

38th

BIENNIAL REPORT



AGRICULTURAL RESEARCH IN KANSAS

DIRECTOR'S REPORT FOR THE BIENNIUM JULY 1, 1994 TO JUNE 30, 1996

AGRICULTURAL EXPERIMENT STATION

KANSAS STATE UNIVERSITY



Agricultural Research in Kansas

38th Biennial Report of the Kansas Agricultural Experiment Station

Report of the Director for the Biennium Ending June 30, 1996



FRONT COVER

Four new cooperative efforts focus on agricultural products, animal health and management, food safety, and soil and water quality.

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Letter of Transmittal

Office of the Director

***To the Honorable William Graves,
Governor of Kansas***

It is my pleasure to transmit herewith the report of the Agricultural Experiment Station of the Kansas State University of Agriculture and Applied Science for the biennium ending June 30, 1996. This report features some new cooperative efforts to focus research on key areas. The research highlights include animal and crop production, soil and water management, pest control, new technology, and economic aspects of agriculture. In addition, there are lists of publications by Station scientists, lists of research projects still active and those terminated during the biennium, a record of personnel changes, and a financial statement for each year of the biennium.

Marc A. Johnson, Director

A Message from the Director

This document represents a report of progress for 1995 and 1996, as well as a report of current research activity of the Kansas Agricultural Experiment Station. Hereafter, the Kansas State University Agricultural Experiment Station and Cooperative Extension Service will be one, unified organization known as K-State Research and Extension. This change recognizes, as Kansans long have understood, that K-State offers a continuum of generation and dissemination of knowledge for Kansas citizens and the world. K-State Research and Extension provides knowledge relevant to the important issues affecting every citizen of Kansas and the nation, namely, a competitive agricultural industry, economic development, food safety, and environmental quality.



The production and marketing of food is increasingly sophisticated and complex. Science is providing ways to maintain an abundant, affordable, food supply. Maintaining the competitiveness of agriculture, in terms of cost and quality, keeps a vital food source within the country and contributes positively to the nation's balance of payments.

Research in more effective utilization of agricultural products for food and nonfood uses creates jobs and adds economic value. Many jobs in the agricultural service, processing, and support industries in Kansas would vanish without a competitive agriculture and agribusiness.

Safe food is a national issue. K-State Research and Extension discovers new ways to detect microorganisms in food, new ways to process food products safely, and new ways to monitor food quality from the processing line to the table.

K-State researchers discover new approaches to use farm chemicals in production and keep the chemicals on the land for intended use and out of streams and lakes. Research on water conservation and cropping systems protects the precious water resource that will determine the future of agriculture in Kansas.

K-State Research and Extension is committed to providing scientific solutions to contemporary issues.

***Marc A. Johnson
Dean and Director
Agricultural Experiment Station***

Contents

Research Departments, KAES	1	12. Communications	56
Forums and Centers Focus on Major Issues	2	13. Diagnostic Medicine and Pathobiology	56
Research Highlights 1994 to 1996	4	14. Director's Office	59
Animal Production	4	15. Economics	59
Field Crop Production	8	16. Entomology	59
Forage, Hay, and Silage	11	17. Family Studies and Human Services	61
Ornamentals, Grasses, and Trees	13	18. Food Animal Health and Management	62
Pest and Disease Management	16	19. Foods and Nutrition	62
Prairie Research	18	20. Grain Science and Industry	63
Environmental and Safety Issues	19	21. Horticulture, Forestry and Recreation Resources	66
New Technology	23	22. Hotel, Restaurant, Institution Management and Dietetics	68
Economics of Production	25	23. Plant Pathology	69
People and Communities	28	24. Sociology, Anthropology, and Social Work	74
Editorial and Publication Activities	30	25. Statistics	74
Personnel Changes	32	26. Agricultural Research Center–Hays	75
Station Publications	33	27. Northwest Research–Extension Center ..	76
Publications of Station Scientists	34	28. Southeast Agricultural Research Center	77
1. Agricultural Economics	34	29. Southwest Research–Extension Center ..	78
2. Agronomy	36	Publication Record of Scientists	80
3. Anatomy and Physiology	41	Research Projects Active June 30, 1996	84
4. Animal Sciences and Industry	42	Research Projects Terminated	93
5. Biochemistry	47	Financial Statement	98
6. Biological and Agricultural Engineering	49		
7. Biology	51		
8. Chemical Engineering	54		
9. Civil Engineering	54		
10. Clinical Sciences	55		
11. Clothing, Textiles and Interior Design	56		

Research Departments, KAES

■ COLLEGE OF AGRICULTURE

Agricultural Economics
Agronomy
 provides soil testing service
Animal Sciences and Industry
 includes International Meat and Livestock Program
 provides chemical analyses of feedstuffs
Communications
 includes Weather Data Library
Entomology
 provides scanning electron microscope service
Grain Science and Industry
 includes International Grains Program and Agricultural Institute
Horticulture, Forestry and Recreation Resources
Plant Pathology
 includes Wheat Genetics Resource Center

■ COLLEGE OF ARTS AND SCIENCES

Biochemistry
Biology
 provides plant identification service
Economics
Sociology, Anthropology, and Social Work
Statistics
 provides statistical consultation and assistance

■ COLLEGE OF ENGINEERING

Biological and Agricultural Engineering
Chemical Engineering
Civil Engineering

■ COLLEGE OF HUMAN ECOLOGY

Clothing, Textiles and Interior Design
Foods and Nutrition
 includes Sensory Analysis Center
Hotel, Restaurant, Institution Management and Dietetics
School of Family Studies and Human Services

■ COLLEGE OF VETERINARY MEDICINE

Anatomy and Physiology
Clinical Sciences
Food Animal Health and Management Center
Diagnostic Medicine/Pathobiology

■ BRANCH STATIONS/CENTERS

Agricultural Research Center—Hays
Northwest Research-Extension Center
Southeast Agricultural Research Center
Southwest Research-Extension Center

■ EXPERIMENT FIELDS

Cornbelt*
East Central*
East Central Horticulture*
Harvey County*
Irrigation**
Kansas River Valley**
North Central*
Pecan Field*
Sandyland**
Sedgwick County*
South Central*

*Agronomy
*Biological and Agricultural Engineering
*Horticulture

Forums and Centers Focus on Major Issues

In recent years, the Kansas Agricultural Experiment Station has encouraged cooperative efforts to focus on key issues and to better utilize limited funds. These forums or centers can include researchers and extension specialists from several departments. Each of them has expertise in some aspect of the issue, and they work together to conduct relevant research and communicate the results through teaching and extension activities. Four such groups that were established during the biennium are discussed.

The Agricultural Product Utilization Forum was established in 1995 and includes over 80 faculty and administrators from three colleges and 11 departments. All of them support or are involved in research/teaching/extension activities related to value-added agriculture.

processes. Some examples are: fish food made from animal and food wastes, biodegradable films made from soybean products, and straw board.

The latter product combines glue derived from wheat starch with wheat straw to make a strong board similar to fiberboard and useful for many commercial applications. A successful process was developed, and small-scale manufacturing is underway in Kansas.

Animal production is a major industry in Kansas and is valued at \$3 billion annually. Beef cattle account for 80 percent of that figure, but production of swine and dairy cattle is increasing. The Center for Food Animal Health and Management was founded in 1994 to support that industry.

The center is housed in the College of Veterinary Medicine and has brought together faculty from several veterinary departments and Animal Sciences and Industry. Their research and postgraduate education program include all aspects of preventative medicine and management that affect the health and well-being



New methods will improve production of value-added products like sausages (above).

