Kansas

Annual Report of Accomplishments and Results

FY2001

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Introduction

Change has been the hallmark of Kansas agriculture. Farms and rural communi ties have gone from simple, self-sufficient places to complex business and industrial partners tied to national and world economies. Cities and towns have experienced wrenching changes, too. All areas, rural and urban, are in need of the kind of educational programs and unbiased scientific information that K-State Research and Extension provides.

To make sure we are on the right track, we are building in new methods to measure the impact and success of what we do. We are also undertaking various means to keep our clientele informed about our programs and their impacts.

Sometimes, by its very nature, research is controversial, but it must be done, and the information it provides must be published. All of the research conducted at the university is sub ject to a great deal of state and federal oversight.

Scientific peer and merit reviews are done to determine the quality and relevance of all projects funded by the state and the federal government. Project evaluations include overall appropriateness of e ach project to the five national goals/four K-State Research and Extension core mission themes and the 16 issues that have been identified as critical to the welfare of Kansas.

This Annual Report describes K-State Research and Extension program impacts and accomplishments for Fiscal Year 2001, as required by the Agricultural Research, Extension, and Education Reform Act of 1998. K-State Research and Extension is involved in numerous projects and building working relationships with many other agencies, bu sinesses, universities, and foundations to support and advance research, education, and international programs for the betterment of people everywhere and especially in Kansas. We believe that those who support K-State's Research and Extension land-grant mission are chief beneficiaries of its knowledge, programs, and improvements. Our achievements have been and will be keys to progress.

In fiscal year 2001, total funding in support of the programs described in the plan totals $80,836,609 (See Appendixes A and B). This total and the program efforts included in this report represent all funding streams–not just Federal dollars.

A. PLANNED PROGRAMS

GOAL 1 – AN AGRICULTURAL SYSTEM THAT IS HIGHLY COMPETITIVE IN THE GLOBAL ECONOMY

Overview (includes sections a, b, c, and d)

Intended outcomes in the **cropping systems** plan include such statements as adopting new cropping systems, adopting best management practices, conserving water resources through improved irrigation management, improving crop rotations and intensifying cropping systems, and reducing the losses to plant pests.

Alternative crop rotations systems to the continuous wheat and wheat-fallow systems of the drier regions of the Great Plains were sorely needed to improve water use, conserve soils, and increase farm profitability. Results of this work have been evidenced by nearly tripling corn acreage from 0.9 to 2.6 million acres in central and western Kansas since 1988. Essentially all of this increase for corn is in dryland crop rotation systems, due largely to the research and educational programs of the cropping systems team.

The potential for soybeans in these rotation systems also became evident, and has resulted in relevant adaptive research for the same drier regions of the Great Plains. This soybean work has focused on row spacing, planter equipment, and plant populations. Similar to the impact of corn, soybean acreage has increased from 0.5 to 1.0 million acres in central and western Kansas since 1988.

Kansas is a leader in the production of grain sorghum. While the increase in corn and soybeans in dryland cropping systems has been dramatic, the emphasis of grain sorghum as a very drought tolerant crop has left the acreage of grain sorghum production effectively the same in those central and western regions of Kansas, 2.6 million acres in 1988 compared to 2.8 million acres in 2000.

The influence of the adaptive research and educational programs cannot be understated when looking at the impact of this work in the increase in crop rotation systems, no-till management, and increased returns, as compared to the traditional continuous wheat and wheat-fallow systems of that region.

Kansas' number-one agricultural enterprise is **livestock production**, with beef cattle systems leading the way. The beef, dairy, and swine industries identify profitability, production efficiency, record keeping, employee management, and environmental concerns as key issues for research and extension. Integrated dairy, swine, and beef teams have shown the value of educational programming directed at individual farm-level problems and issues to be an effective way to design and deliver research and extension education. Some examples include: beef stocker nutrition education that reaches 975 beef producers representing 750,000 stockers and 35,000 beef cows; "Cowboy Colleges" are popular educational vehicles in the feedlot industry with approximately 100 individuals in the feedlot business (representing 30

feedyards, and approximately 1.5 million head capacity) trained through the beef quality assurance curriculum; the Kansas bull test program involves 75 herds from 5 states providing yearling bulls to create research data on the genetics, improvements, and overall performance that result in continued improvements in the genetic soundness of beef cattle herds across the region; and cooperation between the Kansas Livestock Association and K-State results in over 400 farmers and ranchers touring a ranch and gaining knowledge on current issues such as animal health, estrous synchronization, lease hunting, grazing land management, fence laws, and replacement heifer development.

Researchers have advanced **development of new, appealing food products** for Kansas agriculture. Examples of the advances include working on 925 inquiries from mid-sized and small processing plants on ingredients, packaging, product development, analyses, and design. Meat processors have a K-State Web site for which they can find information on latest developments. Milk products and yogurt are be ing studied to improve shelf life and flavor.

With wheat being a major crop commodity in Kansas, research to **enhance value of agricultural goods** has focused on potential uses of wheat straw and other by-products of the wheat production and milling processes. Wheat straw has been incorporated into a biodegradable, edible packaging for potential use in delivering feed to livestock. The barrels of wheat straw have been tested in the lab-scale version and are currently being studied for commercialization. Adhe sives made from protein-based technologies also offer promise for value-added commercialization. These products offer a safer, more environmentally friendly product for consumers.

Agricultural risk management educational programming has taken the approach of developing risk management clubs at the county level that support local interests and needs around the broad topics of risk management. These risk management clubs began in 1998 and have continued through 2001. Common educational topics have included g rain marketing, record keeping, costs of production, financial statements, lease arrangements, cooperatives and other vertical coordination strategies, machinery economics, land economics, environmental economics and policy, labor management, and personnel management. A Risk and Profit Conference held annually drew approximately 250 farmers and farm advisors. This conference focuses on contemporary issues facing Kansas agriculture and delivers information and education from the research-base of KSU and surrounding universities. This premier event is supported with an additional series of agricultural profitability conferences held for Kansas farmers, with over 300 attending. Agricultural economists report high levels of engagement with the Kansas farmers on critical issues facing the future of agriculture and profitability.

Agricultural technologies are advancing through our research and education on such topics as biotechnology, precision agriculture, and utilizing Web-based technology to improve diagnostic services for agriculture. The new K-State Biotechnology Web site was recognized for its comprehensive educational value to readers of all interest and ages. KSU faculty have been instrumental in providing research-based options to ensure a longer life of the Bt technology for corn production in the United States. Precision agriculture research findings are brought to the agriculture community through a premier

conference attended by 130 individuals from 5 states. Digital images are now loaded on the Web for plant disease, insect, or other pest diagnostics techniques, resulting in improved speed of diagnosis and recommendation and an invaluable archive of photos showing various unusual and rare plant problems found across the state.

e. Total expenditures by funding source and FTEs

FY2001 Projected: $55,357,421; Actual: $54,900,568 275.17 FTEs

Key Theme – Adding Value to New and Old Agricultural Products

A Product that Reduces Fat in Rats and Pigs Could Benefit Humans

a. K-State Research and Extension has shown that modified tall oil (MTO) in rat and pig diets reduces fat–in the rats by as much as 21% body fat and 50% abdominal fat. MTO comes from pine trees and is similar to polyunsaturated fatty acids in vegetable oils. The researchers would like to use MTO as a dietary supplement to lower body fat in humans and expect to begin trials soon.
b. Meat from MTO-fed pigs will have an additional two days of product shelf life. Consumers could benefit because the meat they buy at the grocery store will lose less moisture, slice better, and be slightly darker. MTO also could be a value-added product for the paper and pulp industry.
c. Source of Funding – Hatch
d. Scope of Impact – State Specific

Genetic Improvement of Wheat

a. The long-term goal of the wheat breeding program in western Kansas is the development of wheat cultivars, or germplasm, that will improve Kansas production efficiency and also marketability of the grain.

K-State scientists will participate from both research and extension faculty of the departments of Agronomy, Grain Science and Industry, Entomology, Plant Pathology, Biochemistry, and the various off-campus research and extension centers and experimental fields. Funding partners cooperating with the project are the Kansas Wheat Commission and the Kansas Crop Improvement Association.

White-seeded wheat is inherently more susceptible to pre-harvest sprouting than is red-seeded wheat. Red wheats are usually protected from 5 to 10 days of wet weather during harvest.

b. This year KSU identified at least three experimental white seeded lines that demonstrated a level of sprouting tolerance equal to that of Jagger, a red-seeded wheat. This level of sprouting protection will practically eliminate the risk of sprouting in western Kansas, but it will also make it possible to move white wheat production further east in Kansas. All of these lines are being tested in advanced breeding nurseries and could be released in three years.
c. Source of Funding – State Matching
d. Scope of Impact – State Specific

Key Theme – Animal Production Efficiency

A Breakthrough in Swine Nutrition Research

c. Animal scientists with K-State Research and Extension are the first to discover that the reproductive performance of sows is improved by adding the feed ingredients carnitine (a vitamin compound) and chromium (a trace mineral). Both ingredients have proven safe and effective for raising healthy pigs.
d. Carnitine and chromium supplementation improved return-to-estrus interval and farrowing rate, and, thus, total number born alive. The increased number born alive was nearly four pigs per sow on the experiment. A 1000 sow farrow-to-finish operation could realize as much as $96,000 return by adopting this technology.
e. Source of Funding – State Matching
d. Scope of Impact – State Specific

Key Theme – Biotechnology

Biotechnology Core Facility

a. The Biotechnology Core Facility was created in 1992 with the goal of providing reagents and biomolecular analyses of the highest quality in a timely and economical manner.
The facility has assisted more than 80 laboratories located in the colleges of Agric ulture, Veterinary Medicine, and Arts and Sciences within the departments of Biochemistry, Biology, Entomology, Anatomy and Physiology, Animal Pathology, Plant Pathology, Agronomy, Horticulture, Grain Science, and Animal Science.
b. Over the past several years the laboratory has synthesized more than 130 test compounds that produce a potential treatment for patients with cystic fibrosis (CF). Currently there is no treatment that addresses the actual cause of the disease. The drugs being developed would be the first to correct the cellular defect by creating a new pathway for anions to pass in and out of the cell.
c. Source of Funding – Hatch and State Matching
d. Scope of Impact – Multistate Integrated Research and Extension

Key Theme – Plant Production Efficiency

Distance Diagnosis

a. If the local K-State Research and Extension staff members can't identify a plant problem and find a solution, they can quickly tap into a secure site on the World Wide Web to consult with experts. They can send along their own analyses and digital color ph otos taken on the spot, enabling

Kansans to get help on problems ranging from sick ferns at home to insect-infested corn in the field. This kind of distance diagnosis is possible because K-State Research and Extension is linked electronically with all Kansas counties and research and extension centers statewide. The diagnostic labs on the K-State campus in entomology, horticulture, plant pathology, and the herbarium are providing the expertise for the program. They also are linked with experts across the nation and globe for their opinions on problems particularly puzzling. When a quick response is needed, the distance diagnosis system can provide it quicker than ever, which often can mean the difference between saving a plant or a crop or losing it.

b. During 2001, nearly 100 samples were processed through the Entomology Diagnostic Lab. Extension agents and their clients made decisions based on timely information about their insects inquiries.
c. Source of Funding – State Matching
d. Scope of Impact – State Specific

