

Annual Report of Accomplishments and Results

FY00

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

University of Kentucky
Kentucky State University

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

During the past year, the Kentucky Cooperative Extension Service made 911,464 contacts with clientele related to improving production, processing, and marketing. An additional 171,020 contacts with clientele related to the adoption of resource management technologies. 246,225 contacts related home gardening and landscape. Kentucky State University's Small Farm Program made 25,187 contacts with limited resource farmers. Fourteen percent of these contacts were with minority farmers and 25% were with women.

These efforts resulted in 20,110 farmers adopting one or more production practices recommended by Extension. Adoption of these practices resulted in \$25,730,385 of additional profits to farmers. 6,841 producers utilized new marketing opportunities and 39,662 individuals reported changes in knowledge, opinions, skills, or aspirations related to the impact of public policies on agriculture and the environment.

Small farm diversification and the search for alternative crops remains the central focus of the research conducted at Kentucky State University. Three Kentucky State University research projects are highlighted in impact statements found below. Paddlefish, freshwater prawns, and pawpaw are examples of alternative crops which have reached the stage of research and development that they have become viable options for small farmers seeking supplements to tobacco. Interest in these developments is at an all time high. Participants in Kentucky State University field days and meetings represent an increasingly diverse client base.

The Kentucky Agricultural Experiment Station supported 73 research projects related to this goal.

Expenditures	Federal Extension Funds (UK and KSU)	\$2,900,000
	Federal Research Funds (UK and KSU)	\$3,400,000
	State Contribution	\$17,500,000
FTEs	Extension (UK and KSU)	170
	Research (UK and KSU)	56

Key Themes - Diversified/Alternative Agriculture; Plant Germplasm

Difficulties in the propagation of pawpaw [*Asimina triloba* (L.) Dunal], a native American tree-fruit, have been a major factor limiting development of a commercial pawpaw industry. Fruit size and quality vary considerably from tree to tree. Therefore, development of methods that facilitate the clonal propagation of superior varieties would be advantageous to nurseries and subsequently to help growers establish orchards that produce high quality fruit. Determining the optimal conditions for pawpaw seed germination and seedling development would expedite the production of robust seedlings to be used as rootstock in grafting with scionwood of superior cultivars, thereby hastening the production of grafted superior trees.

A comprehensive pawpaw website was established for the general public and scientists (<http://www.pawpaw.kysu.edu>). This site had over 30,000 visitors in its first year. The website includes pawpaw propagation information, a selected bibliography of publications on pawpaw and related species, pawpaw recipes and nutritional information, a guide to buying and growing pawpaws, photos of trees, flowers and fruit, and links to other sites. The site also contains a summary of the pawpaw regional variety trials and information on the national Clonal Germplasm Repository for *Asimina* spp. located at Kentucky State University. The pawpaw planting guide on the website is also available as a Kentucky State University Extension publication.

Source of Federal Funds:	Evans-Allen, 1890 Capacity Building
Scope of Impact:	Multi-State Research and Extension Integrated Research and Extension Multi-Institutional (1890 and 1862 in Kentucky)

Key Theme - Diversified/Alternative Agriculture

Horticultural enterprises offer significant opportunities for diversification of Kentucky's agricultural businesses. Multi-disciplinary teams of faculty have integrated on-station research, on-farm demonstrations, County Agent training, industry workshops and tours, newsletters, websites and publications to assist in the expansion of established and emerging horticultural enterprises. For example, research with bell pepper varieties reported to have resistance to bacterial leaf spot has resulted in recommended varieties and production systems for Kentucky that can be productive even with heavy disease pressure from several races of the pathogen. As a result of an intense Extension program, over 90% of the bell pepper acreage is now planted as per these recommendations. Pepper acreage has increased at least 30% in the past two years and bell peppers have become important, profitable enterprises for the new and expanding produce marketing cooperatives. Profitability of cabbage and apple production has also increased through implementation of integrated pest management practices taught through on-farm demonstrations, workshops and production manuals. Training programs related to professional certification programs for nursery industry personnel and arborists are increasing the professionalism of these groups and the quality of their services.

Source of Federal Funds: Smith-Lever
Scope of Impact: Multi-State Extension (OH, TN, IN, AR, MO, IL, VA, WV)
Integrated Research and Extension

Key Theme - Grazing

Forage in Kentucky represents the agriculture of over 7 million acres of land, over half of all arable land. Forage improvement impacts include using improved varieties of forage for hay and grazing, increased adoption of baled silage, and increased knowledge of grazing tools and techniques.

Farmers have been made aware of the value of improved varieties of forage crops. Improved alfalfa varieties have been shown to add at least one ton of hay yield per acre per year of stand life, plus other potential benefits in terms of stand persistence, forage quality, and pest resistance. The value of these improvements has been calculated to be between \$700 and \$1400 per acre over the life of the stand.

Usage of improved red clover varieties continues to be an area of considerable impact on Kentucky profitability. Better varieties of red clover have been shown to be more persistent and higher yielding than less expensive, uncertified alternatives. Farmer use of improved red clovers has been increasing since 1994.

There has been a significant increase in the adoption of baled silage technology across Kentucky. This technology allows the production of high quality haylage from forage crops that ordinarily would be cut for hay. Farmers have more control over cutting date, are cutting more closely to the ideal time for high quality, and have virtually eliminated storage losses. This technology was virtually unknown and unused as few as 10 years ago. Today, the majority of counties in Kentucky have at least one and in some cases several bale wrappers for making silage. This adoption is the result of an intensive forage quality initiative undertaken by the University of Kentucky Department of Agronomy under the leadership of Mike Collins and Dennis Hancock.

Intensive grazing adoption has increased across Kentucky, partly as a result of intensive, hands-on grazing schools that reached approximately 90 farmers in 2000. These emphasized the art and science of pasture management, livestock nutrition, and the physical setup of systems. In addition, these schools trained farmers how to use intensive grazing to meet water quality guidelines.

Source of Federal Funds: Smith-Lever
Scope of Impact: Multi-State Extension
Integrated Research and Extension

Key Theme - Managing Change in Agriculture

Economic trends have affected the farm family situation with women increasing their role in the day-to-day decision-making. To increase their effectiveness and prepare to manage the change,

the Kentucky Cooperative Extension Service, in conjunction with the Kentucky Department of Agriculture co-sponsored the second Women In Agriculture Conference. More than 400 women participated in the conference that addressed issues including: development of public policy, farm labor, creating niche markets, use of best farm management practices and financial planning. The Kentucky Extravaganza provided free health screenings and a chance to meet Kentucky farmers who have added value to their product.

At the 2000 Women in Agriculture Conference, 87% of the participants were farm owners. 50% had attended the 1999 Women in Agriculture Conference and 42% had attended an area conference during the year. 93% became aware of agricultural products or programs that could be beneficial to their farm. 89% made a contact with a new supporting organization of which they were previously unaware. 86% felt they were better equipped to explain agricultural issues to the public and policy makers. 90% gained knowledge that will make their farm more profitable.

Jenny Souers, a farmer from Eminence, Kentucky, gave a testimonial to open this year's conference. She described the impact that the 1999 Conference had on her life. She and her husband purchased an old run down farm, which others saw as a waste of time. The conference created confidence and enthusiasm and provided her a network of resources to change her life. Jenny and other conference participants will be part of a documentary being produced by the Kentucky State University Cooperative Extension Service and the University of Kentucky Cooperative Extension Service.

Since the first conference, in 1999, regional and county programs have been developed. Farm to Table in the Mammoth Cave area concentrated on value-added opportunities. Women Leading the Way, in Harlan County, built leadership attributes. Area programs in Fort Harrod and Lake Cumberland focused on alternative crops and issues specific to their community. Family and Consumer Sciences agents created, an extension homemaker lesson, Kentucky Food Products to promote consumer awareness and utilization of local agricultural products as Kentucky farmers attempt to reduce their dependence on tobacco.

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

Key Theme - Animal Production Efficiency

One key to increasing profitability in a beef cattle operation is to improve the development of replacement heifers. Producers in several regions in Kentucky have begun to enhance profitability of their operations by marketing properly developed commercial heifers. In 2000, approximately 1500 heifers were marketed in 6 promoted sales in Kentucky. All heifers in these sales were developed under guidelines established by the University of Kentucky Extension. Heifers in these sales averaged approximately \$940 and sale averages ranged from \$850-\$1065. Producers in these sales likely increased their profitability by \$100-250 per head. Thus, the economic impact of heifer development

sales in Kentucky this year was approximately \$1.41 million and profitability on these operations likely increased about \$300,000. Most sales are expecting to expand greatly in coming years.

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

Key Theme - Animal Production Efficiency

The Kentucky Agricultural Experiment Station is currently supporting several projects related to enhancing animal production efficiency. The sections below highlight some of the impacts of these projects

A multi-year project has been designed to evaluate management strategies to improve performance of cattle grazing endophyte-infected tall fescue. Interseeding with alfalfa provided some benefits for calf growth; however, the sustainability of this practice is limited.

We have estimated that the value of an additional pig marketed/sow/year can range from \$35-38.00 in net returns/sow (DiPietro, 1998). Assuming that 50% of the 6,000,000 sows in the United States were fed diets supplemented with CrPic and that the mean response was 0.7 pig/litter, there would be a potential yearly increase of 4.2M pigs from the two litters farrowed per sow per year. The value of this increase could approach \$150M if these pigs are saved and marketed. Current cost for the use of this nutrient in those sows would be about \$6M. Additional costs to raise those pigs would be incurred but there clearly is a large biological and economic potential with the nutrient Cr.

Results from the study on weaning weights of calves will help to answer the question as to what impact level of production, as mediated through weaning weights of calves sired by HIGH versus AVERAGE sires, has, if any, on subsequent re-breeding performance of the cow herd. In another study, there is greater evidence that neonatal calves should be hand-fed colostrum to ensure greater transfer of passive immunity. Physical form of calf starter may affect performance of calves (days to weaning and weight gain) and therefore affect cost of raising dairy replacements. Further study is needed to delineate causes for differences seen in this study.

Nutrient studies show that nutrients interact to regulate pancreatic enzymes in animals. This will contribute to our ability to manipulate digestive processes to maximize animal production efficiency. Our data also describes regulatory signals that are active in ruminants and may provide a means whereby digestive efficiency can be manipulated to improve production efficiency.

Strategic supplementation of beef cows and calves, grazing endophyte-infected KY 31 tall fescue pasture year round, with a molasses-based supplement containing 5% fat + thiamin + yeast maintains heavier cow weights, but does not increase pregnancy rates. This supplement supports greater calf gains, but consumption rates and cost of the supplement prohibit its application on a practical basis.

Approximately 22 million beef cattle gain about 230 kg on corn -based diets (2.2 kg corn/ kg gain) in this country. If optimizing the absorption of lysine results in only a .5% increase in the growth efficiency of cattle over the feeding period, then the same amount of gain will be achieved by feeding about 4.9 million fewer bushels of corn, for a decreased feed cost of \$9.8 million/yr. Similarly, in Kentucky, an annual reduction in feed costs of \$200,000 is expected if a .5 % increase in efficiency of growth and maintenance of its beef herd (570,000 calves and 1.1 million cows).