Value-added refers to increasing the value of raw agricultural commodities by adding ingredients, processing, and/or converting them to new products. These higher value products are more competitive in domestic and export markets, increase income, create jobs, and encourage rural development.

The mission of this forum includes facilitating and promoting agriculturally related value-added activities; fostering collaborative efforts among KSU faculty and partnerships between KSU and representatives from industry, commodity groups, or government agencies; and obtaining more funds from all available sources.

Some faculty members are working on evaluation and improvement of existing, raw, agricultural materials and products at all stages of development. Some examples are: developing white wheat as a speciality crop, new apple varieties, and low-fat meat products and improving wet milling of sorghum, cold-storage methods, and sausage preblending methods. Others are developing new and innovative, food and nonfood products and

On-farm work in food animal health includes collecting water samples for microbiological analysis (right).



of food animals and the wholesomeness and profitability of foods of animal origin.

The center focuses on applied, on-farm research to meet the needs of producers, allied health industries, government agencies, and the public. Collaborative efforts in teaching and research (with other K-State departments and other institutions) contribute to the expertise and success of the center.

Funded projects in progress include nutrition and disease management in swine, antibiotic-resistant bacteria in beef cattle feedyards, cattle management practices that reduce muscle bruising and loss of meat product, and new detection methods for the pathogens *Salmonella* and *Cryptosporidium*.

Consumers expect the food they purchase at supermarkets and food-service establishments to be safe, wholesome, and nutritious. Because of the complexity of the food system and food safety, an interdisciplinary approach is needed to address all the issues; therefore, the Food Safety Forum was established in 1994.

Research and extension faculty in several departments from three colleges are working to improve crop and animal production practices; storage, manufacturing, processing, and distribution of food; and consumer, retail, and foodservice issues. Programs include collaborations with industry, government, and other universities and training for their personnel, as well as education for undergraduate and graduate students and the public. Forum members also develop, assess, and transfer technology to assure safety in the food system.

A combination of high-temperature vacuum technology and steam pasteurization to remove external contamination from beef carcasses, which was developed and tested by forum members, has been approved by the United States Department of Agriculture.

Concerns are increasing about the impacts of agricultural production methods on the environment, the structure and profitability of agricultural enterprises, and rural communities. Environmental research addressing these problems and often involving several departments is well established at K-State. However, the need for a more organized effort was recognized and led to the formation of the Kansas Center for Agricultural Resources and the Environment (KCARE) in 1996.

The mission of KCARE is to coordinate and enhance research, extension, and teaching ac-



tivities pertaining to environmental issues from an agricultural perspective. Its goals are to foster holistic, interdisciplinary research to solve agricultural and environmental problems; to communicate the relationship of agriculture and the environment to producers and the public; and to develop financial resources for the interdisciplinary research, teaching, and communication activities.

Better tests for detecting pathogens will improve the safety of our food.

Four major areas of emphasis are irrigation and water management, surface and groundwater quality, application of solid and liquid wastes to agricultural soil, and maintaining and improving soil quality. Sustainable agriculture, which includes several of these, also will be considered.

The center already has begun a 3-year project with the University of Nebraska to study surface water quality in the Blue River Basin.

Research on soil quality is a major focus of KCARE.



Research Highlights 1994 to 1996

■ ANIMAL PRODUCTION

Interactions of Grazing Systems and Stocking Rates

Systems of grazing management ideally should be designed to accommodate seasonal changes in plant physiology. During mid and late summer, warm-season grasses replace carbohydrate reserves spent on growth and seed production. Allowing pasture to rest during this period can improve plant vigor. Thus, a system of late-season rest-rotation might be well suited for the tallgrass prairie region. Any special management practices can affect forage availability, which in turn, can affect forage intake and animal performance. These effects are related to stocking rate. Thus, comparison of grazing systems at only one rate could be misleading. An agronomist, an animal scientist, a biologist, and a statistician collaborated in a study of two grazing systems with three stocking rates.

sults indicate that a late-season rest-rotation grazing system can support cow-calf performance similar to that with continuous grazing at similar stocking rates. However, the impacts of the system on rangeland plants will have to be measured before definite guidelines can be established.

Wheat Middlings in Cattle Feed

Much of the hard red winter wheat grown in Kansas is made into flour. Among the byproducts of flour milling are wheat middlings (WM), which contain small particles of bran, germ, and the aleurone layer (protein) of the wheat kernel. Although WM are used commonly in livestock feed, little is known about their nutritive value. Animal scientists evaluated the effects of WM on cattle performance, nutrient digestibilities, and ruminal metabolism.

Cattle received a high-concentrate ration with WM replacing various percentages of the concentrate or the roughage. Weights and other indicators of performance were measured during a 112-day trial. Then cattle were slaughtered, and carcass characteristics were measured. Another group of cattle was fed similar rations for 14-day periods, and fecal and ruminal digesta samples were collected for analysis.

The results showed that WM could replace only 5 percent of the concentrate in finishing rations without reducing performance. However, 50 to 100 percent replacement of roughage had no adverse effects of cattle performance. Digestion trials confirmed these results. Nutrient digestibilities decreased when WM replaced part of the concentrate but increased when WM replaced all of the roughage. Only minor changes occurred in ruminal fermentation.

Thus, WM can be used as a nutritious feed for finishing cattle but will be most effective when they replace roughage in the diet.

Marbling Development in Feedlot Cattle

Marbling in beef is the predominant attribute in assigning USDA quality grades and is considered an indicator of flavor, juiciness, and tenderness. It's also an important economic factor to the cattle feeder. Choice carcasses bring average prices of \$40 more than Select carcasses. New technology developed at the Agricultural Research Center-Hays allows researchers to measure marbling accurately in the live animal with ultrasound.

This procedure was used to evaluate marbling in 338 steers during the feedlot period.



Cow-calf pairs performed well in a rotational grazing system that included late-season rest of pastures.

Thirteen native tallgrass pastures were used to compare continuous versus late-season rest-rotation grazing at low, moderate, and high stocking rates. One pasture was left ungrazed to monitor vegetation response. Each pasture in the rotation treatments was allowed to rest once during the 3-year trial. Cow-calf pairs were assigned randomly to pastures each spring.

Cow body weights and condition scores did not differ between grazing systems or stocking rates. However, calf body weight tended to be greater with continuous grazing. The major difference in calf gain occurred during the second half of the grazing system, when forage availability and/or quality may have been lower in the rotation pastures. These re-

Each animal was measured for marbling at least three times, with the final measurement a few days before slaughter. The primary objective was to determine the rate of marbling increase in cattle, so that future carcass grade could be estimated from an ultrasound evaluation

Although much variability occurred among individual animals, the average rate of increase was extremely slow: 0.01 marbling units per day. An average of 100 days on feed was required for an animal to progress from slight marbling to small marbling. The rate of increase was faster in animals with more marbling. Results also showed no relationship between marbling score and carcass backfat thickness. This contradicts the prevailing opinion that improving quality grade must result in overfat cattle. It also disagrees with the contention that subcutaneous fat is deposited first, followed by intramuscular fat.

The slow development of marbling means that holding cattle for a few more weeks in a feedlot will only slightly increase the proportion grading Choice. Also, the great increase in subcutaneous fat during that period would adversely affect yield grade. Producers should focus on marbling in seed stock selection, because the trait seems to be affected much more by the genetics of an animal than by management.