Crop Management and Marketing

a. The Crop Management and Marketing program focuses in several core areas of economics: (1) precision agriculture, (2) machinery, (3) land, (4) environmental economics and policy, and (5) risk management. Applied economics is a science of modeling and generalizing historical data to enhance real-time decision making, and validation ensures relevance across a broad audience.
b. The impact of this program comes chiefly in enhancing profitability for Kansas agricultural producers. Making sound business decisions regarding lease vs. purchase or sharing of machinery can enhance profitability and reduce financial risk. Farmers who adopt new agricultural technologies are the ones who survive and thrive in the future. Yet technology adoption is highly dependent on education–the reason for the focus in this area. The environmental focus helps producers and policymakers better understand the tradeoffs between profitability and environmental soundness. Reduction of negative environmental impacts, enhanced producer profitability, and increased ability to deal with economic risk will lead to retaining as much social capital (viable farm families) as possible in the rural areas of Kansas. An understanding of the economic principles underlying fiercely competitive production agriculture should assist farmers in making sound and psychologically acceptable decisions regarding their future involvement in or exit from the industry.
c. Source of Funding – State Matching
d. Scope of Impact – Integrated Research and Extension

Crop Production in Southeast Kansas

a. In southeastern Kansas, nearly 1,650,000 acres are devoted to crop production. For the 15 county area, soybean occupy 49% of the total acreage, wheat 27%, grain sorghum 15%, and corn 8%. Because of the diversity of crops grown, this research seeks to investigate long-term effects of crop rotation, tillage, soil fertility, and herbicide use on crop production for the shallow, claypan soils of this region.
b. Results indicate that soybean and grain sorghum yields can be increased 10% to 15% with crop rotation. In addition, the use of conservation tillage practices (such as planting double-cropped

soybean no-till into wheat stubble and planting wheat no -till into existing soybean, corn, or grain sorghum residues) can have a significant impact on soil quality as well as reducing soil erosion while maintaining grain yields comparable with a conventional tillage system.

c. Source of Funding – Hatch and State Matching
d. Scope of Impact – Multistate Integrated Research and Extension

• With OK, MO, AR

Wheat Genetics Resource Center (WGRC)

a. The WGRC has a mandate to conserve world's gene pool of wheat; evaluate useful genes and facilitate their transfer to wheat as improved germ plasm; conserve and develop cytogenetic stocks to facilitate genetic analysis and gene transfers; identify and catalogue wheat genes and facilitate their deployment for sustainable and profitable crop production; train students, postdoctoral fellows, and visiting scientists; and promote awareness of genetic resource conservation and utilization needs and potentials to agricultural and academic administrators and professionals, producers, and consumers. The WGRC is participating in 12 state, national, and international collaborative research projects.
b. The germ plasm collection now stands at 10,784, an increase of 22% over last year. Forty-two improved germ plasm lines have been released and are being extensively used in wheat breeding. Sixty-eight requests for WGRC germ plasm and materials were sent to 57 scientists in 15 states of the U.S. and 13 foreign countries.

Host-plant resistance: Genetic materials were developed containing new sources of resistance to scab or other yet unidentified genes from wheatgrass into wheat.

Useful gene markers: Cataloging and tagging of useful genes is an essential step for their exploitation in wheat improvement. Molecular tags were developed for resistance genes to leaf rust, Russian wheat aphid, a dominant male sterility gene, and other metabolic genes.

Biotechnology: The spectrum of wheat genes induced by rust or scab infection was analyzed. The nature of transgene integration in host DNA is complex and provides clues to gene silencing which is a major problem in plant transformation. Two pathogensisis -related genes were cloned and are being deployed to augment host plant resistance in wheat.

c. Source of Funding – Sponsored Award and Matching
d. Scope of Impact – State Specific

Key Theme – Rangeland Management

Rangeland Management

a. The main charge of this research program is to provide information on the conversion of rangeland and seeded forage resources to final animal product. Research in the program focuses on complementary forages and complementary forage grazing systems in conjunction with the utilization of native rangeland. Of major interest for this program is the identification of perennial cool-season

grasses and winter small grain cereal cultivars that provide fast, abundant vegetative growth for grazing purposes from September through April when native warm-season forages are typically dormant. Other topics of interest to this research involve introduced rangeland weed species.

b. The effects of this research program on the public has potential to be very important. Kansas has approximately 1.5 million mature cows and first calf heifers annually. Nearly one-tenth, or 150,000 of these breeding animals, occupy the nine county area surrounding the Agricultural Research Center-Hays. At current prices for fair quality alfalfa hay or good quality forage sorghum hay (approximately $60-$70/ton), producers could feed $3.5-4.0 million of forage in one month to the mature cow population in this nine county area. Statewide, $37 million could be spent in one month's time. Complementary grazing systems that utilize perennial cool-season grasses or winter small grain cereals for forage for one month have the potential to save producers statewide millions of dollars on stored feed. Implementation of a usable complementary system could have a direct and multimillion dollar impact on the clientele within the local economy. Nearby states such as eastern Colorado, eastern Wyoming, Nebraska, and the Dakotas, where precipitation characteristics are similar, may find that complementary systems in Kansas are compatible to their region. Systems which are able to utilize more than one month of grazing on complementary forage rather than utilizing stored feed have even greater economic saving potential.

   Another impact of implementing complementary grazing systems is that animal numbers are likely to be increased. More early spring and late fall grazing pressure will fall on complementary forages, which in many cases have a greater carrying capacity than rangeland of equal area. Nearly two-thirds of Kansas farms are mid- to small-sized farms and ranches of less than 500 acres that have tracts of both rangeland and cropland lying adjacent to each other, which is ideal for complementary grazing. About three-fourths of Kansas farms produce fewer than $50,000 of commodities annually. An increase in volume of cattle sales may be beneficial for many of these small producers that struggle because of low profit margins. Complementary systems could be one tool to try to help save small farms and rural communities from extinction.

   Most research in this program concerned with invasive introduced weed species on native range will involve cultural practices for weed control. The use of herbicides is economically expensive on a land area basis, especially on native range where profit margins are relatively small. Cultural practices for weed control are much less expensive and more environmentally friendly protecting the range resource from potential chemical contamination.

c. Source of Funding – Hatch and State Matching

d. Scope of Impact – Multistate Integrated Research and Extension

• With NE, OK

Soil Fertility and Water Management

a. Research focuses on soil and crop production technologies for dryland and irrigated agriculture in western Kansas with emphasis on soil fertility and dryland cropping systems. The objectives are to: (1) Develop management practices to optimize utilization of inorganic and organic nutrient sources

for crop production without adversely affecting the environment and (2) Determine the feasibility of alternative dryland cropping systems with regard to profitability, grain production, and soil and water quality.

b. The use of fallow (objective 2) is a common practice in semiarid regions to store water for subsequent crops. However, the efficiency of precipitation storage during fallow is often only about 25% in conventional wheat-fallow systems.

   Reduced and no-tillage systems increase fallow efficiency (and reduce erosion), but with the long fallow period in wheat-fallow, storage efficiency is still only about 40%. Another means of increasing efficiency is to reduce the length of the fallow period (increase cropping intensity) by including a summer crop in the rotation. Wheat-summer crop-fallow systems (using reduced or no-till practices) have been shown to increase profitability. Net returns (10-yr average) for sorghum in a wheat-sorghum-fallow rotation were $30/acre greater with no-till than conventional tillage. Further intensification of the system by adding a second wheat or sorghum crop (3 crops in 4 years) is appealing, but average returns for the past four years show no increase in profitability compared to the 3-year rotation. Producers in western Kansas are changing their cropping practices as indicated by the increase in dryland corn and grain sorghum acreage. For example, the number of acres of dryland corn increased from 108,000 acres in 1995 to 481,000 acres in 1999 while sorghum increased from 557,000 acres in 1995 to 999,000 acres in 1999 (total of three western Kansas crop reporting districts as published by Kansas Agricultural Statistics).

   Another advantage of producing corn and sorghum is that they can be utilized locally as a feedgrain in the animal feeding industry while wheat must be exported from the region. This improves the sustainability of the producers, local communities, and the region.

c. Source of Funding – Hatch and State Matching

d. Scope of Impact – Multistate Integrated Research and Extension
   • With North Central Region

Key Theme – Plant Production Efficiency

Insect Pest Management for Profitable Crop Production in Western Kansas

a. The purpose of this program is to disseminate information on insect identification and management to farmers, consultants, aerial applicators, and agribusiness professionals.

b. Data from various insect efficacy trials are used as the basis for developing insect management recommendations published yearly for alfalfa, corn sorghum, soybeans, sunflowers, and wheat. Producers use these data and recommendation guides to help make decisions on the most practical and cost-effective ways to control insect problems.
   During the growing season, observations on insect activity are delivered to extension agents, consultants, and applicators via newsletters, e-mail, and the World Wide Web. These reports allow pest management specialists to make management decisions before significant damage occurs.

c. Source of Funding – Smith Lever
d. Scope of Impact – State Specific

GOAL 2 – A SAFE AND SECURE FOOD AND FIBER SYSTEM

Overview

The goal of food safety programs is to prevent foodborne illnesses. Between 6.5 million and 81 million cases of foodborne illnesses, including 9,000 deaths, occur each year in the United States. The level of illness reported in Kansas is low, but the reporting system is not an active one, and it is a well-known fact that foodborne illnesses are greatly under-reported. Experts believe the risk of foodborne illness is increasing due to multiple factors. One of the goals of Healthy People 2010 is to reduce foodborne illness. Key to accomplishing this goal is to increase the proportion of consumers and c ommercial food handlers that follow key safety practices. With regard to a secure food system, in Kansas in 1996, 7.1 million head of cattle were slaughtered and processed, and 5.1 million cattle were finished (23% of the U.S. total). Kansas had 1.5 million beef cows for reproduction, and 4.4 million calves and feeder cattle were imported into the state. Kansas, in 1996, ranked second nationally with 255 million bushels of wheat production. Kansas ranked first in wheat flour milling capacity and flour mille d, with over 36 million hundred weights milled. Kansas also is a major producer of grain sorghum, corn, and soybeans, with over 750 million bushels of collective production among those grain crops. Fresh vegetable and fruit production through local markets is expanding in Kansas. In addition, Kansas has some 20,000 licensed foodservice operations and about 500 meat and non-meat food-processing facilities.

a. The year 2001 was the fourth year of a major statewide coordination effort for ServSafe i n Kansas. Nearly 500 persons participated in the two-day training workshops. The program benefits participants directly by providing certification in food safety and sanitation. Because of the importance of food safety issues and the need to reach a rapidly increasing Latino population in southwest Kansas, a program was developed to deliver safe-food-handling, mass-media messages to Latino consumers in the Garden City, Kansas, area during the end of 1999 to January 2000 using radio, television, posters, and news articles in Spanish. Extension agents can use materials developed in the Safety Consumer Education and Mass Media for Latino Audiences program for statewide teaching of safe food handling to targeted Latinos in their counties, especially through the FNP program. A Food*A*Syst program was developed to assess food safety practices on the farm and in the home with regard to water, wastewater, solid waste, beef production, poultry production, fruit/vegetable production, packaging/ transporting, open -air markets, food purchasing, and home food preparation. The Master Food Volunteer program was developed to provide base knowledge to volunteers in the areas of food safety, food science, food preparation, and food preservation. A set of publications provides i nformation on minimizing microbial hazards on fruits and vegetables at farmers' markets. An awareness program on new food irradiation and food biotechnologies was developed, and extension agents and FCE members were trained. A set of train-the-trainer HACCP educational materials is being developed for use in child nutrition programs. HACCP and food safety training have been provided to individual food processors experiencing problems. Extension agents were trained on quantity food production and safety. A study of consumer perceptions of risk from food, their demand for safer food, their preferences for

methods of enhancing food safety and factors influencing those preferences was conducted. A Meat Safety and Quality program was presented to KSU students, Kansas Department of Commerce and Housing personnel, and Kansas meat processors. Research has been directed to the improvement of the microbiological safety of meat and poultry products, especially on development of slaughter interventions and interventions that may be applied on-farm and during fabrication of sub-primals, irradiation and chemical treatments, and post-process pasteurization. KSU's research on slaughter interventions has been widely implemented by the meat industry.

