The cooperative marketing has increased net returns per cow by $28. If revenues increase approximately $75 per cow, then AIM has increased profitability by approximately $2,163,000.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme - Plant Production Efficiency

Maple shoot borer is a major pest of nursery-grown maples which comprise about 25% of total landscape plant sales in Kentucky. Infestation of a tree's central leader causes undesirable forked growth form. Training a new central leader is costly and despite those corrective measures, the trunk incurs a crook that reduces tree value. Research confirmed that infestation occurs in April soon after planting. A synthetic sex attractant was developed from analysis of secretions from virgin females. That lure was used in traps to reveal the borer's flight period which will enable growers to pinpoint the timing of preventive control measures. The research on pest-resistant maples and elms will reduce production costs and chemical inputs while supporting recommendations regarding the best-adapted trees to use for Kentucky landscapes. The research on knockdown and residual activity of reduced-risk insecticides against Japanese beetle will support revision of control recommendations for that major invasive pest.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme – Animal Health/Biological Controls

The per annum impact of the horse industry to the gross domestic product of the United States is approximately $112 billion, with $7.4 billion of that attributed to the horse breeding industry. In April 2001, a sudden increase in equine fetal deaths and abortions occurred in central Kentucky. This occurrence cost the Kentucky horse industry an estimated $336 million in that year alone. Economic losses due to fewer Kentucky-bred horses continue to this day.

University of Kentucky College of Agriculture researchers have reproduced Mare Reproductive Loss Syndrome (MRLS) by feeding pregnant mares eastern tent caterpillars (ETC), which were abundant in the area in 2001 and 2002. Studies reported in 2005 have strongly implicated the hairs of the caterpillar to be the causative factor, and demonstrated that the disease may also impact other livestock species of economic importance to the state. Field studies have addressed the question as to how long pregnant mares should be kept off ETC contaminated pastures. Ongoing studies are looking at suppressing ETC populations by infecting caterpillar nests with virus grown in the laboratory as a biological control and other studies are impregnating sticky boards with male pheromones to attract and trap male ETCs to reduce populations. Demonstrations of the effectiveness of attract-and-kill formulations of the pheromone of the eastern tent caterpillar moth suggests that future develop of pheromones for mating disruption in this species should be pursued. If this potential for population suppression using the attract-and-kill approach proves to be effective it will add another tactic for management of eastern tent caterpillars and Mare Reproductive Loss Syndrome.

The University of Kentucky has established a website to keep the Equine Industry apprised of current research efforts and outcomes.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme – Plant Genomics

Seeds with physical dormancy have a specialized structure ("water gap") in the seed coat through which water initially enters; however, this has not been identified in seeds of members of the morning glory family. One aim of the study is to identify the water gap in morning glory seeds of and to describe its morphology, anatomy and function. Then, the environmental factors required to cause an opening of the water gap will be determined.

Using a variety of techniques, including light microscopy, scanning electron microscope, tissue-sectioning and dye-tracking and blocking experiments, the morphology, anatomy and function of the water gap in seeds of morning glory has been determined. Also, researchers have learned that seeds can be made sensitive, and sensitive seeds will respond to warm, humid conditions. After the warm, humid treatment, seeds will take up water. The next step is to test these results in the field and make a predictive model. Understanding how the water gap opens allows researchers to better understand (and predict) when seeds will germinate in the field.

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Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme – Home Lawn and Garden

The Web site http://gardendata.org/ was developed by the University of Kentucky Cooperative Extension Service in response to the overwhelming seasonal demand for consumer home horticulture information. GardenData.org contains "frequently asked questions" in the horticultural subject areas of flowers, fruits, trees and shrubs, houseplants, vegetables, turf grass and water gardening and is an ever expanding knowledge base that grows with the addition of every user. The client also has the option of accessing information from previously asked questions or "ask the expert" by submitting a question of their own.

Use has risen steadily and reached a climax of over 6,000 hits in March 2006 with a total of just over 50,000 hits for 2006. Of these hits, over 7,000 resulted in interactive sessions and amost 12,000 individual answers were viewed on-line. The resulting site effectiveness of GardenData was 96.6%, meaning that during most sessions, users were able to find the information they needed without submitting a question to the system. On-line searchable databases, such as Gardendata.org, provide users with quick, reliable information, and provide an additional conduit through which the public can access Cooperative Extension information. GardenData does not replace the nework of county Extension agents in Kentucky, rather it is meant to inrease the efficiency by which these agents provide information to their clients. Many questions involving such issues as disease diagnosis, soil testing, and site-specific condition can not be addressed through an on-line database. In such cases, the user is refered to their local county Extension office. Currently a Kentucky project, we are now working with other states to merge similar databases into one for eXtension.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Plant Genomics

Cytokinins are plant hormones that control essential aspects of growth and development, including agriculturally important traits such as plant senescence and seed yield. The modification of cytokinin regulation in plants holds great promise as it could be used to engineer increased grain production as well as to prolong the shelf life of produce. The ability to engineer the cytokinin sensitivity of plant cells depends on a detailed understanding of the cytokinin response pathway. Research results show that through regulated alternative reproductive resources proteolysis, the primary cytokinin response pathway contains a dampening mechanism that limits signal intensity and duration to maintain high sensitivity to changes in cytokinin concentration.

This novel finding suggests that the engineering of cytokinin sensivity of plant cells could be more effective by focusing on the controls that regulate the stability of response activators and inhibitors rather than the mechanisms that control their synthesis rates.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme – Biotechnology

Ethanol production from relatively inexpensive lignocellulosic biomass offers an opportunity to reduce the nation's and state's dependence on fossil fuels. There is considerable fibrous biomass in Kentucky, and production of ethanol from this biomass by thermophilic bacteria has a distinct advantage over conventionally used yeast. This project addresses commercial limitations of ethanol from lingo-cellulose production.

This first sub-project investigates the conversion of biomass to value-added chemicals and materials by catalyst moderated liquefaction (CML). To date, researchers have successfully converted 90% of the biomass into useable product. Researchers are also working to develop new catalysts to stabilize the resulting bio-oil and to convert vegetable oils to biodiesel.

Corn stover is a potential feedstock for the production of fuels and chemicals. The overall objective of this component of the research is to increase the value of corn stover as a sugar feedstock by separating the plant fractions that are most economical and efficient to collect, store, pretreat, saccharify, and ferment to value added products. Annually it is estimated that 2.8 tons/acre of stover could be removed that would generate additional farm revenue of $70/acre. Experiments have been conducted to characterize corn stover and have determined that the leaves, husks, and cobs are the most valuable components for the production of fermentable sugars. Re-engineering of combines to allow for the collection of the leaves, husks, and cobs during grain harvest has been accomplished. This should decrease corn stover collection costs, and reduce negative environmental impacts of soil erosion by leaving less valuable plant components in the field. It is expected that the research will decrease the collection cost by 40% relative to existing operations and increase the value of the corn stover by 20% by increasing the sugar concentration.

The next step involves storage of the stover fractions as silage to eliminate the need for drying. A laboratory, pilot-scale facility will be developed to aid in the evaluation of overall system performance, i.e. converting corn stover to ethanol. The resulting data will be used to evaluate the potential for ensiling corn stover, performing pretreatment, and enzymatic on-farm conversion to fermentable sugar.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme – Home Lawn and Gardening

The demand for reliable horticulture information is great, especially in urban areas. Many citizens look to the Cooperative Extension Service for such information; however, staff resources are rarely able to meet the demand for information. Extension Master Gardeners are trained volunteers who assist Extension personnel in delivery of horticulture information. The Kentucky Extension Master Gardener (EMG) Program is active in 40 Kentucky counties and all major urban areas of the state. The program trained 398 Master Gardeners in 2006 and there are 1,1037 active EMG volunteers in Kentucky.

Extension Master Gardener volunteers contribute over 20,000 hours of service to Kentucky Cooperative Extension and are responsible for approximately 50,000 contacts annually. Activites of EMG include writing for local newspapers, conducting educational programs and maning exhibits, installing and maintaining demonstration gardens, answering horticultural questions, and many other related activities. Through their volunteer efforts, EMG provide a valuable service by extending the outreach of the Cooperative Extension to the citizens of Kentucky.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Managing Changes in Agriculture

The Kentucky Agricultural Development Board has approved a model program for hay, straw and commodity storage in 66 counties. County boards committed over $7.4 million and participating farmers agreed to match that amount with an additional $7.4 million to construct on-farm storage facilities. In order to qualify for funds, producers were required to participate in educational programs through the Cooperative Extension Service. Extension engineers from the University of Kentucky's Biosystems and Agricultural Engineering Department worked with county extension agents and other college faculty to develop a package of educational materials that would provide planning and construction guidance for program participants. Teaching presentations were developed and a web page (http://www.bae.uky.edu/ext/HayStorage/) was created to help provide quick and easy access to the materials. As counties learned about the program, requests for information about planning, designing, and constructing storage structures escalated rapidly. Upon completion of their projects, producers participating in the program will be able to realize a savings of over $1,000,000 per year as a result of reduced storage losses.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Plant Genomics

Stalk rots are the number one disease problem of corn in the United States. Between 5-10 percent of the corn crop in the U.S. is lost to fungal stalk rot disease annually. Stalk rots are difficult to control because the fungi that cause them tend to colonize the plants early in the season, but only cause significant rot later when the crop is mature. This project has examined the role of a gene that is critical for pathogenicity of the anthracnose stalk rot fungus to corn stalks. This study has revealed a previously unsuspected mechanism for regulation of secretory activity during biotrophic versus necrotrophic development of an important maize stalk rot fungus. Continued study of the mutant gene and its activities will help researchers to understand more about how pathogenic fungi cause harmful symptoms in their hosts, and how those symptoms relate to fungal colonization of the host tissues. Comparative studies investigating the relative importance of mycotoxins and other factors for pathogenicity to corn stalks versus wheat heads are underway.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State

Key Theme – Precision Agriculture

Recent trends in agricultural field machinery exploit the use of microcontrollers to enhance machine function. Controller Area Networks (CAN) have been developed to facilitate communications between microcontrollers. Off-target placement of crop production inputs is a costly and time consuming problem for agricultural producers. Typical seeding/application problems include: skipped areas, double treatment, unintentional treatment, or treatment of environmentally sensitive areas. The goal of this research effort is the development of CAN-based distributed control systems for precision placement of crop production inputs such as seed, fertilizer, and pesticides. This control system utilizes dedicated microcontrollers for single element metering of inputs. Dynamic adjustment of machine operating parameters such as seed meter air pressure and shaft speed are made in response to feedback from rate sensors, ground speed radar, and GPS position fixes.

Precision placement of inputs will improve Kentucky farm profits through increased crop yield and reduced input costs through the elimination of skipped and doubled treated regions within a field, and by maintaining desired fixed and variable seeding/application rates across the toolbar or effective application width while turning and in point row regions of a field.

It is estimated that the adoption of CAN based meter technologies in Kentucky will result in a reduction in the overall application of pesticides and nutrients of 15% along with similar seed savings.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme – Precision Agriculture

Fertilizer use efficiency is a measure of the amount of applied nutrients that are taken up by the crop. In the past several years, soil fertility research has been conducted concentrating on improving fertilizer use efficiency in Kentucky grown grain crops. Trials included precision variable rate fertilization of wheat and corn, as well as, new fertilizer products (e.g. polymer coated urea) designed to improve efficiency. Numerous studies were conducted on research stations and farmer/cooperator fields to determine potential benefits to Kentucky grain producers. The variable rate technology did not prove to be economically viable for small scale farmers or commercial applicators at a current purchase price of approximately $90,000. New fertilizer technology has proven more useful for these Kentucky producers. Polymer coated urea improves nitrogen use efficiency at some application times; however the added cost of the product will likely offset N savings. The lower N application rates will lead to less environmental N loss.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme – Animal Production Efficiency

Reproductive performance has become one of the major management problems facing dairy farmers. This leads to a decrease in lifetime milk production, premature culling and increased veterinary costs. The total cost of poor reproductive performance has been conservatively estimated to be $500 million.

Controlled internal drug release (CIDR) intravaginal inserts are commonly used in the field to enhance reproductive performance in dairy cattle. The data from University of Kentucky Dairy Unit studies clearly show that CIDRs are able to maintain a significantly lower concentration of progesterone in lactating dairy cows than in the other groups. This implies that these cows metabolize progesterone more effectively than cows in other physiological states and may help explain why lactating dairy cows have such severe problems with fertility. From these data, new methods for the use of CIDRs may be developed that could improve their effectiveness and help improve reproductive performance in dairy cows

Another of the factors contributing to management problems in dairies is a decrease in the efficiency of estrus detection. Kentucky Dairy Herd Improvement Association records established the efficiency of estrus detection rates as just 34%. Previous studies from this project have demonstrated that experimentally induced endocrine deficiencies can result in reduced estrus expression and poor fertility. Results from ongoing research will help to determine if these deficiencies occur naturally and if they contribute to reduced intensity and duration of estrus expression and poor fertility observed in modern dairy cows. Based on the results from this experiment, new management methods will be developed to enhance expression of estrus.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme – Rangeland/Pasture Management

The University of Kentucky is developing stronger ties with the state's horse industry in the areas of research, extension and teaching. Many horse farms in the Bluegrass Region are interested in UK's assistance with pasture evaluation. A team from the UK Forage Extension Program conducted a pilot project to evaluate horse pastures on 14 central Kentucky farms. One of the focuses was the evaluation of pastures for percent tall fescue and their potential to cause fescue toxicity in pregnant broodmares.

The horse pasture evaluation program has been extremely successful from an extension standpoint. Researchers and Extension Specialists have provided new and insightful information to major horse farms in the Bluegrass Region. The applied research aspect of this project has developed accurate methods to make stand and botanical composition estimates of pasture. Researchers and Extension Specialists are perfecting the microscopic procedure to determine diet composition of horses on pasture. This procedure will help provide horse owners with a scientific way to determine the safety of their pastures. The nitrogen application research has already allowed for refined recommendations for pasture nitrogen applications.

Source of Federal Funds: Smith Lever, Hatch
Scope of Impact: Multi-State - KY, LA, FL, SC and Brazil

Key Theme – Adding Value to New and Old Agricultural Crops

Cheese processing efficiency and product quality are improved as the coagulation process is more accurately controlled. In cheese manufacturing, the current practice requires manual selection of coagulum and cutting time based on specific temperatures and times and subjective evaluation of curd texture. University of Kentucky Researchers have developed novel optical sensor technology that is able to monitor both milk coagulation and curd syneresis in a stirred cheese vat. The new syneresis technology consists of a unique large field of view optical sensor that provides the information about gel assembly and curd shrinkage kinetics required for curd moisture control.

The technology makes use of a specific light waveband and regression models which predict cutting time, whey fat losses, cheese yield and curd moisture content. This technology can be used for manufacturing of low, medium and high moisture cheeses. From an applicative point of view this technology would provide more consistent and efficient production capability. The technology also would save energy by avoiding unnecessary processing and allow cheese maker to shift curd size as milk solids change during the year.

Several cheese making facilities (Brewster Cheese Inc., and Kraft Foods Inc.) and an engineering firm (ESE Inc.) have expressed an interest in this technology for cheese manufacture. Recently, the Intellectual Property Development Committee has decided to pursue appropriate protection of this novel technology to control curd moisture content during syneresis in cheese making.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

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Key Theme – Agricultural Profitability

The Kentucky Master Cattleman Program continues to be an integral part of the comprehensive effort underway to replace diminishing tobacco revenue by improving Kentucky's expanding beef-forage operations. It is a collaborative effort of the University of Kentucky College of Agriculture, Kentucky Cattlemen's Association, and Kentucky Beef Network. The program consists of 10 four-hour sessions that focus on management, nutrition, facilities, environmental stewardship, genetics, reproduction, herd health, and marketing. Materials are developed by Extension specialists from the University of Kentucky, who deliver the program and train extension personnel.

In 2006, 419 beef producers participated with 317 completing in 83 counties. The economic impact of this program is substantial. Master Cattleman participants averaged 92 cows each and with 400 participants that would be roughly 36,800 cows impacted in one year. With modest increases in calving percentage (5%), weaning weight (20 lbs), proper vaccination, increased utilization of pastures and home raised forages, and culling open cows, these participants should realize a potential increase of over $4,208,700 though improved management practices.

As a result of the success of this program, the University of Kentucky Beef IRM group has developed a follow-up program. The Advanced Master Cattleman program was launched in 2006 and is designed to take producers to the next level of beef production, marketing, and management. Sessions include both classroom and "hands-on" elements In this first year, this program reached 224 Master Cattleman graduates in 39 counties. A second round of Advanced Master Cattleman will be offered in 2007.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Plant Genomics- Organic Agriculture

A better understanding of how wild relatives of tomato defend themselves against insects will ultimately lead to genetic improvement of the pest resistance of tomato. Crossing in the greenhouse with several Lycopersicon escultentum parents has permitted the production of large F2 and BC1F1 hybrid populations. These populations are just now being planted for evaluation of spider mite resistance. Major effort has also been directed toward identifying the insect-active components present in the leaf hair secretions of the tomato relative, LA2329. To this end, conditions for separation and isolation of individual components have been delineated. In the future, it may be possible to grow tomatoes without application of toxic pesticides.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State

Key Theme – Agricultural Profitability

The economic impact of the research results this year includes the development of an analytical tool for assessing the lowest cost means of adopting new technologies. Identifying the least cost strategy of obtaining a new technology is important to the economic well being of the operation. This study determined the break-even cropped area necessary to economically justify the purchase of Precision Agriculture (PA) equipment versus the custom hiring of the PA services. The results suggest that a commercial Kentucky grain farmer would purchase the PA equipment but smaller operations could alternatively custom hire PA services.