Reimplanting Strategies for Feedlot Cattle

Ultrasound technology can be used to precisely predict the optimal number of days to continue to feed cattle after reimplanting time. Furthermore, it can allow clustering of cattle into outcome groups that will be marketed typically at monthly intervals. More precise reimplanting strategies are needed to allow for differences among response durations and interactions involving increases in weight gain and effects on carcass quality.

A study at the Agricultural Research Center-Hays evaluated 401 steers with ultrasound at reimplanting time and clustered them into three sets to be marketed in about 40, 70, and 100 days. Each set was divided into six groups and assigned to receive one of two different implants or none; each treatment was replicated twice. They already had been implanted at weaning and when placed on full feed.

Differences in carcass weights indicated a much greater response to one implant than the other, but no differences occurred among total weight responses for the three marketing groups. This suggests that much of the response to implanting occurs within a few weeks. The only significant treatment effects



on carcass attributes were reductions in marbling score and quality grade among implanted cattle. Components of carcass cutability were improved numerically but not significantly by implanting. About 8 percent more carcasses from implanted cattle were assigned Yield Grades 1 and 2.

Using ultrasound to sort cattle into outcome groups minimized the number of Yield Grade 4 carcasses. Marbling projections correctly classified 75 percent of the animals into the Select or Choice grades. Apparently, some cattle probably will never grade Choice whether they are implanted or not. Others will have sufficient marbling to grade Choice even if they receive several implants. Ultrasound might be used to identify borderline cattle for which implanting might determine whether they develop enough marbling to grade Choice.

Feeding Dairy Calves

Processed versus Raw Sorghum Grain. Research has showed that the feeding value of sorghum grain is improved by steam flaking, reconstitution, and other processing methods that disrupt the organization of starch and its association with protein in the grain endosperm. Utilization of the grain can be improved by 12 to 15 percent. A study by animal scientists compared effects of raw, roasted, and conglomerated sorghum on the performance of dairy calves from birth to 8 weeks of age. Raw and roasted sorghums were ground and added to complete pellet starters; conglomerated sorghum (prepared by grinding grain, adding water, pelleting, and roasting) was used as pellets or ground again before addition to starters.

The raw sorghum appeared to be palatable and supported acceptable growth rates; processing did not enhance calf performance.

A computerized ultrasound system can follow the development of marbling in cattle and predict the time to market them after reimplanting.

Bloating was a problem for some of the calves fed the conglomerated sorghum and may have reduced feed consumption, thereby masking any potential benefits from the processing. Measures to prevent bloat will be necessary, if conglomerated sorghum is to be used in starter for young calves.

Enzyme-Modified Wheat Gluten in Milk Replacers. Calves in very early stages of life need milk or a milk replacer with high contents of energy and protein. Sources of protein more economical than all-milk protein are needed. Soluble (enzyme-modified) wheat gluten has potential for use in milk replacers. In a study in the Department of Animal Sciences and Industry, wheat gluten was substituted for 30, 33, or 50 percent of the protein, which provided 18 or 20 percent of the replacer.

Calves fed 20 percent protein and the various amounts of wheat gluten had similar performance. With the starter containing 18 percent protein, calves gained more weight when wheat gluten was included. The only problem noted was some incidence of diarrhea in calves receiving 50 percent wheat gluten. Overall, these results indicated that enzyme-modified wheat gluten is a good source of protein for calf milk replacers.

Successful Reproductive Strategies for Dairy Herds

Dairy producers often lose significant income because of poor reproductive performance in their herds. The costs associated with substandard performance can be significant and often go undetected. A study in the Department of Animal Sciences and Industry considered 402 Holstein dairy herds in Kansas

Good reproductive performance is essential for a profitable dairy operation.

that participate in the Heart of America Dairy Herd Improvement Association and divided them onto three production groups based on 365-day rolling herd averages. Then the reproductive performance of the groups was evaluated using the Kansas State University Dairy Herd Analyzer.

Results showed that as the rolling herd average increased, days dry, age at first calving, and calving interval decreased. Average number of services per conception and days in milk increased as milk production increased. Days open were greatest for the low production group. Cows in the higher producing herds tended to breed earlier in lactation. Further analysis showed that the reproductive losses per cow were \$203, \$158, and \$139 for the low-, medium-, and high-producing groups, respectively. These represent losses in potential income. This study led to several recommendations for improving reproductive management.

1. Use an estrus-synchronization program for replacement heifers so insemination can begin by 13 months of age. This ensures that they calve by 24 months of age.
2. Establish an elective waiting period consistent with herd goals. Generally, for each 1-day decrease in days to first service in cows, a 0.8-day decrease in days open or calving interval occurs.
3. Use some estrus-synchronization protocol for programming first services in cows. This will ensure first inseminations by a given target day in milk.
4. Manage repeat services by effective heat detection to reduce intervals between services.
5. Use prostaglandins effectively to induce estrus for efficient rebreeding of cows identified as open at pregnancy diagnosis.
6. Establish and adhere to a herd-specific, preventive, health program, including disease prevention by vaccination, cleanliness, and routine consultation and care by a veterinarian.
7. Make routine observations of suspect cows for various health disorders while watching the herd for estrus.

Swine Nutrition

Swine research in recent years has emphasized nutrition. The increased use of segregated early weaning has necessitated development of appropriate diets for very young pigs. In addition, the starter pig stage has been divided into three phases, each with a specific diet. Nutrition for growing-finishing and lactating swine also has been fine-tuned.



Animal scientists have tested many supplements and additives and various processing methods to maximize animal performance at each of these stages. A few examples are discussed below.

Salt for Starter Pigs. Salt maintains the cation-anion balance of cells, stimulates appetites, and increases feed intake. Salt is added to diets of older pigs but usually not to those of starter pigs. A phase II diet containing dried whey and two levels of salt or no salt was fed to three groups of pigs that all had received a common phase I diet. Added salt improved growth performance by 8 to 9 percent in phase II and by a smaller percentage over both phases. These results indicated benefits from adding up to 7 pounds per ton of salt to phase II diets containing 10 percent dried whey.

Plasma as a Protein Source. Spray-dried plasma is a fairly new product that is used as a protein source in pig diets. Several types are available, and three of them were compared as replacements for dried skim milk in phase I diets for starter pigs. All groups then were fed a common diet in phase II. All plasma types increased average daily gain, feed intake, and efficiency of feed conversion. These effects carried through the phase II period. Regardless of its origin, spray-dried plasma is a good protein source for young pigs. Producers should consider cost when choosing which product to use.

Reducing Phosphorus in Diets. Phosphorus (P) typically is the third most expensive nutrient in swine diets. Excess P is excreted in urine and feces and can have adverse environmental effects. Thus, reducing amounts of P in diets would be beneficial. A study was designed to evaluate effects of removing P from diets of late-finishing pigs (190 to 250 pounds). One third, two-thirds, or all of the P was omitted from a corn and soybean meal-based diet. Omitting up to 66 percent of the P did not affect performance. Only minor differences occurred in carcass characteristics and meat quality. Therefore, reducing total dietary P to about 40 percent during the late-finishing stage can improve profitability and reduce environmental pollution.

An Essential Amino Acid. As genetic improvements continue to increase milk production by sows, nutritional requirements also will change. Little research has been done on the amino acid valine. An experiment compared several levels of valine in lactation diets for sows. Feed intake did not differ among treatments, so valine intake increased with increasing additions to the diets. Valine had no effect on sow performance but



did improve litter weight at selected times and weight gain over the entire experiment. The results demonstrated that high-producing sows have a dietary valine requirement of 117 percent in comparison to lysine (another essential amino acid). This is higher than standard recommendations.