With the increased threats of foreign infectious diseases on the livestock and crop systems of Kansas, research and educational programs have been focused on strategies to improve the security of these food production systems. In cooperation with the Kansas Animal Health Department, USDA APHIS, Kansas Emergency Management Division, and numerous other agencies and organizations, Kansas now has a published action plan in the event of an outbreak of a foreign infectious disease in livestock. This significant s tep was supported through involvement of research and extension faculty in providing the research base for the plan. Threats to the security of livestock and crops are being discussed at seminars, meetings, and field days with agencies, organizations, and producers. The anticipated outcome is a greater understanding of the security steps that can reduce the potential for introduction of an infectious pest in these food systems. In addition, researchers are testing a foam that was found to kill anthrax spore s for use in food and agriculture sectors.

b. Many who have participated in ServSafe have commented that they will change certain practices as a result. Some gain employment as a result of participation in ServSafe. As a result of the Latino mass media food safety program, there was an improvement in knowledge about doneness of burgers and the importance of cleaning after raw meat that is in contact with surfaces. Attitudes about the importance food safety also improved. F eedback on the Food*A*Syst program provided by participants in focus groups was used to modify materials for the program. After modifications were made, focus group participants indicated they thought the materials were useful and that they learned from them. Most participants in the Food Tech New Tech program indicated that they had gained knowledge and believed that food irradiation would make their food safer. The Master Food Volunteer program is being piloted, but expectations are that agents will utili ze this in a way that is similar to Master Gardeners. Many Kansas food and meat processors received training and assistance in developing, implementing, and maintaining GMPs, SSOPs, and HACCP which enabled them to provide consumers with safer foods, stay competitive in the market, and comply with regulatory agency directives. The impact of KSU's food safety research program can be seen throughout the meat industry. Beef carcasses are routinely pasteurized in almost all major beef slaughter plants. The ground beef industry is implementing a technology which was evaluated at KSU for decontaminating beef trimmings prior to grinding –the Sanova process. The research on control of Listeria monocytogenes in processed meats has resulted in the commercial development of a post-process steam pasteurization system which will be offered to the industry in 2002. In addition, the industry is implementing chemical treatments that were evaluated at KSU for Listeria control. KSU's research on slaughter interventions has been widely implemented by the meat

industry. As a result, carcasses are visually and microbiologically cleaner than at any time in our history. The extension of antimicrobial treatments to include pre-harvest and post-slaughter applications will further reduce the risks of microbial hazards in meat and poultry products.

c. ServSafe trained people are sought for managerial positions in food service. Agents who plan and conduct ServSafe workshops gain visibility in their communities for knowledge and expertise in food safety among the foodservice commercial and noncommercial sectors, thus expanding their traditional audience. Food safety and HACCP assistance programs are enabling meat and food processors to comply with regulations and improve their products. Based on the types of assistance provided to plants, the USDA announced the successful implementation of HACCP in all federal- and state-inspected small plants. The direct impact of the Biosecurity program is an increase in the value of Kansas products. By incorporating biosecurity principles, the indirect impact may be to decrease the potential foodborne pathogens that leave the farm.
d. It is believed that substantial progress has been made in Kansas toward the reduction of foodborne illness, improved food production and management practices, and compliance with HACCP guidelines. The faculty of K-State Research and Extension have contributed greatly to this progress. They are recognized both in the state and nationally for their contributions.
e. Total expenditures by funding source and FTEs
FY2001 Projected: $2,438,852; Actual: $2,418,725 19.7 FTEs

Key Theme – Food Safety

Food Safety for Consumers, Food Service, and Retail Stores

a. The focus of this program is research on the economics of food safety–primarily on consumer perceptions of risk from food, their demand for safer food, their preferences for methods of enhancing food safety and factors influencing those preferences.
b. The results of this work provide strong evidence to suggest that consumers are willing to bear the costs of using new technology to enhance food safety, and that a majority of informed consumers have a preference for more effective risk reducing technologies (e.g., 60% of survey respondents preferred food irradiation over carcass pasteurization).
c. Source of Funding – State Matching
d. Scope of Impact – State Specific

Key Theme – HACCP

Meat Safety and Quality

a. The purpose of the Meat Safety and Quality program is to provide technical assistance and support to the Kansas meat industry to enhance the quality, safety, and variety of Kansas meat products. One primary goal during 2001 was to provide HACCP programs, training, and assistance to Kansas meat processing businesses so they could meet the challenges set by regulators and remain

in compliance with current programs.

Last year, USDA provided funding for a three year cooperative project between Kansas State University, the University of Nebraska, the University of Missouri, and South Dakota State University to provide support, training, and technical assistance to meat and poultry facilities in a four state region.

b. The majority of companies serviced through this program are small and very small meat processing businesses, many with fewer than 10 employees. Had this program not been available, these companies would not be able to afford these types of services. In the past year, processors and entrepreneurs realized a savings of over $54,000 while enhancing the quality and safety of meat and meat products for Kansas consumers.
c. Source of Funding – State Matching
d. Scope of Impact – Multistate Integrated Research and Extension

- With MO, NE, SD

GOAL 3 – A HEALTHY, WELL-NOURISHED POPULATION

Overview

Kansans are concerned about their personal health and safety as well as that of their families and communities. Statewide surveys, forums, and other data have revealed that citizens have a keen interest in programs delivered by local and state organizations. Public health planning documents, such as Healthy Kansans 2000 and Healthy People 2010, call for reductions in the incidence and prevalence of certain types of morbidity and mortality. Cardiovascular-pulmonary diseases, cancer, and cerebrovascular disease leading to strokes account for 63% of Kansas' deaths – primarily preventable by adopting healthy and safe lifestyles. Eating disorders and other weight issues are increasing problems. Arthritis affects 40 million Americans, and osteoporosis is present in 9 of 10 women and 1 in 3 men by age 75. Tobacco use increases risk for many diseases, including lung cancer and emphysema. Currently, 22% of Kansans smoke, and more youths are using tobacco products. Alcohol and drug abuse are common, especially inappropriate use of medications and over-the-counter drugs by the elderly and binge drinking by youths and young adults. Fourteen percent of adult Kansans engage in binge and heavy drinking. Exposure to environmental hazards (e.g., lead, radon) in their homes can also be a cause of illness and death for Kansans. Other environmental hazards can result in health problems for people with asthma and allergies or in death from carbon monoxide. Limited-resource and near-poverty individuals and families, those without health insurance, the very young, and the aged are most at risk for poor health and early death.

a. The Office of Community Health offers distance learning, networks, help with training, evaluation systems, process surveys, and basic and applied research expertise and support to help communities change unhealthy environments into places that allow children, youths, and adults to make healthy choices when given the option. In 2001, the Family Nutrition Program (FNP) provided nutrition education to nearly 180,000 food-stamp eligible citizens in 84 counties and included education to improve skills in food resource management, obtain safe and nutritious foods, and balance physical activity with food eaten. The Kansas Nutrition Network (KNN), a sister program to FNP, is a partnership of state-level public and privately funded nutrition education and food assistance programs, led by K-State Research and Extension, that use social marketing techniques to mobilize Kansans with limited incomes to use available nutrition education and food resources to improve their health. The Expanded Food and Nutrition Education Program (EFNEP) is available in four counties for youths and homemakers with limited resources. EFNEP reached 1,722 Kansas families with 2803 children in 2001. Healthy Eating for Life (HELP) promotes healthy eating and well-being among senior citizens in more than 40 Kansas counties. Dining with Diabetes provides dietary guidance to people with diabetes and their caregivers. The Creating a Home for a Lifetime program is used with older audiences (or with people who are concerned about older family members) to improve home accessibility. An intergenerational health education program, Personal Actions to Health, has established 129 exercise and nutrition programs for older adults across the state, with mini-grants available to support activities for youths and seniors to do

activities together that range from building birdhouses to making homemad e ice cream to tutoring about computers. The PANE (Physical Activity and Nutrition Education) project aims to improve the personal health of Kansans with arthritis. Health-related research programs are examining the influence of different dyes on the UV protection value of cotton fabric; developing a protein compound that may alleviate the complications of cystic fibrosis; determining the effect of dietary polyphenols in green tea on the absorption of fats and fat-soluble vitamins after menopause; examining the effect of zinc deficiency on the absorption of vitamins A and E; identifying the food-related concerns of people with macular degeneration; and examining the connection between cigarette smoke, vitamin A, and emphysema.

b. The FNP program resulted in significant intention to change behavior, including 51% intending to move closer to the recommended number of servings of the Food Guide Pyramid; 52% intending to eat more than one kind of vegetable or fruit per day more often; 24% intending to eat fried foods less often; 44% intending to mover closer to the Dietary Guidelines recommending that Americans include a greater variety of foods in their diets; and 37% intending to increase their level of physical activity. The initial social marketing campaign of KNN increased from none to 71 the number of shares of Heartland SHARE (a cooperative food-purchasing program that emphasizes fresh fruits and vegetables) that were purchased by Latinos in Wichita. More than 90% of the EFNEP participants showed improvements in dietary intake after completing the series of EFNEP lessons. EFNEP participants increased frequency of reading food labels (65%), adapted use of a safer method of thawing frozen food (59%), and planned meals ahead of time m ore often (47%). Approximately 45% of elderly HELP graduates increased, or intended to increase, their servings of fruits and vegetables. Participants in the Creating a Home for a Lifetime program intended to use the information in their homes and will r ecommend the program to people they know. Research programs have shown that red, green, blue, and brown dyes provide better UV protection than black or white and light-colored clothes; using computer models, peptide synthesis and laboratory tests, researchers are finding that a specific peptide can restore lost function caused by defective cystic fibrosis cells; research has shown that green tea profoundly lowers the absorption of fat and cholesterol, without compromising the body status of fat-soluble vitamins A and E; zinc deficiency has been shown to markedly reduce the absorption of vitamins A and E; and a connection was found between low vitamin A levels in smokers and the development of emphysema.

c. Dietary behavior improvements that resulted from t he nutrition education programs could affect the risk for a variety of chronic diseases over the next decades. The PATH program has been successful in dispelling common prejudices between youths and seniors. The results of the research projects will likely lead to improved health of the targeted populations.

d. K-State Research and Extension programs are contributing to improvements in health and nutrition behaviors, especially with low income individuals who are at particular risk. Whether these behaviors lead to improvement in health status remains to be seen. The faculty are seen as experts in the state and are looked to for guidance in helping citizens of Kansas and beyond become more healthy and live in safer environments.

e. Total expenditures by fu nding source and FTEs

FY2001 Projected: $3,908,690; Actual: $3,876,432 43.2 FTEs

Key Theme – Human Health

Research to End Cancer in Muscle Cells of Children

a. Biochemical research at K-State could help put an end to cancer in muscle cells of children by investigating a family of proteins that exist on the surface of certain cells. Known as ADAM 12, those proteins do not normally cause cancer, but when they grow out of control in a muscle cell, a cancer common to children can occur. The study focuses on determining why ADAM 12 proteins grow abnormally. Once that is established, scientists might be able to develop a drug therapy to regulate the expression of the ADAM 12 proteins.
b. The mechanism of formation of skeletal muscle in animals is not well understood. Knowing how this process occurs is essential for planning strategies to enhance muscle regeneration after injury or denervation, as well as for optimizing gene therapy employi ng myoblasts as vehicles for targeted gene delivery in many genetic diseases affecting muscle. Studies on muscle differentiation have, therefore, important implications in human and veterinary medicine.
c. Source of Funding – Hatch and State Matching
d. Scope of Impact – State Specific

Community Health Focuses on Healthy Places

a. To develop healthy places, people and communities need a way to connect, promote healthy behavior, and prevent unhealthy behaviors from occurring in the first place. That is the objective of the Healthy Places program of the Office of Community Health.