Precision dairy feeding analysis revealed four points to consider: 1) Manure and nutrient management under precision agriculture technologies may offer opportunities to improve the profitability and environmental risk management of dairy operations. 2) Developing strategies that will use more of their own farm raised feeds and less purchased feeds may provide less nitrogen and phosphorus loading and less manure excretion while improving farm profitability. 3) An optimal whole farm nutrient management plan allows for changes in crop production and feeding that may help reduce the accumulation of excess P and N, while maintaining or improving farm profitability. 4) Efficient production of crops and forages strengthens the economic position of a farm and limits the potential negative impact on the environment.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Agricultural Profitability

A major emphasis of the Integrated Resource Management team has been to obtain software packages for production and economic analyses and encourage the use of these packages by Kentucky beef producers. For herd production analyses, the IRM committee chose CHAPS (Cow Herd Appraisal Performance Software, created by NDSU). Information collected has been used to create a database of Kentucky beef production. The team has developed a pocket record book to help with collection of data on-farm. The IRM team is also heavily involved in economic enterprise analysis of beef cattle operations. The Iowa State University Standardized Performance Analysis (beef cow business records) package was chosen for economic analyses of beef production systems. The goal is to develop state-wide production and economic databases. These databases can be used to help demonstrate the "real world" economic impact of incorporating certain beef production practices. Over 450 copies of CHAPS, over 500 cow-calf SPA records books, and over 3,000 pocket record books have been distributed to Kentucky producers.

The economic impact of this program is difficult to measure because the results of better records is generally reflected in decreased costs instead of increased income. The average herd size of records participants is approximately 50 head. If a profit per head of $200 is assumed and economic efficiency is improved by a modest 5% this would total $225,000 annually with the current users. Efforts to increase the number of users are ongoing.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme - Biofuels

Biomass conversion to liquid products has the potential to reduce domestic dependence on imported petroleum crude used for the production of fuels and industrial chemicals. In this context, the University of Kentucky Department of Biosystems and Agricultural Engineering is working to address the technical issues relating to catalyst-assisted stabilization of crude biomass-derived pyrolysis oils ("bio-oil"), for the ultimate production of fuels and high value chemicals. To date, the upgrading of bio-oil has been achieved using cracking or hydrotreating. Given that hydrotreating requires large volumes of hydrogen, which significantly impairs the economics, cracking represents a more economically attractive option. However, difficulties encountered in the use of acid cracking catalysts such as H-ZSM-5 include (i) high yields of low value gaseous hydrocarbons, and (ii) the occurrence of coke formation, resulting in rapid catalyst deactivation. In view of the foregoing, there is a clear need for a low severity method for bio-oil deoxygenation. Researchers are examining two alternative concepts aimed catalytic deoxygenation of bio-oil to a stabilized product, utilizing mild cracking over base catalysts and metal-catalyzed deoxygenation. The anticipated outcome is the development of catalysts systems that will stabilize crude bio-oil so that it can be stored and shipped, thus reducing domestic dependence on imported petroleum used for the production of fuels and industrial chemicals.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Themes – Niche Markets

Cut flowers from field-grown Hydrangeas are a potential alternative source of income for Kentucky growers, and early production can increase financial returns on one's investment. Typically certain cultivars are more suited for the cut flower market, while other species have been grown as landscape plants. While typically grown as landscape species, interest has been expressed in H. arborescens and H. paniculata as fresh cut and dried flowers by wholesale distributors. Expansion of the cut flower production mix to include these Hydrangea species could create specialty-niche markets for Kentucky growers. Plants are being evaluated for cut stem potential as field, high tunnel or container produced plants. Twelve cultivars are replicated in each of the three systems. Data collected includes bloom counts, stem lengths, bloom diameters, quality rating and flower color. Royal Horticulture Society color charts have been converted to digital data in order to make statistical color analysis.

Approximately 80 cultivars of Hydrangea macrophylla are also being evaluated at two sites (Quicksand and Lexington) for their potential as landscape plants for Kentucky.
Data from these studies aid Kentucky nursery and landscape businesses in purchasing reliable cultivars for resale to Kentucky residents and wholesalers. This shows potential for a new crop opportunity for growers interested in expanding operations or for new alternative incomes.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Diversified/Alternative Agriculture

In Kentucky, the greatest interest in non-timber forest products has been in shiitake mushroom production. Shiitake mushroom production is an important component of agroforestry in utilizing otherwise unmarketable timber cleared out in a timber stand improvement activity. Most clients grow mushrooms for personal use, for small local markets, and for farmers markets, providing supplemental income for their farm or household economies. Eight of a scheduled fourteen sections of a production workbook are in print and available electronically. The video on "Growing & Marketing Shiitake Mushroom Production on Natural Logs" won a regional forestry extension award in 2006, and is available to the public and to county agents. A second video on "New Kentucky Products" includes a section on shiitake mushrooms, focusing on their preparation and nutritional value, in addition to basic information on production.

Christmas trees are the second most popular non-timber forest product. The Christmas tree production program has been in effect since the 1980s, and the number of growers has remained relatively constant, balancing growers coming in with those who are retiring. Clients have available to them a "Kentucky Christmas Tree Production Workbook" as well as a video on "Pruning and Shearing Christmas Trees". A new on "Caring for Christmas Trees" was produced for the public during the holiday season in 2006. The Kentucky Christmas Tree Association (kychristmastrees.com), started by a specialist in 1985, is still active.

Over 100 clients experienced hands-on inoculation workshops with the specialist in 2006. Several clients are now growing mushrooms as a business with start-up first year potential income of $5,400, and an annual potential of $12,000 in subsequent years for the same logs.

Christmas trees have an annual guaranteed market. Growers sell not only the trees themselves, but also wreaths and roping. Growers also sell smaller trees for landscaping purposes at times of the year other than the holiday season. There are approximately 150 growers spread fairly evenly across Kentucky, and their products gross about $3 million per year with each grower averaging about $24,000 per year.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Home Lawn and Garden

Preventive control of turf-infesting white grubs by neonicotinoid insecticides has been presumed to mainly result from residues killing first instars in the soil. University of Kentucky entomologists showed that combining imidacloprid with bifenthrin, a pyrethroid resulted in Japanese beetle (JB) females laying 68-82% fewer eggs in Kentucky bluegrass turf. Imidacloprid residues in soil did not affect egg viability or days to hatch, but killed neonates soon after eclosion. Imidacloprid curatively applied at label rate reduced weight gain, burrowing capability, frass production, and survival of late instars in turf, suggesting that neonicotinoids have greater curative activity than is generally appreciated. Knockdown, residual toxicity and leaf protection capability of 13 conventional and bioinsecticides against JB was evaluated on linden foliage. All pyrethroids except permethrin gave greater protection than did carbaryl, the industry standard, and certain products containing azadirachtin or pyrethrins were also effective.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme – Plant Production Efficiency

Improper irrigation significantly limits the growth, quality and profit of commercial container crops. Generally crops are either irrigated too frequently or more likely insufficiently especially under bright, warm conditions. Also, most crops are not irrigated uniformly. University of Kentucky Horticulture researchers are developing an automatic, no runoff irrigation system. A CWT irrigation system is adaptable relatively inexpensively to existing greenhouse benches using readily available components. The CWT system of production for container-grown plants provides several advantages over other irrigation systems including a reduced disease potential as the solution is not re-circulated and therefore little chance exists to spread disease. The CWT system controls and maintains a uniform water/air ratio in the growing media of all containers in a growing area, automatically irrigates individual plants on the bench and the nutrient solution does not drain from the system, resulting in no pollution of natural water sources. Normally, nutrient concentration is 100 ppm N from 20%N-8%P-17%K. Recent results using this system show that increasing the nutrition concentration from 100 to 150 ppm nitrogen after two weeks increased plant size and may produce a more uniform crop since the plants are rarely under water stress. 2006 research reduced algae growth and salt build-up on the table and methods to monitor air/water ratio at different depths in the growing media..

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Accomplishments and Results for CSREES Goal 2

Goal 2

A safe, secure, food & fiber system. To ensure an adequate food and fiber supply and food safety through improved science based detection, surveillance, prevention and education.

Overview

Despite the fact that America's food supply is the safest in the world, foodborne illness remains one of the greatest food safety threats. The Centers for Disease Control and Prevention estimate that every year about 76 million people in the United States become ill from bacteria in food. Of those persons who become ill due to food spoilage, up to 5,000 people die (Institute of Science in Society, 2001). Estimates of the annual cost to our economy range from $10 billion to over $23 billion. Consumers believe the factors affecting their risk of foodborne disease include changes in diet; increasing use of commercial food service and in food eaten or prepared away from home; new methods of producing and distributing food; new or re-emerging foodborne pathogens; and the growing number of at-risk individuals, such as the elderly and immuno-compromised. In a 1998 survey, only 55 percent of consumers perceived unsanitary handling, processing, or preparation of foods as a threat. Yet, the Centers for Disease Control and Prevention reports that 97 percent of foodborne illness could be prevented with good personal hygiene and improved food handling techniques. According to the National Restaurant Association, a single outbreak of food borne illness can cost an establishment in excess of $85,000 in legal fees, medical claims, lost wages, sanitation cost, and decrease in present and future business. This could spell disaster for those small Kentucky businesses trying to capitalize on the growing trend to purchase "Kentucky Grown" and home processed goods.

During the past year, the 47,160 individuals in Kentucky indicated that they gained knowledge related to safe food storage, handling, and preparation as a result of involvement in Extension programs. Of these, 27,509 (or 58%) reported that they have put what they learned into practice. Due to recent high profile outbreaks of foodborne illness related to processing of green vegetables for salads, interest in food safety and clientele contact numbers have increased. Increasing use of commercial food service and the growing amount of food eaten or prepared away from home is providing us with an additional focus for educational programs. As a result of new farm friendly legislation and technologies which make home processing safer and more affordable, Kentucky farmers are now processing home grown food products in home kitchens taking advantage of the statewide emphasis on Agritourism. 4130 Extension contacts were related to home based and micro-processing of food, with over 200 entrepreneurs being trained in food safety issues.

The Kentucky Agricultural Experiment Station enhanced research efforts in pre- and post-harvest food safety and quality. An antibiotic-free swine herd has been maintained for 30

years and has allowed researchers to study the nature of development of antibiotic resistance. In partnership with Extension, a value-added incubator allows application of research findings to small meat processors. Research also investigates the effects of diet on mechanisms that control cardiovascular health. The station conducted a full-time equivalent of seven projects related to this goal in FY06.

After reviewing the Key Themes listed for each goal, the Kentucky State University projects listed in the Five-Year Plan for this goal are now listed under Goal 3 and Goal 4, whichever was deemed more appropriate.

Expenditures	Federal Extension Funds (UK)	$291,319
	Federal Extension Funds (KSU)	N/A
	Federal Research Funds (UK)	$575,641
	Federal Research Funds (KSU)	N/A
FTEs	Extension (UK)	23.0
	Extension (KSU)	N/A
	Research (UK)	7.0
	Research (KSU)	N/A

Key Theme – Food Security

The National Animal Identification System (NAIS) is USDA's effort to identify U.S. livestock and poultry, where they reside, their location during commerce, and to trace significant animal movement. NAIS goals include the ability to locate, within 48 hours, potential sources of disease, animals and facilities that harbor disease and to enhance our ability to response to animal emergencies other than disease outbreaks.

The Kentucky Cooperative Extension Service, through funding from the Kentucky Department of Agriculture, has established an Animal Identification System Education Project. Extension Associates provide educational programs at field days and producer meetings, with a goal of registering 100 new premises per month at these events. Extension has also developed web-based learning modules on NAIS and premises registration. These courses are available to anyone with Internet access.

During a six-month period, over 600 new premises were registered at producer educational events through these efforts. Total registration is higher, as many producers pick up applications at programs and submit them later.

Kentucky's producers and livestock industry benefit from this project in several ways:

-Registered producers can participate in value-added marketing opportunities which are yielding premiums of $5 - $10 per hundredweight

-Producers who register benefit through participation cost-share programs supported by the Agricultural Development Fund, funded by tobacco settlement dollars

-Participation helps protect the $2.5 billion livestock industry from disease outbreaks and other emergency animal health threats.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Food Safety

The objective of the University of Kentucky Biosystems and Agricultural Engineering Milk Transport Security project is to develop a cost effective wireless system for enhancing the secure delivery of milk from the farm to the processor. Beginning with locks on the dome lid and rear door, a systems approach is being used to develop a wireless electronic security system for monitoring the transport of milk and milk samples obtained at the farm level, as well as GPS transport information from the farm to processor. The proposed security system will be designed to operate within existing milk collection procedures and equipment as much as possible. As a bonus the system can provide the hauler with the most up-to-date information regarding pick-up scheduling, logistics, etc. A laboratory and functional unit installed on a milk truck are planned for 2007.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State

Key Theme – Food Safety

The future success of Kentucky's diversified agricultural economy is dependent on building stronger producer-consumer relationships. Consumption of Kentucky farm and value added food products can result in increased profits for farmers and a positive economic and social impact on surrounding communities, but along with this comes a responsibility to insure that on-farm processing follows proper food safety, sanitation and USDA-recommended processing procedures. Resource materials and county programs are offered that showcase locally grown and processed products and encourage the consumer-producer link. The University of Kentucky Cooperative Extension Service (UKCES), Kentucky Department of Agriculture and Kentucky Cabinet for Health Services have been successful in their efforts to establish farm friendly and visionary legislation allowing Kentucky farmers to grow, process, and sell their value-added food products from home kitchens. This created a need for developing and implementing an educational program of food safety techniques. Since developing these materials, over 200 on-farm entrepreneurs have been trained in the microprocessing aspects of home based business. *Homebased processors* (low risk items such as jams, jellies, cakes and pies) and *homebased microprocessors* (higher risk items such as barbecue sauce, salsa, pressure canned green beans and pickled corn relish) can now sell their home grown, value added products from the farmers market, certified roadside stands or their own farm.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Food Safety

A primary concern with feeding antibiotics at sub-therapeutic levels is the putative stimulation of a reservoir of drug-resistant enteric bacteria; thereby constituting a potential public health risk. Although chlortetracycline (CTC) was originally used to reduce deleterious effects of certain species of gut flora on the intestinal mucosa, it is now known that CTC is absorbed by and accumulates in animal tissues. One way to gain the economic benefits of CTC without its associated health risks is to identify the proteins/biochemical pathways responsible for improved animal performance so that microflora-inert CTC "mimics" can be developed. Currently, in the United States alone, it is estimated that about 45% of steers and heifers fed for slaughter each year (16 million head) suffer a loss of at least one quality grade from inferior grading of carcasses, whereas the feeding of CTC increases the carcass quality grade by 0.5 units.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Food Quality

One of the meat processing operations that require improved control is the emulsification process for manufacturing of finely comminuted meat products (e.g., frankfurters, bologna). The meat industry incurs major economic losses estimated to range between $200 million and $1.65 billion/year in the US as a result of an inadequate emulsification control during chopping. Before cooking, proteins must surround fat particles to allow proper fat emulsification. The chopping process is designed to reduce meat and fat particle sizes, which results in better protein extraction and fat-water holding capacity. Under-chopping or over-chopping yields an unstable product because more protein is required to emulsify the fat. Surpassing the optimal chopping point is not associated with any visible sign or changes in appearance, texture, etc. Thus, the emulsion breakdown is only evident during the heat process. Currently, there is a lack of an effective on-line optical sensor technology for determining meat emulsion stability to produce high-quality comminuted meat products. The goal of this research project is to develop an on-line light backscatter sensor technology for monitoring and controlling emulsification of comminuted meat products during the chopping process. Light backscatter was selected for monitoring emulsification because experimental evidences support that cooking loses are correlated to optical parameters.

The proposed technology will allow selection of the chopping end-point and application of corrective procedures during meat emulsion processing. The development of a meat emulsion sensor technology for controlling the emulsification process would have a considerably effect on meat manufacturing in terms of economics and product consistency and would be a significant contribution to the sensor development program at the University of Kentucky and to the development of the local optoelectronic industry.

Source of Federal Funds: Hatch, Other Federal
Scope of Impact: State Specific

Key Theme – Food Quality

A joint study between the University of Kentucky's Department of Community and Leadership Development and the School of Human and Environmental Sciences focuses on the cost of living in rural areas. Two key features of the food assistance program's ability to meet local food needs are access and the cost of food. The familiar assumption is that it costs less to live in a rural area. However, research indicates higher food prices in rural areas. This research results from Kentucky examining the question: If a person made the same purchases in an urban and rural area, would they encounter the same prices?

Replicating the same methods used in a national study, local prices were collected from eight rural counties and compared with urban counties participating in the national project. The results did not indicate a consistent pattern of lower prices across all rural places in the study. Instead, this research found that given the diversity of rural places, while some items had higher prices in urban areas, other items were lower priced. While the popular perception is that it costs less to live in a rural area, a much more complex picture emerged. Consequently, while it may cost less to live in some rural areas, this was not generalizable to all of the rural areas in this study.

Source of Federal Funds: Hatch, Smith Lever, other federal
Scope of Impact: State Specific

Key Theme – Food Quality

Improved sensors and their resulting process control benefits are needed in the food industry to achieve tighter production tolerances, increased consistency of food properties, process optimization, improved quality and savings in raw materials, energy and waste disposal. This research investigates the use of optical fibers to measure the light scatter characteristics in food products. The scatter of light is modeled and the model used to establish design criteria for optical sensors to measure selected food composition. Prototype sensors are then tested to confirm that they measure the targeted composition. Backscatter sensors which measure food composition or consistency will have several applications in the dairy, pharmaceutical, and biotechnology industries where an inexpensive sensor is required to monitor and control composition. In the dairy industry backscatter sensors can measure coagulation, homogenization and hopefully product compositions such as fat and moisture.

A specific application for a composition sensor is for separator control in the dairy industry. There is need for an inline sensor capable of measuring the milkfat content of creams (35 to 45 wt% milkfat) so that efforts to automate the cream separation process can move forward. A cream sensor that provides separator control will give better consistency of product; minimize heating and cooling costs while improving downstream pumping and cooling operations.

Source of Federal Funds: Hatch, other USDA
Scope of Impact: State Specific

Key Theme – Food Quality

Applied research projects include a multi-state project to assess stored grain management practices for wheat in Kentucky and Tennessee, an investigation of post-harvest processing of specialty grains, the development of alternate energy resources from grain crops, a study on merging precision farming tools with near infra-red (NIR) instruments that rapidly measure grain quality properties, an experiment to convert soybean oil to hydrogen gas, and the development of software to enhance identity preservation of grain lots for assured quality and security.

Experiments are being conducted to improve the mathematical models available for predicting airflow resistance in stored grain. This will lead to modifications to the aeration system design that will minimize the cost and quality deterioration of grain during storage. Grain deterioration leads to mold and insect development that change the flow pattern and loads in the bin. Collaborative research between the Institute of Agrophysics in Lublin, Poland and UK is being conducted to determine the loads created by grain that has spoiled.