Effects of Sire Performance on Lamb Growth Traits

Rams were obtained from a lamb performance test for growth to an end point of .25 inches of backfat. Two top-ranking and two bottom-ranking rams were used each year and bred to four genetically similar groups of ewes at the Northwest Research-Extension Center. Reproductive data for ewes and production data for their lambs were recorded.

Conception rate and pounds of lamb produced generally were affected more by breed and age of ewes than by performance of the rams. However, ewes mated to the high-ranking rams did produce more pounds of lamb. The advantage at marketing was almost 15 pounds, which would increase price by nearly \$9.

Early weaning of pigs requires carefully balanced diets to ensure maximum performance.



Ewes mated to high quality rams will produce heavier lambs that increase profits.

■ FIELD CROP PRODUCTION

New Crop Releases

Several hard red winter wheat germplasms were registered between 1994 and 1996. KS92WGRC16 has good resistance to leaf rust. KS92WGRC17, KS92WGRC18, and KS92WRRC20 all have resistance to the several biotypes of Hessian fly. KS93WGRC27 is resistant to wheat streak mosaic virus, and KS93WGRC28 is resistant to powdery mildew. Germplasm 2137 has multiple resistance to leaf rust, viruses, and Hessian fly. KS94WGRC29 (hard white wheat), KS94WGRC30, and KS94WGRC31 are resistant to Russian wheat aphid and stem rust. The latter germplasm also has resistance to leaf rust and Hessian fly.

Among the soybean germplasms released were KS3494 with high yield potential and good pest resistance; KS4895 with high yield potential; and KS5292 with high yield potential, low lodging, and resistance to Races 1 and 2 of the soybean cyst nematode. Variety Magellan also was registered. In tests, it yielded more than several popular varieties, and seeds had high quality.

Finally, a rapeseed germplasm, KS3579, was registered. It has greatly improved winter survival in the Great Plains, and the seed is low in erucic acid.

Wheat Breeding Program

The Wheat Field Day at the South Central Experiment Field in 1995 featured unique displays illustrating the development of hard red winter wheat and the breeding program at K-State.

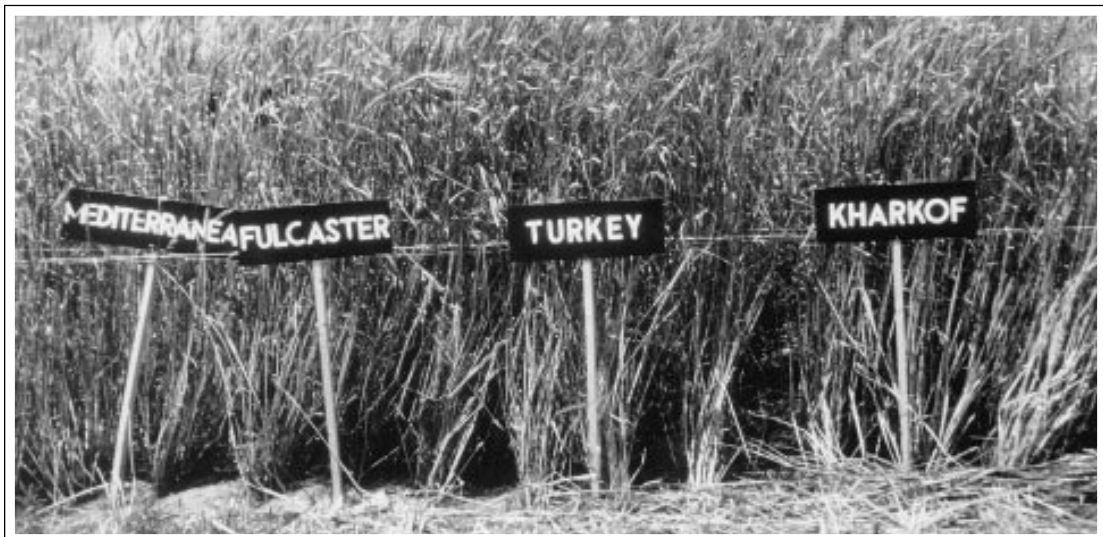
The largest display featured 260 varieties of hard winter wheat grown in the Great Plains and the intermountain West during the 120

years between the introduction of Turkey Red in 1874 and the fall 1994 planting. Varieties were grouped by the time periods when they were developed and released. Differences among the varieties were obvious and indicated adaptation to different growing areas. Starting with the original genetic base, wheat breeders from Washington to Texas have selected for reliable productivity in their respective regions.

Another section illustrated the breeding program at K-State. Wheat breeders develop varieties by hybridizing (crossing) well-adapted varieties or breeding lines with other strains of wheat having specific, desired characteristics. These strains, often called germplasm, may be acquired from breeders in other states or countries. The Wheat Genetics Resource Center at K-State collects germplasm and transfers useful genes from wild or primitive grass species into wheat germplasm lines. The crossing is done in a greenhouse in Manhattan, but germplasm lines also are grown in fields so their characteristics can be observed.

The final display was a living pedigree showing the development of *Triticum aestivum* (the species we call wheat) and of several K-State varieties. Two primitive species hybridized naturally thousands of years ago somewhere in the Mideast to form a new species. It was domesticated by humans and became durum wheat, which is still used today to make pasta. About 6,000 years ago in northern Iran, a wild Asian goatgrass crossed with durum wheat and produced *T. aestivum*. Farmers later selected types in which the hulls threshed free of the kernels. The display included six farmer-developed varieties (land races) from southwest Asia. One of these, Turkey Red, was brought to Kansas by Rus-

Old varieties like these contributed to the development of hard red winter wheat as the major crop in Kansas.



sian Mennonite settlers and became the genetic foundation for the hard red winter wheats we grow today. The newer K-State varieties often contain genes for insect or disease resistance derived from wheat's original ancestors, which represent a storehouse of valuable genes.

Wheat and Soybean Rotations

Producers in southeastern Kansas often plant wheat after full-season soybeans or double-crop soybeans after wheat harvest. Soybean maturity has a significant effect on grain yield in both rotations and also affects wheat planting date after soybean harvest. A study at the Southeast Agricultural Research Center has examined effects of wheat and soybean rotations on yield and soil properties over a 15-year period.

Full-season soybeans have had average yields of 6 bushels per acre more than those of double-crop soybeans. However, when both types were planted at the same time, yields did not differ significantly. Yields of full-season soybeans were higher following a wheat/summer fallow rotation than following wheat/double-crop soybean. Yields have been highest with maturity group IV cultivars in both full-season and double-crop systems. Wheat following early maturing soybeans (maturity groups I and III) has yielded nearly the same as wheat following wheat.

Chloride Fertilizer for Winter Wheat

For wheat and some other cereal grains, chloride (Cl) apparently affects diseases by suppressing the disease organism or allowing the plant to withstand infection. Decreased disease pressure can lead to increased yields. Agronomists established studies in four countries in central and southeast Kansas to evaluate effects of Cl fertilization on hard red winter wheat.

Two Cl fertilizers were topdressed at three rates. Nitrogen was balanced on all fields. Leaf tissue samples were taken at the boot stage and analyzed for Cl content. Grain yields were determined, and samples were kept for analysis.