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Adding Value to New and Old Agricultural Products

Kentucky livestock producers are looking to off -set the decline in tobacco revenues through direct marketing of animals. The Safe Meat Marketing Alternatives through Research and Technology (SMMART) project was started as a collaboration between UK, KDA, and Partners for Family Farms. Interested producers had livestock processed through the UK Meat Lab at a reduced cost and gained valuable marketing assistance. Over two dozen producers explored opportunities for adding value to their livestock.

Source of Federal Funds: Smith-Lever
Scope of Impact: State-Specific
Integrated Research and Extension

Key Theme - Aquaculture

An international, multi-disciplinary team of researchers, lead by a Kentucky State University aquaculturist, have been investigating the production of all -female chondrosteans for caviar fish farming. The project completed a series of detailed studies to refine and optimize gynogenetic and sex reversal procedures for direct production of all -female progeny. Motility of shovelnose sturgeon sperm, used as a donor sperm for gynogenesis procedure, was characterized to develop standard irradiation procedures. The main results were (1) a protocol for the histological analysis of sturgeon (*Scaphirynchus platyrinchus*) and paddlefish (*Polyodon spathula*) eggs to evaluate the progression of meiotic maturation and cellular attributes of post -activation and (2) an investigation on the hormonal triggers for complete oocyte maturation using an in vitro egg culture system.

Mature sex-reversed gynogenetic fish will be induced to spermiate in the spring of 2001. Producing and culturing all -female paddlefish assures a constant supply of eggs as an alternative source of black caviar to the endangered sturgeon of the Caspian Sea. All-female culture would provide larger profit margins for the farmer by higher caviar yield per culture unit.

Source of Federal Funds: Evans-Allen, 1890 Capacity Building
Scope of Impact: Multi-State, International; research team includes individuals from Kentucky State University, University of Oklahoma, the Czech Republic, and France

Key Theme - Aquaculture

The objectives of this project were to develop and refine culture procedures for alternative aquaculture species in Kentucky, specifically hybrid bluegill, yellow perch, largemouth bass, and freshwater prawn. Diets, stocking density, and temperature were examined for maximum grow out under Kentucky conditions.

There were several commercially important impacts of this research. The work conducted on largemouth bass has stimulated interest in the culture of this species in Kentucky and surrounding states, including the establishment of two commercial growers. Currently, largemouth bass production in Kentucky is estimated at 30,000 pounds annually, with a gate value of \$135,000. The second major impact has been the increased production of freshwater prawn in Kentucky and surrounding states. The use of additional substrate has allowed a doubling of production to 2,000 lbs per acre. Since 1996 commercial production of prawns has increased from 1.5 million pounds to an estimated 15 million pounds in 2001. During this time the number of producers in Kentucky and Tennessee has increased from 10 to 100.

Source of Federal Funds: Evans-Allen
Scope of Impact: Multi-State; research team includes individuals from Kentucky State University, Mississippi State University

Key Theme - Animal Health

The Kentucky Agricultural Experiment Station is currently supporting several projects related to animal health. The sections below highlight some of the impacts of these projects.

Results of one project have shown that neonatal dairy calves should be hand-fed colostrum to ensure greater transfer of passive immunity. Results indicate that the physical form of calf starter may affect performance of calves (days to weaning and weight gain) and, therefore, affect cost of raising dairy replacements. Results obtained thus far provide an indication that calves fed milk replacer containing nitrate-N may not be as adversely affected by nitrates as was expected. Results from these studies provide additional information needed by Kentucky producers, and producers across the country, for raising dairy replacement heifers in an efficient and economical manner.

A study aimed at gaining a better understanding of the reproductive physiology of bull calves during sexual development is currently being conducted. Information concerning the neuroendocrine control of LH secretion, and reproductive behavior will provide the basis for future studies aimed at

improving management of bulls for breeding and slaughter. One area of focus is the evaluation of serving capacity of bulls maintained under different types of pasture (e.g. endophyte - infected fescue). Now that we have established basic information on endocrine control of reproduction in the bull, studies can focus on how various types of forage-based management systems impact bull performance.

Research on cows has shown that fatty liver syndrome can result when cows are not transitioned properly from the dry to the lactating state. If severe feed problems occur, not only can the cow suffer from fatty liver syndrome but she is prone to other metabolic disorders such as ketosis. Chromium may alter the manner in which cattle handle lipids and may offer a means to lower serum and lipid triglycerides during the transition phase.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Agricultural Profitability

The Kentucky Agricultural Experiment Station is currently supporting several projects related to agricultural profitability. The sections below highlight some of the impacts of these projects.

Agronomic and composition data for commercial corn hybrids is available for farmers to use when choosing among the many hybrids available for the production fields. Yield, disease and insect resistance, and desirable protein and oil composition can be determined to choose the best hybrids for any Kentucky farm situation.

Improved varieties of tall fescue and other cool season forage grasses are being developed that have superior seed yield, agronomic performance and forage quality. This will allow improved livestock production and profitability.

Research has provided farmers with the information to select top yielding forage varieties. There are over six million acres planted to forages in Kentucky and within this amount there are over 2.3 million acres planted for alfalfa and grass hay production.

Analysis of economic efficiency of producing, marketing and managing environmental plants has shown that if the customer is willing to pay more, plant development entities would be willing to select and introduce new plants with benefits when knowing their costs could be recovered. New plants could reduce pesticide use and/or improve esthetic quality. Production nurseries may not be pricing product optimally in relation to their production cost. Better tracking of costs and appropriate pricing may help a farm develop a better return on investment. The healthy financial status of the industry during the 1980s was not maintained during the 1990s.

Storage bin research has shown that improved bin designs are more cost-effective and act as a

more reliable grain storage for producers and allied industry. The focus on corrugated bin wall loading increases the research basis for design, fabrication and construction of grain storage structures in the U.S. and world wide.

Research has shown that phage proliferation in hard cheese plants is the number one problem confronting the U.S. cheese industry. Studies have shown that inhibition of phage proliferation in hard cheese plants (e.g. Cheddar plants) may result in an annual savings of more than a 100 million dollars worldwide.

The use of supplemental Cr swine nutrition will increase litter size across genetic/geographical/environmental boundaries. The relatively large benefit:cost ratio can then be reasonably expected to apply for producers throughout the US.

Source of Federal Funds:	Hatch
Scope of Impact:	Multi-State Research Integrated Research and Extension

Key Theme - Plant Production Efficiency

The Kentucky Agricultural Experiment Station is currently supporting several projects related to plant production efficiency. The sections below highlight some of the impacts of these projects.

Research has shown that the range of heat and drought tolerance within strawberry species is apparent and limited. Thus, as long as the more heat and drought susceptible material is avoided or used sparingly in cultivar improvement programs, new cultivars will likely be as tolerant as current cultivars. However, a rapid method for characterizing these traits has not yet been developed. Nor has a superior accession been identified. Determining how apple fruit carbohydrate (i.e., sugar) accumulation is regulated may lead to new management strategies to improve fruit quality as well as set the stage for genetic modification of fruit quality. With the development of the molecular tools needed for this work will soon be complete, the regulation of sorbitol dehydrogenase expression and activity, the primary enzyme responsible for carbohydrate accumulation during apple fruit development, can be ascertained. Results from this research open the possibility for engineering improvements in crop productivity without utilizing foreign genes.

A controlled water table automatic irrigation system for container-grown plants can be commercially adaptable. Plants determine the rate of water application, therefore the labor cost is reduced. This closed system produces no runoff to impact surface or ground water. It also is an inexpensive, reliable tool for studying water potential on plant growth and quality.

The commercial use of exogenous 1-amino cyclopropane-1-carboxylic acid (ACC) to treat seeds will reduce the time required for germination and seedling emergence. Seed companies currently

accelerate germination by either priming or pre-germinating seeds. The advantage of the proposed system is that it is a simple application process, has apparently universal response between species, is a natural plant product, and could be delivered to seeds as a coating thereby not detrimentally impacting seed storage life as current practices do.

Soybean variety trials allow for appropriate variety adoption decisions by Kentucky soybean producers, thus improving soybean productivity. Other research furthers our understanding of the physiological processes regulating pod and seed number in soybean.

Several maturing soybean cultivars will have broad application in our production environment; that is, be of additional value to a broad market swatch. Some novel varieties will fill niche markets; while we will move to help our growers take advantage of such limited opportunities, we are most interested in novel soybean types which will allow broader grower participation.

Loline alkaloids have been found to be significant for agronomic adaptation and the genetics of loline production and accumulation in fescue is important for an acceptable forage grass in Kentucky. Lolines are known to provide increased protection from insects and other herbivores, and thus enhance grass growth. Also in 2001 we expect to release the new Freedom variety of red clover which is expected to provide faster drying and less dusty hay for Kentucky forage producers.

The potential for freeze injury causes hybrid seed corn (*Zea mays* L.) producers to harvest seed prematurely, which can result in poor quality. We have found that differences in moisture content between the embryo and endosperm seed tissues should be considered when evaluating losses in seed quality related to freeze injury.

Pesticides that have been essential for production of many U.S. crops in recent decades are slowly and constantly being withdrawn, and new pesticides are appearing with slowing frequency due to development costs. Consequently, it is essential that we understand the factors controlling soil productivity so that we may design production systems that result in high productivity without extensive use of pesticides. Arbuscular mycorrhizal fungi almost certainly have effects on crops. This project seeks to understand these relationships so that we may design cropping systems which suppress the pathogens and promote the mutualists.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Biotechnology

The Kentucky Agricultural Experiment Station is currently supporting several projects related to biotechnology. The sections below highlight some of the impacts of these projects.

Polydnaviruses are the focus of research because they inhibit insect growth and development of larval lepidopteran insects without virus replication. Identifying these genes may identify novel physiological mechanisms for insect control. However, this project demonstrated that studies of individual genes did not mimic virus infection, possibly because multiple copies of related genes are expressed from the viral genome. Polydnavirus genomes also regulate expression of genes by altering gene copy number. This more complex organization has direct implications for polydnavirus function and for strategies to deliver genes in diverse recombinant systems. Determining the structural organization of a polydnavirus genome suggests that gene delivery systems are as important as the specific genes delivered. This has implications not only for identifying genes that disrupt insect physiology but assessing the rate at which these genes evolve. As polydnaviruses are one of the functional determinants of host range in many parasitoid species an improved understanding of polydnavirus evolution may allow improved assessment of the risk that biocontrol agents will adversely affect non-target species. Thus, this project has impacted three areas. Genes have been identified that inhibit host immunity and development. The viral genome organization has been described and suggests strategies for enhancing delivery of recombinant proteins in transgenic systems. Finally, the rate at which viral genes change may provide a physiological indicator of the potential for adverse non-target effects.

The research on the genetic engineering of soybeans for accumulation of epoxy fatty acids is to develop new valuable markets for soybeans with industrially useful epoxy fatty acids in the seed oil. The comparative feeding studies should elucidate the mechanisms responsible for selective accumulation of epoxy fatty acids in triacylglycerol and not in membrane phospholipids. This information is providing a basis for metabolic engineering soybeans for high accumulation of epoxy fatty acids in seed oil and increasing oil content while at the same time holding protein content steady. The studies with *Artemisia* are providing a basis for understanding the formation of oxylipins including those valuable in foods and beverages and perfumes. This information is being used to develop plant bioreactor systems for the commercial production of these valuable compounds.