The work has led to checklists and protocols for producers and processors to reduce chemical inputs into grain storage. The checklists have been adapted by commercial grain buyers in the western Kentucky and southern Illinois. Changes in grain quality and their effects on bin loads and the structural integrity of grain bins are being developed into national standards

Source of Federal Funds: Hatch
Scope of Impact: Multi-State

Key Theme – Food Safety

The goal of the Expanded Food and Nutrition Education Program (EFNEP) is to not only improve diet and nutritional practices for low income families with children but to reduce the incidence of food borne illness in these homes through improved food handling and storage procedures. Educational classes are conducted by program assistants in one-on-one, small group, and school settings. The University of Kentucky collected FY 06 impact data from 14,201 participants in 4,289 Kentucky families. Food safety practices, such as thawing frozen foods and storing foods properly, improved for 76% of participants.

Source of Federal Funds: Smith-Lever, Other Federal
Scope of Impact: State Specific

Accomplishments and Results for CSREES Goal 3

Goal 3

A healthy, well-nourished population. Through research and education on nutrition and development of more nutritious foods, enable people to make health promoting choices.

Overview

During the past year, the Kentucky Cooperative Extension Service made 133,816 contacts related to Food and Nutrition education. These contacts did not include targeted audience programs such as the 272,363 Expanded Food and Nutritional Educational Program (EFNEP) contacts or the 322,022 Food Stamp Nutrition Education Program (FSNEP) contacts. Due to the tremendous expansion of the program in Kentucky, FSNEP funding has increased from $300,000 in 2000 to over $2.5 million in 2006 with 50% of the funding federal and 50% state funds. Fiscal year 2006 evaluations showed that 91.5% of participants completing six or more lessons have improved in their dietary intake in one or more food groups. Kentucky continues to have a high prevalence of obesity with the percentage of the population that is classified as obese increasing by 134% since 1990. More than a quarter of Kentuckians are obese. In response to the general public's increasing concern over proper diet and obesity and its effects on health and longevity, 346,299 additional contacts were made in FY06 related to promoting healthy lifestyle practices by coupling proper diet and nutrition with exercise and preventive health practices in order to make informed health choices. This area represents one of the fastest growing programming needs in Kentucky Extension. In order to best deal with increasing demand, Kentucky Extension has collaborated with other organizations and agencies to co-sponsored 1,343 different events or activities focused on comprehensive health maintenance. Program such as *Get Moving Kentucky* (18,849 enrolled in 84 counties) and *LEAP for Health* (12,090 participants in 67 counties) are creating an awareness of the breadth of Extension program opportunities among an "expanding" clientele base.

These efforts resulted in 47,608 citizens making lifestyle changes for the purpose of improving their health. Because the availability of fresh, high quality foods effects consumption, 37,843 people reported adopting practices to increase access to food or make it more affordable as a result of Extension educational efforts. An additional 32,130 individuals implemented personal health protection practices appropriate for their life stage (preventive health practices, participation in screening and detection opportunities, immunizations, etc.) and 28,492 people adopted at least one new safety practice (bicycle helmets, fire extinguishers, tractor roll bars, radon testing, smoke detectors, proper ATV operation, etc.).

University of Kentucky College of Agriculture researchers were involved in seven USDA research projects related to the CSREES Goal 3. With the addition of a dietetics program to the College of Agriculture, as well as the statewide focus on human nutrition, Goal 3 will become even more prominent in research.

Human nutrition and health is a focus area of research and extension at Kentucky State University. Childhood obesity, the use of functional foods to improve human health, and determine the effect of human exposure to pesticides are long range goals. Four research projects are currently supported by KSU Research and one is reported on here: Indicators of risk for overweight in preschool children: food consumption and physical activity.

Expenditures	Federal Extension Funds (UK)	$1,395,262
	Federal Extension Funds (KSU)	$269,092
	Federal Research Funds (UK)	$680,304
	Federal Research Funds (KSU)	$496,391
FTEs	Extension (UK)	109.7
	Extension (KSU)	12.0
	Research (UK)	4.0
	Research (KSU)	8.0

Key Theme – Human Nutrition

Kentucky has over 500 Superfund (hazardous waste) sites. Exposure to environmental contaminants from these sites contributes to an increased risk for chronic diseases including cardiovascular disease, diabetes, hypertension, and cancer. Nutrition impacts overall health, particularly chronic conditions, as well as the body's response to environmental pollutants. Drawing on the strength of the nutrition-related research of Superfund Program, University of Kentucky faculty and Extension Specialists have developed nutrition education outreach programs for families living near Superfund sites, health care professionals, and other broad audiences as well as provided training for Extension Agents on the subject of environmental safety**.** Kentucky's community outreach model of translating safe effective nutrition information to those affected by Superfund sites has been presented at national meetings and has received attention as a model for other Superfund research programs.

Source of Federal Funds: Smith-Lever, Other Federal
Scope of Impact: State Specific

Key Theme – Human Health

Kentucky 4-H's traditional focus on health has been food and nutrition projects, however research has shown that mental, emotional, physical and environmental health are just as important. The goal of Kentucky's 4-H Health Curriculum is to provide resources to address each of these components of health education. This past year county 183 agents, specialists, staff, volunteers, and youth were trained by the 4-H Health Curriculum committee on the various opportunities available in KY 4-H Health programming, specifically physical activity and making healthy choices. A focus has been on the 4-H Youth Development partnership with the HEEL (*Health Education through Extension Leadership*) program, and the "Health Rocks!" curriculum through workshops and sessions like "4-H Healthy Living Day" at the 2006 Kentucky State Fair.

County Extension Agents are currently developing community partnerships to aid in the development and implementation of Kentucky 4-H Health programming opportunities. Grant funding totaling $66,241.55 has been distributed from the *Health Education through Extension Leadership* program to 4-H Agents to implement planned programs on childhood obesity, 4-H Health & Safety Fairs, 4-H Safety Days, 4-H Health Camps, Kids Being Healthy Expos and participation in the national "Longest Day of Play" program.

The current level of impact is that more County Extension Agents are providing quality opportunities for their clientele to become educated about the importance of having a physically active lifestyle, making healthier lifestyle choices while also actually increasing physical activity at county 4-H programs and events. Since this is one of the newly reorganized 4-H Core Programs, evaluation of participants is currently underway. Preliminary evidence shows hours of physical activity, number of youth compiling physical activity logs, and the number of youth adopting at least one health or nutrition habit has increased as a result of involvement in these programs.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Human Nutrition

The goal of the Expanded Food and Nutrition Education Program (EFNEP) is to improve diet and nutritional practices for low income families with children. Educational classes are conducted by program assistants in one-on-one, small group, and school settings. The University of Kentucky collected FY 06 impact data from 14,201 participants in 4,289 Kentucky families.

A total of 96% showed a positive change in food consumption habits; fruit and vegetable consumption increased from 3.2 servings per day to 4.8 servings per day. A total of 92% of participants improved in one or more food resource management practices including: planning meals, comparing prices, using a grocery and running out of food less often. Nutrition practices (planning meals, considering family health, not adding salt, reading labels and eating breakfast) improved by 95% in one or more areas. Youth education is conducted in schools, after-school programs, camps, and summer feeding program sites. 29,119 youth participated in at least six hours of nutrition education during FY 2006.

Source of Federal Funds: Smith-Lever, Other Federal
Scope of Impact: State Specific

Key Theme – Human Health

In conjunction with faculty in Mechanical and Electrical Engineering, the University of Kentucky Department of Biosystems and Agricultural Engineering is exploring a novel approach for a three-dimensional fabrication and manufacturing process at nanometer-scale. Research efforts will demonstrate, both theoretically and experimentally, the feasibility of surface plasmon-assisted assembly for a variety of sizes of gold and other metallic particles. The ideas fueling the project put this project at the frontier of nano-scale research, and the outcome will open a new vista of possibilities for both theory and application. The project will result in a comprehensive system that selectively assembles nano-size (1-100 nm) particulates in a coherent, 3-dimensional fashion. Illumination of metal nano-particles at their surface-plasmon resonance wavelength allows selective excitation based on particle size and material dielectric constant. In addition, a nano-scale probe placed in close proximity to a particle can locally enhance excitation over distances of only a few nanometers. The enhanced absorption of the targeted particles, combined with the reduced energy required for surface melting of nano-particles, will allow particles to fuse to one another or to an underlying surface. The outcome is a high resolution nano-patterning tool that can produce user defined structures in three dimensions. With this technology researchers would be able to build nano-sized devices and parts, simply particle by particle. These assembled structures can be used for a variety of applications in fields such as engineering, medicine, information technology, textiles, and filtration.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State

Key theme – Nutricueticals

One aspect of the Department of Plant and Soil Science research is focused on developing plant systems for the production of natural product biochemicals that may be used in the pharmaceutical, nutricuetical, cosmetic, disease, and pest management industries.

Current focus is on plant trichomes that secrete chemicals to the surface of plants. These secreted products are in the form of secondary metabolites or proteins. There is a demand for environmentally-friendly compounds to replace existing chemicals whose desirability is in question. Researchers have isolated new disease resistance proteins called phylloplanins and are characterizing these and determining their usefulness as alternatives to fungicides and bacteriosides. Researchers are studying diterpenes and sugar esters as potential chemical feedstocks and anti-microbials and anticipate that certain plants can be developed as factory plants for producing useful chemicals that are related to their species and cultivar specific capabilities.

Another project involves studies of how plants partition between roots and shoots the undesirable pollutant metal cadmium. Food plants contribute ~70% of Cd intake in humans, and tobacco use can increase this intake. The goal is to prepare modified plants that can retain Cd in roots, so that food and tobacco products derived from shoot tissues (seed, leaf) have reduced Cd contents. Researchers have prepared a transgenic tobacco that in the field has ~30% less Cd in leaves, without impact on agronomic properties. Researchers anticipate that Cd in tobacco shoot tissues (and those of other plants) can be reduced by at least 50% by stacking transgenes.

The surface chemistry of tobacco has been altered by genetic manipulation of trichome expressed genes. Researchers have produced plants that are resistant to aphids in the field and have isolated a new class of surface secreted proteins that confer resistance of tobacco to the blue mold causing oomycete. Researchers have genetically altered tobacco to produce a plant that accumulated ~30% less cadmium in leaves.

Source of Federal Funds: McIntire Stennis
Scope of Impact: Multi-State

Key Theme: Family Development and Management Program

Kentucky State University's Family Development and Management (FDM) Program provides comprehensive services to limited resource families throughout Kentucky, including individual and family counseling, a series of youth heath and nutrition workshops, and statewide implementation of a life-skills curriculum.

The FDM Program has successfully distributed information to several hundred families in the Commonwealth, in addition to assisting in promoting healthy eating habits to hundreds of youth.

Source of Federal Funds: 1890 Extension Funds
Scope of Impact: State Specific

Key Theme – Human Nutrition

Soybeans are the second largest food-crop grown in the U.S. with 85 million metric tons produced in 2004 with a value in excess of $17 billion. Only about 1.5 percent of soy proteins are used in human foods, largely because of flavor problems. Soy protein products with improved flavor will promote their consumption by humans and add value to the U.S. soybean crop. Sulfur-containing compounds (e.g., methanethiol) and lipid oxidation products (e.g., hexanal) are the most potent odorants found in soy protein products. This research shows that certain additives that are generally used to reduce lipid oxidation in foods (reducing agents such as ascorbic acid and sodium erythrobate) cause large increases in both hexanal and the sulfur-containing odorants when added to aqueous soy proteins.

The largest soy processing companies in the United States have already applied this simple but important finding to their soy products. Furthermore, as a result of the findings of this research, commercial processes are being designed to minimize the occurrence of free sulfites in soy protein products and thus reduce the level of sulfur-containing odorants.

Source of Federal Funds: Hatch, Other Federal
Scope of Impact: Multi-state Research

Key Theme – Human Health

Medical nutrition therapy results in health benefits and cost savings for the public. According to the Surgeon General, eight of the 10 leading causes of death, including coronary heart disease, stroke, some types of cancer, and diabetes, are related to diet and alcohol consumption.

A major focus of current research is the role of leptin in appetite regulation. Malnutrition and weight loss commonly occur in patients with inflammatory bowel disease (IBD). In pediatric patients with IBD, malnutrition and weight loss may cause permanent growth stunting. Recently, leptin, an appetite hormone, has emerged as a potential mediator of inappropriate satiety in inflammatory states such as IBD. University of Kentucky researchers hypothesized that patients with IBD may have elevated leptin concentrations contributing to inappropriate satiety and reduced food intake. In an animal model of IBD, research results showed a dramatic increase in leptin concentrations in the IBD mice compared to controls. An investigation is currently underway to determine if the same is true in humans. Confirmation of this will lead to therapies to reduce leptin levels in those IBD patients who have the added problem of anorexia and weight loss.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme – Human Health

Kentucky leads the nation in the percentage of adults who report low physical activity. Cooperative Extension staffs are addressing this health risk factor through an innovative program, called "Get Moving Kentucky." The program includes a media awareness campaign, an eight-week physical activity program and health lessons. It also includes a web-based tracking system that allows participants to keep a record of their physical activity. Communities are forming a physical activity task force to not only implement the program but also to develop a year-round physical activity plan. The UK Wellness Center and Kentucky Cabinet for Health Services are partners in the program.

The implementation of this program has spawned a variety of educational efforts on physical activity within CES. 84 Kentucky counties have implemented this physical activity program with over 12,000 hours devoted to physical activity programming by agents and another 11,000 hours by program assistants. In 2006, over 15,800 individuals participated in "Get Moving Kentucky" bringing total involvement to over 92,000 Kentuckians. "Get Moving Kentucky" has resulted in increased in daily physical activity, with participants reporting weight loss, improved cholesterol and blood pressure, improved mood and feelings of well-being, and spending more quality time with family and friends. Actual numbers on activity and weight loss will be captured in the new, Featured Programs reporting system. An evaluation of the program in three counties where 240 participants were surveyed revealed that participants were active an average of 42 minutes per activity day of the eight-week program. This meets the recommendation of 30 minutes of physical activity five days a week to reduce the risk of chronic disease. Over half of the participants reported weight loss averaging 4.6 pounds and over a quarter reported a decrease in blood pressure.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Human Health

Next to fluoridation, oral health education can make the greatest difference in the oral health of Kentuckians. The Cooperative Extension Service in 37 counties has established local partnerships to implement the Oral Health Wellness and Disease Prevention Program. This program has provided opportunities resulting in unique partnerships with schools, head start programs, local health departments, family resource centers and daycare facilities. Also, provider-based partnerships have been initiated as Cooperative Extension Agents work in tandem with local dental professionals to conduct oral cancer screenings and oral health educational workshops. Over 6,500 Kentuckians, the majority of those being children ages 0 -12, have improved their oral health by implementing new procedures due to their involvement in the Oral Health Wellness and Disease Prevention Program.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Human Health

"Weight: The Reality Series" is a ten-week educational course designed to help adults learn to control their weight. The curriculum includes lesson plans, participant handouts, marketing materials and evaluation tools. There is also a downloadable educational display which emphasizes the connection between behavioral risk factors, such as physical activity and weight, and diabetes. In an evaluation of this program in ten counties with over 150 participants, an average weight loss of 5% of initial body weight was realized. County Extension agents are now expanding the use of the program in their communities with local partners as part of increased demand for programming in diet, health and nutrition. In 2006, over 108,000 individuals reported an increase in knowledge or skills related to diet and exercise as a result of involvement in Extension programs related to improving personal health, one of the fastest growing components of Extension programming for families.

Source of Federal Funds: Smith-Lever, Other Federal
Scope of Impact: State Specific

Key Theme – Human Health

The purification of proteins from various sources is an important aspect of bioprocessing of pharmaceuticals, enzymes, antibodies, etc. Traditional separation and recovery techniques can be quite expensive. Hence, targeting better protein separation and purification techniques will result in a significant reduction in downstream processing costs. Foam fractionation has been shown to be a feasible technique for the separation and concentration of a variety of proteins and enzymes. This project focuses on the feasibility of using foam fractionation as a means to separate/concentrate industrial enzymes and other valuable proteins.

The University of Kentucky Department of Biosystems and Agricultural Engineering is currently working on optimizing the concentration of whey proteins from dilute and concentrated whey solutions and the development of a light based sensor to monitor the foam fractionation process. Research efforts have resulted in recovery of as much as 90% of the original whey proteins and have been able to achieve a nine-fold increase in the whey protein concentration. Researchers have been able to demonstrate that a light scattering technique has the potential to monitor the bubble size and the liquid hold up in liquid foams; however it doesn't appear that the inclusion of the polarized state of the light contributes to the system. This overall project represents a wide-range of application of foam fractionation as a recovery strategy. Foam fractionation is expected to be a low-cost alternative for the recovery and concentration of various proteins that could result in significant decreases in the cost of producing industrial enzymes and pharmaceutical proteins, as well as waste disposal.

Source of Federal Funds: Hatch
Scope of Impact: Multi-state

Key Themes -Human Health

During the preschool years, changes in food habits and physical activity occur in children which undoubtedly influence eating and activity behavior in later life. This can lead to the development of overweight in adolescence and obesity in adulthood. The preliminary data from a cohort of 62 children with an average age of four years, eight months, showed that about 48% of the male and 30% of the female children were "At Risk for Overweight" or "Overweight", while about 3% were underweight. The children in this preliminary survey came mostly from lower income groups, and the total percentage at risk or already overweight children (38.7%) was higher than previously reported nationally (31%) and in Kentucky (35.7%). This preponderance of at risk/overweight preschoolers is perhaps linked to the socioeconomic status; possible causes could be higher-calorie food choices and/or low physical activity. The results of this ongoing survey will have significant impact on the health status of children by enabling us to: 1) delineate the factors responsible for overweight in preschool-aged children; 2) make recommendations that will improve children's food and nutrient consumption patterns and caloric intake; and 3) document the need for mandatory structured and unstructured physical activity both in the preschool and at home. The ultimate outcome would be a decrease in the incidence of overweight in the preschool children, which would later translate to healthier adolescents and adults. This will consequently reduce the risk of overweight associated health problems that include type 2 - diabetes, hypertension, heart disease, and cancer.