Chloride significantly increased grain yields at four of six sites and significantly increased leaf Cl concentrations at all sites. Chloride does seem to suppress or slow the progression of some diseases but does not eliminate them. Wheat responds to Cl even in the absence of disease, suggesting that some Kansas soils may not supply needed amounts of Cl. Results to date suggest that Cl responses are most likely when soil Cl levels (at 0 to 24 inches) are less than 35 pounds per acre.

Wheat Production on Acid Soils

Acid soils with high contents of aluminum (Al) have existed in south central Kansas for many years, but response to lime application was not demonstrated until 10 to 15 years ago. Awareness of potential lime response has prompted producers to do more soil testing. More than a third of the soil samples tested by the KSU Soil Testing Laboratory in 1994 were of pH 5.5 or less. With lime quarries more than 100 miles from this area, producers are interested in alternatives to increase soil pH. Researchers from the Department of Agronomy have been evaluating phosphate fertilizer to reduce Al in soils and to compare the responses of wheat varieties with different tolerances to Al.

Studies in Sedgwick County have included three rates of lime and phosphate, different application methods, and two varieties of wheat. Soil pH and Al levels and grain yields were determined.

Addition of lime even at lower rates has raised soil pH, reduced soil Al levels, and improved wheat yields. Banding P fertilizer also has been effective in improving wheat yields of acid soils. Producers should use lime when possible but consider reduced rates, banded P, and selection of Al-tolerant varieties as short-term alternatives for wheat production on acidic soils.

Phosphorus

Effects on Corn

Phosphorus (P) fertilization is essential for optimum production and profitability of corn in western Kansas. Corn plants deficient in P yield less and mature later than plants receiving adequate P. A long-term study is being conducted at the Southwest Research-Extension Center with irrigated corn to determine the effects of P and nitrogen (N) fertilizers on grain yield and moisture content at harvest. Several rates of N were used with and without one rate of P. Grain moisture

Corn receiving phosphorus fertilizer had higher grain yields and lower moisture, which both increase profits.



content was recorded at harvest and used to determine drying cost.

The optimal rate of N for irrigated corn has been 160 pounds per bushel, and addition of P has increased grain yields by about 80 pounds per bushel. The increase was less with lower rates on N. This interaction indicates the need for a balanced fertility program.

Corn was harvested at relatively high moisture levels. Earlier harvest reduces the potential for crop losses from lodging and adverse weather conditions. It also can increase marketing flexibility and crop rotation alternatives. Applications of P reduced grain moisture by an average of 5 percent. Artificial drying of corn consumes scarce natural resources and is expensive. The addition of P reduced drying costs by an average of 10¢ per bushel. The overall economic benefit of P fertilizer varied from \$125 per acre to \$200 per acre, depending on corn price. Thus, regardless of corn prices, returns on irrigated corn can be improved greatly with P fertilizer plus application of N at optimal rates.

hastened grain sorghum maturity. Accelerated crop development can improve grain yields, especially if unfavorable weather (early freeze or cool fall nights) that slows maturity should occur. Grain sorghum yields and gross farm income can be increased and fertilizer efficiency improved with the use of banded N-P fertilizer in either of those ratios.

Canola for the Great Plains

Canola is a type of rapeseed that is genetically low in erucic acid and glucosinolates. The seeds are sources of a healthful cooking oil and a high protein meal for livestock. The United States imports the equivalent of 2 million acres of production each year, so a domestic market exists for these products. Canola production would fit well into Great Plains agriculture, but poor winter survival has been a problem. However, cold-tolerant varieties have been developed and should be released in 1997.

A group of researchers throughout the Great Plains, including four in Kansas, has developed detailed guidelines for growing, harvesting, and storing canola. These include management of weeds, diseases, and insects. Cost-return projections for canola in a rotation with sorghum and fallow in western Kansas showed returns up to \$150 per acre.

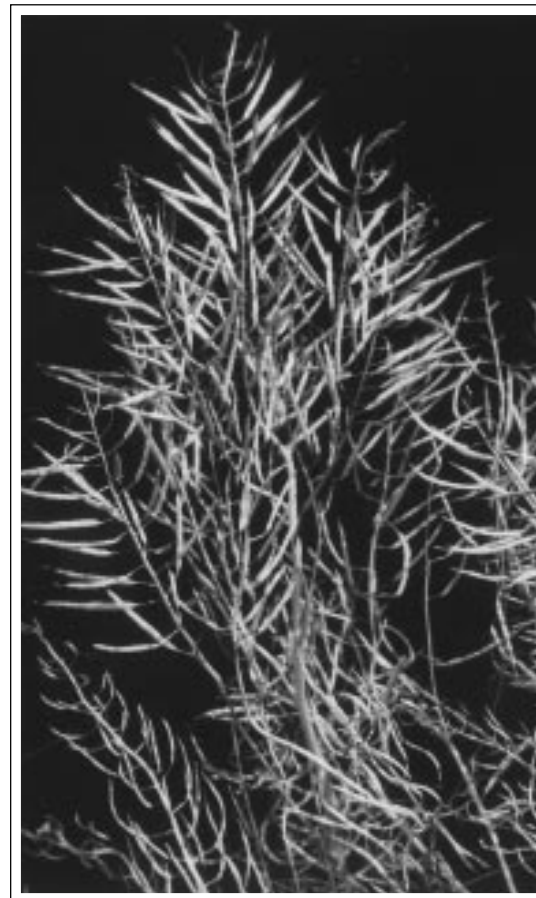


Subsurface banding of fertilizer including phosphorus can increase yields and hasten maturity of grain sorghum (above).

Phosphorus for Ridge-Tilled, Furrow-Irrigated Grain Sorghum

A 3-year experiment was initiated by agronomists near the Irrigation Experiment Field to study the effect of phosphorus (P) application method and rate on furrow-irrigated, ridge-tilled grain sorghum. Four application methods of two P rates were used at planting. Nitrogen (N) was balanced to a constant amount on all plots.

Results indicated that producers could improve the efficiency of fertilizers by subsurface banding rather than broadcasting fertilizer in a ridge-tilled cropping system. Application of N and P fertilizers in a 1:1 or a 3:1 ratio increased grain yield, whole-plant dry matter production at the 6-leaf stage, and grain P uptake. These two treatments also



New cold-tolerant varieties will allow increased production of canola (right), a source of healthful oil.

Another aspect of this research program was the establishment of two regional nurseries. The Great Plains Regional Germplasm Evaluation Nursery evaluates plant introduction lines for their potential use and value in breeding programs. The Advanced Canola Nursery evaluates material that has been selected and has potential to become new released varieties for the Great Plains. Five sites in Kansas are involved in both efforts. Results from 1994-95 rated yield, winter survival, bloom date, plant height, shattering, moisture content of seed, test weight, and oil content of seed.

With this information, the production guidelines, and the cold-tolerant varieties, Kansas producers can add this profitable crop to their rotations.

Production Systems for Sunflower

Production of sunflowers in northwestern Kansas has increased rapidly since the arrival of processing plants in the area. Studies are ongoing at the Northwest Research-Extension Center to determine the best conditions for maximum yield of this crop.

A 3-year project evaluated effects of planting date and plant population on yield. Oilseed and confectionary varieties were planted on four dates, and plots were hand-thinned to achieve several populations. Results showed that the optimum planting period for both types was from May 25 to June 5. Planting full-season sunflowers on May 10 or earlier subjected them to greater danger of damage

by severe weather or increased weed competition and lowered yield potential. Planting as late as June 17 delayed maturity and harvest. For the oilseed types, populations of 17,424 and 23,332 plants per acre (12- and 9-inch spacing, respectively, in 30-inch rows) provided equally good oil contents and yields. However, yields of larger seeds for confectionary types were improved with a lower population (13,939 plants per acre with 15-inch spacing). Significant differences did occur among varieties, so producers should consult variety performance reports before making a choice.