   Healthy Places development helps communities to work together to change unhealthy environments into places that allow children, youth, and adults to make healthy choices when given the option.

   Lifestyles and community environments are tied to such health problems as arthritis, cardiovascular disease, cancer, diabetes, obesity, and pulmonary disease. Lifestyles and community environments are also tied to such youth problems as dropping out of school, early and irresponsible sexual behavior, delinquency, violence, and substance ab use.

   Often, problems in health are considered in isolation. In one community, a hospital will offer diet and exercise programs to obese children, while the nearby school offers a program for substance abuse prevention. Yet the same children may attend an after-school program on conflict management. These programs are often costly, have limited research, and are confusing because they approach problem-behaviors and unhealthy lifestyles in different ways.
b. The solution is to coordinate community resource s to develop a healthy place, or community, that reaches all the people needing it and to give them the capacity to make healthy choices and learn

from their successes and failures.

As part of its responsibilities, the Office of Community Health offers such aids as distance learning, networks, help with training, a healthy youth evaluation system, a healthy places developmental process survey, and basic and applied research expertise and support.

c. Source of Funding – State Matching and Other Foundation
d. Scope of Impact – State Specific

Uncovering a Potential Cystic Fibrosis Treatment

a. Cystic fibrosis is caused by a defective gene inherited by offspring from each parent. On e in 29 Americans–more than 10 million people–is an unknowing carrier of the defective gene. Cystic fibrosis is the most common fatal genetic disease in the country. Typically diagnosed in children by the age of three, the life expectancy for someone with the disease is 31 years. Treating the disease costs an average of about $50,000 per patient (1997 figure). At that rate, treatment costs in Kansas are more than $11 million a year. In addition to helping find a cure for the disease, this kind of research may help decrease the cost of treating the disease.
b. Researchers with K-State Research and Extension have developed a protein compound that may alleviate the complications of cystic fibrosis, a deadly disease that costs Americans more than $1 billion in annual treatment costs. The compound —a peptide or mini-protein— may restore normal function to the cells most affected in cystic fibrosis patients. Use of that peptide would be a completely new approach to treating cystic fibrosis. The team of scientists on the project is stringing together amino acids to form this potential therapy. Using computer models, peptide synthesis, and laboratory tests, they are finding that the peptide can restore lost function caused by the defective cystic fibrosis cells.
c. Source of Funding – Hatch and State Matching
d. Scope of Impact – Multistate Integrated Research and Extension

Biochemistry of Signaling in the Eye

a. This project seeks to identify how cells in the lens differentiate and repair themselves in order to maintain proper cell functions, taking a basic research approach to answer the questions of how lens cells utilize signal pathways through protein kinase C to control repair processes and to respond to disease states such as diabetes. The long-term goals of this research are to develop treatments and preventive programs to enable individuals to maintain healthy vision throughout their lives. This will have a vital impact on human health and the quality of life.

A leading cause of blindness among people in this country is complications of the eye due to diabetes. These include both cataracts and retinopathy. In addition, as the population ages increasing numbers will suffer from macular degeneration, a defect in growth, repair, and communication of cells in the eye. This could have a profound effect on the health of the population and on the cost of medical treatment. In addition, there will be a loss of the viable workforce if individuals suffer from age-onset or disease-related blindness.

b. Our work will have a direct impact on the economy as better drugs are developed to treat these diseases, and as basic research-related findings will direct future drug development. Better human health will mean less medical costs and a healthier work force . Blindness can also have a great effect upon families, groups, and communities. As we continue to do basic research to understand how cells in the eye communicate, we can develop preventive strategies or diets to correct disease states such as diabetes and we can prolong proper vision during aging.
c. Source of funding – Hatch
d. Scope of impact – State Specific

Key Theme – Human Nutrition

Family Nutrition Program in Southwest Kansas

a. Families and individuals with limited resources are hard pressed to make eating and food management choices that help maintain or improve health. Their compromised health results not only in sick and/or marginally performing children and adults but also in increased public and private health care costs for all Kansans.

In southwest Kansas, limited-resource groups include families with young children, single parents with young children, farm families with high debt, pregnant teens, the elderly, and immigrants and refugees attracted to the animal production and food-processing industries located here. Much of this region is identified as physician underserved or with difficult to reach under-served people.
b. Approximately 50% of participants reported they intend to use a spending plan and a shopping list; 52% intend to follow the Food Guide Pyramid recommended servings for healthy eating; and 30% intend to increase their level of physical activity.
c. Source of funding – USDA Food Stamp Program
d. Scope of impact – State Specific

Expanded Food and Nutrition Education Program

a. EFNEP – the Expanded Food and Nutrition Education Program – provides nutrition education for limited resource families through K-State Research and Extension, with funding from USDA. EFNEP programs serve Kansans in Sedgwick, Shawnee, and Crawford counties. Through EFNEP, families with limited resources improve their skills and increase their knowledge of basic nutrition, food preparation, food budget management, and food safety. Kansas EFNEP assists youths and young families with children in developing skills and behaviors needed to improve their diets and effectively manage available resources. Reaching Kansans where they live and work, today's EFNEP nutrition assistants teach in homes, schools, assisted living sites, prisons, clinics, and libraries. EFNEP collaborates with community agencies to strengthen local support of families.
b. In 2001, 1,722 Kansas families, with 2,803 children, enrolled in EFNEP. Sixty-five percent of EFNEP graduates increased their frequency of reading food labels, 59% adapted use of a safer method of thawing frozen food, and 47% more often planned their meals ahead of time than they

had prior to EFNEP.

In this past year, Kansas EFNEP participated in a regional EFNEP cost/benefit analysis, where it was determined that for every $1 spent on EFNEP, $8.22 is saved on heath care costs.

c. Source of Funding – USDA Federal Grant
d. Scope of Impact – State Specific

GOAL 4– GREATER HARMONY BETWEEN AGRICULTURE AND THE ENVIRONMENT

Overview (includes sections a, b, c, and d)

Concern about the quality of the environment continues to guide K-State Research and Extension in developing programs that ensure quality and conservation of surface water and groundwater; promote community residential environmental management; generate systems for improved soil and air quality; and maintain plant diversity.

Topics in this area have been making headlines recently due to new research and changing regulations. The Kansas Center for Agricultural Resources and the Environment (KCARE) has led a number of environmental efforts which have helped K-State Research and Extension's progress towards its 5-year plan of work goals.

Fecal coliform bacteria are often present in Kansas surface waters. Research is underway to identify potential sources of fecal coliform contamination. Best management practices to reduce fecal coliform bacteria are being tested. Vegetative filter strips were shown to reduce concentrations of the bacteria at four K-State research sites near feedlots.

K-State Research and Extension is working to develop and evaluate such integrated agricultural management systems as reduced tillage, fertilizer placement, and vegetative filter strips that reduce runoff of major contaminants such as pesticides, nitrogen, and suspended solids while maintaining or improving production and profitability.

Efficient use of water and energy resources is the focus of K-State Research and Extension irrigation management programs. The programs have resulted in new irrigation system designs, more effective water usage, and increased economic returns from irrigated agriculture. The programs include field studies of subsurface drip irrigation and multiyear, on-farm demonstration projects. Participants in the irrigation scheduling program were able to reduce pumping of water by three inches, resulting in a saving of pumping cost by $1,500 per center pivot.

Groundwater quality is a key consideration near animal waste lagoons. A K-State Research and Extension study of seepage losses from 15 lagoons across the state revealed an average loss of $1/20^{th}$ inch/day. Constructing soil liners with bentonite and other materials that adsorb potential contaminants could reduce the risk of groundwater pollution from nitrogen, phosphorus, salts, and other nutrients. Computer modeling is being developed to optimize lagoon design using site-specific criteria.

Chemical and biological components in liquid animal waste may have a significant impact on the kinetics of ammonium adsorption and desorption by soil. A study is being conducted to investigate the sorption and desorption behaviors of NH_4^+ (ammonium cation) on soils under lagoon liners.

In response to increasing concern about problems associated with livestock wastewater from confined animal feeding operations, K-State Research and Extension initiated a project to address odor, seepage into groundwater, and runoff into surface water supplies. Subsurface drip irrigation (SDI) is a potential tool that can alleviate these problems and also use livestock wastewater for crop production. Current research focuses on identifying appropriate amounts of swine wastewater for corn production using SDI. Approximately 9,500 acres in Kansas are under subsurface drip irrigation, up from 7,000 acres in 1999.

Phosphorus represents a significant threat to surface water quality. A majority of phosphorus comes from surface runoff with a large portion attributable to agricultural lands. A K-State study is examining the influence of the addition of varying amounts of cattle manure on phosphorus levels in soils and runoff.

The Consortium for Agricultural Soils Mitigation of Greenhouse Gases (CASMGS) represents a multiyear, collaborative team effort to improve the scientific basis of using land management practices to increase soil carbon sequestration, reduce greenhouse gas emissions, and provide the tools needed for policy assessment, quantification, and verification. The five tasks are: (1) basic processes and mechanisms controlling soil carbon sequestration and greenhouse gas emissions; (2) evaluate best management practices to reduce net greenhouse gas emissions from soils; (3) predict and assess carbon sequestration and greenhouse gas emissions and provide decision-support tools and evaluate alternative national economic and policy strategies; (4) provide measurement and monitoring tools for quantifying and verifying soil carbon sequestration rates and greenhouse gas emissions; and (5) outreach to policymakers and the agricultural and energy industry.

The keys to successful implementation of carbon sequestration programs are accurate quantification and verification methods and tools to assess the impacts of policies and economic factors on carbon sequestration rates and the farm economy. Furthermore, policies to foster soil carbon sequestration will need to consider their economic impacts as well as the potential collateral effects (both positive and negative) on other greenhouse gas emissions (e.g., nitrous oxide (N_2O) and methane (CH_4)), nitrate and pesticide leaching, and soil erosion.

Representatives from five task groups prioritized potential projects and developed a coordinated plan of work. The work plans are under review before the final projects are approved and the funds released. Some CASMGS investigators are preparing a report on "Agriculture's Role in Greenhouse Gas Mitigation" for the Council on Agricultural Science and Technology (CAST) which is expected to be released Spring 2002.