Source of Federal Funds: 1890 Evans-Allen
Scope of Impact: National

Key Theme – Human Health

The ability of the Health Education through Extension Leadership (HEEL) program to react quickly to emerging issues by facilitating and coordinating university and agency partnerships was demonstrated by the Medicare Part D intervention coordinated by the HEEL project. The HEEL approach addressed the complex issue of getting rural Kentuckians enrolled in Medicare Part D with an extension approach. This collaboration with the Center for Rural Development, Kentucky TELEHEALTH network and a regional television station resulted in 90 minutes of broadcast discussion on the Medicare Part D benefit to 1/3 of the state's population. In, 2006 a 28-minute broadcast with HEEL staff was aired in 27 eastern Kentucky counties by WYMT television station. HEEL staff sent timely updates and news releases to extension agents across the state who worked with State Health Insurance Provider (SHIP) coordinators to enhance local efforts.

As of May 1, 2006, 74% of eligible Kentuckians have signed up for this new prescription drug plan.

Source of Federal Funds: Smith-Lever, Other Federal
Scope of Impact: State Specific

Key Theme – Human Health

Since its inception, the Health Education through Extension Leadership (HEEL) Program‘s goal has been to impact the overall health and wellness of Kentuckians. Extension Agents have historically conducted programs that address health through nutrition related topics. The focus has now expanded to the overall health and wellness of Kentuckians. It is understood that manyl health conditions and factors are responsible for the poor health status of Kentuckians and now that Extension has expanded its formal partnerships with colleges of health and dentistry, we are doing a better job of programming beyond nutrition alone. These include, sedentary lifestyle, a poor diet high in fat and low in nutritional value, the use of tobacco, and poor health literacy.

Programs developed and implemented to address the issues Kentucky families face include:

- **Get Moving Kentucky** – addressing physical activity and Kentucky’s national ranking as having the worst statistics for physical activity.
- **Calming the Storm** – Addressing social-emotional well being
- **Walk Your Land** – addressing Methamphetamine dangers to landowners.
- **Kentucky Alliance for Drug Endangered Children** – health literacy for serviced providers addressing the dangers to children residing in meth homes.
- **LEAP for Health** (Literacy, Eating and Activity for Pre-Schoolers) – health literacy for preschoolers using storybooks.

Extension Agent Impact Statements reported for FY 01 vs. FY 05 showed a marked increase in Extension health programming (196 in 2001 vs. 319 in 2005) that address the broader issue of diseases and health topics focused on by the HEEL Team. Clientele contact numbers showed a similar increase (349,745 in 2001 vs. 748,489 in 2005). Extension Agents report a cost benefit of $5,353,689 to communities as a result of Extension health programming.

Source of Federal Funds: Smith-Lever, Other Federal
Scope of Impact: State Specific

Key Theme – Human Health

The Asian lady beetle, Harmonia axyridis, is a perennial fall invader of homes and businesses in Kentucky and much of the United States. Until recently, the pest was considered mainly a nuisance. The University of Kentucky, Department of Entomology, in collaboration with a team of allergists at the University of Louisville Medical School, conducted the first study to examine the prevalence of hypersensitivity among people whose homes were infested with ladybugs. The results, published in the Annals of Allergy, Asthma and Immunology and Pest Control Magazine, suggest that Asian lady beetles could be a significant cause of respiratory allergy in heavily infested homes. Management recommendations are provided in an entomology department extension publication which is listed at or near the top of Google™.

Source of Federal Funds: Smith-Lever
Scope of Impact: Multi-State

Key Theme – Human Nutrition

The goal of the Food Stamp Nutrition Education Program (FSNE) is to improve the likelihood that persons eligible for the Food Stamp Program (FSP) will make healthy choices within a limited budget and choose healthy lifestyles consistent with the current Dietary Guidelines for Americans and the USDA Food Guidance System.

University of Kentucky County Extension Agents had over 300,000 educational contacts making potential families aware of this program and in conducting educational components of the program. FSNE Program Assistants had ongoing regular contact with 2459 participants in 1216 Kentucky households of white, black and Hispanic races, with ages from youth to over 60, with nearly three quarters of the participant families having children at home.

The Food Stamp Family Nutrition Education Program is making a difference. Nearly 93.7% of participants showed a positive change in their eating habits. Fruit and vegetable consumption increased from 3.2 serving per day to 4.5 servings. 87% improved in one or more areas of food resources management, 90% improved in one or more dietary quality behaviors and 60% improved in one or more food safety behaviors.

Source of Federal Funds: Smith-Lever, Other Federal
Scope of Impact: State Specific

Key Theme – Human Health

Literacy, Eating, and Physical Activity for Preschoolers (LEAP) has been used by the Cooperative Extension Agents, Extension Homemakers, EFNEP, and other volunteers to promote nutrition, physical activity, and literacy in preschoolers across Kentucky. All 120 Kentucky Counties have at least one set of LEAP books and curriculum. LEAP activities have been delivered in day care facilities, preschools, family resource centers, head start programs, libraries, and community literacy programs across the state, as well as by out-of-state extension programs in Oregon and Virginia.

In FY 2006 10,257 preschool children participated in LEAP activities. Since implementation of the LEAP program in August 2004, approximately 23,080 Kentucky preschool children have participated in program activities. Agents, teachers, volunteers, and others report youth are trying new fruits and vegetables, using good hygiene (good hand washing and food safety), and participating in better lifestyle choices and demonstrate an ability to discuss the importance of eating healthy and participating in physical activity. Parents are also reporting trying new recipes at home with their children. LEAP has been chosen as a model program through the Foundation for Healthy Kentucky.

Source of Federal Funds: Smith-Lever, Other Federal
Scope of Impact: State Specific

Accomplishments and Results for CSREES Goal 4

Goal 4

Greater harmony between agriculture and the environment. Enhance the quality of the environment through better understanding of and building on agriculture's and forestry's links with soil, water, air, and biotic resources.

Overview

During the FY06 program year, the Kentucky Cooperative Extension Service made 223,248 contacts related to promoting the effective stewardship of natural resources through educational programs related to water quality, youth environmental education, land use planning, the Kentucky Water Awareness Program, urban drainage issues, pesticides and their proper use both alone and as joint efforts with other federal and state agencies. In addition to these programs, the success of the Kentucky Master Logger Program is evident in that the Kentucky Legislature requires a trained University of Kentucky Master Logger to be on site at all commercial logging operations. The Master Logger Program has created a demand for a new program planned for FY07 targeted toward the woodland owners themselves entitled the Kentucky Woodland Owners Education Program.

As a result of current efforts, 23,034 individuals reported adopting practices that protect the water, 3509 individuals began using new forest management practices and 28,899 individuals report adopting one or more practices related to conserving, sustaining, or protecting soil resources. New conservation practices were used on an additional 597,552 acres of land.

In the summer of 2005, the Kentucky 4-H Camping program, for the first time, adopted a statewide curriculum on water quality for 8493 junior 4-H campers resulting in 10,065 youth contacts.

University of Kentucky College of Agriculture researchers were involved in 33 USDA research projects related to the CSREES Goal 4. The projects include animal waste management and biological control, two areas of research important to the state and region.

Research into soil conditioners and constructed wetlands for water quality improvement; the ecological impact of organic, conventional and biotechnology enhanced cropping methods for sweet corn; weed control in organic vegetable production; and assessing biodiversity as a means of evaluating environmental health are active programs in this goal area at Kentucky State University. Four research projects are currently supported by Kentucky State University Research and one is reported on here: Weed control in organic vegetable production.

Expenditures	Federal Extension Funds (UK)	$383,314
	Federal Extension Funds (KSU)	N/A
	Federal Research Funds (UK)	$1,308,276
	Federal Research Funds (KSU)	$504,767
FTEs	Extension (UK)	29.9
	Extension (KSU)	N/A
	Research (UK)	20.0
	Research (KSU)	8.0

Key Theme – Energy Conservation – Air Quality

A residential fan control system has been designed and tested to demonstrate the feasibility of a demand control ventilation system based upon inputs of temperature and wind speed. The device has been tested three ways: a) using a randomized block experiment consisting of combinations of constant inputs of temperature and wind speed, b) using a year of simulated hourly weather data, and c) testing under actual weather conditions on real structures using infiltration test cells. Infiltration was measured using a constant-injection tracer gas method. Preliminary results indicated that the DCV system was able to maintain a ventilation rate within an acceptable range of the desired amount and that natural ventilation takes over when it exceeds the desired amount of ventilation.

It was found that the previously identified models of combining mechanical ventilation and infiltration were not adequate to sufficiently describe the combined airflow in a single zone structure such as a residence and that the constant-injection tracer gas measurements were not very reliable. The models previously used were developed for larger commercial buildings with dedicated outdoor air, return and exhaust ventilation systems. Experiments have been designed and are being conducted to validate a single cell model which has been developed. A more fundamental technique of measuring the airflow through the chambers using the pressure/flow relationships across calibrated orifice plates has been designed and calibrated.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Themes – Organic/Sustainable Vegetable Production

A four year Kentucky State University research project has shown that some low-cost weed management and cultivation techniques work better than more expensive alternatives. The rolling cultivator, one of the least expensive weed management alternatives tested, has proven to be the most effective. Its use will save organic growers more than $400 per acre over hand weeding or over the much less effective tactic of applying corn gluten meal as an organically-approved herbicide. Similarly, research has shown that an articulated spading machine does not offer a sufficient soil conservation advantage to justify its high cost. Through numerous workshops, results have been presented to more than 250 southeastern growers interested in organic production. 48% of those who attended one of these workshops in 2005 planned to start growing organically; some of them contributed to the tripling of certified organic farm numbers in Kentucky in 2006. Researchers expect continuing rapid growth in organic vegetable production in the southeast, and in Kentucky, in particular. This will allow southeastern growers to access a market which has grown by 20% each year for more than a decade, bringing premium prices to organic growers. Results save organic farmers money.

Source of Federal Funds: 1890 Evans-Allen
Scope of Impact: Regional Research

Key Theme – Water Quality

Forestry Best Management Practices (BMPs) are designed to reduce nonpoint source pollution (NPSP). Previous work at the University of Kentucky has demonstrated that forestry BMPs lessen NPSP, however, the importance of specific BMP recommendations, such as the width and disturbance allowed within a riparian zone, are still unknown. Efforts thus far have involved the selection of sites, characterization of stream geometry and morphological metrics, flume and weir installation, hydrologic monitoring, water chemistry monitoring and characterization of macroinvertebrate communities within the stream systems. Storm flow hydrographs and statistical relationships between event magnitude and hydrologic response have been developed for each watershed. Statistical relationships for water chemistry at both the perennial and intermittent section of each stream were also developed.

The importance of streamsite management zones (SMZs) in maintaining hydrologic function and filtering sediment is obvious, but is not well quantified.This data will allow us to determine if a change in stream discharge or water chemistry after the treatments have been installed is the result of natural variability or a true effect of the harvest activity. Pre-harvest characterization of the watersheds will continue until harvesting begins, which should occur in 2007. The ultimate goal of this research is to develop streamside management zone BMPs that are appropriate for the Central Appalachian Region.

Source of Federal Funds: McIntire-Stennis
Scope of Impact: State Specific

Key Theme – Forest Resource Management

Fire has been an important disturbance agent in forests for thousands of years, and is thought to have been integral to the long-term development of upland oak forests in the Appalachian region. Starting in the 1930s, fire suppression was initiated as a control measure to limit the negative impacts of fire on forest stands. Although seemingly necessary at the time, recent evidence suggests some negative effects of fire suppression on oak forests. In some cases, evidence researchers have gathered to date does not strongly suggest that prescribed fire can accomplish management objectives, perhaps because fire is an imprecise management tool whose effects unfold over long time periods. This project builds on ten years of research examining the role of carefully prescribed fire in the management of upland oak forests. The publication of a research report describing changes in stand structure over nine years in burned and fire-excluded oak stands was an important accomplishment, as it details the effects, and sometimes lack of effects, of prescribed burning on attributes of forest structure that could lead to improved oak regeneration. Similarly important long term datasets are under development that will describe impacts of burning versus fire-exclusion on seedling survival and growth, forest fuels, and damage to residual trees. These components of the research are of interest and importance to forest managers as they plan ongoing and future burning programs across large acreages of public land.

Source of Federal Funds: McIntire-Stennis
Scope of Impact: State Specific

Key Theme – Agricultural Waste Management

Pervious concrete is a mixture of coarsely graded aggregate and cement that results in a material that easily transmits water. Pervious concrete has mainly been used to control runoff from parking lots and to allow groundwater recharge. Since the mixture has a porosity and permeability, there could be several advantages of using pervious concrete for agricultural purposes including solid/liquid separation and waste remediation. Current research is exploring the belief that the pore structure of pervious concrete will provide space for bacterial growth, which will enhance organic material digestion as well as aid in carbon dioxide evolution, urease production, and reduction of pathogen colonies in the samples during and after manure additions.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme - Forest Resource Management

Considerable research has been conducted on the effects of nitrogen deposition on forested ecosystems throughout the United States and Europe. Significant understanding of the impacts of long-term elevated rates of nitrogen deposition has resulted from this body of research. The objectives of this project were to establish baseline information regarding soil N processes in four dominant forest community types, evaluate seasonal patterns of soil N processes among forest types, and examine relationships among N cycling and concentrations in soil solution, and cation leaching, among different community types. Understanding differences for among forest types will contribute to a developing body of scientific literature identifying those forest types that are most susceptible to continued and increasing N deposition.

Results of this research demonstrated strong differences among forest types in nitrogen cycling, with stands dominated by oak species showing much lower nitrogen concentrations and rates of nitrogen cycling in soil.

The results of this research have been presented to Mammoth Cave National Park. Mammoth Cave National Park was an ideal location to evaluate the soil processes that control production, retention and release of nitrogen due to its extreme carst geography with sinkholes and the extensive cave system. The projected development of a coal-fired power generation facility near this National Park mandate the initiation of protocols for quantifying the rate of nitrogen transformations in the soil and the fate of soil nitrogen necessary.

Researchers and managers will use the findings to design and implement a program of monitoring to measure the future impacts of atmospheric deposition of nitrogen on forest stands and to predict how ongoing and potentially increasing rates of nitrogen deposition will differentially impact forests differing species composition.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme – Endangered Species

This research related to the re-establishment of elk and black bear populations in Eastern Kentucky is important in understanding the ecological relations between colonizing large mammals and their environment in a landscape that has been without them for more than a century.

In this project 42 elk calves were captured and studied. Studies of elk calves include survival rates and reasons, movement within the habitat region and blood analysis to determine meningeal worm infection.

In a related study, 25 black bears were captured and radio-collared. Studies include cub numbers, gender, and location and movement within the region. Rearchers also continue their analysis of the Kentucky Department of Fish and Wildlife Resources black bear database. The Kentucky black bear population appears relatively small, young, and recolonizing.

Researchers are also examining how the presence of the black bear near the Kentucky towns of Cumberland, Benham, and Lynch, affects area residents and how their views may affect bear colonization. Using interviews and surveys, researchers explored the motivations and interests of people who visit Kingdom Come State Park to see bears and their perceptions about wildlife. Using microsatellite DNA analysis researchers are examining kinship and dispersal paterns of black bears in Kentucky and their probable genetic origins. Initial results are consistent with recolonizing populations elsewhere and indicate that many of the bears in Kentucky originated in West Virginia.

Such information is important in devising long-term management strategies and providing direction for short-term adaptive management that promotes ecological restoration and acceptance by the local human population. Researchers expect that the black bear and elk will continue to increase in conservation and tourism value as both populations grow and as the public becomes more aware and appreciative of the services both species provide.

Source of Federal Funds: McIntire Stennis
Scope of Impact: State Specific

Key Theme – Forest Resource Management

Invasion of forests by exotic plant species often leads to a substantial reduction in the diversity of native plants within the forest, a loss in the regeneration of native trees, and may result in a long-term loss of ecosystem function. An exotic invasive plant that has proliferated rapidly throughout Kentucky and the southeastern US in the past 15 years is Amur (or bush) honeysuckle. Amur honeysuckle presents a major problem in Kentucky forests as well as an obstacle to the restoration of nature preserves in the region. The Kentucky Forest Health Task Force has identified the proliferation of this invasive plant in Kentucky as a 'forest health crisis.' Not only does Amur honeysuckle lead to a reduction in herbaceous understory species, it also negatively impacts the establishment of tree seedlings and forest productivity, leading to potential long-term impacts on forest community composition as overstory trees age and senesce. Researchers are examining the proliferation of a suite of invasive plant species in multiple forest remnant sites, mesuring potential site factors that may influence invasion including light availability, soil factors, land use history, forest age, size of the forest remnant, and degree of fragmentation by roads and trails.

While removal of Amur honeysuckle is a necessary first step in restoring forest remnants and forest edges, it is apparent that the extent of the honeysuckle invasion vastly exceeds our existing capability to remove the species, pointing to the need for a stronger understanding of the factors that contriute to the spread of invasive plant species. This project will contribute to the accumulating expertise and knowledge base needed by the individuals and organizations working to protect and restore forest sites in central Kentucky.

Source of Federal Funds: Hatch
Scope of Impact: State Specific

Key Theme – Forest Resource Management - Water Quality

The Kentucky Master Logger program is a comprehensive state wide education and training program for timber harvesting professionals. Kentucky loggers feed the $5 billion forest industry in Kentucky and training through the Kentucky Master Logger program is required for every commercial logging operation in the state. In 2006 a total of 10 three-day introductory training programs graduated 350 new loggers. The participants were exposed to training in environmental protection, safe logging practices and laws and regulations impacting timber harvest. In 2006 the Kentucky Master Logger program conducted 34 advanced training courses for 1,604 Kentucky Master Loggers. Topics included Logging Aesthetics, Advanced BMPs, Timber Cruising Basics, Logging Mechanics and Equipment, Map and GPS for Loggers, and Log, Lumber and Tie Grading. In addition to logging practices and safety issues, end results are also focused on the use of best management practices for stream and environment protection.

The Kentucky Master Logger Program has 4,155 active loggers in Kentucky representing over 1,500 small businesses. Annually these loggers impact 240,990 acres of woodlands, harvesting over 899 million board feet of timber providing over $130 million of timber revenue to 9,556 landowners in Kentucky..

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme - Forest Resource Management

At the University of Kentucky, researchers have undertaken a large-scale project to simultaneously address several coal mining related environmental and ecological problems. As such, specific research projects pertaining to mineland reforestation, headwater stream restoration, water quality improvement, wildlife habitat enhancement, and atmospheric CO2 mitigation are underway. Use of newly-developed reclamation methods intended for minimizing environmental and ecological damage will greatly benefit for the citizens of Kentucky. Thus far, the following has been accomplished from this research:

•Over 1.8 million seedlings have been planted on 2,656 acres of previously reclaimed (grasslands) and active mine lands in Kentucky.