New findings regarding the structure and biochemical activities of the pea nuclear poly(A) polymerase suggest novel interplay between seemingly unrelated processes. These findings have the potential to impact, not only our understanding of how mRNAs are synthesized, but also how RNA processing regulates, or is regulated by, other events such as RNA turnover.

Trichome glands of certain plants produce and secrete copious amounts of exudate chemicals that are thought to provide disease and pest resistance on the plant surface. Genetic engineering of exudate may provide for enhanced natural-product-based disease and pest resistance in crop plants. Glands may be exploited for molecular farming to provide additional uses for crop plants.

The first transgenic lines of soybean have been field tested in the state of Kentucky. The first reported recovery of a stable, fertile transgenic line of soybean derived from *Agrobacterium*-mediated transformation of soybean embryogenic tissue was also achieved during this project. The progress made in soybean transformation during this project and overall soybean research identity of the

University of Kentucky enabled the group to submit an accepted invitation to host the 8th Biennial Conference of the Cellular and Molecular Biology of the Soybean, an international conference bringing together more than 260 academic and industry participants.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - New Uses for Agricultural Products

The Kentucky Agricultural Experiment Station is currently supporting several projects related to the discovery of new uses for agricultural products. The sections below highlight some of the impacts of these projects.

The concentration of dislodgeable foliar pesticide residues determines to some extent the degree of hazard that an agricultural worker faces when he enters and works in a field that has been treated with pesticide. The ability to determine these residues quickly and accurately will lead to a better assessment of the hazards that agricultural workers encounter. Thus the ability to identify and quantify novel capsaicinoids may lead to genetic improvements in pepper (*Capsicum*) and may also lead to a better understanding of why certain capsaicinoids modify insect behavior.

Trichome glands of certain plants produce and secrete copious amounts of exudate chemicals that are thought to provide disease and pest resistance on the plant surface. Genetic engineering of exudate may provide for enhanced natural -product-based disease and pest resistance in crop plants. Glands may be exploited for molecular farming to provide additional uses for crop plants.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Animal Genomics

The Kentucky Agricultural Experiment Station is currently supporting several projects related to animal genomics. The sections below highlight some of the impacts of these projects.

The tools developed for horse genomics make collaboration and progress in development of the gene map easier and faster. The tools also make it possible for scientists to apply the information to address health problems. During the current year, scientists are consulting the map to select markers close to candidate genes. Candidate genes are localized to chromosome regions based on comparative map studies. The workshop primer sets are available to workshop participants and represent considerable savings in research dollars. Projects underway include those addressing diseases of muscle, skeletal development, gene defects and infectious diseases of the horse. We anticipate that this work will result in the development of diagnostic tests, better understanding of the diseases and

therapeutic approaches to curing these diseases.

FISH mapped markers allow us to effectively compare the genome organization of the horse to that of other species. Knowing the correspondence between the horse and human genome makes it possible to use human genomic information to make predictions about the organization of the horse genome. Microsatellite DNA markers are highly polymorphic and useful in family studies to determine which of two chromosomes was transmitted by a parent to its offspring. The synteny maps and linkage maps demonstrate the linear relationships among the markers. These markers will be useful in studies designed to identify QTLs for horses. Development of polymorphic markers was defined as a priority activity for the gene mapping workshop. The tools developed in objective 3 make us better able to develop and use the gene map for the horse. The development and use of the genome scanning panel boosts our ability to conduct research using the map. The successful applications of the map to characterize genes for coat color and for epitheliogenesis imperfecta bode well for application of the map to characterizing more complex traits.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Agricultural Competitiveness

The Kentucky Agricultural Experiment Station is currently supporting several projects related to agricultural competitiveness. The sections below highlight some of the impacts of these projects.

A key question regarding U.S. competitiveness is whether exports and foreign direct investment (FDI) are complements or substitutes e.g., does FDI displace or enhance exports. Empirical results indicate a strong complementary relationship between U.S. exports and FDI into China. Thus, agribusiness firms seeking to access Chinese processed food markets should increase overall business activity, both FDI and exports into China.

The palm oil research has important implications for the demand for U.S. soy bean oil. U.S. soybean producers have benefitted from Indonesia's export tax on palm oil and substantially reduced palm oil production there for many years. However, this policy has harmed Indonesian palm oil producers. The research on overshooting shows that agricultural prices will overreact to monetary policy changes, increasing their volatility over time. U.S. agricultural policy formation should recognize this tendency for agricultural prices to cycle based on economic policy shocks.

Project survey analysis will provide data about citizen attitudinal and consumer behavior response to changes in the U.S. agro-food system and local communities brought about by globalization processes in the rural/agricultural sector. This data will provide important information to guide decision-making both in the private and in policymaking circles. Comparative analysis of project case studies will facilitate discussion of policy initiatives that facilitate positive impacts and deal with negative side effects

of globalization dynamics.

A study revealed that simultaneous interactions generally existed among employment, per - worker earning and per - worker pollution growth rates for all industries combined. The results suggest that communities whose objective is to increase employment growth rates should strive to increase environmental quality in the county. Communities whose goal is to decrease pollution growth rates should try to attract high-paying industries while, paying close attention to the pollution in intensity of that industry. Job growth occurred at the expense of reduced earnings growth. The results suggest that non-metro counties should impose policies that would result in higher environmental quality to be able to create new jobs whereas it is not clear that higher environmental quality would stimulate rates of employment growth over time in metro counties.

Counties with lower initial level of earnings but with higher rates of earnings growth were at an advantage in creating new jobs in almost all industries. In agriculture, higher initial per - worker earning led to lower pollution growth rates. Although industry shifted employment away from counties with initially high wages, they were not deterred from locating in areas with high rates of earnings growth. Compensation benefits had a significant effect on employment growth rates. Amenities had a significant effect on earnings growth rates for agriculture.

Research results on the demand for dairy products have been used by industry advocacy groups to support policy positions on interstate dairy compacts, they have been presented in academic and industry venues, and have been reported in industry publications ranging from The Cheese Reporter to a German dairy periodical. Research results from the project were the subject of expert witness testimony in a breach of contract lawsuit during this reporting period. The nutraceutical commercialization research is intended to directly improve the competitiveness of Kentucky dairy producers and enhance the healthfulness of dairy product consumption.

It is expected that the successful completion of a project on a planning model for assessment of agriculture potential in the Appalachian region will provide a mechanism for identifying viable crop land for vegetable and alternative crop production as tobacco is phased out.

Knowledge of solid state fermentation process (SSF) studies would improve the phytase enzyme used in animal diets and would allow the U.S. to better compete in the global enzyme market. This research addresses several of the obstacles to commercial implementation of SSF technology in the United States. If successful, the proposed work will demonstrate that fermentation and separation processes are predictable based on fundamental principles.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

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 the greatest of all food safety threats. The annual cost of foodborne illness to our economy is estimated at over \$10 billion. Consumers continue to display misconceptions about food safety. Only 55% of consumers surveyed in a 1998 Food and Drug survey, perceived unsanitary handling and processing/preparation of foods as a threat. These findings are an increase of 40% over the last two years suggesting that education by numerous agencies concerning food safety issues are making a

difference in how consumers handle food. The Centers for Disease Control and Prevention reports that 97% of foodborne illness could be prevented with good personal hygiene and improved food handling techniques. So proper food handling needs to be a priority in every stage of the farm-to-table education link.

During the past year, the Kentucky Cooperative Extension Service made 54,116 contacts related to food safety, preservation and preparation. These efforts resulted in 27,097 people adopting practices that ensure safe handling of food. 153 processors (meat, vegetable or fruit) developed HACCP plans for their businesses.

More than 8000 limited-resource individuals participated in programs designed to help them make maximum use of their food dollar.

The Kentucky Agricultural Experiment Station supported 28 research projects related to this goal.

Expenditures	Federal Extension Funds (UK and KSU)	\$900,000
	Federal Research Funds (UK and KSU)	\$900,000
	State Contribution	\$3,200,000
FTEs	Extension (UK and KSU)	37
	Research (UK and KSU)	11

Key Theme - Food Safety

In Kentucky, food preservation has increased. This home preservation has changed greatly since the days of our ancestors. Food science has led us to safer canning techniques and better quality canned, frozen, and dried foods. With the resurgence of an interest in gardening, and economic considerations in the state of Kentucky, home food preservation increased. Last year, Extension trainings which promoted using USDA food preservation recipes and techniques, saw a reported 42% increase in food preservation in the home (365 to 517 individuals). The food was valued at over \$300,000. More canners were tested in Extension offices than ever before. Over 10,000 food preservation publications were requested from clients across the state. Exhibits which emphasized food preservation at county fairs were viewed by thousands of individuals.

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

Key Theme - Food Safety

The Kentucky Agricultural Experiment Station is currently supporting several projects related to food safety. The sections below highlight some of the impacts of these projects.

Research on enhancing and validating the microbiological safety of foods includes the use of natural plant-derived volatile compounds that demonstrate the ability to kill or inhibit selected food borne pathogens of fresh produce. These volatile compounds will provide a natural alternative to the Kentucky producers. In addition to validating the microbial safety and shelf stability of country cured hams.

The finding that heat stress does not influence the somatic cell count of milk from uninfected cows reinforces the concept that udder infection is the primary factor influencing milk quality. Season appears to have little influence on somatic cell count per se. Therefore mastitis control is the key factor to producing quality milk with low somatic cell count.

The use of subtherapeutic concentrations of antibiotics in swine feeds to prevent or reduce the incidence of infectious disease and to improve feed efficiency and growth is very common. A mandatory ban on these practices is possible, due to the potential hazard to human health. Active approaches to prevent or reduce the prevalence of antibiotic resistant bacteria in livestock is required in today's swine production facilities, and will improve the safety and quality of Kentucky grown pork.

The objective of this research is to enhance and validate the microbiological safety of foods. This approach includes the use of natural plant-derived volatile compounds that demonstrate the ability to kill or inhibit selected food borne pathogens of fresh produce. These volatile compounds will provide a natural alternative to the Kentucky producers, in addition to validating the microbial safety and shelf stability of country cured hams.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Foodborne Pathogen Protection

The most susceptible individuals to foodborne pathogens are the elderly and school-age children. To address these concerns, educational programs on the safe preparation and handling of food were sponsored by the Cooperative Extension Service. 11,117 youth and 279 seniors participated in Kids in the Kitchen, Food Safety and Sanitation and other food safety related programs. On average, 95% of the participants report they will make behavioral changes as a result of newly learned food preparation and safety skills. After many of the programs involving children ended, students were heard singing the song suggested for the proper length of time while washing their hands; proof that food safety can be fun as well as life changing.

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

Key Theme - Foodborne Pathogen Protection

The Kentucky Agricultural Experiment Station is currently supporting several projects related to foodborne pathogen protection. The section below highlight the impact of one of these projects.