Several riparian buffer research and demonstration sites have been established on the Potawatomi Reservation and at other sites across Kansas in the past few years. One of the tree establishment techniques being documented is the use of plastic tubular shelters to accelerate seedling height growth and prevent deer damage in riparian plantings. Due to the dramatic success of these shelters at

improving tree seedling establishment, the shelters have recently been added to the approved cost-share items allowed under the Farm Service Agency conservation programs.

The Kansas Family Farmer and Rancher Resources and Services Guide was completed. The guide is a comprehensive listing of the programs and information available to Kansas family farmers and ranchers. The programs offer grants, loans, cost-share, regulatory support, and technical information to assist producers in being profitable while improving natural resources. The impact has been increased communication between agencies and organizations as producer needs are served.

e. Total expenditures by funding source and FTEs
   FY 2001 Projected: $9,073,497; Actual: $8,998,616 66.0 FTEs

Key Theme – Agricultural Waste Management

North Farm Agricultural Waste Training Center

a. The center was constructed during 2001 to demonstrate best management practices to collect, treat, store, and land-apply livestock wastes. Sites demonstrate center pivot and subsurface drip application of lagoon contents, use of wetland and grass filters to treat lagoon contents, and composting of manure.
b. Eighty people observed site demonstrations and hauled compost for home horticulture use.
c. Source of Funding– State Matching and Hatch
d. Scope of Impact– State Specific

Key Theme – Yard Waste/Composting

Waste Management

a. The solid waste management program is an ongoing long-term educational program to improve solid waste decision-making capabilities of local officials, business managers, and citizens. Primary emphasis is on beneficial use of organic residuals through organ ics recycling. Increased emphasis this year was on in-depth training of compost operators and on production of quality products in the composting of yard and livestock waste.
b. At least 74 individuals participated in in-depth training on composting for compost operators. A research/demonstration/educational compost site was constructed and equipped and is in operation. A full-time assistant provides site management and educationa l program assistance. Funding was obtained to complete development of demonstration compost activities across the state.
c. Source of Funding – State Matching
d. Scope of Impact – State Specific

Key Theme – Soil Quality

Testing Soil Samples for Kansans

a. The Soil Testing Laboratory of K-State Research and Extension analyzes some 12,000 soil samples each year for Kansas farmers and horticulturists. Each soil sample represents 20 acres, and the lab in one year tested 8,000 samples from producers. In addition to those soil samples for the public, the laboratory also analyzes a similar number of soil samples for various research projects in K-State Research and Extension. Those projects range from environmental issues to development of new soil-testing methodologies.
b. The results have implications for 160,000 acres at $5/acre from either higher yields or lower fertilizer usage and cost. The indirect cost is about $800,000. In addition the impact on the horticulture industry is conservatively estimated at $20 0,000. Overall indirect contribution by the soil testing lab is $1 million.
c. Source of Funding– State Matching, Fees, Smith-Lever
d. Scope of Impact– State Specific

Key Themes – Soil Quality and Air Quality

Carbon Sequestration

a. The major concern in the soil quality area is carbon sequestration which means increasi ng organic matter of the soil to reduce carbon dioxide in the air. This work could have a huge impact on global climate change. K-State is leading a consortium of nine universities that are studying agricultural practices that sequester carbon and are also determining the economic benefits of this approach.
b. Economic analyses suggest that soil carbon sequestration is among the most beneficial and cost-effective options available for reducing greenhouse gases, particularly over the next two to three decades while new, less carbon-intensive technologies are introduced into national and global energy systems. America's farmers and ranchers, and society in general, would benefit if reductions in agricultural greenhouse gas emissions due to conservation practi ces were counted toward national goals. Recent estimates of the potential for U.S. agriculture, using existing technologies, are on the order of 75-200 million metric tons C per year or about 20% of the targeted emission reductions in the U.S. Corollary benefits of carbon sequestration are increased soil fertility, reduced soil erosion, and increased asoil quality.
c. Source of Funding – USDA Special Grant
d. Scope of Impact – State Specific

Key Theme – Sustainable Agriculture

New Center Supports Sustainable Agriculture

a. Expanded research, education, and outreach on sustainable agriculture will be the result of the new Kansas Center For Sustainable Agriculture and Alternative Crops recently created by the Kansas

Legislature and housed at K-State. It will especially benefit producers on small farms. K-State Research and Extension also hopes to provide farmers with new research and information on organic products; energy-saving technology; investments that are less capital-intensive; and agricultural practices that reduce soil erosion and restore soil health.

b. The Center assists farmers with identification and development of markets for products by collecting and analyzing basic information and providing opportunities for existing or new crop production and direct marketing.
c. Source of Funding – State Matching
d. Scope of Impact – State Specific

Earth Awareness Researchers for Tomorrow's Habitat (E.A.R.T.H.)

a. Selected as a Program of Excellence, the E.A.R.T.H. program is a year-long environmental education program that served 1,000 middle school students from three school districts in 2000-01. Each fall, award-winning curriculum, supplies, and training are provided to 12 area middle school teachers. The curriculum is built around four major themes: land, water, air, and living resources, and it encourages students to increase their capacity for critical thinking, problem solving, and decision making.

In the spring, E.A.R.T.H. participants attend an off-site interactive student workshop sponsored by the E.A.R.T.H. Steering Committee, with sessions taught by local business and community organization representatives. At the workshop, children apply the lessons they have learned in the classroom and use their critical thinking skills to learn more about , or become active participants in, some local environmental issues.

During the two years that E.A.R.T.H. has been in existence, all of the participating students have been from urban or suburban schools located in Sedgwick County. School demographics indicate that 55% of participants are minority students, and 41% are members of families who live at or below the federal poverty-level guidelines.

b. In 2000-01, students and teachers completed written, oral, and observational evaluations of the in-class E.A.R.T.H. curriculum lessons and the spring workshop activities. About 85% of students said that they learned something new at the spring event, and 75% said that they had fun learning. According to teachers, the students had a chance to experience things in the E.A.R.T.H. that they would never have learned otherwise. Some students were so excited

about E.A.R.T.H. that they wrote about it in their English essays at school and taught E.A.R.T.H. activities to their brothers and sisters at home.

c. Source of Funding – State Matching and Smith-Lever
d. Scope of Impact – State Specific

Kansas Environmental Leadership Program

a. The Kansas Environmental Leadership Program is for individuals across the state wishing to better understand water issues and improve their leadership skills. The KELP mission is "To prepare individuals to practice leadership by working collaboratively to bring about positive environmental change for the future of Kansas."
b. Twenty-seven of the 29 participants in Class 2 have graduated. They are prepared to initiate and coordinate community education, goal setting, implementation of action plans, and promote and develop a collaborative approach to leadership in Kansas watersheds
c. Source of Funding – Smith-Lever
d. Scope of Impact – State Specific

Key Theme – Water Quality

Irrigation and Water Management for Profitable Crop Production in Western Kansas

a. Irrigation in Western Kansas is mostly dependent on groundwater pumped from Ogallala aquifer. The major economic concern for the area is the rapid decline of water level. Conservation of water resources is essential for prolonging the life of the aquifer. Rapid expansion of confined animal feeding operation of livestock industries has created a concern about groundwater pollution from application of livestock manure, both liquid effluent and solids to cropland.
b. Year 2000 was very dry and hot. Yet, the participants of irrigation scheduling program reduced pumping of water by three inches. This resulted in a saving of pumping cost by $1,500 per center pivot. The total for the project amounted to a savings of approximately $16,500 and about 112 million gallons of water. Three technical sessions along with product and service expositions on SDI were attended by 130 participants. Establishment of SDI system has gone up by another 2,500 acres in the year 2000, totaling approximately 9,500 acres in Kansas. The innovative research results on the use of SDI for lagoon wastewater has prompted the livestock feedlot owner to establish 40 acres of subsurface drip system for wastewater use. The research on variable application amount of swine effluent to develop BMPs got started.
c. Source of Funding – State Matching
d. Scope of Impact – Integrated Research and Extension

The Leader in Subsurface Drip Irrigation

a. Providing water to row crops in dry areas of the Great Plains has always been a challenge, but scientists with K-State Research and Extension have found a way to get the job done at a water savings of 25% or more while protecting groundwater quality. They have advanced subsurface drip irrigation (SDI) technology to the point it's now a viable option for corn producers, and K-State is recognized nationally and internationally as the place to go for information about subsurface drip irrigation (SDI) on corn. SDI is a method of irrigation to deliver water to crop roots below the soil surface at small emission points from a series of plastic lines spaced between crop rows. It is an emerging technology that also allows producers to use wastewater in their irrigat ion system without the odor or risk of human contact or drift, because it is applied under the soil.
b. The value of annual water savings associated with widespread adoption of SDI on currently furrow-irrigated areas in western Kansas has been estimated to range between $175 million to $350 million. The associated investment costs might approach $400 million to $500 million but could be amortized over the estimated 10 to 20 years of SDI system life. In a widely distributed AP newspaper story, one southwest Kansas irrigator is quoted as saying he "wished SDI had been available 30 years ago, so that further water savings could have been made."
c. Source of Funding – USDA Special Grant
d. Scope of Impact – Multistate Integrated Research and Extension

Irrigation Scheduling

a. Improving irrigation equipment and utilizing irrigation scheduling are the goals of a 4-year research project in south central Kansas. Irrigation scheduling calculates the water demanded by the crop based on weather, soil moisture, and crop development. This allows producers to apply just enough water to meet the needs of the crops.
b. As a result of success experienced with a small group, the project is now focusing on reaching a larger group of farmers, with the possibility for a mobile learning center to visit and demonstrate irrigation scheduling and reach water conservation principles to producers.
c. Source of Funding – State Matching and State Fee Grant
d. Scope of Impact – Integrated Research and Extension

Key Theme – Air Quality

Air Quality Associated with Confined Livestock

a. Animal feeding operations can emit odors, dust, and trace gases into the atmosphere. These emissions impact air quality and can potentially effect the quality of life in neighboring communities. Research is being conducted to quantify emission rates and gain a better understanding of the biological and physical factors that control emissions. For example, methane and CO_2 emissions were measured continuously from an anaerobic lagoon at a 10,000-head swine finishing unit.
b. Two years of data showed that methane losses were very seasonal, with 70% of the emissions occurring over a two-month period in early summer. Emission rates were computed per pound of pork produced. Results will allow estimates of total statewide emissions from lagoons and provide

clues for developing best management practices for odor control.

c. Source of Funding – Departmental
d. Scope of Impact – Multistate Research
   • With AR, CA, IL, IN, IA, MI, MN, MD, NE, NC, OH, OK, OR, PA, SD, TX, UT, WA

Key Theme – Integrated Pest Management

Controlling Insects in Stored Grain without Pesticides

a. K-State is part of the new Consortium for Integrated Management of Stored Product Insect Pests. Involving two other universities and the USDA, the consortium's goal is to find alternatives to harmful pesticides in controlling insects in stored grain and fo ods.
b. Producers and consumers benefit from the use of natural controls such as combining heat treatments with insect hormone replacement instead of using insecticides that are potentially harmful to humans and the environment.
c. Source of Funding – State Grant
d. Scope of Impact – State Specific