•Seedling survival varies by species, site and reclamation approach with averages approximating 80% for loose dumped spoil, 70% for ripped spoil and less than 25% using traditional reclamation techniques.

•Use of the forestry reclamation approach has resulted in savings of ≈ $2,000 per acre over traditional reclamation practices. Lands reclaimed to forests are selling for as much as 20% higher than those reclaimed to wildlife habitat.

•Carbon sequestration rates as high as 2.9 metric tones per hectare per year have been measured in recently reforested loose dumped spoil. Total carbon production (plant and spoil carbon) on eight year old stands with loose dumped spoil average 40 metric tones per hectare. Given that carbon credits are currently being traded at ≈ $4 per metric ton on the Chicago Climate Exchange, carbon capture may provide opportunities for alternative post-mining land use.

•Designs for the restoration of the Guy Cove watershed were approved by the Kentucky Mitigation Review Team and funds for the project ($1.07 million) were released to UK. The project will involve the reforestation of a 110 acre watershed, creation/restoration of approximately 6,000 feet (1.14 miles) of stream channel and the creation of approximately one acre of wetland habitat. The project will also evaluate the use of passive treatment systems, including bioreactors and artificial wetlands, for water quality improvement.

Source of Federal Funds: Hatch, Other USDA
Scope of Impact: State Specific

Key Theme – Agricultural Profitability

At the University of Kentucky, Department of Agricultural Economics, investigation is continuing of the potential impacts of alternative production practices, enterprises and technologies on the profitability and risk experienced by Kentucky producers. These further efforts focus especially upon the further research of break-even area analysis and precision livestock feeding economics.

First, results of break-even area analysis (number of acres farmed to justify ownership of equiment) suggest that both custom hiring and ownership of equipment have potential economic advantage depending on the conditions being considered. A framework for assessing the least cost alternative between these two options was developed as the first study objective and empirically applied to establish guideline benchmarks for producers as a second study objective. Producers with a farm size larger than the calculated break-even area would spend less money by purchasing equipment than custom hiring to adopt in precision agriculture. Break-even cropped area results can guide farm managers in evaluating if they have sufficient cropland to spread fixed costs of ownership associated with a new technological investment.

Precision dairy feeding analysis revealed four points to consider: 1) Manure and nutrient management under precision agriculture technologies may offer opportunities to improve the profitability and environmental risk management of dairy operations. 2) Developing strategies that will use more of their own farm raised feeds and less purchased feeds may provide less nitrogen and phosphorus loading and less manure excretion while improving farm profitability. 3) An optimal whole farm nutrient management plan allows for changes in crop production and feeding that may help reduce the accumulation of excess P and N, while maintaining or improving farm profitability. 4) Efficient production of crops and forages strengthens the economic position of a farm and limits the potential negative impact on the environment.

Source of Federal Funds: Smith Lever
Scope of Impact: State Specific

Key Theme – Agricultural Waste Management

An issue facing livestock producers is the amount of nitrogen (N) excreted from animals and applied to cropland. Nitrogen excretion in the waste is both inefficient and environmentally wasteful. To minimize N excretion, many producers and feed companies are using lower protein diets (N comes from unused protein) and supplementing the diet with critical amino acids. When supplementing with amino acids, there are alternatives available.

A project related to methionine, one of the most important amino acids in livestock nutrition, was completed by University of Kentucky researchers. Methionine is a limiting sulfur amino acid in pig diets. It is commonly supplemented as dry DL-methionine (DLM) , or as liquid DL-methionine hydroxy analog-free acid (MHA-FA) .The present studies determined the relative efficacy of MHA-FA compared to DLM to support growth performance and N retention in pigs using diets with corn as the principle cereal grain. Using a slope ratio procedure for comparison, data indicated that the mean relative bioequivalence of MHA-FA to DLM was 64% on a product-to-product (wt/wt) basis or 73% on an equimolar basis.

The demonstration that the bioequivalence of the two primary methionine sources is not equal has major impact on purchasing and use decisions. Failure to make needed adjustments would mean that pigs actually were not receiving adequate sulfur amino acids and would result in less protein (i.e., muscle) deposition in the body and more nitrogen excretion in the waste which is both inefficient and environmentally wasteful.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State

Accomplishments and Results for CSREES Goal 5

CSREES Goal 5

Enhanced economic opportunity and quality of life for Americans. Empower people and communities, through research-based information and education, to address economic and social challenges facing our youth, families, and communities.

Overview

In FY06, the Kentucky Cooperative Extension Service made 1,671,911contacts related to the development of life skills in youth and adults. These include Parenting, Family and Consumer Sciences, Family Resource Management, Leadership, Personal Development and Civic Engagement. 147,908 contacts were related to community capacity building, such as Community Systems and Processes, Economic Development and Small and Home-based Business Development. Extension assisted 1504 small and home based-businesses in FY06. 142,468 contacts were related to the development of communication skills in youth with 35,116 youth participating in 4-H Speech and Demonstration Contests, a hallmark of the 4-H Youth Development Program.

202,904 Kentucky youth participated in Extension 4-H Youth Development programs with over 168,000 (86%) receiving 6 hours or more of instruction in science, technology and life skills education. 18,950 adult and youth volunteers provide leadership to the Kentucky 4-H program. 19,441 individuals were members of Extension Homemaker Clubs affiliated with the Kentucky Extension Homemaker Association. This approach of using multiple contacts through clubs and instructional programs allows us to impact people's lives rather than just touch them.

As a result of these efforts, 78,845 individuals demonstrated informed and effective decision-making. 84,015 youth and adults demonstrated the application of practical living skills. 94,116 youth reported the acquisition of one or more life skills as a result of participation in non-formal youth development programs conducted by Extension.

Extension helped an additional 7,395 prepare to enter the workforce. 4,883 dependent care providers (adult or child care providers) reported changes in knowledge, opinions, skills, or aspirations as a result of programs conducted by Extension. 22,166 individuals reported changes in knowledge, opinions, skills, or aspirations related to parenting or personal relationships and 17,916 individuals adopted one or more practices to improve their financial wellness.

University of Kentucky College of Agriculture researchers were involved in 6 USDA research projects related to the CSREES Goal 5.

After reviewing the Key Themes listed for each goal, the Kentucky State University projects listed in the Five Year Plan for this goal are now listed under Goal 3 and Goal 4, whichever was deemed more appropriate.

Expenditures	Federal Extension Funds (UK)	$3,089,510
	Federal Extension Funds (KSU)	$304,239
	Federal Research Funds (UK)	$104,662
	Federal Research Funds (KSU)	N/A
FTEs	Extension (UK)	242.8
	Extension (KSU)	6
	Research (UK)	5.0
	Research (KSU)	N/A

Key Theme – Agricultural Financial Management

The 1990 Farm Bill mandated that borrowers obtaining loans from the Farmers Home Administration (currently the Farm Service Agency) would be required to receive training in farm business planning, financial management, and crop and livestock production practices. Farm Management Specialists with the University of Kentucky, Department of Agricultural Economics responded with an intensive, 16-hour training program for this clientele group. More that 1,530 borrowers representing 1,004 farms have participated in 82 workshops across the Commonwealth.

Evaluations show that over 97% of the farmers would recommend this workshop to another farmer. This is a real accomplishment considering that this is a two-day program in which they are required to participate, they must pay for the workshop, and their participation is graded. Two of the most revealing comments indicating the educational value of the workshops have been, "I wish they would have made us do this 30 years ago," and "Every farmer should be hogtied and made to take this workshop."

A more in-depth evaluation of all past participants was conducted during the summer of 2006. For some of the participants it had been 10 years since they had completed the workshop. 75% of respondents believed their farm management skills had been improved by participation in the workshop. 55% of those responding believed that their farming operation was more profitable as a result of participating in the FSA Workshop. The average annual increase in farm profits for those believing their farm operation was more profitable was 18.2%. The increase in profits ranged from $500 to over $2,500 per year. These absolute dollar amounts may not seem that large, however, one must realize that the farm operations represented in these workshops are typically quite small. Further, these improvements were made by improving management capabilities of the farm business manager with no additional costs, investments, or improvements required.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme: Community Resource and Economic Development Program

The Community Resource and Economic Development Program aims at disseminating information to small business owners, future entrepreneurs, and women and/or minority business enterprises (W/MBEs) to assist them with establishing long-term and sustainable economic and business development plans. The targeted communities represent some of Kentucky's largest tobacco-dependent counties, which make this project crucial for supporting new venues for locally-based economic development. Additionally, several of these communities are facing population loss if they are unable to create stable local economies.

The impact has been increased partnerships with County Chambers of Commerce in five counties across the Commonwealth. The partnerships have then led to initiatives to increase small business development and support from county governments for entrepreneurs.

Source of Federal Funds: 1890 Extension Funds
Scope of Impact: State Specific

Key Theme – Estate Planning

Approximately 70 percent of probated estates are filed in testate (without a valid will). The transfer of assets at death is a financial matter for which more family members need to make plans. Estate laws are state specific, so wills prepared in other states are not always valid in the Commonwealth of Kentucky. Thirteen Kentucky counties and other special interest groups have held estate planning workshops in the past two years. The workshops consist of a series of four three-hour meetings. Extension Agent evaluations and feedback from these workshops report that 100 percent of attendees gained knowledge and plan to have more discussion with their families. In one county, 100 percent of participants stated that they are better prepared for end-of-life situations. In a three-month follow-up survey, 44 percent have started or have completed an estate plan. Actions reported as a result of the workshops included: preparing a will, talking with an estate planning attorney, making changes in beneficiaries and communicating with other family members the need to make wills. In another county, 90 percent of participants indicated that they will use the knowledge gained to further investigate estate planning tools. In all counties, the participants recommended the class be repeated.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Consumer Management

Over the past 15-20 years, more and more private land has been converted to recreational lease uses. In this study within the Appalachian Region of the United States it is found that the consumptive (hunting and fishing) and non-consumptive (camping, hiking, etc.) uses of private land provide income to rural communities and farmers that are willing to lease their land to the public. The reasons for leasing are varied. Some private landowners, many of whom formerly let some hunters on their property for nothing, are now leasing those hunting rights to generate income. In other situations, the farm operators have died and their sons and daughters now own the family farm, and they turn to leases as a way to pay the taxes. Regardless of the reason, the price at which this acreage is being offered varies with the ability of the individual farm operator to properly value their acreage. Data from this University of Kentucky study has resulted in a mathmatical method of calculating lease value based on the supply function of private land opened to public use This supply value is a function of private land owner characteristics, characteristics of the land itself, proximity to protected land, amount of protected land within 60km, and accessibility of this nearby protected land. The information generated becomes useful to farmers and other private land owners, outdoor sportsmen, and rural communities in placing values on private lands used for recreational purposes. Communities stand to benefit from more efficient pricing of private land, which may attract outdoor sportsmen, and generate income for the community.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State

Key Theme: Family Economics and Management Program

Kentucky State University's Family Economics and Management Program played a vital role in providing information to eligible families across the State of Kentucky on the Earned Income Credit (EIC) and Child Tax Credit (CTC) campaigns for the 2006 tax season. The Family Economics and Management Specialist provide annual leadership to the program for the state.

To help spread the word, EIC informational kits are purchased and distributed to all county Family and Consumer Science Agents (in 120 counties), EFNEP Assistants, FDM Assistants, Small Farm Assistants, and some churches, day care centers, nursing homes, and libraries, etc. Informational articles and evaluation tools are also enclosed in packets. The specialist collaborates with the IRS Volunteer Income Tax Assistance Program (VITA) to inform citizens about the availability of free tax preparation at locations throughout Kentucky.

An example of the effectiveness of this program comes from Daviess County. One hundred community volunteers and twenty-five tax preparers donated their time in support of nine free tax-prep sites where five hundred thirty families received free tax preparation assistance. Families saved $60,000 in tax preparation fees and loans. Of the more than $500,000 in income tax refunds, $280,000 was in the form of Earned Income Tax Credits.

As a result of the efforts of KSU's Family Economics and Management Specialist, county agents, program coordinators, it is estimated that over 950 families received information on the EIC and CTC, and more than 600 applied.

Source of Federal Funds: 1890 Extension Funds
Scope of Impact: State Specific

Key Theme – Children Youth and Families at Risk

160 teens and adults from 20 western Kentucky counties spent two days in late September gathering information on drug abuse prevention to take home and combat the problem in their communities. In addition to the highlighted youth-adult partnerships, youth development specialists, law enforcement and health and prevention specialists shared information and curriculum with the participants.

The retreat had a positive effect on both youth and adult attendees in acquiring more ideas about working with each other on substance abuse prevention programming. 71% of the youth indicated they were leaving with more ideas on how to work with adults. 76% of the adults indicated they had more ideas on how to involve youth in substance abuse prevention activity. Overall, the complete data seem to indicate that the retreat increased the youth participants' sense of belonging and being valued. Existing research supports that these assets along with the availability of non relative adult mentors and advisors serve as an important deterrent to substance abuse and a number of other common developmental problems. The six month and one year surveys will continue to explore these themes established through the retreat.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Jobs/Employment

Extension Foresters focus on a variety of educational and service components including industry training programs, industry service activities, and economic development projects. Industry training programs have included such topics as Profile Knife Grinding and Moulder Set-up and Operation, Introduction to Hardwood Lumber Grading, Blue Print Reading for the Wood Industry, and level II forest ranger technician training programs. The industry service programs include such activities as; in plant visit/consultations, plant layout work, and product and tooling design and development. The economic development projects may be where a company wants or needs to expand production through vertical integration or where a business/plant is starting new.

An example of the industry service is with Thornberry Enterprises. Their facility employs nearly 100 people. Because of their size they had reached a point where they needed to increase efficiencies in their rough mill area by changing some out-dated equipment. Because of the expense (nearly a million dollars) and size of the equipment, the management team had some misgivings on how the new equipment would work and fit in their current facility. Working with Extension Foresters to develop a plat of their operation, they have since made the changes and in doing so increased production, total capacity, and flexibility in terms of the types of products they can now produce.

An example of an economic development project would be Northern Kentucky Cedar. NKC has traditionally produced and sold green Eastern Red Cedar Lumber, but in 2006 their largest customer discontinued making products and instead started purchasing these products already assembled from China. For the last several years Extension Foresters had been working with them to assist in finding ways to integrate their operation. During this process they have already added much of the equipment needed for this conversion. Extension Foresters assisted them in identifying and developing value-added products they could produce and sell. They now produce a line of outdoor furniture which Extension worked with them to design and develop. In addition, they are currently in the process of gearing up to start producing a line of birdhouses and birdfeeders.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Community Development

Kentucky AgrAbility is celebrating over 10 years of service to rural Kentuckians with disabilities. The Kentucky Cooperative Extension Service provides education and technical assistance to agricultural operators and farm families who face the challenges of a disability. Farm families many times feel that an injury or disability may make it too difficult to continue farming activities. Kentucky AgrAbility assists rural and farm families in overcoming limitations. Kentucky AgrAbility exists as a partnership between the University of Kentucky Cooperative Extension Service and Cardinal Hill Rehabilitation Hospital. Over the past four years, Kentucky AgrAbility has provided direct assistance to 131 clients and families with disabilities as a result of referrals across the state. There have been a surprisingly large number of clients from the Eastern portion of the state; unexpected, given the east is not considered as large an agricultural economy. AgrAbility has also worked with a large number of agricultural operations on small acreage. Kentucky State University has become more active in the program resulting in more farmers from minority backgrounds succeeding in farming. Kentucky's farmers are getting older and experiencing disabilities that accompany aging. Kentucky AgrAbility has seen a predominance of amputations and spinal cord injuries, with many of these injuries taking place off the farm, in motor vehicles and in participation in recreation activities.

In addition to individualized assistance AgrAbility has provided training opportunities to:

- Disability service providers (Kentucky Office of Vocational Rehabilitation staff, supported employment specialists)
- Rehabilitation hospitals and healthcare provides (occupational therapists, physical therapists, speech language pathologists, case managers, social workers and physicians)
- Kentucky Cooperative Extension Service staff
- Association of Driver Educators
- Recreation therapy program staff
- Undergraduate and graduate students in Rehabilitation Counseling, Social Work, Biomedical Engineering, Agricultural Engineering.
- Other AgrAbility professionals around the country

Source of Federal Funds: Smith-Lever, Other Federal
Scope of Impact: State Specific

Key Theme – Tourism

Agritourism enterprises provide small business development opportunities and potential profitability to sustain family farms and the rural landscape. The Kentucky Cooperative Extension Service has facilitated the establishment of leadership networks which have resulted in farm enterprises and tourism organization members networking to increase individual enterprise revenues and state tourism dollars through collective marketing.

Successes to this point have been numerous. These Extension initiated local networks have successfully obtained State/County Agricultural Development funds from Tobacco Settlement Funds, grants from the State Agritourism Council, and matching funds from state, county and regional farm bureaus, agribusinesses and tourism promotion organizations for marketing plan implementation. In addition to sparking legislation which encourages the production, processing and marketing of farm raised/process goods, significant marketing initiatives include the current development of member promotional brochure/map, websites, regional tourism advertisements and brochure distribution at state welcome/rest areas and state/national parks – all designed in cooperation Kentucky's "Unbridled Spirit" campaign. State government has increased directional signage on Kentucky interstates and other major highways and enhanced the Kentucky Product State Purchasing Program. Offshoot programs include "Hospitality Matters," a 'train the trainer' program for agritourism producers and tourism employers focusing on the importance of hospitality services to the community, businesses, visitors and employees.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme-Youth Development/4-H

4-H Camp in Kentucky involves over 12,000 youth annually in traditional summer residential and environmental camps. In fact, 4-H camp, along with speech and demonstration projects, are the most often mentioned experiences of former 4-Hers. Youth development at 4-H camp is often measured in terms of the subject matter taught to youth at camp but it has been understood for some time that the camping experience itself has a significant social and developmental impact on youth. In order to better understand the significance of the camp experience on youth development, Kentucky 4-H participated in a multi-state project to pilot an evaluation instrument aimed at measuring the positive youth development outcomes of the 4-H residential camping experience. The instrument is based on concepts of the 4-H Essential Elements and the Circle of Courage to (1) find out how campers feel about their camping experience and (2) assess their perception of life skills impacted by their experience. A total of 1729 campers attending the Western Kentucky 4-H Camp completed the survey.