Control of pathogens at the pre-harvest stage is the first step to reducing the potential hazards of foodborne illness. The occurrence of the pathogen is related to a number of factors including the innate resistance of the animal, the infectious dose, the virulence and the serotype. Certain measures can and have been used to successfully lower or abolish the incidence of salmonellosis. These efforts are very much dependent on improvements in management. Environmental stresses, poor feed or nutrition, improper sanitation and animal density all play a vital role in salmonella control. Because of the great diversity in the manner in which pathogens spread no one single solution will solve the problem. Prophylactic use of antibiotics in animal feeds has also come under fire by many consumer groups with concerns over the increasing number of antibiotic resistant strains. Other options available to the producer for control of potential pathogens include: early weaning to remove the young animal from possible contamination from the adult, higher pelleting temperatures, acidification of the feed or water with propionic or other organic acids, identification and removal of carrier animals, improved sanitation in the facilities and nutritional manipulation of the gastrointestinal tract through the use of oligosaccharides, probiotics or competitive exclusion products. This multi - state project allows several scientists to study different factors under the same conditions to determine which ones are most effective in reducing the pathogen in the live animal.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Food Handling

Safe Food to Go, The Thrill of the Grill, and Slow Cookers reached an audience of 2,644 individuals. Proper time/temperature relationships were emphasized, along with proper sanitation procedures. Foodservice employees continue to be a target audience. Over 585 farmers and food producers received food safety training in the past year. 153 individuals were assisted in writing HACCP plans for their businesses.

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

Key Theme - Accessibility and Affordability

The University of Kentucky Food Stamp Nutrition Education Plan (FSNEP) was implemented in 1997 to educate food stamp recipients and eligibles on food budgeting, food handling, food preparation techniques and wise grocery shopping. “Kentucky Gets FoodWise” is the name given to this program which is in conjunction with the USDA Food and Nutrition Service Southeastern Region and Kentucky’s Cabinet for Families and Children.

Many food stamp eligibles and recipients were not successful in school because they were not traditional learners. Educational settings typically depend upon two learning styles: visual and auditory. This is frustrating for those who learn kinesthetically or for those with limited literacy. They learn by manipulating and sorting. To meet the needs of those with different learning styles, nutrition programs (“waves”) which depend upon participant discovery of knowledge, values, and skills were designed. Nutrition messages were developed by the participants through activities.

Family and consumer science agents who chose to participate in FSNEP signed an annual time commitment contract. In return for this commitment, the agent received two “waves” of materials including additions to the initial food demonstration kit, targeted lesson materials, social marketing tools, and support materials. Over the years, agents from 14 counties have participated in this program. These county agents have collaborated with Headstart, Workforce Training Programs, Social Service Offices, Senior Citizen Community Centers, Community Actions, Housing Authorities, and Family Resource/Youth Service Centers.

Evaluation data from October 1999 through September 2000 was obtained for over 8,000 face-to-face statewide contacts. When measuring nutrition, food safety, or food economics outcomes for these participants, 70% gained knowledge, 64% aspired to change one or more behaviors, and 66% of those participating in on-going groups adopted new behaviors.

County success stories continue to come in from all over the state. For example, during a committee meeting, an Extension agent had to leave early to do a “Kentucky Gets FoodWise” program. A State Senator attending the meeting said, “Let her leave. The work she is doing is more important than what anyone else is doing. She’s making a great impact with limited resource families!” Other county success stories involve how people are grocery shopping more economically or how the participants are learning to cook rather than relying on expensive frozen food packages. The participants’ new behaviors are saving money that they can use on nutritious foods.

Source of Federal Funds: Smith-Lever
Scope of Impact: Multi-State Extension (40+ States)

Key Theme - Food Quality

The Kentucky Agricultural Experiment Station is currently supporting several projects related to food quality. The sections below highlight some of the impacts of these projects.

Meat proteins, including those from under-utilized meat sources, can be rendered more reactive through enzyme cross-linking treatment, and hence, can be more efficiently utilized as functional ingredients in value-added products (e.g., as binding materials in luncheon meats). Increased interaction between muscle proteins with preheated soy proteins will allow the inexpensive non-meat ingredients to be more effective in modifying meat product texture as well as enhancing related sensory characteristics.

The complete elimination of raffinose using null mutants in raffinose biosynthetic enzymes would advance the discovery of the role(s) of raffinose in all aspects of seed biology as well as permitting the initiation of studies on the health benefits accrued from consumed raffinose. This information will complement endeavors directed at altering the soluble sugar composition of agricultural products that could then be conducted with the consequences of a lack of raffinose on seed biology and human and animal health more completely understood.

Data from our research on consumer demand for dairy products have been used by industry advocacy groups to support policy positions on interstate dairy compacts, they have been presented in academic and industry venues, and have been reported in industry publications ranging from The Cheese Reporter to a German dairy periodical. Research results from the project were the subject of expert witness testimony in a breach of contract lawsuit during this reporting period. The nutraceutical commercialization research is intended to directly improve the competitiveness of Kentucky dairy producers and enhance the healthfulness of dairy product consumption. Also, it has been determined that the reflectance curve during the coagulation of milk yields information of the chemical status during coagulation. These results will improve the opportunity to manage and control coagulation to maximize production efficiency and quality.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Food Security

The Kentucky Agricultural Experiment Station is currently supporting several projects related to food security. The section below highlights the impact of one of these projects.

Kentucky's agricultural and horticultural industries are directly benefitting from this national program by having available the needed pest controls, while consumers benefit through local and national availability of abundant and safe fruits, vegetables, and ornamentals. This program is especially beneficial at this time of declining tobacco production, since minor crop production is increasing in Kentucky as the state diversifies its agriculture. The IR-4 program has contributed directly to the majority of pesticide registrations currently being used on minor crops. These pesticides are key components in pest management of fruits, vegetables, and ornamental plantings in the state. The initiative supporting registrations for ornamentals has been especially beneficial to Kentucky.

Source of Federal Funds: Hatch
Scope of Impact: State Specific
Integrated Research and Extension

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 195,577 contacts related to promoting healthy lifestyle practices. An additional 106,552 contacts related to helping Kentuckians know and understand the Food Guide Pyramid. Agents and specialists made 58,920 contacts related to injury reduction and 9,357 contacts related to the development of comprehensive health management systems. Extension collaborated with other organizations and agencies to co - sponsored 1,366 different events or activities which focused on comprehensive health maintenance.

These efforts resulted in 49,490 citizens making behavioral changes designed to achieve a

minimally balanced diet. An additional 35,497 individuals implemented personal health protection practices appropriate for their life cycle stage (preventive health practices, participation in screening and detection opportunities, immunizations, etc.) and 31,255 people adopted at least one new safety practice (bicycle helmets, fire extinguishers, tractor roll bars, radon testing, smoke detectors, proper ATV operation, etc.)

Human nutrition and health is also a major area of research at Kentucky State University. The focus of much of this research has been on the eating habits of African Americans. Educating and empowering individuals to make better food choices can have a dramatic and direct effect on human nutrition and health. This is also true for our ongoing studies into strategies to combat the effects of osteoporosis via functional foods and exercise. Three Kentucky State University research efforts are highlighted in the set of impact statements which follow.

The Kentucky Agricultural Experiment Station supported 5 research projects related to this goal.

Expenditures	Federal Extension Funds (UK and KSU)	\$2,000,000
	Federal Research Funds (UK and KSU)	\$700,000
	State Contribution	\$8,000,000
FTEs	Extension (UK and KSU)	113
	Research (UK and KSU)	8

Key Theme - Human Health

Approximately 50% of Kentucky adults are overweight and participate in no leisure time physical activity. Cardiovascular disease continues to be the leading cause of death and the prevalence of diabetes has increased 33% over the 1994-2000 time period. But a common bond which tends to bring Kentuckians together is a strong allegiance to University of Kentucky athletic program, particularly the basketball Wildcats. The positive image of the Wildcat was harnessed and serves as the primary marketing tool for *The Wildcat Way to Wellness*. During the first two years, the program has reached over 25,000 Kentuckians. Follow-up data from 1999 participants indicate that 75% have made a positive behavioral change toward better health as result of this program. The program provides a wide variety of current, research-based information to help consumers make well-informed choices about behaviors related to health and well-being. This popular, fresh approach to better health for Kentuckians promises to have a significant impact on the social and economic status of our citizens.

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

Key Theme - Human Health

The Kentucky Agricultural Experiment Station is currently supporting several projects related to

human nutrition. The section below highlights the impact of one of these projects.

While soybeans provide a high-quality protein, and there are increasing reports of health benefits from consuming soy protein products, the demand for soybeans in human foods has not been large. This is largely due to the undesirable flavor associated with soy products. Understanding the factors contributing to the flavor of soy protein products is an necessary step toward improving their sensory qualities.

Source of Federal Funds: Hatch
Scope of Impact: State-Specific
Integrated Research and Extension

Key Theme - Human Nutrition

The Expanded Food and Nutrition Education Program (EFNEP) paraprofessionals in Kentucky, teach limited resource homemakers skills to improve the nutritional quality of meals, how to safely prepare meals and to maximize food related resources to better feed their families. Of the 2,732 EFNEP graduate families, 93% showed a positive change in their food intake as a result of learning and developing skills and behaviors taught through EFNEP. Using Medical Economics figures for the cost of unhealthy eating habits and EFNEP reporting system results for Kentucky, this equates to annual claims savings of \$623,500.05. Behavior changes that brought about the increase in healthier eating habits included: 53% increase in number of graduates consuming 5 - A - Day; 66% improvement in the number of graduates preplanning meals to save time and money, 75% increase in homemakers reading food labels; homemakers making their own baby food with fresh fruits and vegetables; and ensuring that all family members, including children, eat breakfast. Using data from a University of Kentucky Horticulture Specialist and a garden survey conducted by EFNEP paraprofessionals, 517 limited resource families grew a standard or container garden and preserved fresh produce in 2000 saving a total of \$319,476.24 on their combined grocery bills. Data suggest that every person (child and adult) that receives education regarding some aspect of food borne illness prevention, saves the state an estimated \$1,000.00. Ten thousand, nine hundred and nine Kentucky youth and adults were reached with food safety programing by the EFNEP program in 2000. Potential savings to Kentucky citizens, businesses and government, due to these food safety programs is \$10,909,000.00.

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

Key Theme - Human Nutrition

The Kentucky Agricultural Experiment Station is currently supporting several projects related to human nutrition. The section below highlights the impact of one of these projects.

Kentuckians are experiencing a high incidence of nutrition-related health problems, which may be due to over consumption of fat and lack of protective nutrients such as antioxidants and micronutrients. Our findings contribute to the understanding of the interactive role of high fat/calories diets and subsequent hypertriglyceridemia with inflammatory components and nutrients that exhibit antiatherogenic properties, in the development of atherosclerosis. Furthermore, results from our research further supports the concept that high-fat/calorie diets and associated postprandial hypertriglyceridemia are significant risk factors of atherosclerosis.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Medicinal Plants

With the sales of natural herbal remedies at an estimated \$3 billion per year and growing, Dietary Supplements were a hot topic which has grave safety issues. 5,216 people, including doctors and other health professionals, participated in training sessions on the Dietary Supplement and Health Education Act, label reading for supplements, the supplements of benefit, and those considered toxic. As a result of the trainings, it was found that over half of the population is self medicating with medicinal herbs. 26% of the individuals taking supplements were not informing their physicians but plan to do so in the future.