Key Theme – Natural Resources Management

Solving Sewage Problems in Small Towns

a. Many small municipalities that are growing in population do not have the funds to upgrade their sewage treatment facilities. K-State Research and Extension is investigating a process that uses sewage to irrigate farmers' fields. The research is focusing on a project near Rossville that involves taking sewage water from the city's lagoon and flushing it through irrigation systems to water farm crops.
b. The cost for the system under investigation is less than $100,000 or a fifth of the cost of building a larger municipal lagoon. The sewage water is chlorinated to kill bacteria and other microbes.

c. Source of Funding – KDHE Grant
d. Scope of Impact – State Specific

GOAL 5 – ENHANCED ECONOMIC OPPORTUNITY AND QUALITY OF LIFE FOR AMERICANS

Overview

An educated and knowledgeable citizenry is the foundation of our state's economic productivity, democratic character, social system, and quality of life. K-State Research and Extension programs inform and help people through research and education, including building strong, healthy communities; improving parenting skills and family relationships; preparing youth to be responsible citizens; balancing demands of work, family, community, and time for self; and developing consumer and financial management skills.

a. As public resources come under pressure with smaller pools of tax dollars, cooperation and partnership between units within and outside of the university is essential. Building upon the successes of the two previous years, K-State Research and Extension is now recognized as the community-based agency of choice to support change and positive outcomes in Kansas communities. Because of its physical presence in each county as well as networks established by local educators, K-State Research and Extension brings knowledge of community dynamics and social interactions that far surpass agencies that are not located in each county. Working with other regulatory agencies, Extension can present prevention education to audiences who might not otherwise participate due to fears of being cited or penalized. In 2001, inroads were made with the Kansas Association of Counties to communicate the potential opportunities available through fullest local engagement with K-State Research and Extension with planning and economic projections for local governments; community based individual, family, and youth development programs; and local leadership capacity building to support and sustain communities of all sizes throughout the state.

b. Since 1999, K-State Research and Extension youth, family, and community development (YFCD) programs are more interconnected. There are fewer faculty and local community educators who continue to work in complete isolation. After three years of team building efforts, issues are being tackled with cross-disciplinary interests, state policy development, and agency collaboration to benefit the lives of Kansans, their families, and communities.

   Older youths, especially teens, do have positive and constructive voices in community issues. Through being genuinely listened to and respected by adults, teens develop a connection with their communities, increasing their ability to see themselves as vital, active participants in their community's future. Adults who listen to youth increase the confidence of young people and are more willing to partner with them on community issues while they are still in adolescence.

   Adult youth mentors require support and instruction to optimize their experiences. Mentoring is not merely being physically present but engaged on a mental and emotional level with youth. It cannot be assumed that willingness on the part of volunteer mentors or staff equates with competency in

youth development.

Tolerance education and the development of conscience in young people are centered in the home. While community environments can reinforce norms, intentional instruction and role modeling from parents and/or care providers are powerful factors in shaping these life skills.

Rural communities with aging median populations and restricted economic enterprises are most at risk of disappearing from the Great Plains. Extension leadership education is helping communities begin from within to identify strengths and existing capacities upon whic h they can reconstruct a viable future. External consultants do not effectively impact community development over time. Community change occurs from within the existing population when it is tapped and empowered.

c. Structured-out-of-school programs standards directly increase the quality of the learning environment. 4-H youth development included more than 35,000 Kansas youth in long-term, continuously mentored clubs and groups where skills were mastered and recognized. One third of Kansas' school-aged population (165,579) participated in some type of Extension 4-H youth development educational program in 2001.

Adult youth mentors (18,061) were trained and supported during 2001 in creating healthy places for youths to learn in structured out-of-school programs (i.e., 4-H youth development).

Leadership programs have increased the capacity of individuals within communities for political participation, managing not-for-profits, community service volunteering, and in bringing the voices of youth to discussions about community futures.

Childcare provider training and parent education strengthen individuals, families, the workplace, and communities. Children are more prepared to engage in learning while in school and to cope with life's issues.

County Profiles were updated to reflect 2000 census changes to support local government leaders with planning and decision making.

d. In keeping with the spirit of ConnectKansas, an initiative of the Kansas Legislature and Governor to coordinate activities, provide common long-term impacts, standardize funding applications, and provide a common language to all public and private ag encies that support youth, families, and communities in the state, K-State Research and Extension has adopted the Healthy People 2010 goals and is cooperating in the development of Healthy Kansans 2010. Positive social behaviors across the life span are significant part of the 2010 goals. K-State Research and Extension is adopting the standards of the National Research Council and Institute of Medicine of the National Science Academies for its youth-development outcomes in youth development. Family relation ships, parent education, 4-H youth development, and community leadership education are now better

customized within each community context. K-State Research and Extension is perceived as more relevant to a greater number of Kansans than it was in 1995, and measurable indicators are charting progress on outcomes in positive social behaviors, once only anecdotally documented.

e. Total expenditures by funding source and FTEs
FY2001 Projected: $10,730,828; Actual: $10,642,268 148.35 FTEs

Key Theme – Family Resource Management

Choose Life Balance

a. Choose Life Balance is an informal educational program combining a social marketing campaign with a family resource-management curriculum presented through group meetings or in a self-study format. The purpose is to raise awareness of the benefits of balance and to help busy people learn how to better manage time for work, family, community, and self in today's complex world. The lesson series has been used in group meetings for diverse audiences such as hospital wellness groups, golf course superintendents, Parents As Teachers, planning committees, as well as through self-study.
b. Initial results from the pilot program showed that the marketing campaign was effective at raising awareness and creating interest. Before the program, 43% of the 200 participants reported not effectively balancing demands of work, family, and community. After the program, 94% of the participants reported learning at least one new technique to help achieve a better balance among work, family, and time for self.
c. Source of Funding – State Matching
d. Scope of Impact – State Specific

Key Theme – Leadership Training and Development

Youngsters Learn Leadership Skills

a. Four counties in the Kansas City metropolitan area have consolidated efforts and resources to provide youths in that area with skills in leadership and citizenship. The participating counties are Douglas, Johnson, Leavenworth, and Wyandotte.
b. Adults, businesses, and institutions in the communities become involved with the Kansas River Youth Leadership (KRYL) program, which helps youths to increase communication skills, prepare them for entry-level jobs, foster healthier behaviors, increase their confidence, and encourage them to become more involved in community service.
c. Source of Funding – State Matching
d. Scope of Impact – State Specific

Key Theme – Youth Development/4-H

Prepare Youth to be Responsible Citizens through Volunteer Development

a. In support of the five-year plan, the Volunteer Development Action Team focused its energies in 2001 on one primary goal: Develop a system which provides opportunities for staff development and enhancement of volunteers at the county/district, area, and state levels.
b. The Spring State 4-H Forum was planned and produced by a core group of five volunteers who designed a wide variety of learning experiences for the participants. Interactive, hands-on, and action-packed, the "Hooray for Heroes" theme was brought alive by the keynote speaker Dennis Dennenberg.

   Working in small groups that focused on one specific 4-H event or function, the participants put into practice what they had learned about heroes and applied it to the real world of 4-H programs (e.g., club meetings, county fairs, club days, achievement program, judging contests, after-school programs). During the evening session, participants were introduced to and experienced the concept of "skillathons" as a viable learning experience for any project.
c. Source of Funding – State Matching
d. Scope of Impact – State Specific

Learn and Serve 4-H

a. Selected as a Program of Excellence, Douglas County's Learn and Serve After-School 4-H Clubs are taking the best of 4-H work and delivering it by a new method. When working with today's youth the traditional methods of delivery are not always appropriate. It becomes important to use creative, innovative delivery methods that are designed to reach the particular needs and characteristics of your audience.

   Learn and Serve 4-H Clubs are located in three Douglas County sites: Kennedy Elementary, Pinckney Elementary, and the Douglas County Youth Center. These three school youth programs are built around three basic components: education, community service, and mentoring.

   The National Impact Study Workgroup (1998) established a list of eight critical elements critical for any organization, program, or place to be healthy for youths. Learn and Serve 4-H includes these eight critical elements in its program and reports quarterly on how it is creating a healthy place for children and youths.
b. Primary outcomes for youths who are enrolled in the project are leadership skills, communication skills, increased self-esteem, relationship skills, valuing diversity, personal safety, problem solving, social/environmental navigation, goal setting, subject-matter skills and knowledge, decision making, and critical thinking.
c. Source of Funding – State Matching
d. Scope of Impact – State Specific

Aerospace

a. Also selected as a Program of Excellence, the Kansas 4-H Aerospace Program has expanded its mission from a primary focus on rockets to many other aspects that link to space. This includes astronomy, aviation, weather, kites, and other projects. This program has very strong grassroots efforts. It was developed by youth for youth, with the extension specialist as advisor and resource.
b. The Kansas 4-H Aerospace Program has accomplished a lot in a very short time and has made a tremendous impact on youth involved, counties, the state of Kansas, and, in a few cases, the nation. One outstanding result of this program –as compared to the other 4-H programs–was that every individual who registered for the aerospace experience fulfilled his or her contract.

   As a result of the success, two "action team" members were invited to Wisconsin's AirVenture 2001, a national program sponsored by the Experimental Aircraft Association (EAA). These team members volunteered and taught more than 2,500 youths and adults to build rockets within a 5-day period. Kansas' aerospace team is now guaranteed a leadership position in future EAA Kid Ventures.
c. Source of Funding – State Matching
d. Scope of Impact – State Specific

OPEN-K Helps Native American Youths

a. Through the OPEN-K project, K-State Research and Extension is a partner with Haskell Indian Nations University in Lawrence on the American Indian Extension Youth Leadership program. It focuses on activities and education that can empower American Indian youths to grow and develop self-respect, dignity, self-sufficiency, and self-determination. OPEN-K stands for Opportunities for Prevention Education and Networking in Kansas. The program serves as a hub to connect nine targeted American Indian communities on tribal land and in Kansas cities so they can benefit from each other's youth development experience and knowledge.
b. Partnering with Haskell Indian Nations University to accomplish Haskell Youth Extension/OPEN-K goals has resulted in steady progress toward understanding the need to be culturally relevant when working with native youths and youth workers. History matters when two cultures seek to work cooperatively and respect each others' traditions.