Kentucky results showed that the camp experience resulted in (1) positive relationships with other campers and adults, (2) campers felt positive toward their experience and (3) a perception of increased life skills. These results along with those from other participating states will be used to finalize a nationwide survey instrument for use in measuring outcomes from the 4-H camping experience and to strengthen future camp program planning efforts.

Source of Federal Funds: Smith-Lever
Scope of Impact: Multi-State KY, OH, MT, VA, WV

Key Theme – Consumer Management

Identity theft is a growing problem facing businesses and consumers and has increased along with the expansion of databases containing individuals' private information. Identity theft has led the list of consumer complaints for seven years in a row, now accounting for 36 percent of the 674,354 complaints received by the Federal Trade Commission.

The Kentucky Cooperative Extension Service has joined forces with the Kentucky Attorney General's Office of Consumer Protection to develop identity theft educational materials such as, "Let the Consumer Beware! A Guide to Fraud and Rip-Offs" and "Making Your Ride on the Internet Safer." Efforts have focused on helping to guard against identity theft as well as steps that can be taken to mitigate its impact on consumers.

Although there are few ways of measuring what didn't happen as a result of educational efforts, according to the FTC, Kentucky ranked 44th in the nation in identity theft complaints per 100,000 people in 2006. Identity theft was not only not the number 1 complaint area in Kentucky, it was not even in the top five areas of complaints that the FTC received. The education of consumers has resulted in savings of thousands of dollars for Kentucky citizens, let alone the amount of time saved trying to get their identity back.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Jobs/Employment

This program enables small Kentucky manufacturers in the Secondary Wood Industry to take advantage of the expertise and technically advanced equipment available through the University of Kentucky, Department of Forestry and its Wood Utilization Center. At the heart of every secondary manufacturer lies a moulder. A moulder is a machine that shapes a piece of wood on all four sides. Nearly every piece of wood that is in a house at some point was processed through one of these machines including the flooring, studs, trim, cabinets, and even the furniture. This piece of machinery is the biggest obstacle to expanding production and sales because the complexity of the machine as well as cost of ownership and operation.

This process involves the development of a template or guide, which will be used to manufacture the tooling. This process is done by hand, takes a long time, is tedious in nature, and is not very accurate. Technology is available to reduce these problems; however, because of the expense involved and the small size of most Kentucky manufacturers, few have purchased it. The UK Wood Utilization Center has acquired the technology and the Department of Forestry extension staff offers template making and tooling design as a service to the industry. This creates an open line of communication with the industry that otherwise would probably not exist. Not only is the University of Kentucky providing a tool for the industry, UK is also now training those in the industry on how to design and manufacture the tool resulting in significant reductions in error and set-up time, improved quality, and increased production, providing a huge advantage for Kentucky manufacturers. Training has been conducted for three different companies during the current year with an estimated impact of $587,749 saved or earned for the Kentucky forest industry.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Youth Development/4H

Research has shown that positive adult/child interaction results in youth with a higher self esteem and who become contributing members in society. In Kentucky, there are currently 202,000 4-H'ers and over 18,950 volunteers assisting those youth. By assessing the needs of the 4-H Agents and 4-H Volunteers who lead 4-H clubs it was determined that there was a critical need for organization information, and guidelines with regards to the formation and execution of 4-H clubs. A group of Kentucky 4-H Agents took the lead in the development of the Kentucky 4-H Club Handbook which is now assisting 4-H Agents and leaders in developing positive adult/child relationships.

Currently 110 of Kentucky's 144 4-H Agents have completed the training designed to provide instruction on the handbook. The development of this resource has established statewide standards and program development and training materials which have enabled 4-H agents to (1) more clearly define the roles of the 4-H leaders, and (2) establish expectations for the 4-H Club members. The planning guides have resulted in increased interaction between youth, their parents and club leaders in planning their 4-H career. The Kentucky 4-H Club Handbook has become ***the*** instrumental manual in the development of the Kentucky 4-H Club System.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Consumer Management

Recent national studies show that most high school seniors are not "financially literate." In Kentucky, Cooperative Extension's Department of Family Studies has chosen to use a program titled High School Financial Planning Program (HSFPP) to address this issue. This six-unit, award-winning program produced by the National Endowment for Financial Education provides teens with a greater understanding of their personal finances in the areas of goal setting, budgeting, saving, credit, and risk management. The program uses unique games, simulations, case studies, and interactive exercises providing hands-on experience for teens to understand and apply the financial principles and concepts being taught.

In 2006, 97 volunteer leaders and teachers engaged 10,620 teenagers in this program. An evaluation of the program shows that teenagers who studied through the program reported significant improvement in their financial knowledge, behavior, and confidence. Three months after completing the curriculum, 59% of the students indicated that they had changed their spending patterns by 1) now only purchasing things they really need and 2) spending more wisely. 60% indicated that they had changed their savings patterns. Those who reported having changed their savings habits, 80% said they now save for what they need or want and 20% indicated that they now save every time they receive money.

For those who choose not to use the High School Financial Planning Program, Family Studies sends 4-H Extension Agents and teachers weekly financial education lessons to use with after school programming. Based on development of weekly financial education lessons for used by teachers and county 4-H agents the National Association of Security Dealers Foundation has funded ($189,000) a new program development titled, Future 4-H Millionaire Club.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Youth Development

A recent study on the level of environmental literacy in Kentucky concluded that nearly 50% of the respondents incorrectly answered basic knowledge questions about Kentucky's environment. One method of correcting this poor understanding of the environment is to reach preschool and elementary age school children. Extension Foresters worked extensively with The Louisville Science Center in completion of their latest permanent exhibit: *The World Around Us*. This exhibit is unlike any other exhibit in Kentucky in that through interactive learning the exhibit will introduce environmental concepts to children and adults. The centerpiece exhibit, ***Ecoexplorer***, is a hands-on electronic display that responds to children's efforts to explore wetlands, grasslands, forests, and urban parks and helps them understand environmental concepts like "why do leaves change color," or "what types of spring flowers occur in the Appalachian forests," or "why do birds migrate?"

Extension Specialists at the University of Kentucky have been working directly with personnel from the LSC to develop ***Ecoexplorer*** and other exhibits. More than 600,000 children from Kentucky and southern Indiana visit the museum each year. Staff at the LSC, in partnership with Extension personnel have developed educational outreach materials that teachers and other environmental educators use with elementary age school children. Formal evaluations of the extent of understanding and knowledge gain by fifth grade students are currently under way.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Parenting

The Bluegrass Healthy Marriage Initiative is a collaborative effort between the University of Kentucky Department of Family Studies and Bluegrass Healthy Marriages Partnership to affirm and enable healthy marriages for the purpose of increasing child well-being. This project has engaged 10 community organizations to facilitate research among the constituents and to deliver educational services related to marriage and co-parenting. Ongoing research is being conducted to enhance ther understanding of marriages in Central Kentucky. To date, more than 500 individuals (male and female, married and single) have participated in the research efforts of the initiative. Under an agreement with Bluegrass Healthy Marriages Partnership, the University of Kentucky will provide marriage education activities directly to partners' constituents, roughly 70,000 individuals in the service area. The initiative has successfully engaged the domestic violence prevention community in the development of a protocol for use in all initiative-sponsored educational activities. This protocol and findings from the initiative's research activities have been featured at major national conferences and have received high reviews. Efforts are also underway to expand the service area to include additional Bluegrass regional counties.The initiative is funded by the Kentucky Cabinet for Health and Family Services through a Section 1115 waiver awarded to the state by U.S. Department of Health and Human Services, Administration for Children and Families.

Source of Federal Funds: U.S. Department of Health and Human Services
Scope of Impact: State Specific

Key Theme – Youth Development/4-H

Youth in rural Kentucky communities often report having limited experiences in the civic engagement process. Adults often make decisions on behalf of youth, with little or no input as to what issues are most pertinent. As a result, there are fewer positive youth-adult relationships, less sense of civic responsibility and fewer youth involved with volunteer efforts. Ultimately, there is a lack of community connectedness and sense of belonging on the part of youth. Counties witness a "brain drain," where youth leave these communties as adults, with no desire to return.

Kentucky recently completed year five of its "*Engaging Youth, Serving Communities*" initiative. As a result, three community-based youth-adult partnerships addressed issues directly affecting youth and their peers. The Lyon County youth-adult partners promoted a drug and alcohol awareness campaign. A partnership in Monroe County organized a backpack program, which provided food for children suffering from hunger at the local elementary school. Youth and adults in Spencer County worked with a number of local agencies and organizations to clean up Taylorsville Lake State Park, one of the county's main tourist attractions.

The project has allowed youth and adults to see one another in a different light. Youth and adults have more positive perceptions of each other's leadership skills and a new-found respect for the community. Moreover, two of the communities have developed a willingness to nurture youth leadership through practical experience. Both Lyon and Monroe 4-H programs have received more than $1000 each from local businesses to support the projects, which were implemented primarily by the youth. Lyon County's drug awareness taskforce is utilizing the knowledge and networks of young people, by inviting them to give presentations during city council meetings and serve as an advisory group to the taskforce. Monroe County youth have captured the attention of local leaders by enlightening them on critical social issues that are impacting families. On a weekly basis during the fall of 2006, the group provided the local Family Resource Center with up to 26 snack-filled backpacks for hungry children.

Source of Federal Funds: Smith-Lever, Other Federal
Scope of Impact: State Specific

Key Theme – Leadership Development

Kentucky took a distinctive approach to the problem of assisting tobacco farmers who would suffer economically as the tobacco quotas were eliminated. They strategically set aside a portion of the funds from the Master Tobacco Settlement to help communities in tobacco-dependent regions adjust to changes in the tobacco sector and encourage agricultural diversification. The Kentucky Entrepreneurial Coaches Institute is designed to encourage economic diversification in 19 Northeastern Kentucky Tobacco Dependent Counties and focuses on training two classes (30 each) of community volunteers who are willing to coach or mentor entrepreneurs in the region.

The KECI is structured as a 16-month program. Each person selected for the program receives a fellowship covering the costs of a series of nine seminars (2-3 day sessions). Eight seminars are held within the region and one seminar provides an opportunity for international travel to learn about entrepreneurship development in a different cultural setting.

58 individuals have graduated during the past two years. The results of the program evaluation suggest that the fellows have been actively involved in building their own skills and, in turn, using them to create a culture of entrepreneurship in Eastern Kentucky. The numbers are impressive. Fellows had contact with 1162 entrepreneurs or potential entrepreneurs, providing information about the coaching process and helping to increase awareness of the benefit of entrepreneurship in Kentucky. Over 500 of these contacts were in small groups and 166 formal meetings between the fellows and persons interested in learning more about partnering with an entrepreneurial coach – an average of six personal contacts with entrepreneurs for each coach.

Given the fact that the training has just completed, the long term impact of this program is yet to be measured, however early results show increased confidence, knowledge and skills related to the program participants ability to bring about economic impact to the region.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme – Workforce Preparation

Nationwide, sewing is experiencing a resurgence in popularity with five million new sewers over the past five years. Although there may be some financial incentive, much of this interest comes from the development of life skills, an interest in heritage skills, as well as for crafts and hobbies. The acquisition of sewing and clothing construction skills enriches the quality of life and has been identified as a stress reliever. In Kentucky, the Master Volunteer in Clothing Construction Program gives program support to the Cooperative Extension Service by providing highly trained volunteers to serve as para-professionals assisting Extension agents in planning, carrying out and evaluating programs related to sewing.

During the past year, 83 active Certified Master Clothing Volunteers contributed over 13,400 volunteer hours in teaching clothing construction and related skills to youth and adults. This represents a value of $243,000.00 in volunteer time. Nearly 38,000 contacts were made by the 83 volunteers across the Commonwealth. Since its beginning 17 years ago, the Kentucky Master Volunteer in Clothing Construction program has trained 252 volunteers. 16 new volunteers began their two-year apprenticeship in the fall of 2006 bringing the total number of active volunteers to 99. Fifty-three counties representing all seven Extension districts have active volunteers.

In the fall of 2005, a program called “Come Sew with Us” was introduced by Master Clothing Volunteers and agents in central Kentucky to teach beginning sewing classes. A total of 225 new and returning sew-ers have participated in these various workshops across the state. Due to the success of this new program it is scheduled for statewide expansion in FY07.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific

Key Theme- Leadership Development

4-H Livestock Programs have historically been a foundation cornerstone for the 4-H Program. Due to changing demographics of the country which are reflected in 4-H membership, youth involvement in livestock programs has declined through the years, although 99 of Kentucky's 120 counties still have active livestock programs involving over 35,000 enrolled youth. In response to growing concern over the uniformity and quality of these programs, the Kentucky 4-H Livestock Volunteer Certification (KLVC) program was developed to (1) ensure that all youth and volunteer leaders have access to high quality, comprehensive materials regardless of county resources, (2) ensure a sound and well-rounded educational experience for youth enrolled in livestock and livestock-related projects, and (3) empower local volunteer leaders to successfully lead a club in a fun, interactive environment. A comprehensive curriculum with over 100 individual lesson plans and a state-of-the art resource kit has been developed for use by local volunteer leaders for work with county livestock clubs. Counties wishing to offer livestock projects are required to have volunteer leaders who attend workshops and have been certified in the use of the curriculum and resource kit.

Over 400 local volunteer leaders in 99 Kentucky counties (which represents every county with a 4-H Livestock Program) have been certified in the Kentucky 4-H Livestock Volunteer Certification program. Evaluations of workshop participants indicated increased knowledge and skills on the part of program graduates. This has resulted in over 70 new livestock clubs, which has in turn increased number of youth enrolled in livestock programs, and developed a better understanding of rules, regulations and expectations by leaders and the youth themselves.

Source of Federal Funds: Smith-Lever, Other Federal
Scope of Impact: State Specific

Key Theme – Workforce Prep

Youth poverty has become an increasingly attractive topic as policymakers, government and non-government officials become interested due to the tremendous social and financial cost. A new study by the University of Kentucky Department of Agricultural Economics examines the incidence of poverty among Kentucky youth by employing only recently-available Zip code level data from the 2000 Census. The analysis now being completed estimates the extent of youth poverty in Kentucky, provides Gini coefficients for various age groups in Kentucky by Zip code, and compares the socioeconomic and demographic factors that influence differences between rural and urban youth poverty for Kentucky Zip codes. Male and female education rates are significant contributory factors on youth poverty in Kentucky. However, participation in the labor force was found to be the most important factor influencing the incidence of youth poverty.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State

Stakeholder Input Process

Cooperative Extension

The Kentucky Cooperative Extension program development process is based on a grass roots, six-stage model which begins with the engagement of local advisory councils and the citizenry the organization is charged to serve. For the development of the current Plan of Work, agents involved members of the County Extension Council in data collection which includes local resident perspectives, current research, and existing data. Through an analysis of this data and facilitated dialogue, councils identified program opportunities where Extension and local community resources could effectively bring about positive change. County Extension Councils then established program priorities for which county program plans were written. In all, 10,790 people were involved in the Kentucky Extension Advisory Council System needs identification process for the current Plan of Work.

High priority issues and needs identified by County Extension Councils are acted upon locally by county Extension staff and leaders but are also brought to the Regional Issues Committee and Programming Committees. These regional committees are composed of county agents, state extension specialists from the University of Kentucky and Kentucky State University, Department Chairs and Regional Issues and Program Coordinators. This was done to assist university personnel and Extension Specialists in better understanding the county level issues, to speed up the development of resources and to better focus educational methods for dealing with these locally identified issues. Programs of greatest need in the greatest number of counties were referred to Quick Response Teams which identified existing resources and then developed supplemental materials to address issues and concerns. Quick Response Teams have been effectively developing programs and resources to address such topics as agritourism, methamphetamines and drug abuse, elder care, working with Hispanic audiences, technology, urban programming issues, Asian Soybean Rust, and more.

The next step was to implement a Logic Model Development Process to identify outcomes for program improvement and for measuring the impact of programs. 2006 was the year for development and implementation of this process which standardizes process and outcome measurements of Featured Programs from clientele for additional input into programming processes and to measure the extent of program offerings, participation and practice changes of clientele.

Experiment Station

As a full partner with the Extension Service, the Experiment Station sets priorities for research activities with information from the County and State Extension Councils and the Kentucky Council for Agricultural Research, Extension and Teaching (UK-CARET). Beginning in the fall of 2003, UK-CARET's role as an advisory and advocacy group for the College of Agriculture was increased. Members have an opportunity to advise in the development of college priorities and assist in generating public support for those priorities at state and national levels. UK-CARET is representative of the full scope of the land grant mission: extension, research, instruction, and service. Membership is composed of active and progressive leaders in agricultural and natural resource enterprises. UK-CARET provides a direct link to the national CARET organization managed by the National Association of State Universities and Land Grant

Colleges (NASULGC). Two members of UK-CARET are designated as national CARET representatives.

In addition, the Experiment Station meets formally with other entities: quarterly with the Kentucky Tobacco Research Board to set priorities for research by the Kentucky Tobacco Development Center to assist in the transition from the tobacco-based economy; biannually with the Gluck Equine Research Center Board to discuss priorities for the equine industry; and regularly with the Tracy Farmer Center for the Environment on conservation-based research. The station also receives input through the Community Farm Alliance, the Sierra Club, and other environmental groups through the UK Biotechnology Research and Education Initiative.

Program Review Process

There are no changes in the program review processes described in the Plan of Work which has been approved by CSREES.

Evaluation of the Success of Multi-State and Joint Activities

Work across state lines and across functional boundaries is quickly becoming an expected mode of operation for faculty and staff of the University of Kentucky, College of Agriculture. Issues such as the transition from a tobacco-dependent economy, economic development, insect and disease management, obesity, youth development, agricultural profitability, energy research, and gene and nano-level technology are not single-state issues. Nor can they be addressed by the research and knowledge base under girding a single discipline. Addressing issues such as these requires that land grant universities work across disciplinary, functional, and state boundaries to deploy resources in a planned and systematic manner.