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

Key Theme - Human Nutrition

Focus Area in FY2001 CSREES Budget - Modifying Food Intake Behavior

African Americans face a disproportionate risk for hypertension, stroke, heart disease, diabetes and some cancer - all of which are diet-related. While diet modification can help reduce risks, changing eating habits is difficult. The goal of this project was to nutritionally enhance traditional recipes and test their acceptability. Traditional recipes for selected popular foods were modified using alternative fats, sweeteners, textured soy protein meat substitutes, and different preparation methods to reduce total calories, total fat and cholesterol and to increase fiber at least 20%, while maintaining acceptability.

Results show that low fat/high fiber recipes were acceptable to African American panelists, and their eating habits could be modified through nutrition education. In an exit interview, 52.7% of panelists indicated that participation in the taste panel had made them more aware of the nutrient content of foods and they were more likely to choose low fat foods. This was supported by a comparison of the initial and exit 24-hour dietary intake recalls: intake of calories, total fat, saturated fat, and cholesterol decreased substantially with a slightly higher intake of dietary fiber. The results suggest that nutrition

education should be conducted along with popularization of modified recipes for maximum impact on the eating habits and health of African Americans.

Source of Federal Funds: Evans-Allen
Scope of Impact: Multi-State (National)

Key Theme -Human Nutrition

Focus Area in FY2001 CSREES Budget - Scientific Basis for Optimal Health

A study was conducted to determine the effects of dieting with exercise on calcium metabolism and bone structure. Effects of energy restriction and exercise on bone composition and strength were studied on intact and ovariectomized mature rats. Diets with various amounts of protein, vitamins and minerals were tested with rats trained to run on a motorized treadmill at 30 m/min, 30 min/day for 5 days per week. Running caused slightly more body weight loss without decreasing bone mineral density. Bone ash, calcium, magnesium content and bone breaking strength declined and were further reduced by energy restriction, but not by exercise. These parameters in the energy-restricted groups tended to increase with the amount of soy extract in the diet.

This project confirmed that dietary energy restriction resulted in bone loss in intact rats and further bone loss in ovariectomized rats. Running exercise could not prevent bone loss associated with energy restriction. However, the inclusion of a soy extract in the diet tended to slow bone loss. Further research is needed but the addition of soy products in the human diet may slow the onset of osteoporosis.

Source of Federal Funds: Evans-Allen, Capacity Building Grant
Scope of Impact: Multi-State (National)

Key Themes - Human Health, Human Exposure, Farm Safety

This study dealt with the biochemical responses of rats to combinations of synthetic and natural ag-chemicals. Exposure to several classes of pesticides is known to increase lipid peroxidation, which is caused by endogenous reactive oxygen species that are the by-products of metabolism. The goal was to determine the effects of low level exposure and cessation of exposure to either individual or a mixture of commonly used pesticides on the alteration of antioxidant enzyme activities in tissues of young adult rats. Tobacco farm workers are often exposed to the pesticides used in this research: acephate, methamidophos and nicotine. Dermal exposure to pesticides decreased erythrocyte activity by 17%. Metabolites and intact chemicals were transported to the liver and other tissues over time.

Farms workers, especially limited resource farmers and tobacco workers, are often exposed to unknown amounts of chemicals. The results of experimental studies using an animal model suggests that

low level application of pesticides to the skin can over a period of time modify certain enzymes in the red blood cell and liver that could eventually be harmful to human health. The data also suggest that this enzyme activity could be used to monitor exposure to pesticides in humans.

Source of Federal Funds: Evans-Allen
Scope of Impact: Multi-State (National)

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 past year, the Kentucky Cooperative Extension Service made 96,871 contacts with related to promoting the effective stewardship of natural resources. An additional 27,564 contacts related to the maintenance of a safe, accessible, and economically affordable water supply. 22,534 contacts related to the management of waste through reduction, reuse, or recycling and 12,406 contacts related to the management of forests and woodlands.

As a result of these efforts, 26,638 individuals adopted practices that ensure safe water, 2,807 individuals began using new forest management practices. 30,873 individuals adopting one or more practices related to conserving, sustaining, or protecting soil resources. Conservation tillage practices were used on additional 771,277 acres of land.

Research activity at Kentucky State University focuses on small farm water quality and

environmentally-friendly practices for controlling pests in stored grain. Water quality in Kentucky is directly affected by pesticide applications due to the Karst topography and sloping land. Our research has demonstrated that pesticide runoff and sediment runoff can be easily reduced by the intercropping of fescue rows. The challenge will be to convince growers to adopt these strategies to enhance water quality. A longer term challenge is to discover Bt isolates or other means to control insect pests in grain storage. Two Kentucky State University research projects are highlighted in the set of impact statements found below.

The Kentucky Agricultural Experiment Station supported 29 research projects related to this goal.

Expenditures	Federal Extension Funds (UK and KSU)	\$1,600,000
	Federal Research Funds (UK and KSU)	\$1,600,000
	State Contribution	\$3,400,000
FTEs	Extension (UK and KSU)	32
	Research (UK and KSU)	32

Key Theme - Agricultural Waste Management

In 1994, the Kentucky General Assembly passed the Agriculture Water Quality Act. Through this legislation, each Kentucky landowner with 10 or more contiguous acres in agriculture or silviculture production is required to develop and implement a water quality protection plan by October, 2001. Since the legislation was enacted, many state agencies, federal agencies, and farm-related organizations have been working in partnership to make farmers aware and assist them in developing plans.

Extension has played a key role in this process. Working with three state agencies, two federal agencies, and one farm organization, Extension staff planned and conducted fifteen training sessions for agency professionals between 1995 and 1998. Attendance totaled over 1000. This partnership formed through the Environmental and Natural Resource Issues Task Force also developed two informational brochures and two educational videos.

In addition, Extension partnered with the Kentucky Division of Conservation to plan and conduct seven workshops for county agriculture leaders, reaching 318 individuals. These grassroots leaders, along with agency professionals and farm organizations, have conducted multiple informational meetings, water quality field days and tours, and plan writing workshops since 1996. As of December 29, 2000, more than 16,000 plan certifications had been filed with local conservation districts.

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

Key Theme - Water Quality

Water is a precious natural resource and plays an integral role in our lives. From drought to water quality impairments and limited access to safe drinking water, a variety of water issues take center stage. To insure citizens receive factual information about water issues, the Environmental and Natural Resource Issues Task Force targets May as Kentucky Water Awareness Month. Each year a packet of materials is developed and distributed to Extension agents across Kentucky. The packet includes promotional items, fact sheets, news articles, radio scripts, pencil -and- paper activities and hands-on activities, with materials geared to both youth and adults. Issues addressed change each year, and packet items target current topics of concern.

Since 1997, counties across the state have reported conducting over 600 educational programs as part of Kentucky Water Awareness Month. These programs have reached more than 74,000 people with information about current water issues and concerns. Data collected through the Kentucky Poll, a random telephone survey of Kentucky households, verify that citizens across the state are aware of the observance. In 1997, 14% of the 635 survey respondents were aware of the observance. That number increased to 17% of 633 respondents in 1999.

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

Key Theme - Water Quality

The Kentucky Agricultural Experiment Station is currently supporting several projects related to water quality. The sections below highlight the impacts of some of these projects.

Further investigation is needed on several parts of the OPUS computer model: nitrogen cycle, and modeling of water movement through the soil profile. If this model can be improved, then it can be used to consistently evaluate environmental effects to reduce the possibility of groundwater contamination from agricultural practices. While it is too early to determine the impacts of any new findings on water quality, the education effort has begun to show how farming practices can be modified to improve water quality. Information is also being gathered to understand how colloid transport can be used to reduce ground water contamination. The results of this information will suggest alternative solutions to dispose of animal and municipal wastes. Also, because future environmental regulations will be based on phosphorus (P) contributions to surface water runoff. Our studies will assess the impact of a soils ability to retain added P from various sources in different areas of the state. The increased ability of a soil to retain added P will likely reduce the amount of P in surface runoff.

Research is also being conducted to understand the distribution and activity of soil bacteria and the role they may play in predicting and preventing pollutant movement to groundwater.

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

Key Theme - Air Quality

The Kentucky Agricultural Experiment Station is currently supporting several projects related to air quality. The section below highlights the impact of one of these projects.

Residences and other buildings are being built tighter to reduce the amount of air infiltration and resulting energy use in heating and cooling buildings. Between 30 - 50% of the cost of heating and cooling a residence is due to infiltration energy losses. Reducing this infiltration saves energy costs but leads to indoor air quality problems. This project is designed to determine the amount of reduction possible in infiltration while maintaining adequate indoor air quality. It was found that in some locations in the US, air infiltration does not supply sufficient ventilation to be relied upon for adequate IAQ control. However in many locations, infiltration could be relied upon to provide ventilation for IAQ control provided there was sufficient leakage area predicted to occur as a result of global climate change. It appears that extensive intraguild predation may make it difficult to predict the net impact of changes in one component (i.e. members of a single family) of the predator complex. Our experiment with gnaphosids suggests that even relationships between abundant predators are not clearly defined and may not be as simple as they seem in the laboratory. Thus, environmentally induced changes in one or a few related predator species may have minimal impact on other components of the food web, whereas concurrent, similar changes in densities of most spiders in the community can exert significant indirect effects on other species. In vegetable crops the ability to manipulate densities of arthropod generalist predators and predict the consequences for crop production is an integral component of conservation biological control. The ability to enhance densities of generalist predators by increasing densities of detritivores and fungivores in the detrital web will be improved by uncovering the trophic relationships of predators such as spiders and carabid beetles.

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

Key Theme - Forest Resource Management

The Kentucky Master Logger Program was initiated in the fall of 1992 to provide broad-based training for loggers. The primary training involves a three - day course for first time participants and four one-day courses which are provided as continuing education opportunities for individuals who have completed the primary training. To date 4301 loggers have completed the course. The program teaches loggers to use best management practices (BMPs) to bring hardwood timber out of the forest with minimal environmental impact. Loggers also learn about safety in the forest and how to stay in compliance with federal and state laws. The program is a cooperative partnership between the Kentucky Cooperative Extension Service, Kentucky Division of Forestry, and the Kentucky Forest Industries Association and is sponsored by industry support and the Kentucky Division of Water's 319 program. The program has been so successful that the Kentucky General Assembly has passed a law

requiring that at least one Master Logger be on each timber harvesting site. Kentucky Master Loggers currently harvest approximately 1 billion board feet of timber on 300,000 acres. This resources is worth 120 million dollars to landowners in Kentucky.

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

Key Themes - Water Quality, Pesticide Application Focus Area in FY2001 CSREES Budget - Water Quality

Research was conducted to determine the influence of landscape features and soil amendments on runoff and infiltration of pesticides on highly erodible land (10% slope). Three soil treatments (living fescue mulch between rows, every other row, no mulch) were used to reduce soil erosion and surface water runoff in plots planted with pepper and tomato transplants. Endosulfan infiltration was monitored through the vadose zone using pressure lysimeters.