The rate of breakdown of crop residue is affected by the types and amounts of tillage used, especially for crops like sunflower that produce little residue. Another study is determining the effects of conventional tillage (CT) versus no tillage (NT) before planting and after harvest on sunflower residue in a rotation with wheat. In a year with above-average rainfall, preplant tillage had no effect on sunflower yield and residue. Stems accounted for about half the residue. With CT, very little wheat residue remained at sunflower planting. A complete NT system conserved 2,100 pounds more total residue than complete CT but only slightly more than the CT-NT system. Because of herbicide limitations for sunflower, CT may be needed before planting to eliminate weeds, but NT after harvest can conserve reasonable amounts of crop residue.

■ FORAGE, HAY, AND SILAGE

Tall Fescue for Southeastern Kansas

Tall fescue is a vigorous cool-season grass under southeastern Kansas condition, but much of its stress resistance may relate to an endophytic fungus. Thirteen fungus-free cultivars were tested for productivity and persistence under hay-production and intensive-clipping management systems. The latter simulated grazing. Hay also was tested for forage quality.

During 7 hay-production years, yield, crude protein content, and digestibility of forage varied among cultivars. Average fall tiller density was higher under hay management than intensive clipping, but summer tiller densities varied between management systems. Of the cultivars tested, Stef was most poorly adapted to southeastern Kansas in terms of productivity and persistence, followed by Johnstone. The most productive cultivars for hay production were Physter, Mo-96, and Festorina; the former two also

ranked high in forage quality. Medium-late to late maturing cultivars generally seemed best adapted for hay production in southeastern Kansas. Festorina and Physter usually appeared most productive under simulated grazing.

In tests in southeastern Kansas, this variety of tall fescue produced the most hay with high forage quality.



Fertilizer Effects on Eastern Gamagrass

Eastern gamagrass is a warm-season, perennial grass native to the tallgrass prairie. It has better potential for forage yield and quality than other warm-season grasses and might respond well to more intensive management practices, such as added nitrogen (N) or more harvests. Research to evaluate these practices was undertaken at the Southeast Agricultural Research Center.

Established eastern gamagrass was burned in April and then fertilized with potassium and phosphorus. Two rates of N were applied by two methods. Grass was cut once (July) or twice (June and August).

Forage yield was increased by the two-cut system in 2 of 3 years. The first rate of N increased total yield by 40 to 45 percent, and the higher rate increased it by an additional 14 to 18 percent. Application method had no effect on total seasonal yield or first-cut yield; however, second-cut yields were higher with knife placement of N than with broadcast placement at higher N rates.

Wet weather in 1995 prevented N application, but residual N from the 3 previous years increased yields by 23 percent and 12 percent, respectively, for the low and high rates. Treatments in which N had been knifed for the previous 3 years gave 15 percent higher yields than treatments with broadcast placement. However, forage yield was greater with the one-cut system.

Small-Grain Cereals for Forage

In the Great Plains, forages that supply high-quality feed in the fall and early spring can greatly extend the grazing season for beef cattle. A study was established in 1992 at the Agricultural Research Center-Hays to evaluate the forage and grain yields and forage quality of several small grains. Results through 1995 led to the following conclusions.

Because Hessian fly and wheat diseases are not problems with fall-planted winter rye or triticale, these crops could be planted from mid-August to mid-September, thus providing substantial fall grazing. A blend of winter rye and winter triticale should provide good fall grazing (primarily from the rye) and substantial spring grazing (primarily from the triticale).

If winter rye or triticale is included in a blend, high intensity grazing or removal as hay in the boot stage is recommended, so that field contamination of succeeding crops is reduced. Destroying the crop soon after haying or grazing in the spring also is recommended.

Depending on the rainfall area of the livestock producer, destroying the crop in May and planting a fall small grain cereal in mid- to late-August are quite possible.

Fall-planted cereals will produce more dry matter than spring-planted cereals. Previous trials have shown that grazing of small-grain cereals often delays maturity. Thus, late spring freezes occurring on fields that have been grazed should not greatly affect putting up hay in May or early June. The choice of cereal grain for grazing or hay will depend on the quality required for a particular cattle feeding operation. Additional costs for protein supplementation need to be considered when selecting a high-yield, low-protein variety. Additionally, higher acid detergent fiber values generally will be associated with lower average daily gain of cattle consuming the forages.

Grain Content of Sorghum Silage

Grain sorghum hybrids usually are selected for grain yield potential and for silage traits. However, previous research in the Department of Animal Sciences and Industry has shown that sorghum hybrids (both grain and forage) with a high proportion of grain in the whole-plant dry matter are nutritionally superior to those with a low proportion of

Sorghum varieties with a high proportion of grain in their total dry matter make more nutritious silage.





A cover or roof on a horizontal silo will greatly reduce dry matter losses and preserve silage quality.

grain. A follow-up study was designed to determine the optimum grain content in sorghum silage.

Stover and grain of a grain sorghum hybrid were harvested and chopped separately. The grain was added to the stover at four levels, and an all-stover silage also was used. The silages were stored in 55-gallon, pilot-scale silos for 90 days. Because quantities were too small for cattle, the silages were fed to sheep. Rations contained 90 percent silage and 10 percent supplement.

All silages were well preserved and showed minor variations in chemical composition. Dry matter intake by sheep and nutrient digestibilities increased with high levels of grain in the silage. Thus, the optimum amount of grain would be at least 48 percent of the dry matter (the highest level used in this study).

Top Spoilage in Alfalfa Silages

Large horizontal silos (bunkers, trenches, and stacks) are economical for storing large quantities of ensiled feeds, but most of the silage is exposed to the environment. In a silo with about 1,000 tons capacity, up to 25 percent of the original silage mass is within the top 3

feet. Previous studies showed that a covering of polyethylene sheeting reduced dry matter (DM) losses. Researchers in the Department of Animal Sciences and Industry compared the effects on alfalfa silage of combinations of sealing with polyethylene and covering with a roof. Treatments were established in farm-scale bunker silos and in pilot-scale silos (55-gallon drums). Thermocouples were placed in the silos at various depths to record temperatures, and samples were removed at various times for analysis.

Sealing silage with and without a roof dramatically reduced DM losses and storage temperatures in both sizes of silos. In the unsealed silos, silage was of unacceptable quality at depths above 20 inches. Placing a roof over the unsealed farm-scale silos also reduced silage DM losses, particularly at the 10-inch depth, and maintained high temperatures for a longer time. Sealed silages had higher nutritive value than unsealed silages; addition of a roof had no significant effect. Delayed sealing of pilot-scale silos (7 days after filling) greatly improved preservation efficiency in the top 36 inches of silage. These results confirmed previous work showing the importance of covering silage to preserve quality.

■ ORNAMENTALS, GRASSES, AND TREES

25 Years of Research

The Horticulture Research Center in Wichita celebrated its 25th anniversary in 1995. The woody ornamental research program includes the introduction, evaluation, and sometimes propagation of plant materials that have shown superior performance in adaptability and offer potential for landscape use in south central Kansas. Over 50 accessions can be received in one year.