Joint activities with the University of Kentucky and Kentucky State University are another expectation of faculty and staff. The two institutions are barely 40 miles apart, which is convenient in terms of faculty and specialist cooperation, but in many respects the institutions are co-located. Agents and Program Assistants are co-located in county offices, sharing not only office space but also budget, supervision and facility management responsibilities. This strong and somewhat unique bond has resulted in shared program efforts, many of which are reported in this document. Efforts include programming and research in:

Grapes and Wine
Goats
Cattle Production
Pawpaws
Small Farm Programs
Aquaculture
Sustainable Agriculture
Kentucky Entrepreneurial Coaching Institute
Home Horticulture
Environmental Education for Youth
Gardendata.org Horticulture web site
Tobacco Sector Farming Adjustments
U.S. Animal Identification Program
Organic Ag and Vegetable Programs
AgrAbility
Limited Resource Families
and more…

Kentucky State University and the University of Kentucky share adjunct faculty with at least 3 positions in entomology, 3 positions in horticulture, 3 positions in animal science and one position in agricultural economics.

Kentucky has a unique opportunity to work across state lines. It shares borders with seven states: West Virginia, Virginia, Tennessee, Missouri, Illinois, Indiana, and Ohio. These states represent three of the four Extension regions. The opportunity to work across state lines is clearly evident.

During FY06, Kentucky Cooperative Extension Specialists and County Extension Agents participated in over 200 different Multi-State Extension activities. In planning and conducting each activity, key consideration was given to either increasing efficiency (through such things as economies of scale) or effectiveness (by contributing the resource each partner was best equipped to provide). For example, Kentucky frequently contributes the expertise and services of its award-winning Educational Media unit to multi-state projects. In other cases, Kentucky

relied upon out-of-state expertise in subject areas not well supported by our current array of faculty and staff.

Nearly 40% of these multi-state activities were developed and implemented by county Extension agents working in border counties. The predominant state partners were Tennessee, Indiana, and Ohio. Examples of the variety in this type of programming include Beef Production/ Record Keeping Conferences and Tours, Part-Time Farmer Programs, Master Gardener and Urban Horticulture for homeowners and for employees of horticultural businesses, Home Based Businesses, Greenhouse and Nursery Production, Diversity Conference, Programming for Urban Audiences, Youth Exchange Trips and more. The grass-roots nature of this multi-state collaboration provides further evidence that multi-state activities addressed the needs and issues of those local alliances. Impacts and outcomes of many of these multi-state efforts are clearly documented in impact statements written by county Extension agents.

A large proportion of the multi-state efforts focused on the needs of under-served and under-represented populations. Examples include small business owners, small farmers, food stamp recipients, and loggers.

Research and Extension functions have been, and will continue to be, integrated to a unique extent within in the Kentucky system. The Dean of the College of Agriculture serves as Director of Land Grant Programs to link Research and Extension. The dean works closely with the Director of the Kentucky Cooperative Extension Service and Director for the Kentucky Agricultural Experiment Station who also have close working relationships. Extension, research, and teaching faculty are housed together within academic departments and all participate in regularly scheduled department meetings. Extension faculty conduct applied, collaborative research while research faculty participates in Extension and other outreach/service activities. Many faculty hold joint appointments to both Research and Extension.

Yet, even with all of these structural and functional attributes which promote integration activities, Kentucky used the mandates of the AREERA legislation as a catalyst to bring Research and Extension programs closer together. The Extension staff is more cognizant of the need to support their activities with sound research. Research faculty realize the dissemination of findings involves more than publishing results in a scholarly journal.

Both the Kentucky Agricultural Experiment Station and Kentucky Cooperative Extension Service expended in excess of 25% of qualifying funds on integrated activities in FY06.

Brief Summary of Multi-State Activities

The University of Kentucky Experiment Station engaged in 39 Multi-State Regional Fund (MRF) projects, including 12 in the Southern Region, 6 in the Western Region, 13 in the North Central Region, 5 in the Northeastern region, and three National Research Support Projects: the National Animal Genome Research Program, the Species Coordinator for the Horse project, and the National Agricultural Program to Clear Pest Control Agents for Minor Uses program. Over 80 College of Agriculture faculty members have some research effort devoted to these projects.

During FY06, specialists and agents in the Kentucky Cooperative Extension Service were involved in over 200 different Multi-State Extension activities. Just over sixty percent of these multi-state activities were state-level partnerships led by state-level administrators, specialists, and associates. The remaining programs were conducted by county Extension agents working across state lines. Virtually all of multi-state Extension activities involving state-level faculty and staff can best be characterized as on-going collaborations lasting a year or longer. These included such things as serving on national and regional committees, production of multi-state publications, and curriculum exchange agreements. County-level projects tend to be more short-term in nature. These included such things as study tours, exchange trips, workshops, conferences and training schools in border counties.

The following impact statements are a representative sample of some of the multi-state Extension activities involving the Kentucky Cooperative Extension Service.

Strengthening Extension Advisory Leadership – Leadership Development

As a grassroots organization Cooperative Extension relies on input from county advisory groups. *"Re-envisioning"* of the Kentucky Cooperative Extension Service brought with it an identified need to strengthen advisory leadership in their roles, namely engaging advisory members in program development, recruiting a diverse cadre of advisory members, and enhancement of the leadership skills of advisory group members. Kentucky Cooperative Extension has collaborated with the Southern Region states to develop ***SEAL – Strengthening Extension Advisory Leadership*** - a series of sound, comprehensive materials and teaching plans which allowed County Extension Agents to enhance leadership skills and the program development process at the county level. All Extension agents in Kentucky have been trained in the use of these materials with the expectation that they establish local goals in regards to the expansion of the leadership base and the development of leadership skills. Agent evaluations of this program indicate an increase in diversity on local advisory councils, rotation among advisory council members, increased frequency of meetings with improved attendance of advisory group members, more engagement of advisory groups in programming, implementation and evaluation of programs, and improved leadership skills among officers. A higher level of commitment by advisory group members exists from these educational efforts which has resulted in state funding for a newly established Career Ladder for Extension Agents as well as catch-up money to bring agent salaries closer to those of benchmark institutions.

Children, Youth and Families at Risk

This multi-state project focused on helping at-risk children, youth and families improve their overall health by increasing the number of health assets present within the family. Three targeted communities in Kentucky participated in the project results are reported here - Hopkins, Jessamine and Wayne Counties. The primary tasks completed were training for grant sites, agents across the state, and Extension personnel at select conferences throughout the country; evaluation and federal year-end reporting; sustainability planning and grant completion; and integration of the Children, Youth and Families at Risk (CYFAR) philosophy into base county Extension programming.

Two of the three funded grant sites sustained their programs after completion of the program. Based upon from parents on a one-year follow-up survey, the following was observed in regard to their children: 33.3% were eating more healthy foods; 8% increased hand-washing in children; 5% improved dental care; 4% increased use of sunscreen; and 6.7% increased physical activity. Based upon second administrations of the Health Asset Inventory, there was a 22% increase in families engaging in physical activity. Other outcomes include the following: over 632 children, youth and families made first aid kits during programs to take home to their families; more than 500 smoke-free home pledge cards were signed by parents; a 2004 youth survey showed a decrease of 1% in early initiation of tobacco use and a 2% decrease in tobacco usage in the last 30 days compared to the 2002 data. In one community; 708 children received dental sealants; several thousand toothbrushes were given out to children and families; 636 children received free dental screenings; and 234 of 260 pre-schoolers and kindergartners were able to verbalize that they should brush at least two times per day; there were no reports of any of the 210 boys being sunburned at Cub Scout Day Camp for the first time in six years after the program assistant provided a Sun Safety Educational Presentation.

Approximately $294,204 in additional grants, donated resources, and donation of professional screening services was secured to leverage grant funds. 110 pints of blood were collected at a value of $11,400 and 79 child care providers received free training at a value of $7,900. More than 100 local and state collaborations were developed over the course of the grant. 289 children and adults participated in walking programs and 485 children and adults participated in exercise programs. 139 recorded referrals were provided for appropriate community services and resources. 1,130 people used public access computers purchased by the grant to access health information and 1,409 people participated in computer-based health programs. Finally, over the course of the 5-year grant, 27,723 children and 21,735 parents or adults were reached through the 3 community grant sites.

Workforce Prep- Youth Poverty

Youth poverty has become an increasingly attractive topic as policymakers, government and non-government officials become interested due to the tremendous social and financial cost. A new study by has University of Kentucky Agricultural Economists working with other states to examine the incidence of poverty among youth by employing data from the 2000 Census. The analysis now being completed estimates the extent of youth poverty in Kentucky, provides Gini coefficients for various age groups, and compares the socioeconomic and demographic factors that influence differences between rural and urban youth poverty for Kentucky youth. Male and female education rates are significant contributory factors on youth poverty in Kentucky. However, participation in the labor force was found to be the most important factor influencing the incidence of youth poverty.

Anti-inflammatory Action of Omega-3 (n-3) Polyunsaturated Fatty Acids – Human Health

Many studies have shown that fish oil supplementation inhibits tumor necrosis factor-alpha (TNF-alpha) production in mice and humans, however, the mechanisms remain unclear. .

Researchers have demonstrated that the underlying mechanisms of the anti-inflammatory action of omega-3 (n-3) polyunsaturated fatty acids involve their inhibitory effects on the activation of oxidative stress-sensitive nuclear transcription factors. These nuclear factors regulate the production of mediator for inflammatory response. It appears that ingestion of fatty fish rich in n-3 polyunsaturated fatty acids or taking fish oil supplement can modulate inflammatory response which is involved in many human diseases including cardiovascular disease, rheumatoid arthritis, inflammatory bowl disease, etc.

Arsenic and Antibiotics in Chicken Litter – Agricultural Waste Management

Arsenic and other antibiotics are widely fed to broiler chickens, and high concentrations of these compounds are commonly found in poultry litter. While poultry litter is considered a valuable fertilizer source when applied to agricultural soils, repeated and intense applications of litter can also contaminate surface and groundwater with arsenic and other livestock antibiotics, which poses health risks to people living in areas where poultry manure is used as a soil amendment

Researchers have discovered for the first time that all FDA-approved antibiotics used in the poultry industry inhibited at least one N cycling reaction, including nitrification, denitrification, and ammonification. Also the extent of inhibition depended on antibiotic concentration and presence of soil minerals, which tended to reduce antibiotic bioavailability and effects by sorption. Additional research is planned to evaluate livestock antibiotic effects on bacterial populations and activity at different positions in the landscape which is needed to make improved decisions about when and where to apply manure in order to maximize the benefits and minimize the ecological/health risks. Thus, research has a direct impact on both production agriculture and natural resource management in Kentucky and the nation.

Professional Forestry Workshops - Forest Resource Management

Multi-state Extension Forestry efforts include national workshops which Extension Foresters conduct and a Department of Energy research project which involved corporate participation and results dissemination throughout the southeast United States.

Wood railroad ties are most often made from species that have little commercial value, or from logs whose defects would prevent their conversion to higher-valued products. Instructing railway tie graders about allowable defects, different species and how preservative treatments work helps to ensure that only sound wooden ties are treated with preservatives such as creosote and used in rail service. This assures cost-effective tie production, good tie service life, and safe railroad transportation. This has a secondary benefit that extends to forestry operations, as good wood ties can bring about $20/tie in Kentucky, and up to $27/tie in other regions. Alternatively, many of these logs would be sold for pallet lumber, and pallet boards have a very low value compared to ties.

Research presented at meetings, mills in Kentucky, Tennessee, Georgia and Mississippi as well as an international conference of scientists and corporate research personnel in Wales, UK demonstrated a practical, low-cost method to minimize the production of fine wood particles during the machining of flakes for oriented strand board production. This is important to the industry because these fines create air pollutants when they are dried, and this is a problem that is expensive to abate. Creating fewer fines also improves product quality. Thermal oxidation units can control these pollutants but are expensive to run. University of Kentucky Department of Forestry research findings along with studies conducted at Georgia Tech have shown that a seasonal change in the knife angles used to cut wood will reduce the proportion of fines so dramatically (and at essentially no cost to a mill) that expensive emissions control equipment is not necessary in most cases.

Small Ruminant Animals – Goats - Small Farm Viability

The goat industry has grown very rapidly in Kentucky between 1997 and 2002. The number of farms raising goats has increased by over 170% according to the USDA Census of Agriculture. Goat numbers in Kentucky have increased from approximately 16,000 head in 1997 to approximately 70,000 head in 2005. As a result, Kentucky currently ranks fifth in the nation in total number of goats. According to the UK Livestock Disease and Diagnostic Center, the number one cause of death among goats in Kentucky is internal parasites. Unfortunately, the repeated use and reliance on chemical de-wormers for gastrointestinal parasite control has lead to parasite resistance in several Kentucky goat herds. In 2004, a goat forage program, funded by the Phase I Tobacco Settlement Fund, was initiated at the UK Robinson Station to conduct applied research and on-farm demonstrations in the eastern region of the state. Several small plot studies designed to evaluate the establishment and management of alternative goat forage species are currently being conducted. This research, along with efforts at Kentucky State University provides information needed on the various processes and products effectively utilized in goat production.

Forest Nutrient Cycling - Forest Resource Management

The effects of forest age and succession on forest nutrient supply have not been sufficiently addressed, especially in the context of nutrients other than nitrogen. In the northern

hardwood forests of the the northeastern U.S., there is some evidence that stand age may have a significant impact on the cycling and availability of calcium for forest growth, despite the fact that ongoing atmospheric deposition of nitrogen has been shown to lead to losses of calcium and other nutrient cations beyond that expected in forested ecosytems not impacted by acid deposition. Based on previous research which showed that soils in young forest stands serve as a source of calcium, whereas older forest stands are in approximate steady state with respect to calcium, we hypothesized that young stands differ in their ability to access calcium, and that differences may be associated with the presence of apatite or other non-silicate minerals.

Characterization of the mass and nutrient content of woody debris in relation to stand age has provided a fuller understanding of changes in stand structure with succession. Stand age, coupled with differences in soil nutrient availability, lead to differences among forest stands in species composition and the nutrient concentration and content of leaf litter.

Understanding how stand age influences patterns of biogeochemical cycling is key to the development of sustainable forest harvesting and effective environmental policies. Findings from this research will contribute to the peer-reviewed literature, and will be disseminated more broadly to forest managers.

Research Programs in Post-Harvest Grain Processing - Adding Value

Applied research projects include a multi-state project to assess stored grain management practices for wheat in Kentucky and Tennessee, an investigation of post-harvest processing of specialty grains, the development of alternate energy resources from grain crops, a study on merging precision farming tools with near infra-red (NIR) instruments that rapidly measure grain quality properties, an experiment to convert soybean oil to hydrogen gas, and the development of software to enhance identity preservation of grain lots for assured quality and security. Experiments are being conducted to improve the mathematical models available for predicting airflow resistance in stored grain. This will lead to modifications to the aeration system design that will minimize the cost and quality deterioration of grain during storage. Grain deterioration leads to mold and insect development that change the flow pattern and loads in the bin. Collaborative research between the Institute of Agrophysics in Lublin, Poland and UK is being conducted to determine the loads created by grain that has spoiled.

The work has led to checklists and protocols for producers and processors to reduce chemical inputs into grain storage. The checklists have been adapted by commercial grain buyers in the western Kentucky and southern Illinois. Changes in grain quality and their effects on bin loads and the structural integrity of grain bins are being developed into national standards.

National Priester Extension Health Conference – Human Health

The University of Kentucky, College of Agriculture Cooperative Extension Health Education through Extension Leadership Program (HEEL) hosted the 2006 Priester National Extension Health Conference. This multi-state conference attracted 172 practitioners and educator

participants from across the country. The 2006 Conference featured a Youth Summit entitled, "Youth, Substance Abuse and Protective Factors: Integrating Research, Policy and Community Practice." Participants shared research and programming efforts on topics which focused on the increasing influence of socio-cultural and peer pressures toward experimentation and addiction with illegal and addictive substances. As a result of the Youth Summit, 39 Kentucky Counties are developing county teams with youth and adult partnerships working with the University of Kentucky HEEL Program to develop the capacity of local communities to deal with substance abuse issues.

As a result of previous Priester Conferences, Kentucky has worked with Mississippi to adapt their Master Health Volunteer program and the two states have collaborated on writing a NIOSH grant to fund collaborative research and outreach in the two states. Kentucky has partnered with several states on methamphetamine abuse programs, sharing the "Are Drugs Knocking at Your Door" and "Walk Your Land" Programs which have been highly successful at creating local coalitions to address drug issues and discovering meth labs.

Foam Fractionation for Purification of Proteins – Human Health

The purification of proteins from various sources is an important aspect of bioprocessing of pharmaceuticals, enzymes, antibodies, etc. Traditional separation and recovery techniques can be quite expensive. Hence, targeting better protein separation and purification techniques may result in a significant reduction in downstream processing costs. Foam fractionation has been shown to be a feasible technique for the separation and concentration of a variety of proteins and enzymes. This project focuses on the feasibility of using foam fractionation as a means to separate/concentrate industrial enzymes and other valuable proteins. The University of Kentucky Department of Biosystems and Agricultural Engineering is currently working on optimizing the concentration of whey proteins from dilute and concentrated whey solutions and the development of a light based sensor to monitor the foam fractionation process. Research efforts recover as much as 90% of the original whey proteins and have been able to achieve a nine-fold increase in the whey protein concentration on a laboratory scale. Researchers have been able to demonstrate that a light scattering technique has the potential to monitor the bubble size and the liquid hold up in liquid foams; however it doesn't appear that the inclusion of the polarized state of the light contributes to the system. This overall project represents a wide-range of application of foam fractionation as a recovery strategy. Foam fractionation is expected to be a low-cost alternative for the recovery and concentration of various proteins that could result in significant decreases in the cost of producing industrial enzymes and pharmaceutical proteins, as well as waste disposal.

CYFERNet – Children, Youth and Families at Risk

The University of Kentucky coordinates efforts which this year included eight trainings coordinated with public and private sectors; resource development, solicitation, review, and posting; and maintenance, improvement, and marketing of CYFERnet. Major foci were providing quality information on immigrants in the United States and prevention of school

violence. A second focus was on continued development of national collaborations with eXtension and the National Youth Organization Database.

Reliable, high quality information on the Web can be a major challenge. The Children, Youth and Families Education and Research Network (CYFERnet) is a web based, peer reviewed collection of top quality resources rlated to children, youth and family programming from land-grant universities.