Cultivation of turf between cropping rows and pepper intercropped with tomato reduced water and sediment loss and endosulfan movement from application site to surface water runoff. Treatments planted with pepper intercropped with tomato reduced runoff water discharge 67.3% and sediment loss 85.9% compared with pepper plants only. Ten rows of filter strips in pepper plots reduced Dacthal residues in runoff water and runoff sediment by 95% and 100%, respectively.

Source of Federal Funds: Evans-Allen, 1890 Capacity Building
Scope of Impact: Multi-State (National)

Key Themes - Biological Control, Integrated Pest Management

The objectives of this research were to search for beetle-active isolates of *Bacillus thuringiensis* (Bt) and examine the impact of a moth-active Bt-derived product on non-target insects in on-farm stored corn. Assays were conducted on 44 Bt isolates with several pests of stored grain. Overall, no mortality exceeded 34% for adults or 42% for larvae. There was no impact of moth-active Bt-products on beneficial insect, wasp parasitoids.

The long term impact of this research will be to reduce the application of pesticides in on-farm stored grain. Bt products are non-toxic to humans and will help insure a safe food supply.

Source of Federal Funds: Evans-Allen and 1890 Capacity Building
Scope of Impact: Multi-state (National)

Key Theme - Agricultural Waste Management

The Kentucky Agricultural Experiment Station is currently supporting several projects related to agricultural waste management. The sections below highlight the impacts of some of these projects.

Our research will be useful to state and federal regulators (and has direct relevance for the writers of the Joint EPA/USDA Unified Strategy on AFO/CAFOs) who are considering setback legislation as a means to protect surrounding properties from animal waste odors. Specifically, setback lengths tend to be stationary while odor generation is dynamic. A one-policy-fits-all attitude is not beneficial to producers or surrounding landowners. This study provides a method by which different setback lengths can be associated with changes in a producers manure management cost. The second study is particularly important. Specifically, the second study clearly indicates that, at least, small and medium sized Kentucky dairies benefit from federal and state program investment in Best Management Practices (BMP) cost share programs. The programs result in substantial reductions in production cost and installation of manure management BMPs are beneficial to environmental quality. The implication of this study is that funding of state and federal programs should continue.

Reduction in phosphorus (P) in swine and poultry manure has a major impact on Kentucky agriculture because of the negative environmental impact associated with excessive P application from animal waste to crop land. One of the long-standing challenges of broiler litter management is the relatively high phosphorus to nitrogen ratio in the litter. The direct consequence is that, to apply sufficient nitrogen for crop growth, excess phosphorus is nearly always applied when litter is used to supply nitrogen needs. This excess phosphorus is then available to contribute to soil phosphorus build-up and/or elevated phosphorus in runoff. This study indicates that dietary manipulations can help to alleviate the problem of elevated runoff phosphorus, even though additional measures might be required for maximum effect.

Research is being conducted on the transport of water and solutes at different spatial scales under steady state, saturated flow conditions. Information to support predictive capability could be used to develop improved guidelines for locating agricultural and industrial waste disposal/storage facilities. If implemented, such guidelines might lead to significant improvements in ground water quality.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Natural Resource Management

The Kentucky Agricultural Experiment Station is currently supporting several projects related to natural resource management. The sections below highlight the impacts of some of these projects.

Research activities to help expand and improve the existing soil database while maintaining high quality assurance standards are in progress. This will generate new information to address local, regional, and national concerns related to shifts in land use and management and their environmental

implications. Such information is in high demand and of paramount importance to public and private sectors for making more informed and sound agroenvironmental assessments and resource management decisions.

An adequate food supply is vitally dependent on the identification, availability and use of crop cultivars that dependably produce high yields in the environments where grown. Crop yield trial data are typically fettered by high experimental error and differing rank order of cultivar yields in different environments. Multiplicative models have been found useful for separating pattern from random error in the statistical analysis of multi-site cultivar trials. This project seeks to develop improvements in the multiplicative model statistical methodology. The ultimate objective is to provide more effective statistical methods for extracting yield performance information from multi-site crop cultivar trials, and, thus, to enhance selection of cultivars by plant breeders, seed producers and farmers. While analysis of multi-site cultivar trials is the targeted application, the methodology has potential usefulness in analysis of multi-site experiments evaluating other crop production factors, e.g., soil fertility level, pesticide treatments, date of planting, tillage practices, etc.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Wetland Restoration

The Kentucky Agricultural Experiment Station is currently supporting several projects related to wetland restoration. The section below highlights the impact of one of these projects.

The study of watershed processes and lateral transport of water near stream channels has evolved into a research focus studying wetland restoration concepts. The impact is to develop riparian corridors that can treat water or enhance the quality of water in a passive setting. Design tools do not exist that describe the restoration process. Past research on lateral transport modeling will help us develop design tools.

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

Key Theme - Biological Control

The Kentucky Agricultural Experiment Station is currently supporting several projects related to biological control. The section below highlight the impact of one of these projects.

Studies have determined several aspects of the ecology and behavior of important predatory arthropods in soybean and corn fields. This knowledge will be useful in attempts to conserve and

augment the beneficial effects of these naturally occurring biological control agents. Information on diapause of G. punctipes will be useful to anyone attempting to rear this predator, including those who wish to produce and market this species for augmentative biological control.

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

Key Theme - Biodiversity

The Kentucky Agricultural Experiment Station is currently supporting several projects related to biodiversity. The section below highlights the impact of one of these projects.

Research is being conducted to understand the evolutionary genetics of insect behavior and life history traits so that we can make intelligent predictions as to how insects will adapt to modifications of their environment, such as those that occur when new crop species (or varieties, including transgenic plants) are introduced to a location, or new control techniques are implemented.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - IPM

The Kentucky Agricultural Experiment Station is currently supporting several projects related to IPM. The sections below highlight the impacts of some of these projects.

Research is being finalized to answer growers' questions concerning possible impacts on insect populations of growing transgenic soybeans and the associated changes in herbicide treatments. Our results thus far indicate minimal impact on insect pest and predator populations.

Preliminary economic thresholds for European corn borer have been determined and await oil analysis of the fall-harvested crop. Also, biologically active protein that causes developmental arrest in tobacco budworm larvae has been isolated from an insect parasite. The cDNA has been cloned and expressed in both a recombinant yeast and Sf9 insect cell systems. This gene has potential application in the development of transgenic crops and modified insect pathogens.

Studies on Japanese beetles, white grubs, and other insects provide key information on some of the most injurious landscape pest problems in the eastern United States. This work, and our related studies in ecotoxicology, are providing a foundation for integrated pest management. These findings will help landscape managers, nursery growers, and millions of homeowners to

manage insect problems of woody plants and turfgrasses more effectively, with reduced hazard.

The economics of high-oil corn production in Kentucky are marginally -beneficial. This research is likely to improve those economics such that this corn, along with other value-enhanced corn varieties, are more profitable commodities for the Kentucky corn farmer.

We have found that some compounds in fescue can be toxic to insects, suggesting that feeding cattle on fescue might help in reducing insect pests that develop in cattle dung. Our results show that feeding cattle on fescue is not an effective means of reducing arthropod pest populations since during digestion, cattle degrade and remove the toxins. Organophosphate insecticides continue to be an effective means for controlling horn and face flies. Resistance to pyrethroid insecticides continues to be widespread in Kentucky.

Soil erosion continues to be a significant problem of rolling topography and no -tillage crop production is needed to prevent serious soil erosion. We have demonstrated that weeds grow similar in tilled and nontilled conditions and that weeds can be controlled in corn in tilled and nontilled fields.

Research on the potential for evolution of insect's resistance to pheromones has demonstrated that this could be restricted by tradeoffs between sensitivity and specificity of male insect's behavioral responses.

We have demonstrated that the genes for dimethylallyltryptophan synthase can potentially be disrupted by molecular genetic techniques to give tall fescue endophyte incapable of producing ergot alkaloids toxic to livestock. Also, genes for loline alkaloid production may potentially be moved into non-food crops, trees, and ornamental plants for environmentally safe biological protection from insects.

The discovery that over expression of a fungal gene encoding an alcohol oxidase is induced by virus infection leading to a debilitating phenotype provides opportunities for development of novel biocontrol control measures to combat plant pathogenic fungi.

We are providing basic insights into population structure, host specificity and fungicide resistance in an important pathogen of rice and grasses. The information derived from these studies will be useful for designing disease management strategies and in the development of grasses that are resistant to disease.

The aphid-transmitted potyviruses cause serious losses of many crops important to U.S. and world agriculture. The rapidity with which potyviruses can be acquired and transmitted makes prophylactic measures based on vector control virtually impossible. These studies are providing both fundamental information on potyvirus-aphid interactions that are required for transmission as well as information that will be of importance in understanding virus epidemiology.

Source of Federal Funds: Hatch

Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Weather and Climate

The Kentucky Agricultural Experiment Station is currently supporting several projects related to weather and climate. The section below highlights the impact of one of these projects.

Preliminary data indicate that periods of warm weather during winter may have the potential to decrease the number of seeds of weedy summer annuals that germinate in early spring. Further, warm periods in winter may prevent seeds of some winter annuals from entering dormancy; thus, seeds of some species that normally do not germinate in spring may be able to do so in early spring. This, in turn, can lead to increased weed management problems and costs in crop production.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Wildlife Management

The Kentucky Agricultural Experiment Station is currently supporting several projects related to wildlife management. The sections below highlight the impacts of some of these projects.

A research study has provided data useful in developing forest management plans that support the conservation of tree roosting bats, and that are consistent with the long-term protection of forest biodiversity. Results from a portion of the published works have already led to changes in trail management and public use patterns in Natural Bridge State Park, Kentucky. Two PhD students and one post-doctoral scientist are associated with this station project.

The findings of our on-going work with elk have been important to other states that are now engaged in elk restoration programs of their own. Because this is the most intensively monitored elk restoration in history it will serve as a benchmark against which future efforts will be compared. The findings of the research are now appearing in regional and national publication outlets.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Pesticide Application

The Kentucky Agricultural Experiment Station is currently supporting several projects related to

pesticide application. The section below highlights the impact of one of these projects.

Simazine is registered for use as a fall treatment to provide control of cool season weeds in fields that will be planted to corn the following spring. It is important to know the duration of simazine persistence in soil and to determine the amount of weed control provided in corn. Low simazine concentrations were measured and weed control in corn was not obtained. Additional herbicides were required for weed control in corn.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Land Use

The Kentucky Agricultural Experiment Station is currently supporting several projects related to land use. The section below highlights the impact of one of these projects.

The ability to predict soil deformation in response to soil physical properties and wheel operational parameters would be useful in designing vehicle propulsion systems and running gear to execute essential field operations while protecting soil productive potential. A protocol for optimal application of deep tillage to alleviate detrimental soil compaction would be useful in conserving energy and maximizing crop returns. A mechanical system for reconstructing severely disturbed land without compaction by equipment is essential to reclaim prime farmland after surface mining of coal or other minerals.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

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

During FY00, the Kentucky Cooperative Extension Service made 564,526 contacts related to the development of life skills in youth and adults. 374,463 contacts related to community capacity building, 212,604 related to decision-making, and 162,186 related to the development of interpersonal communication skills. An additional 167,146 contacts focused on character education.