Long-term research projects have involved osage orange, flowering dogwood, crabapples, evergreen azaleas, boxwood, yew, holly, crape myrtle, and maples. Achieve-

ments include a thornless osage orange (cultivar Wichita), a hardy flowering dogwood (cultivar Ozark Spring), and the Caddo maple with brilliant autumn color.

A heat- and drought-tolerant Asiatic maple has been the focus of some recent studies. The Shantung maple was introduced from northern China and was sent to Wichita from the USDA Regional Plant Introduction Station in Ames, IA. It provides a display of color throughout the growing season: yellow-green flowers in spring followed by reddish-purple leaves that change to dark green during the summer and then develop autumn colors ranging from yellow to maroon.



The Caddo sugar maple is one of the many woody ornamental plants developed at the Horticulture Research Center.

The center also conducts research on ornamental and turfgrasses. This includes participating in national cultivar trials for tall fescue, buffalograss, and bermudagrass. Bentgrass and zoysiagrass are evaluated on a smaller scale.

Research at the center helps support the \$50 million horticultural industry in the Wichita area. A recent private donation of 40 adjacent acres doubles the area of the center and will allow expansion and improvement of studies on woody ornamentals and turfgrass.

Ornamental Sunflowers

In recent years, seed companies have marketed many varieties of smaller sunflowers suitable for use as cut flowers. A horticulturist evaluated field production and post-harvest life of 33 cultivars. Size of plants and size and color of flower heads were noted. Cut flowers were placed in containers of water only or a solution of flower preservative and held at room temperature under fluorescent lights.

Yields varied widely, partly because of weather conditions and insect damage. Vase life in days ranged from 13.3 to 5.5 with water and from 14.7 to 5.3 with preservative. These results will help Kansas producers choose the best sunflowers to grow for the cut-flower market.

Peonies for Fresh and Dried Display

Freeze-drying is a relatively new technique to preserve flowers and maintain their color for use in arrangements and wreaths. The market for these flowers is increasing. Peonies are popular cut flowers and grow well in Kansas. A researcher in the Department of

Horticulture, Forestry and Recreation Resources has established a trial of 82 cultivars with red, pink, and white flowers. Commercial-size beds of two cultivars were added to provide flowers for postharvest evaluations. Harvest date and yield were recorded. Cut flowers were placed in water and held at room temperature, in cold storage, or in a controlled atmosphere of oxygen and carbon dioxide. Flowers of 30 cultivars were freeze-dried and then measured for moisture content, stem strength, and flower strength.

After 3 years, most plants have not reached their full production potential, and cold, wet weather delayed or damaged flowers in 1995. Yield varied considerably among cultivars. Many cultivars had an acceptable vase life of 7 days. Storage generally decreased vase life, and the controlled atmosphere gave only a slight improvement at 4 and 8 weeks. Cultivars varied widely in strength after freeze-drying. The white flowers of James Pillow and the red flowers of Shawnee Chief were the most durable, but many others were acceptable. Producers have a wide choice of peonies to grow for fresh or dried flowers.

Turfgrass Management

Planting Methods. Horticulturists conducted a survey of contractors, landscapers, and turfgrass managers in Kansas and four nearby states. They wanted to determine how much money the turfgrass industry spends annually on planting/maintenance; what percentage of grass is planted by sodding, seeding, and hydroseeding; what factors are considered in the choice of planting method; and what types of areas are most favorable for planting by the three methods. Over 1200 responses were received and analyzed.

Results showed that the most money was spent for turfgrass on golf courses and on roadsides. Within the turfgrass industry, landscapers used the most sod. Golf courses and ground maintenance used mainly seed. Use of hydroseeding was fairly low, but roadside establishment was the biggest user. The four lowest spenders (schools, athletic fields, lawn maintenance, and parks) used the lowest percentages of sod. Size and visual impact of the area were the major factors in the choice of planting method. Availability of irrigation also was important, and intended use of area and quality needed ranked in the middle. Cost ranked low for all groups.

This survey will help turfgrass researchers and dealers to provide materials and information that the industry needs.

Plant Growth Regulators. Traditionally, plant growth regulators (PGRs) have been used to suppress vegetative or reproductive growth of turfgrass on sites where high quality turf is not required. Their use on golf course turf is increasing. Some studies have suggested that PGRs may enhance turfgrass drought resistance by reducing evapotranspiration or increasing rooting.

Researchers in the Department of Horticulture, Forestry and Recreation Resources applied three PGRs to perennial ryegrass and measured response in comparison to an untreated plot. Data were collected on turf quality, clipping dry weight, canopy height, canopy temperature minus air temperature, relative water content, leaf osmotic adjustment, and soil moisture extraction.

Perennial ryegrass quality was acceptable with three of the PGRs, and clipping weights and canopy heights were lower with two of them. Canopy temperature minus air temperature was increased by two of the PGRs; this indicates that the turf is under stress and unable to cool itself effectively by transpiration. Measurements of water relations showed no significant effect of PGRs. Overall results identified one PGR (trinexapac-ethyl) that suppressed shoot growth without adverse effects and deserves further study for use in Kansas.

Susceptibility of Junipers to Diseases

Junipers continue to be major components of the urban landscape in Kansas, because they tolerate a wide range of sites and rapid temperature fluctuations. Unfortunately, several fungal diseases and insect problems may adversely affect the appearance and health of these trees and shrubs in certain years. Juniper selections are highly diverse, not only in shape and color but also in their relative susceptibility to various diseases. Therefore, a plant pathologist and a horticulturist cooperated to establish plots of 36 juniper cultivars in Manhattan and Wichita. They were observed and rated for susceptibility to four fungal diseases. The wet springs of 1993 and 1994 encouraged development of these diseases and allowed a rigorous rating.

Cedar-apple rust and Kabatina tip blight were the most common diseases. Both caused damage but did not kill plants. Most *Juniperus virginiana* cultivars were susceptible.

Cercospora needle blight was severe on several cultivars of *J. scopulorum*. Planting trees in an open area with plenty of air movement will help control this disease. Several of these cultivars also were susceptible to



Botryosphaeria canker (Sky Rocket, Sparkling Skyrocket, Blue Haven, Wichita Blue, Cologreen, Moonglow, and Medora). These should be avoided, because the disease can cause considerable damage in a short time, and affected branches must be removed.

Most selections of *J. chinensis* were relatively free of the fungal diseases. Some examples are Ames, Mountbatten, Robusta Green, and Spartan. Incorporating junipers of this group in a landscape design would reduce pesticide use and disfiguring fungal disease.

Intercropping Trees and Vegetables or Forages

Agroforestry is the general term for growing trees and crops together. Annual crops can provide income until the trees are large enough to harvest. Horticulturists and a forester collaborated to determine the costs and benefits of growing a fine hardwood (walnut) with Scotch pine (harvestable at a younger age) and various annual crops.

Research on turfgrass varieties and management provides useful results for an expanding industry in Kansas

An annual crop like muskmelon grown between rows of hardwood and pine trees can provide income until trees mature.



A 3-acre site was planted with alternate rows of walnut and pine trees. A herbicide and two fabric barriers were compared for weed control on sections of the alleys between the trees. The remaining areas of the alleys were planted with tomatoes, muskmelons, pumpkins, soybeans, or smooth brome. Black plastic mulch and drip irrigation were used for the vegetables.

During the study period, overall survival was better for the walnut trees. Both tree species grew equally well with the fiber weed barriers, but walnut trees were 40 percent shorter when herbicide was used. Yields of all crops were high.