Impact: A total of 996 resources were posted (1,316 resources reviewed; 76% acceptance rate). There are now over 7,700 resources in the database. There were 1,369,533 hits on the web site (more than 3,700 day on average), providing peer-reviewed, research-based information for free to 129,682 users - a 73% increase in usage over last year and a 47% increase in the number of different users to the web site. The most heavily searched content areas were health (134,799 hits), child resources (30,996 hits), community resources (6,537 hits), and evaluation resources (4,568 hits). This information is used to determine gaps in the resources in order to continually make the site more functional for its users.

Conversion of Exotic Introduced Pastures to Native Grasslands

Tall fescue has been planted on more than 30 million acres in the eastern United States for erosion control, for livestock forage, and on conservation reserve set-aside acres. More than 97% of all tall fescue fields are infected with an entophyte fungus that causes numerous reproductive and nutritional problems for livestock and wildlife. Livestock eating tall fescue typically have reduced weight gains, lower reproductive rates, and reduced milk production. Estimated annual costs to the livestock industry range from $500 million to $1 billion. Beef cattle operators traditionally "manage" around the problem. Dairy and horse operators, however, have no tolerance for endophytic fescue because it causes lowered milk production and spontaneous abortions in horses.

The purpose of this research and extension program at the University if Kentucky is to develop methods to convert exotic introduced pastures into native grassland habitats and to use herbicides to restore existing habitats. Applied research studies have been implemented over the past decade in Kentucky, Alabama, Indiana, Texas and South Dakota in a variety of native grassland habitats. Researchers in Kentucky, South Dakota, Texas and Alabama are seeking methods of converting old world bluestems, Bermuda grass, and smooth brome to native grasses. More than 65,000 acres of Tall Fescue have been converted to natives in Kentucky during the past decade using information generated by this research. As standardized protocols are developed the information is being disseminated and utilized by appropriate clientele including Fish and Wildlife Agencies, Federal Agencies, Quail Unlimited, Wildlife Society and interested individuals.

Green Industry Expo – Home Lawn and Gardening

The Tri-State Green Industry Expo is a true educational, in-service type training program for landscape and green industry professionals from Kentucky, Ohio and Indiana. The Northern Kentucky County Cooperative Extension Services participated in planning, producing, and evaluating this conference which attracted nearly 400 industry professionals in FY05. New and

emerging practices in arboriculture, turf grass, landscape, greenhouse, insect and weed control and business management practices demand that industry workers strive for continued professional improvements. The Cooperative Extension Service is the primary provider of timely information on research based topics to ensure best management practices and public safety. In a survey of the value of training they received in prior-year programs, participants acknowledged increased knowledge and practice changes as having occurred and indicated that they have now:

1. Adopted new practices regarding the safe usage of pesticides,
2. Gained new knowledge on best management practices,
3. Have increased awareness of and now use improved plant cultivars, and
4. Adopted economically sustainable business practices.

Emissions from U.S. Poultry Facilities – Air Quality

Agricultural air quality has received increasing scientific and regulatory focus in the past few years. A multi-state, multi-disciplinary project (funded by USDA IFAFS) to quantify ammonia emissions was completed and publications printed during 2005-2006. Ammonia is a contributor to poor air quality, and agriculture is a major source of ammonia. The US EPA is required as part of the Federal Clean Air Act to determine sources and quantities of key air pollutants including ammonia.

In 2006, University Of Kentucky Department of Biotechology and Agricultural Engineering and Iowa State University began the first-in-nation Air Consent Agreement study site, on two broiler growout farms in western Kentucky. This study was funded by the broiler industry, and includes multiple gases and particulate sizes, and will include building emissions data for ammonia, hydrogen sulfide, carbon dioxide, methane, non-methane hydrocarbons, volatile organic compounds, particulate matter (2.5 and 10 microns) and total suspended particulates. Fifteen other facilities and seven waste storage basins or lagoons will be studied by other researchers in the next few years as part of this agreement funded.

The IFAFS project has resulted in over 16 months of high quality ammonia emissions data from broiler and layer housing in three states, and represents key new baseline emission data for the U.S. poultry industry. These data are being used by both national and international researchers to find abatement strategies to reduce emissions. An innovative uncertainty analysis to evaluate the relative importance of different input measurement errors on overal building emission error has proven invaluable for future project instrumentation selection.

National leadership has been provided by UK and ISU researchers involved in the Air Consent Agreement Study and results will be available before other ACA studies are underway.

Post Tobacco Buyout; Extension Programming Activities – Managing Change in Agriculture

The tobacco extension group at the University of Kentucky has been instrumental in the development of regional production guidelines, recommendations, and educational materials for burley and dark tobacco producers. An interdisciplinary team from the departments of Plant & Soil Sciences, Plant Pathology, Agricultural Economics, and Biosystems and Agricultural

Engineering work together to develop educational programs and materials that are intended to increase the profitability of burley and dark tobacco producers. One of the most notable accomplishments is the development of a comprehensive production guide for burley and dark tobacco that includes pictures and descriptions of common field problems in burley and dark tobacco. Another effort of this team is the Innovative Tobacco Grower Program, an annual three-month course conducted in four regions throughout Kentucky where tobacco extension specialists provide producers with intensive training on all aspects of tobacco production. In addition to these educational efforts, tobacco extension specialists conduct over 50 grower meetings in individual Kentucky counties and six county grower meetings are conducted annually in Tennessee to make growers aware of the latest research results and recommendations for dark and burley tobacco production. Over 30 extension publications have been developed for tobacco growers, disseminated to tobacco growers through meetings, popular press publications and websites. The burley tobacco website and the dark tobacco website provide a centralized location for tobacco publications and other information.

10,000 copies of the Kentucky Tobacco Production Guide and 5,000 copies of the tobacco field manual will be distributed to tobacco producers. Approximately 100 tobacco producers will participate in the Innovative Tobacco Grower Program annually. The dark and burley tobacco websites have been visited by approximately 30,000 viewers since their release. Collectively, these efforts increase grower awareness and knowledge of tobacco production issues and will result in increased tobacco yields, quality, and marketability, lower input costs, and increased profitability.

Summary of Integrated Research and Extension Activities

Activities of Research and Extension faculty were considered to be integrated if at least one of the following conditions were met.

- The leadership team for the Research project or Extension program was comprised of both Research and Extension faculty.

- An Extension program is directly related to dissemination of the findings of Experiment Station research projects.

- The program component falls within the scope of one of the College's formally established teams or work groups which integrate Research and Extension Activity.

The following impact statements are a representative sample of some of the integrated Research and Extension activities of the University of Kentucky College of Agriculture.

Advanced Energy Guide for Small Offices – Energy Conservation

The major reasons small buildings have traditionally not been very energy efficient is that there are insufficient design fees for architects and engineers to do any energy optimization on their designs and/or they are designed and constructed by design-build construction contractors lacking the resources necessary to build energy efficient buildings. A Biosystems and Agricultural Engineering faculty member at the University of Kentucky organized and is leading a consortium of professional organizations consisting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), the American Institute of Architects (AIA), the Illuminating Engineering Society of North America (IESNA), the New Buildings Institute (NBI), the US Green Building Council (USGBC) and the US Department of Energy (DOE) to perform research and to develop and publish design guides. *The Advanced Energy Design Guide for Small Offices* (AEDG-SO) was recently completed and published. The purpose of the series is to develop ways to design and construct buildings which will use 30-, 50- and 70% less energy than buildings built to today's building codes. The development of this Guide required approximately 5000 person-hours of professional input over a period of one year. Over 2800 copies of *The Advanced Energy Design Guide for Small Office*s were sold last year.

It is estimated that this AEDG will lead to an annual energy savings of over $400 million and an annual reduction of 2.2 million metric tons of CO2.

Bioinstrumentation - Animal Health

A critical need for assessing animal health and well-being and to evaluate various livestock and poultry management systems is the ability for real time monitoring of key physiological and related parameters. Researchers and Extension faculty along with students at the University of Kentucky Biosystems and Agricultural Engineering, Animal and Food Sciences, and Veterinary Science have developed and tested an assortment of bioinstrumentation for horses, cattle and poultry. Research includes confirming accuracy and placement of radio transmitter systems used for real-time monitoring of core body temperature and heart rate; developing procedures for recording blood flow data for cattle under diet related stress, and the

assessment of the transport stress levels of horses using an assortment of body readings at various times and distances during transport. From this research, standards can be established to characterize factors affecting the biology of the stress response. Results confirmed the systems and sensitivity of blood flow characteristics of cattle to ergot alkaloids. Efforts to publish results of horse transport stress also included a comprehensive study of horse trailer ventilation and thermal environment.

Soybean Rust – An Integrated Approach to Management

Grain production is the number two agricultural crop for Kentucky (behind tobacco) and soybeans represent the most planted acres of grain in this state. A recent threat to this crop has brought a rapid response by Extension throughout the grain growing regions of the U.S. Soybean rust is a wind-borne fungal disease recently introduced into the southern and southeastern U.S.

Soybean rust (SBR) is the most significant disease to threaten soybeans in the U.S. and KY and has the potential to reduce yields by up to 80%. There are fungicides that can protect the canopy and reduce yield loss, but these fungicides are expensive. By determining the amount of yield loss potential due to this disease, then farmers can determine whether the potential yield loss is sufficient to justify the cost of the fungicide. Yield loss prediction tools are therefore helpful as farmers make more informed management decisions that would avoid unnecessary fungicide application.

The University of Kentucky's College of Agriculture represent the lead institution in an international, multidiscplinary study conducted to develop a yield loss prediction tool for Asian soybean rust. Based on the first year of work conducted in Brazil, Louisiana, Kentucky and Florida, it was found that the impact of the disease on yield could be modeled based on healthy leaf area duration. The impact of the disease was greater the earlier in reproductive development the infection began. Algorithms are being produced to predict yield loss based on when the disease develops as well as the role of row widths and maturity groups on the potential yield loss.

Kentucky is fortunate to have the Coordinator for the Southern Soybean Rust Sentinel Network among faculty in the Plant Pathology Department, actively involved in a host of SBR Extension and research activities at the state, regional, and national levels. Efforts thus far have resulted in that soybean producers (in the US and specifically KY), and other stakeholders had access to highly accurate, detailed, and diverse SBR surveillance and management information. Nationally, it is estimated that as much as $299M was saved by producers not making unnecessary fungicide sprays for SBR control. In Kentucky, it is estimated that as much as $9M was saved.

Demand Controlled Ventilation – Air Quality

A residential fan control system has been designed and tested to demonstrate the feasibility of a demand control ventilation system based upon inputs of temperature and wind speed. The device was tested three ways: a) using a randomized block experiment consisting of combinations of constant inputs of temperature and wind speed, b) using a year of simulated hourly weather data, and c) testing under actual weather conditions on real structures using infiltration test cells. Infiltration was measured using a constant-injection tracer gas method. Preliminary results indicated that the DCV system was able to maintain a ventilation rate within an acceptable range of the desired amount and that natural ventilation takes over when it exceeds the desired amount of ventilation.

It was found however that the previously identified models of combining mechanical ventilation and infiltration were not adequate to sufficiently describe the combined airflow in a single zone structure such as a residence and that the constant-injection tracer gas measurements were not very reliable. The models previously used were developed for larger commercial buildings with dedicated outdoor air, return and exhaust ventilation systems. Experiments have been designed and are being conducted to validate a single cell model which has been developed. A more fundamental technique of measuring the airflow through the chambers using the pressure/flow relationships across calibrated orifice plates has been designed and calibrated.

Grassland Restoration for Rebuilding Soil Carbon Pools

Grasslands, both native and naturalized, play an important role in American agriculture and environmental health. These plant communities cover ~30% of the land area of both the United States and Kentucky and are capable of sequestering atmospheric carbon into relatively stable soil carbon pools which enhance soil fertility and overall ecosystem health. University of Kentucky Research, in combination with several Midwest universities, addresses how grassland ecosystem carbon and nitrogen pools, fluxes, and microbial communities respond to agricultural practices such as grazing, long-term cultivation, and conversion back into grass. Sites for this research exist throughout the mid-west and are currently being established in the southeastern U.S.

Sampling at 40 tallgrass prairie relicts throughout the midwest confirm that these ecosystems contain some of the highest soil carbon stores in the U.S. and that through continuous long-term cultivation ~50% of those pools have disappeared. Grassland restoration on these croplands is capable of re-building the soil carbon pools, but at a relatively slow rate. The results from this research suggest that substantial environmental benefits may be gained from restoring grassland to these agricultural areas.

Bed Bug Infestations and Information – Human Health

After a 50-year absence, bed bugs are back and wreaking havoc in Kentucky and throughout the United States.

People of this generation are not accustomed to being bitten by bloodsucking parasites while they are sleeping. Infestations are appearing in homes, apartments, hotels, dormitories, laundries, patient care facilities, and modes of transport. Infestations of the bed bug are increasing around the world at an alarming rate and have become a major public health concern. The University of Kentucky's discovery of pyrethroid resistance in bed bugs may help to explain the sudden resurgence of bed bugs in many parts of the country and the world. Resistance of bed bugs to pyrethroids may necessitate the development of products with new modes of action and

re-labeling of existing efficacious products, both of which are currently under study. Increased public awareness and education as well as greater reliance on alternative tactics such as heat treatment, vacuuming, mattress encasements or barriers are also needed to minimize the risks of acquiring or transporting bed bugs. The University of Kentucky Entomology Department is working on the front lines of this epidemic The pest control industry, news groups and other clientele consider the University of Kentucky the premier academic institution in the country and perhaps the world for practical research, information and management advice.

Kentucky Extension information on bed bugs continues to be listed #1 in Google™ and received over one million hits in 2006, a nearly 300% increase over 2005. High-profile news interviews have appeared in such places as USA Today, The New York Times, CNN.com, and CNBC, as well as many media outlets in Kentucky. A team of research and extension faculty and graduate students is working on solutions to the problem, funded in part by the Kentucky Pest Management Industry.

Head Scab in Wheat – Plant Production Efficiency

The University of Kentucky Wheat Science Group (UKWSG) is comprised of 16 individuals from six departments in the UK College of Agriculture. The WSG works closely with the Kentucky Small Grain Growers Association, county agricultural agents, wheat consultants and agribusinesses for the benefit of Kentucky's wheat producers.
Head scab is an economically destructive disease of wheat in Kentucky and the entire soft red winter wheat region. The Wheat Science Group has established screening protocols that 1) allow accurate assessment of scab resistance profiles of diverse genetic material under an array of management practices and 2) facilitate the development of scab resistant wheat varieties. Development of accurate scab resistance profiles will enhance profitability of wheat production by allowing growers to spread their risk by choosing to grow resistant varieties. Release of additional resistant varieties will reduce grower vulnerability to this devastating disease. There are between 400,000 and 600,000 acres of wheat planted in Kentucky each year. Implementation of one of the above improved practices on ½ the planted acres would improve the income to Kentucky wheat producers by over $5 million per year.

Kentucky Grapes and Wine– Diversified/Alternative Agriculture

Before prohibition, Kentucky was the third largest grape and wine producing state in the nation. As an alternative crop, producers found tobacco. Kentucky farmers are faced once again with finding alternative crops. Wineries are now being developed as a way to market Kentucky grapes planted by former tobacco producers

Over the last 10 years the fan system of training vinifera grapes, has been recommended in Kentucky based on one growers success. This six trunk training system, allows the removal of winter injured or crown gall infected trunks without a serious loss of yield. A planting was established at the Horticultural Research Farm in Lexington, Kentucky to evaluate the fan system in comparison to the Vertical Shoot Positioning System (VSP). The vinifera grape varieties, 'Cabernet Franc', 'Chardonnay' and 'Syrah' and the hardy French American grape variety, 'Vidal

blanc' are being evaluated in a replicated trial using these two trainng systems. Results show that excessive canopy shading in the fan system induces excessive bud development, producing more non-count shoots, which need to be removed to avoid shading and over-cropping. Yields were similar between the two training systems, but the non-count shoots, non-count clusters, count shoots and count clusters that needed to be removed were more that twice as high on the fan system when compared with the VSP system. At harvest the fan trained vines still had more clusters to harvest than the VSP vines. Thus, fan trained vines have a substantially higher annual labor cost. Berry weight and juice pH were both lower with the VSP system. Conversion to the VSP system will reduce annual labor costs by at least 96 hours per acre or by $38,400 per year on this acerage.

Reduction of Nitrosamines in Burley Tobacco – Agricultural Profitability

The study of the formation of tobacco specific nitrosamines (TSNAs) in various tobaccos continues as a topic of importance to the tobacco industry. Tobacco-specific nitrosamines (TSNA) are found only in tobacco products, and are considered highly carcinogenic. The significant formation of TSNAs in burley tobacco occurs after the yellowing phase of curing and is dependent on several factors, notably the fertility level during growth and the curing environment during the later stages of curing and post-curing conditions. Curing studies have focused on the relationships of curing environment and the resulting TSNAs of lamina. Research is being conducted to determine the effect of bale moisture content and the curing environment upon formation of tobacco-specific nitrosamines (TSNAs) in burley tobacco. Generally, lower levels of TSNA have resulted from curing in a more rapid drying regime than normal with the resultant leaf quality not as desirable to the buying representatives. Successful determination of moisture contents with minimal effect on leaf quality combined with the minimal formation of TSNAs will enhance the value and acceptance of Kentucky burley tobacco.

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Actual Expenditures of Federal Funding for Multistate Extension and Integrated Activities
(Attach Brief Summaries)
Fiscal Year: 2006

Select One: □ **Interim** **X Final**
Institution: University of Kentucky
State: Kentucky

	Integrated Activities (Hatch)		**Multistate Extension Activities (Smith-Lever)**		**Integrated Activities (Smith-Lever)**	
Established Target %	25%	**%**	10%	**%**	25%	**%**
This FY Allocation (from 1088)	$3,849,651		$8,115,065		$8,115,065	
This FY Target Amount	$1,308,274		$811,507		$2,028,766	
Title of Planned Program Activity						
Comprehensive Agriculture	473,696		740,494		1,836,654	
Safe Food and Fiber	183,158		5,469			
Health and Nutrition			13,539		1,311,159	
Agriculture and Environmental Quality	614,889		193,805		886,635	
Social and Economic Opportunity	36,531		204,731			
Total	$1,308,274		$1,158,038		$4,034,448	
Carryover	$0		$0		$0	

Certification: I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays represented here accurately reflect allowable expenditures of Federal funds only in satisfying AREERA requirements.

___M. Scott Smith_____ March 30, 2007
Director **Date**