235,627 Kentucky youth participated Extension 4-H Youth Development programs during FY00. 23,704 youth participated in science education programs. 3,508 participated in technology programs. 3,341 were involved in citizenship programs and 4,801 participated in consumer education programs. Of these, 25,748 youth attended residential camping programs. 87 county Extension agents participated in training on 4-H science and technology projects.

20,299 individuals were members of Extension Homemaker Clubs affiliated with the Kentucky Extension Homemaker Association.

As a result of these efforts, 78,498 individuals demonstrated informed and effective decision-making. 82,378 youth and adults demonstrated the application of practical living skills. 66,045 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 and additional 11,448 prepare to enter the workforce. 5,079 dependent care

providers (adult or child care providers) reported changes in knowledge, opinions, skills, or aspirations as a result of programs conducted by Extension. 27,211 individuals reported changes in knowledge, opinions, skills, or aspirations related to parenting or personal relationships and 20,388 individuals adopted one or more practices to improve their financial wellness.

More than 22,000 youth discovered a relationship between choice of career, education required for that career, and the possible lifestyle the career choice might provide. 7,049 youth discovered that the community is a place to learn about work and developed skills needed to ask workers about their careers. 439 of youth learned about a specific job by interacting one-on-one with an adult through shadowing, mentoring, or an internship. 27 youth learned skills related to entrepreneurship. 95 Extension staff were engaged in community-based partnerships focusing on preparing youth for the workforce.

The Kentucky Agricultural Experiment Station supported 8 research projects related to this goal.

Expenditures	Federal Extension Funds (UK and KSU)	\$3,600,000
	Federal Research Funds (UK and KSU)	\$200,000
	State Contribution	\$20,000,000
FTEs	Extension (UK and KSU)	291
	Research (UK and KSU)	4

Key Theme - Jobs/Employment

Kentucky AgrAbility provides direct services to farmers with disabilities and educational programs for healthcare providers about farming with disabilities. Special emphasis has been placed on serving traditionally underserved and high-risk populations such as older farmers, children, minorities, and limited resource farmers. Since its inception, the Kentucky AgrAbility Project has built a solid reputation for providing reliable information and realistic service to its clients. Over the past seven years, the Kentucky AgrAbility project has provided direct service to 400 farmers with disabilities. The number of requests for information from the AgrAbility office has doubled each year of the program. Last year, the Kentucky AgrAbility program participated in the National Farm Machinery Show, University of Kentucky College of Agriculture Roundup, Kentucky Women in Agriculture Conference, Robinson Forest Field Day, National FFA Convention, Kentucky Rehabilitation Association State Meeting, and Kentucky State Fair. AgrAbility staff also assisted with an in-service training for staff of the Frazier Rehabilitation Hospital in Louisville.

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

Key Theme - 4-H Youth Development

According to the Kentucky Science and Technology Corporation, Kentucky has fewer scientists and engineers in the work force than all other states except three, ranking Kentucky 47th. It is unlikely that Kentucky will produce many more scientists and engineers since fewer than 43 students per 100,000 residents are enrolled in science and engineering programs. Because of this identified need, science has become one of three major focus areas for the Kentucky 4-H program. Three new science curricula were introduced this year to Kentucky 4-H youth development agents. They are Aerospace, Rockets Away, and In-Touch Science. In-Touch Science was introduced to the state by means of an in-service training conducted by Cornell University Extension specialists. Participants in this training included 4-H agents, volunteers, and elementary school teachers. A special grant provided funding for the development and printing of 1000 4-H Science Program flyers which were inserted into Kentucky Agriculture and Environment in the Classroom packets which were distributed to public and private school teachers throughout the commonwealth. Kentucky 4-H staff have built partnerships with staff of the Appalachian Rural Systemic Initiative (ARSI). ARSI recently received a six million dollar grant from the National Science Foundation to increase math and science scores in six states within the Appalachian Region. Kentucky 4-H staff provided 4-H science training to ARSI resource collaborators working in the six state region and will soon train ARSI teachers in southeastern Kentucky.

Source of Federal Funds: Smith-Lever
Scope of Impact: Multi-State Extension (NY)

Key Theme - Family Resource Management

Consumer debt continues to increase every year. Personal bankruptcies continue to increase. In late 2000, consumer savings rates were negative for the first time ever. These factual statements are an indicator that consumers (and families) are in serious financial difficulty. MONEY2000+ is a financial management program that encourages families to set written financial goals to save money and/or reduce their debt. The first six months that a family is enrolled in the program, they are mailed monthly lessons that help them look at their own money management, set goals and establish a budget. Each enrolled family receives a quarterly newsletter with financially related information. Another county is sending monthly lessons on investing to families enrolled in the program.

Enrollment in the program has been less than hoped for. However, for the 100+ families that have consistently been enrolled in the program, the program has yielded positive results. Data for the last six months of 2000 show that families saved \$65,110 of the \$97,960 they planned to save. These same families had reduced their debt of \$189,000 by \$55,190. One family reduced their debt to a level where they could qualify for a consolidated bank loan at a lower interest rate. many families report cutting up their credit cards and discontinuing use of them. Several families have reported having money in savings to meet emergency expenses for the first time in their lives. New families continue to call and ask if we have a program that will help them reduce their debt.

Source of Federal Funds: Smith-Lever

Scope of Impact: Multi-State Extension

Key Theme - Parenting

Cutting-edge brain research unequivocally tells us that early environment largely determines the growth and wiring of a child's brain. The trillions of brain connections that infants and toddlers make each day can form an amazing latticework for ideal language development, problem solving and moral values. But far too often, particularly in at-risk families, just the opposite is happening. The brains of our children are literally being wired for underachievement, failure, poverty and violence. The cost to society in later abusive behavior, health problems, remedial education, welfare, and incarceration is beyond calculation. In response to these findings, the Kentucky Cooperative Extension Service has created "Keys to Great Parenting" a parent education program which specifically targets low literacy, and limited resource audiences. Designed to promote optimal development among infants and toddlers, the flexible curriculum is built around seven research-based keys that unlock a child's potential. In-depth teaching guides accompany publications which focus on the seven keys. Over 100 Extension agents and other professionals have already been trained in using the program; and a comprehensive web site will soon be operational.

Source of Federal Funds: Smith-Lever
Scope of Impact: State Specific
Integrated Research and Extension

Key Theme: Home-Based Business Education

Selfemployment, including home-based business opportunities, adds diversity not only to employment choices but to the mix of services and products available in rural areas. Over 377,000 people operate home-based businesses in Kentucky (almost 14% of the population over the age of 18.) People who would otherwise have to commute elsewhere to support their families can work at home. The cumulative effect of many home businesses can make a difference in the local economy. A 1996 research project indicated 86% purchase the majority of their supplies within their multi-county area, 55% purchase within their own counties. 66% purchase the majority of their services within their multi-county area, 49% within their own counties. 94% sell their product or service within a multi-county area, 49% sell in their own counties.

The Kentucky Cooperative Extension Service addresses the needs of these businesses through educational programs, educational materials, packets, videos, etc., research to relay to the businesses that will assist them in operating their businesses and marketing their products, and help in maintaining support networks.

Johnson County Extension has assisted in the development of three products (apple butter, t-shirts, and cards by local artists) plus quilts, chairs, baskets and candles. Samples have been produced and people have been trained in production. These items are placed for sale at local historic sites and/or

tourism related places.

Fayette and Jessamine counties offered a twelve-hour training course for entrepreneurs. 94% indicated that after participating in the seminar they were confident about starting or maintaining their own businesses. 94% said they would benefit economically as a result of the seminar. By participating in the seminar, the participants indicated they would save approximately \$12,000 in fees to professionals for legal advice. One participant used the information to assist him in opening a bed and breakfast business in a neighboring county. As a result of information gained, the loan officer stated it was the best business plan he had ever received.

To help increase the success rate of the home-based businesses in Jefferson County, Jefferson County Cooperative Extension has assisted in establishing the Greater Louisville Home - Based Business Association. The mission of the non-profit group is to promote and support the growth and development of home-based business through education, advocacy, and communication. Educational sessions feature peer learning experiences and a quarterly newsletter was developed. One association member reported that her business doubled since becoming involved with the association.

To assist clientele whose jobs were lost in the closing of garment industry plants, Lake Cumberland Area counties provided home-based business education opportunities. Over 312 participants attended programs related to writing business plans, taxes, bookkeeping financing, marketing, bed and breakfast businesses, basketmaking, and forming a network of home-based business owners. Community leaders became aware of Extensions efforts through community economic forums, employment councils and individual banking and consumer sciences professionals. Results from a return-by-mail participants survey indicated that Cooperative Extension Service assisted 12 new businesses in start-up, 16 businesses in the planning stage, and 9 others who are thinking of starting a business. One business moved from the home to a store front while another received out of state contracts. 25 businesses from the area were listed in the 2000-2001 Directory of Kentucky Home-Based Businesses.

Source of Federal Funds: Smith-Lever
Scope of Impact: Multi-State Extension (50)

Key Theme - Workforce Preparation

Surveys completed by employers across the state indicate Kentucky has a problem. Workers aren't prepared to go to work when they get out of school. In Louisville, 3500 employers said that two-thirds of their workers need improvement in basic skills: reading, writing and math. In 1996, 14 out of every 100 Kentucky teens (ages 16 - 19) dropped out of high school. (The national average was 10.)

Local communities (Cooperative Extension, Family Resource Centers, Chambers of Commerce, school teachers and administrators, and local businesses) are administering a "dose of reality" to kids across the state. Kids, mostly middle school youth, who can't wait to grow up, are

stunned when they learn how much it costs to pay taxes, raise a child, and own a home. Reality Store, a simulation of the financial demands of adult life, has been an effective wake up call for over 16,000 youth in Year 2000.

Results of a follow-up evaluation show that kids are getting it. In Hardin County, a county with a population of 90,000, youth indicated these results: 87% now have a better idea of what it costs to maintain a household. 83% learned a lot about what it costs to raise a child. 90% have an idea of what type of education it takes to get the job they want. 93% realized the type of job they have affects how much money they will make. 94% learned the amount of money they make will determine their lifestyle. The experience caused youth to consider their future. 66% said they will try harder in school. 83% said they are more likely to continue their education after high school. 60% indicated they are likely to delay having children. 88% said they will strive to make wise financial decisions. 76% said they are likely to save more money as a result of the Reality Store experience.

Extension's WorkBook project series is another response to workforce needs. Open Your Eyes to the World of Work encourages 4th-5th graders to take a good look at people working in their own community, to view the community as a real-life laboratory. At the middle school level, "Scope It Out" activities encourage youth to look at their own interests, careers related to their interests, an employer's expectations, earning potential, lifestyle choices and options for post secondary education. The high school WorkBook, "Jump Start for Job Seekers" offers practical tips on how to find a job. The WorkBook Series requires that young people get out into workplaces to see what the work environment is really like.