   The OPEN-K site best equipped with local technology support is Haskell Indian Nations University/Haskell Youth Extension which developed the Haskell Youth Extension Web site < www.hass.haskell,edu/hx/homepage>. It features internet/computer training for native leaders and youth workers and "trouble-shoots" computer issues for Haskell Youth Extension.
c. Source of Funding – USDA Grant
d. Scope of Impact – State Specific

Key Theme – Community Development

PRIDE

a. The PRIDE Program is a volunteer, grassroots effort to improve the quality of life in rural communities. The program is a collaborative effort between K-State Research and Extension and the Kansas Department of Commerce and Housing. These two organizations work together to assist local, citizen-based organizations to address local quality of life issues and implement efforts for community improvement. The goal of PRIDE is to help maximize community and economic development efforts by encouraging all local groups to coordinate and work collaboratively for community betterment.
b. A total of 63 communities participated in the program during 2001. The PRIDE Program encouraged these communities to work through a process of organization that includes: the assessment of current community needs and opportunities, prioritization of projects, setting achievable goals, involving the community in project efforts, and documenting and celebrating successes. Thirteen communities were designated a "Community of Excellence" based on their development and implementation of a community development process. Thirteen additional communities were awarded the Star award, which recognized them for accomplishing an outstanding community enhancement project. These projects were highlighted in the Kansas Government Journal.
c. Source of Funding – State Matching
d. Scope of Impact -- State Specific

Building Healthy Communities

a. A facilitated Vision to Action strategic planning process for the county commissioners in Washington County led to the development of a county economic development plan.
b. The process resulted in a clear sense of direction for county-wide economic efforts. Washington County community members have for the first time come together to discuss and plan for their collective economic future.
c. Source of Funding – State Matching
d. Scope of Impact – State Specific

Key Theme – Other - County Government

Report Details Economic Social Health Indicators for Every Kansas County

a. The K-State Research and Extension Office of Local Government has released the 2002 Situation and Trends reports for each Kansas county. Ranking counties against statewide averages, the reports highlight the direction of each county by using long-term economic and social health indicators. The information outlined in the report includes each county's population, income, economy, housing, household composition, education, health, social environment, public finance, and agriculture. This information, originally produced for Extension agents to use with program planning, now has a much wider audience.
b. The data can assist local officials making decisions, community organizations applying for grants, or citizens curious about changes in their counties.
c. Source of Funding – State Matching

d. Scope of Impact – State Specific

B. STAKEHOLDER INPUT PROCESS

The stakeholder input process is a comprehensive effort to seek input throughout the planning process. Ongoing oversight and review by stakeholders involve three key points: (1) each county uses the Program Development Committee to determine current priorities;
(2) an integrated Research and Extension Advisory Network regularly identifies issues and priorities for area Extension faculty and off-campus Research faculty; (3) the State Extension Advisory Council meets biannually to review Research and Extension priorities for a multicounty area.

The usefulness of the process is apparent through the identified priorities and the commitment of the stakeholders to the process.

C. PROGRAM REVIEW PROCESS

There have been no significant changes in the program review process since the 5-Year Plan of Work was submitted.

D. EVALUATION OF SUCCESS OF MULTI AND JOINT ACTIVITIES

1. Faculty members frequently work in teams within their units and in interdisciplinary teams. In addition to these ad hoc teams, K-State Research and Extension has supported the formation of teams around the 16 issues that identify our organizational priorities during this five year planning period. The ad hoc teams always work well; they are voluntary, and people gravitate to the team for professional stimulation and comradery. Teams that are formed by the organization are sometimes seen as another layer of meetings and bureaucracy. Nonetheless, we are committed to nurturing teams to achieve the many benefits that good teamwork provides the faculty and our total productivity. Another difficult issue is that of reporting; at this time reporting is incorporated in individual, annual, comprehensive accomplishment documents that go to each unit leader. There is no mechanism for team reports.

   K-State Research and Extension hired a professional trainer from Wichita State University to conduct a workshop for our unit leaders. This consultant has worked with many public and private organizations, including Boeing. He told us not to expect a team culture to develop overnight, 15 to 20 years is not uncommon. This was encouraging to us because we have several teams that are working well. The others need more support, more incentives, and time.

   Team responsibilities include:

   a. **Host plant resistance to and Best Management Practices for Karnal Bunt of Wheat**

      NC503 is a rapid response research activity of the North Central Regional AES Directors.

NC503 coordinates research and extension activities on karnal bunt using multistate research approach and funding. Membership goes well beyond the NC region and includes international partners from Mexico and Canada.

In view of the large economic risk, research on new methods to control or manage karnal bunt is urgently needed. Several states have modest research programs on KB biology and host plant resistance. Extension is developing improved recommendations to producers. NC503 has proven to be an effective mechanism to bring extension and research scientists together to solve a global problem.

b. **Livestock waste issues as part of a comprehensive production system**

An interdisciplinary research and extension team has focused on livestock waste management issues. The team's efforts were coordinated through K-State Research and Extension's Kansas Center for Agricultural Resources and the Environment (KCARE). Livestock waste management is a complex subject with large potential implications for policymaking in the dairy and meat industries. Livestock waste management team members have operated in a highly charged political environment, but they have succeeded in developing a body of relevant, useful knowledge and have provided objective, science-based recommendations to stakeholders that range from family farmers to industry and government. Key findings have sometimes gone against conventional wisdom. Members of the team have frequently appeared at governmental hearings and producer meetings. The following important points have been widely disseminated.

(1) Season of the year and type and phase of production significantly affect the nutrient content of Kansas swine lagoons. Producers will benefit from obtaining individual analyses from their lagoons when developing nutrient management plans rather than utilizing published reference concentrations.

(2) Seepage rates from lagoons in Kansas were small but not negligible, averaging 1.1 mm/d (1/22 inch/d). Most soil-lined lagoons probably seep between 0.3 and 1.6 mm/d (1/80 and 1/14 inch/d).

(3) The liner permeability of earthen lagoons is likely reduced by accumulated organic sludge on the bottom of lagoons, so for liners with relatively high permeabilities at the time of construction, the operational seepage rates tend to converge to relatively low values. The low values and narrow range of observed seepage rates for a wide range of lagoon and site characteristics are consistent with this hypothesis.

(4) Even with low seepage rates, the high concentration of nutrients in the effluent can cause significant movement of nitrogen and other compounds into the underlying soil.

Ammonium-N and organic-N will accumulate over time in a relatively shallow zone (0 to 3m or 0to 10ft) near the bottom of the lagoon. Chloride, however, will penetrate to much greater depths and readily move into shallow groundwater. The levels of nutrient accumulation and/or leaching is largely determined by the nutrient levels in the wastewater of the lagoon.

(5) The risk of groundwater contamination from lagoons is very site specific and dependent on five main factors: seepage rate, concentration of the waste, native soil properties beneath the lagoon, depth to the water table, and duration of lagoon use (or expected life).

(6) Perhaps the greatest risk for groundwater contamination occurs not while the lagoon is operating but after lagoons are closed or abandoned. The large reservoir of ammoniacal nitrogen accumulated in soil underneath lagoons (can exceed 230 Mg or 250 tons per site after 25 years of use) can convert to nitrate and move toward or into the water table.

(7) The level of nitrogen accumulated underneath lagoons is too h igh to be remediated by plant uptake or denitrification. The best approach to safe lagoon closure is to excavate a shallow layer of soil from the bottom of the lagoon. The depth to be excavated should be determined by sampling soil from 0 to 4 m (0 to 12 ft) from the lagoon bottom at several locations in the lagoon.

(8) Geomembranes and Geosynthetic Clay Liners significantly retard ammonium -N transport from lagoons. Composite liners that use compacted clays underlain by Geosynthetic Clay Liners show significant delays in contaminant transport.

(9) Horizontal drainage patterns underneath lagoons were shown to exist above soil layers of very high clay content and of a minimum thickness. A model was developed to predict the clay content and thickness of a layer that would cause horizontal drainage.

(10) Clay soil underlying lagoons tends to have a greater affinity for ammonium in swine waste than for ammonium from an inorganic salt (like ammonium sulfate). The organic constituents in swine waste apparently play a significant but not well understood role in ammonium adsorption by clay.

(11) Experimental attempts to reclaim soil under swine lagoons using vegetation showed that plants took up less than 1% of the total ammoniacal-N adsorbed in the soil. Losses by leaching accounted for 1-11% of the initial N, and other loss processes like denitrification and volatilization accounted for much larger losses of 35% to 47% of the initial soil N. Plants were generally not inhibited by high salt contents, but the amount of

soil-ammoniacal N is simply too large for plants to recover a significant portion. Plant uptake does not seem to be an efficient method of N recovery for lagoon-impacted soils. Soil amendments like lime and/or crop residues (like corn cobs or wheat straw) could enhance the processes of denitrification and volatilization.

(12) A comprehensive literature review of environmental impact of land application of animal wastes in Kansas confirmed that the environmental risk from land application of livestock wastes is minimal as long as agronomically appropriate rates of application and other agronomically sound practices, such as runoff and erosion control measure s, are used.

(13) Survey sampling of several sites around the state where animal waste or municipal waste had been applied to land showed no nutrient accumulations in the surface soil of environmental significance except where municipal waste had been ap plied at excessive rates. Zinc and copper accumulated in soils only where municipal waste had been applied. For several soil profiles studied, evidence of nitrate accumulation below the crop root zone was evident. The exact rates of waste application were unknown at these sites, but it is likely that excessive rates were applied at sites where significant nitrate accumulations were found.

(14) Field experiments to monitor nitrate leaching from swine waste applied to cropland showed that limiting animal waste applications to recommended levels and managing irrigation to minimize drainage early in the growing season can effectively limit nitrate leaching. Significant nitrate leaching occurred from swine waste applied at greater than recommended rates.

(15) With regard to the impact of waste application on soil physical properties, at one experimental site where excessive rates of waste had been applied, the soil physical structure was significantly degraded by the actio n of excessive salts. At locations where appropriate rates had been used, soil physical condition was either not impacted or even improved by the application of livestock wastes.

(16) A series of studies were conducted to better understand the phosphorus dynamics in soils amended with livestock wastes. Results from these studies show that Soluble P concentrations and losses in runoff were significantly increased by manure additions. Total P lost, including P associated with sediment, was not significantly increased by manure, because manure application increased water infiltration and/or the water holding capacity of soils, thereby reducing soil losses in runoff. Soluble P lost in runoff was correlated with soil test P levels.

(17) Recycling livestock wastewater though subsurface drip irrigation has proven to be a

viable option that decreases odor and human contact, decreases the risk of runoff, and improves the ability to manage N and water for crop production. The smaller emitter sizes that are normally used with groundwater sources may be risky for use with lagoon wastewater due to the risk of clogging over long-term usage (>3 years).

c. **Food safety and biosecurity**

Food Safety research at K-State Research and Extension has focused on the development of methodology to detect foodborne hazards, particularly biological hazards. Additionally, K-State emphasizes the investigation of intervention strategies that minimize or eliminate those hazards. K-State food safety researchers have long served as part of the Food Safety Consortium, a regional association that includes Kansas State, Iowa State, University of Arkansas.

Recent K-State successes in the intervention area include the development of Steam Pasteurization of beef carcasses. This work was done together with industrial collaborators at Excel Corporation and Frigoscandia. Steam Pasteurization technology eliminates 99% of the pathogens on beef carcasses. It is now used by the three largest meat processors, that process over 85% of all beef.

The same technology is being developed by K-State for packaged, finished meat products to eliminate post-process contamination with pathogens, particularly Listeria monocytogenes. Among all the major pathogens found in processed meat, Listeria accounts for the most deaths per 1000 incidences of food poisoning.

The fermented sausage industry has used K-State validation research to demonstrate to USDA that their process produces a safe product, meeting a USDA requirement. This research ensures the marketability of their product. For example, the Lebanon Bologna industry would not be able to market its product without the K-State validation research. The same is true for other restructured meat products. USDA is using K-State research to draft processing regulations for these products.

K-State food safety researchers have also demonstrated the conditions required to produce quality beef and pork products upon irradiation. Irradiation processors are using this information when implementing meat irradiation processes in commercial facilities. That implementation is a current industry emphasis.

Those areas cannot be effectively investigated without supportive microbiological technologies. K-State has emphasized development of rapid, automated, and sensitive methods for detecting and enumerating numerous pathogens, including Salmonella, Listeria, E. coli 0157:H7, various Clostridia species, Yersinia, and Campylobacter. This research area

has been a major success, resulting in the K-State International Workshop on Rapid Methods and Automation in Microbiology, which draws upon the technologies developed at K-State to train participants from around the world.