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

Key Theme - Jobs/Employment

The Earned Income Tax Credit is a special tax benefit for working people who earn low or moderate incomes. It helps workers to reduce the tax burden and to supplement their wages. Workers within certain income guidelines are able to receive a check from the IRS by filing an earned income credit (EIC) when filing their taxes. Workers can also receive free tax filing assistance. The IRS has sought numerous outlets for spreading the word to workers about the credit.

In Kentucky, 1316 families received information regarding the Earned Income Tax Credit from EFNEP assistants. 611 filed for the EITC as a direct result of this information. It is estimated that over \$1,083,350 was received by these families as a result of learning about the EITC

Source of Federal Funds: Smith-Lever
Scope of Impact: Multi-State Extension (National)

Key Theme - Impact of Change in Rural Communities

The Kentucky Agricultural Experiment Station is currently supporting several projects related to the impact of change in rural communities. The sections below highlight the impacts of some of these projects.

Studies now being conducted are of significant importance with respect to better understanding how the US and Kentucky farm and non-farm economy are related. Many of these studies question widespread myths relating to the role that farm level production plays in the viability and vibrancy of the rural non-farm economy. In reality, farm level production is playing an ever less important role in determining the welfare of those living in the rural non-farm economy. For most counties in Kentucky and throughout the US, the viability of the non-farm industrial economy is becoming of ever increasing importance as the real returns to the production of crops and livestock persistently decline. It is a tribute to the increasing strength of the rural non-farm economy that job opportunities have evolved to a point where farm residents no longer must rely on the sales of crops and livestock as their primary source of income, and the economies of most rural communities are no longer subject to the wild economic swings that would have otherwise taken place had the community been heavily dependent of the crop and livestock sectors as a major income source.

We are now gathering data to provide a guide for the state's efforts in the general provision of Business Incentives. Among the programs, there is the Kentucky Rural Economic Development Act (KREDA), Kentucky Jobs Development Act (KJDA), the Kentucky Economic Opportunity Zone Act (KEOZ) and the Kentucky Industrial Revitalization Act (KIRA). There are also direct loan programs as well as tax credits and incentives that are administered by the Kentucky Economic Finance Authority (KEDFA), Commonwealth Small Business Development Corporation (CSBDC) and Local Government Economic Development Fund (LGEDF).

Two types of finance research were conducted during 2000. The first continued to build upon prior work on the Farm Credit System and focused on the ongoing need for a dedicated provider of capital to farmers and the role of the Farm Credit Administration as the regulator of the Farm Credit System. The second main thrust of work was to continue to exam methods for providing equity finance in rural areas, in particular the role of venture capital. In addition general U.S. farm policy issues were reviewed in a web-based presentation that was developed for an international electronic symposium sponsored by Agriculture Canada.

Source of Federal Funds: Hatch
Scope of Impact: Multi-State Research
Integrated Research and Extension

Key Theme - Community Development

The Kentucky Agricultural Experiment Station is currently supporting several projects related to community development. The section below highlights the impact of one of these projects.

Research has been aimed at increasing the capacity of communities and families to enhance their own economic well-being, increase understanding of individual and family circumstances of rural low - income families and to understand how evolution is influencing rural families and communities. Also the research provides insight into interactions of federal, state, and local welfare policies, community infrastructures and individual family well - being.

Source of Federal Funds: Hatch
Scope of Impact: State-Specific
Integrated Research and Extension

Stakeholder Input Process

Strategic Goals

Research and Extension programs of both institutions continue to work toward the achievement of a set of six strategic goals introduced in 1997. Goals were established through a broad-based strategic planning process that involved more than 3000 people. In addition to providing direction, the goals also provide a framework for organizing accountability data collected from across the state. The process used for identifying these goals was described fully in the FY00 -04 Plan of Work.

Local Program Development

In the winter of 1999, each Kentucky county conducted a broad-based assessment of local needs which resulted in the development of program priorities that would be addressed under the framework provided by the strategic goals. Action plans were developed for each program priority. The program plans developed for these priorities went into effect with the FY00 program year.

Extension Advisory Council System

Historically, the Kentucky Extension Advisory Council System has served as the primary mechanism for gaining stakeholder input into establishing program priorities. During FY00, a County Extension Council (CEC) continued to function in each of Kentucky's 120 counties. Area Extension Councils provided the opportunity for discussing needs and issues across county lines. A State Extension Advisory Council meets annually identify program priorities to be addressed under the framework of the strategic plan. Similar structures for establishing program priorities at the county, area, and state level also continue to exist within the 4-H, Family and Consumer Sciences, and Agriculture and Natural Resources program areas, but operate under the umbrella provided by the overall Extension Advisory Council System. Last year, 12,868 individuals were members of these councils and actively participated in the program development process.

Agricultural Advancement Councils

While structurally functioning within the Extension Advisory Council System, the relatively new Agricultural Advancement Council system also serves as a sounding board for research and teaching programs of the College of Agriculture as well. More than 100 counties now have Agricultural Advancement Councils which send representatives to one of fourteen Area Agricultural Advancement Councils. A fifteenth Area Agricultural Advancement Council provides input into Kentucky State University's research and Extension programs. A state Agricultural Advancement Council meets twice a year. In all, 2227 individuals served on Agricultural Advancement Councils during FY00.

Speak Out On Extension

During the summer of 1999, nearly 400 individuals participated in a series of public meetings held throughout Kentucky to assess how well the Cooperative Extension Service was meeting the needs of the Commonwealth. A questionnaire and small group discussions were used to collect the data from those who participated. The results suggest that Kentuckians place are highly pleased with the service they receive from their local county Extension Service.

Participants cited local program development, a long track record, flexible delivery, credible and unbiased research, and friendly and courteous service as things they liked about Extension. Ninety -two percent said their community is better off because of Extension and just over ninety percent said that Extension was a worthy investment of public funds. Participants also had suggestions for improvement. Mentioned most frequently were improve public awareness of Extension, reach out to new audiences, and make better use of technology to deliver programs.

Program Review Process

There have been no significant changes in the review processes described in the Plans of Work submitted for the Research and Extension programs of the University of Kentucky and Kentucky State University.

Evaluation of the Success of Multi and Joint Activities

Evaluation of Multi-State Extension Activities

The effects of salient issues such as the transition from a tobacco-dependent economy, market development, land use, community empowerment, youth development, health, and economic development are not bounded by the arbitrary boundaries which exist between states. Rather, they affect particular regions of the country in clearly defined ways. Addressing issues such as these requires that land grant universities work across state lines to deploy resources in a planned and systematic manner. We believe that the multi-state activities of the Kentucky Cooperative Extension Service have contributed to a more efficient and effective mobilization of public resources in addressing critical issues of people.

Working across state lines is a natural for Kentuckians. Since its days as a “border state” during the Civil War, Kentucky has been known as a state willing to work with others for the well being of all people.

Geography also makes collaboration across state lines easy. Kentucky shares contiguous borders with more states than any other. Specifically it shares borders with 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 FY00, the Kentucky Cooperative Extension Service supported a total of 159 different Multi-State Extension activities, each of which was clearly linked to one of the state’s six strategic goals established through broad stakeholder input. 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 our state was best equipped to provide. For example, Kentucky often provided the expertise and services of its award-winning Distance Learning unit. In

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

Thirty-six percent 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. The grass-roots nature of this multi-state collaboration provides further evidence that multi-state activities addressed the needs and issues of stakeholders. Impacts and outcomes of most 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.

Evaluation of Joint Research and Extension Activities

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 formally serves as Director of both the Kentucky Agricultural Experiment Station and the Kentucky Cooperative Extension Service. The Associate Dean for Extension and Associate Dean for Research are housed in the same office suite. 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 participate in Extension and other outreach/service activities. Many faculty even 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 for bring Research and Extension programs closer together. Extension staff are more cognizant of the need to undergird their activities with sound research. Research faculty are realizing 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 FY00. Calculation of the percentages were done using the procedures outlined in the FY00-04 Plans of Work.

**U.S. Department of Agriculture
 Cooperative State Research, Education, and Extension Service
 Supplement to the Annual Report of Accomplishments and Results
 Multistate Extension Activities and Integrated Activities
 (Attach Brief Summaries)**

Institution: University of Kentucky

State: Kentucky

Check one: **Multistate Extension Activities**
 Integrated Activities (Hatch Act Funds)
 Integrated Activities (Smith-Lever Act Funds)

Title of Planned Program/Activity	Actual Expenditures				
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Community Development	46,914.90				
Sustainable Agriculture	445,620.12				
Leadership Development	47,667.30				
Nutrition and Health	66,491.64				
Life Skill Development	264,734.52				
Environment and Natural Resources	119,429.94				
Total	\$990,858.42				

M. Scott Smith
 Director

3/1/01
 Date

**Cooperative State Research, Education, and Extension Service
 Supplement to the Annual Report of Accomplishments and Results
 Multistate Extension Activities and Integrated Activities
 (Attach Brief Summaries)**

Institution: University of Kentucky

State: Kentucky

Check one: **Multistate Extension Activities**
 Integrated Activities (Hatch Act Funds)
 Integrated Activities (Smith-Lever Act Funds)

Title of Planned Program/Activity	Actual Expenditures				
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Social and Economic Opportunity	46,000				
Competitive Agriculture	546,000				
Safe Food and Fiber	213,000				
Agriculture and Environmental Quality	707,000				
Total	\$1,512,000				

<u>M. Scott Smith</u>	<u>3/1/01</u>
Director	Date

**U.S. Department of Agriculture
 Cooperative State Research, Education, and Extension Service
 Supplement to the Annual Report of Accomplishments and Results
 Multistate Extension Activities and Integrated Activities
 (Attach Brief Summaries)**

Institution: University of Kentucky

State: Kentucky

Check one: **Multistate Extension Activities**
 Integrated Activities (Hatch Act Funds)
 Integrated Activities (Smith-Lever Act Funds)

Title of Planned Program/Activity	Actual Expenditures				
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Sustainable Agriculture	2,714,712.00				
Nutrition and Health	299,442.00				
Environment and Natural Resources	598,884.00				
Total	\$3,613,038.00				

M. Scott Smith
 Director

3/1/01
 Date

Form CSREES-REPT (2/00)

Brief Summary of Multi-State Activities

During FY00, the Kentucky Cooperative Extension Service supported a total of 159 different Multi-State Extension activities, each of which was clearly linked to one of the state's six strategic goals. Sixty four percent of these multi-state activities involved exclusively state-level administrators, specialists, and associates. Thirty-six percent were conducted by county Extension agents working across state lines.

Virtually all of multi-state 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.

Conversely, nearly 60 percent of the county-level projects were short term in nature and were completed during FY00. These included such things as study tours, exchange trips, and training schools in border counties.

Multi-state activity is recorded in a Microsoft Excel spreadsheet.

Brief 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.

1. The leadership team for the Research project or Extension program was comprised of both Research and Extension faculty.
2. An Extension program is directly related to dissemination of the findings of Experiment Station research projects.
3. The program component falls within the scope of one of the College's formally established initiatives which integrate Research and Extension Activity. Examples include the Weed Science Group, Food Quality and Safety Task Force, and the Beef Integrated Resource Management Team.

Integrated Research and Extension Activity is recorded in a Microsoft Excel spreadsheet.