K-State Research and Extension has teamed with the KSU College of Veterinary Medicine to develop a proposal to construct a state-of-the-art Food Safety and Security Research Facility. This is a proposal for a specialized high-level biosecurity facility which will enable faculty to conduct in-depth investigations of infectious diseases (microbiology, food safety, zoonotic diseases, epidemiology, and risk analysis) and biotechnology research as it relates to infectious diseases of animals and crop plants. This research facility will enable high-containment investigations of infectious disease, pre- and post-harvest food safety in meat and meat products, crop plants, food, feed, and agricultural commodities. Events of the past year have shown the vital importance of detecting, understanding, and responding effectively to biological attacks. K-State's ongoing programs in food safety, as well as plant and animal diseases, will position its researchers to use the new Food Safety and Security Research Facility in developing robust new systems to protect our food supply, our citizens, and our economy from biological attack.

2. Addressing the needs of under-served and under-represented populations, the Family Nutrition Program hired a bilingual nutrition specialist to develop materials and train agents on ways to work with our growing Hispanic audience.

   The Kansas Center for Sustainable Agriculture and Alternative Crops was created to facilitate agricultural systems-based research and outreach. The center acts as a resource center for producers, researchers, and educators seeking information on sustainable agriculture topics. The center has increased communication between agencies and organizations that advise and support agricultural producers. Multi-disciplinary research and outreach grants have been submitted as a result of center facilitation. Existing outreach programs are being revised to include more systems-based or holistic training on the food system–from production to the table.

   The working relationship with Haskell Indian Nations University continues to strengthen. Two K-State Research and Extension faculty members are housed on the Haskell campus. One works directly with the Haskell staff in developing 4-H youth development opportunities for Native American youth on four reservations in Kansas.

   Documenting impact in structured, out-of-school, positive youth development programs has become a pressing need during the last five years. While public and private funds were previously made available for programs that apparently seemed appropriate or were well received by communities, instructors, and participants, today the funding climate de mands science-based interventions. In independent community-based youth and teen programs as well as in time-tested youth movements such as Extension's 4-H, local autonomy makes it difficult to measure the

benefits of programs. In partnership with the Department of 4-H Youth Development, Office of Community Health, the School of Family Studies and Human Services, and the Department of Kinesiology, K-State Research and Extension has initiated an AES study to compare 4-H community clubs for their effectiveness as positive youth development environments. This pilot study utilizes a healthy places framework from the field of public health rather than the more traditional models. Clubs were identified, matches, and randomly assigned as well as measures confirmed with indicators during 2001. Results of the pilot will be available in 2002 and 2003.

3. Multistate activity as discussed in the initial plan continues. Because we are more conscious of the need to work with other universities to be more competitive in receiving grant funding, the level of this effort has increased in the last few years. Budget constraints have also forced land-grant universities to work together more closely in order to develop the depth and breadth of science needed for many projects.

   4-H youth development is a partner with the states of the Great Plains in the North Central ECOP region (North Dakota, South Dakota, and Nebraska) to support the competency development of Extension youth development professionals and volunteers. K-State Research and Extension is a major partner by creating a career plan for youth development workers that focuses on four periods: new, novice, mid-career, and late-career educators. In 2001, new educator training was formalized. Three training sessions written and delivered and a set of self-study, computer assisted modules for community youth development were piloted (in the states of Virginia, Kansas, and Arizona). Cooperation is essential as budgetary constraints have removed professional development offices from three of the four Great Plains states.

4. This five-year planning cycle has provided some important organizational learning. Some actions that are taking place include development of electronic data-gathering software to support planning and reporting needs for both research and extension. We have learned the importance of having an outcome-based orientation rather than an issue-based orientation. We anticipate that clear outcome goals will give us much better evaluation of results.

   We have learned that the Logic model is an excellent project management framework that works for joint research/extension projects. We have made some minor language changes to the model which makes it more user friendly to researchers. When we develop our next 5-year plan, we will put the greatest emphasis on the short- and medium-term outcomes and the long-term impacts that we anticipate will occur from our work. Crisp, specific outcome statements provide a benchmark that makes the evaluation process much easier.

   We have determined that different levels of evaluation should be used for different issues. For some, examples of how K-State Research and Extension has solved the problem and how stakeholders have used the science-based information in their business/life meet the accountability requirements. For others, more extensive evaluation is needed to convey the social,

environmental, or economic impact that has been achieved; decisions need to be made during the planning phase as to what level of evaluation/documentation will be utilized with a given project.

Survey information generated through a scientific process by an independent, credible source is very powerful. We have found that these data, along with several examples of project impact, are very effective ways of communication with decision-makers at all levels of government.

Expanding the reach and saturation of the 4-H youth development movement to all school-aged youth of Kansas is challenging. While the club/group delivery method is clearly substantiated in science to have the most positive potential in promoting positive y outh development, 4-H is difficult to "enter" and "hold-onto" without some previous type of Extension or 4-H "heritage" in one's family. By redefining the essentials of a 4-H club/group, new models of long-term, continuous contact mentoring, knowledge, and skill mastery environments are being tested, acknowledged, and being sustained across Kansas.

The Expanding 4-H Opportunities Team has gone back to 4-H basics to remove the veneers of traditional activities to expose the beauty of the original 4-H philosophy. By giving people with all types of experiences the freedom to form their own clubs/groups based on the four-fold youth development model, partnerships have exploded with other community based organizations where young people find themselves. K-State Research and Extension is involved in more than 40 of the 48 21st Century Community Learning Grants in Kansas. In addition, healthy 4-H places are now funded with funds from the Juvenile Justice Authority, Social and Rehabilitative Services, Center for Substance Abuse and Prevention, Big Brothers and Big Sisters, and Boys and Girls Clubs.

E. MULTISTATE EXTENSION ACTIVITIES

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 Kansas State University
State Kansas

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

	Actual Expenditures				
Title of Planned Program/Activity	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Collaboration at National and Regional committees, meetings, and projects.	58,614	111,284			
Total	58,614	111,284			

SUPPLEMENT TO THE 5-YEAR PLAN OF WORK
MULTISTATE EXTENSION ACTIVITIES

Actual Expenditures for FY 2001

The multistate interactions at Kansas State University, as listed in the approved 5-Year Plan of Work, represent participation at national and regional professional meetings, panels, conferences, and seminars by extension specialists, administrators, and faculty.

F. INTEGRATED RESEARCH AND EXTENSION ACTIVITIES

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 Kansas State University
State Kansas

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

Actual Expenditures

Title of Planned Program/Activity		FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
NC 205	5,608		39,146			
Pecan Fields		25,478	39,209			
Institutional engagement	672		9,392			
Total		31,758	87,747			

SUPPLEMENT TO THE 5-YEAR PLAN OF WORK
INTEGRATED ACTIVITIES - HATCH ACT FUNDS

Actual Expenditures for FY 2001

NC 205: Ecology and Management of European Corn Borer and Other Stalk-Boring Lepidoptera
The amount reported represents actual federal expenditures for FY 2001

Pecan Field: Joint research and extension activity to study pecan hybrids as alternative agriculture.
The amount reported represents actual federal expenditures for FY 2001

Environmental Management of Livestock Systems - Action Plan number NREM 1.3
The amount reported represents actual federal expenditures for FY 2001.

Grazing Land and Forage Issues - Action Plan number AIC 2.5
The amount reported represents actual federal expenditures for FY 2001.

Plant Biotechnology - Action Plan number AIC 5.3
The amount reported represents actual federal expenditures for FY 2001.

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 Kansas State University
State Kansas

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

	Actual Expenditures				
Title of Planned Program/Activity	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
NC 205		017,989			
Pecan Fields		0	21,113		
Environmental management of livestock systems		11,309	61,290		
Grazing, land and forage issues		37,226	47,294		
Plant Biotechnology		20,32528,716			
Total		68,860	176,402		

SUPPLEMENT TO THE 5-YEAR PLAN OF WORK
INTEGRATED ACTIVITIES - SMITH LEVER FUNDS

Actual Expenditures for FY 2001

NC 205: Ecology and Management of European C
orn Borer and Other Stalk-Boring Lepidoptera The amount reported represents actual federal expenditures for FY 2001

Pecan Field: Joint research and extension activity to study pecan hybrids as alternative agriculture.
The amount reported represents actual federal expenditures for FY 2001

Institutional Engagement: attendance at regional research and extension meetings.
The amount reported represents actual federal expenditures for FY 2001

Grazing Land and Forage Issues - Action Plan number AIC 2.5

The amount reported represents actual federal expenditures for FY 2000.

Plant Biotechnology - Action Plan number AIC 5.3

The amount reported represents actual federal expenditures for FY 2000.

Appendix A

KANSAS STATE UNIVERSITY
FISCAL YEAR 2002 ESTIMATED SOURCE OF FUNDS
FISCAL YEAR 2001 ESTIMATED & ACTUAL SOURCE OF FUNDS

February 24, 2002	FY 2001 Estimate	FY 2001 Actual	FY 2002 Estimate
RESEARCH			
Base Programs	$3,535,222	3,551,144	3,527,144
Special Research Grants	2,600,000	2,597,937	2,600,000
Competitive & Other Grants	6,500,000	6,906,846	7,000,000
Total Federal Distribution	12,635,222	13,055,927	13,127,144
State Appropriation and Match	29,119,088	29,119,088	29,887,841
Total Research Funding	$41,754,310	42,175,015	43,014,985
EXTENSION			
Base Funding (Including CSRS Ret.)	$5,043,159	5,010,240	5,010,240
National Priorities	850,000	868,653	850,000
Other Extension Programs			
RREA	42,000	42,019	42,000
FERS Ret.	190,000	216,807	216,807
Total Federal Distribution	6,125,159	6,137,719	6,119,047
State Appropriation and Match	17,737,964	17,634,033	18,529,352
County Contribution	15,891,855	14,889,842	15,272,338
Total Extension Funding	$39,754,978	38,661,594	39,920,737
Kansas State University Research & Extension			
Research and Extension: Federal	$18,760,381	19,193,646	19,246,191
Research and Extension: State	46,857,052	46,753,121	48,417,193
Research and Extension: County	15,891,855	14,889,842	15,272,338
Total Appropriation	$81,509,288	80,836,609	82,935,722

Appendix B

KANSAS STATE UNIVERSITY
FISCAL YEAR 2002 ESTIMATED SOURCE OF FUNDS
FISCAL YEAR 2001 ESTIMATED & ACTUAL SOURCE OF FUNDS

	FY 2001 Estimate	FY 2001 Actual	FY2002 Estimate
Research Base - Federal		3,551,144	3,527,144
Reductions		0	0
Total Federal Research		3,551,144	3,527,144
Research Base - State			
Base		29,119,088	29,992,666
Reductions		0	(104,825)
Total State Research		29,119,088	29,887,841
Extension - Federal			
Base		4,594,125	4,594,125
CSRS		416,115	416,115
Total Federal Extension		5,010,240	5,010,240
Extension - State			
Base		17,634,033	18,620,418
Reductions			(91,066)
Total State Extension		17,634,033	18,529,352
County Expense:		14,899,842	15,272,338
National Priority			
Integrated Pest Mgmt		179,902	180,000
EFNEP		668,751	670,000
Farm Safety		20,000	0
Total National Priority		868,653	850,000