■ PEST AND DISEASE MANAGEMENT

The cost for establishing only trees on this site would be \$700 per acre; planting trees in rows reduced the cost to \$125 per acre. The annual, gross, wholesale incomes ranged from \$1,999 to \$5,400 per acre for vegetables, \$148 per acre for bromegrass, and \$220 per acre for soybeans. However, these high incomes for the vegetable crops required intensive cultural practices and much labor input. The study period did not include harvesting of pine trees for sale.

An agroforestry system like this clearly can provide income while producers wait for hardwood trees to mature. Trees can be profitable alternative crops.



A new biotype of greenbug has appeared in Kansas and threatens grain sorghum.

A New Greenbug

A greenbug collection from Haskell County has yielded a new biotype that can injure grain sorghum resistant to the previously known biotype I. Entomologists and a sorghum geneticist at the Agricultural Research Center–Hays conducted further tests with this new biotype K. In a greenhouse study of 129 sorghum hybrids, 83 appeared resistant to biotype E, four were resistant to biotype I, and only one was resistant to both I and K. Tests of other sources of greenbug resistance again identified four that were resistant to biotype I; two of these also showed resistance to K.

Because greenbugs also are major pests of small grains, tests were conducted to compare resistant and susceptible entries of wheat, barley, oat, and rye. All of the genotypes that were resistant to biotype I also showed resistance to biotype K.

Biotype I seems to be replacing biotype E in the field, so sources of resistance to I are used

widely in sorghum breeding programs. Because the most common source is susceptible to biotype K, this new form is likely to increase in the future. As yet, not much is known about the prevalence and distribution of K. Fortunately, the greenbug resistance currently used for breeding small grains remains effective and can be utilized even if biotype K becomes dominant. The sorghum hybrids showing some resistance need to be evaluated further and perhaps used to prevent widespread occurrence of biotype K.

Controlling Soybean Cyst Nematodes

The soybean cyst nematode (SCN) is the most serious threat to soybeans throughout much of the United States. It was first found in Kansas in 1985 and has spread to at least 15 counties, mostly in the eastern part of the state. The SCN is a tiny worm that lives in the soil. Juvenile nematodes can travel short distances and infect root tips of soybean plants. Females remain attached to the roots and form cysts that each contain 100 to 200 eggs. Any agent that can move soil (flood waters, farm equipment, birds) can introduce the cysts. Only a few can infect a whole field.

Complete eradication of SCN is difficult, so control involves methods to keep populations below a level that can severely reduce crop yields. Chemicals usually provide only temporary reductions. A researcher in the Department of Plant Pathology is involved in a long-term project to determine the best control measures for different areas of Kansas.

Results so far show that planting resistant cultivars of soybean and crop rotation are the best management options. A resistant variety can be alternated with a nonhost crop (corn, grain sorghum, or alfalfa). Wheat is also a nonhost, but the rotation must include a fallow period to reduce SCN populations be-

tween soybean crops. Different resistant cultivars should be used, because repeated exposure to SCN can break down resistance.

The research also includes screening soybean varieties for SCN resistance and collecting soil samples from infected sites in Kansas to measure population densities and characterize the races. This will help find the best control for each infected area.

Wheat Streak Mosaic Virus Attacks New Crops

The wheat streak mosaic virus (WSMV) is an important pathogen of wheat in western Kansas. The virus is carried by the wheat curl mite, which sometimes also infects barley, corn, and rye. In 1994, pearl millet and grain sorghum plants at the Agricultural Research Center-Hays showed signs of WSMV infection. Field and greenhouse studies were done to verify the cause.

Viruses were isolated from the symptomatic plants and from wheat. Antiserums were prepared against WSMV and several other viruses. Plants with symptoms showed a positive reaction only to WSMV antiserum. When sorghum and millet were grown in a greenhouse and mechanically inoculated with WSMV, they developed typical symptoms and had a positive immune reaction. Inoculation of different sorghum lines showed that they differed in susceptibility and also that various WSMV isolates differed in their ability to infect.

These tests proved that WSMV was the cause of the infection in pearl millet and grain sorghum at Hays. This was the first known occurrence of the pathogen on these crops. The

problem could become more widespread, if susceptible sorghum lines are planted widely. Mites carrying the virus could migrate from ripening wheat into young sorghum plants.

Chitinases for Pest Control

Chitin is a complex chemical that occurs in the cuticles of insects, cell walls of fungi and some algae, some nematodes, mollusks, and other organisms. However, it is not present in higher animals or plants. Enzymes that can break down chitin are called chitinases and also occur in many organisms. Biochemists at K-State have been studying chitin and chitinases in insects to characterize them and to discover more about what they do and how they interact. They know that a certain amount of chitin must be maintained during each stage of insect development, and an excess or a deficiency can have adverse effects. Thus, chitinases have potential to serve as selective insecticides applied directly.

They also could control insects as constituents of transgenic plants. Plant pathologists have collaborated in tests of tobacco plants containing a chitinase gene. They had far less damage from feeding by tobacco budworms than normal plants.

Chitinases could enhance biological control agents. A recombinant virus with a chitinase gene killed larvae of fall armyworm faster than the unaltered virus. Because fungi contain chitin, these enzymes also could be used to control some plant diseases.

Research will continue with the goal of developing successful pest control agents using these naturally occurring enzymes.



The first occurrence of wheat streak mosaic virus on pearl millet and grain sorghum was confirmed at Hays.

■ PRAIRIE RESEARCH



Grazing by bison increases plant species diversity in the tallgrass prairie and affects plant growth differently than cattle grazing.

Plants in the legume family thrive in annually burned prairie and are important contributors of nitrogen to the soil.

Bison Grazing

Since the reintroduction of bison to Konza Prairie Research Natural Area several years ago, researchers in the Division of Biology have been studying their effects on the vegetation.

One 4-year project determined how their grazing affected the floristic composition and diversity in the tallgrass prairie. Sites with different burning frequencies and grazing treatments were sampled.

The cover and frequency of cool-season grasses and sedges and some forbs (broad-leaved herbs) were higher in grazed areas, but the dominant warm-season grasses (e.g., big bluestem) and other forbs decreased. Responses of other plants varied depending on fire frequency and soil type. Plant species di-

versity was increased significantly by bison grazing on all sites, probably because of greater microsite diversity generated by the animals. This effect increased with larger areas and was greater in annually burned than in periodically burned areas. However, preferential grazing of the dominant grasses and increases in other species resulted in similar species abundances.

Comparison of Bison and Cattle Grazing

Availability of bison on Konza Prairie also allows comparison with cattle, which have grazed selected areas for many years as part of the management program. Ecologists sampled populations of five major perennial plants in ungrazed and grazed areas with two burning frequencies.

The results showed that plant responses to grazers are complex and vary significantly among plant species, grazers, fire regimes, and life history stages of plants. Three species showed increased growth and production in grazed sites in response to selective grazing of warm-season grasses. Others showed reduced performance, probably related to disturbances by the animals, because these plants were not grazed. Effects of grazers on patterns of flowering and seed production did not correspond to effects on population densities. This indicated that variation in sexual reproduction plays a minor role in regulating local population abundances. Effects on plant growth and production from cattle and bison grazing were significantly different.

Effect of Fire on Legumes

The legume (pea-bean) family is a major component of the tallgrass prairie. Fire is used to maintain the prairie; annual burning favors warm-season grasses and usually reduces forbs. However, the specific response of common legumes to fire has not been determined.

Researchers in the Division of Biology sampled and analyzed 10 species of legumes in four ungrazed pastures on Konza Prairie, two that were burned annually and two that had been unburned for many years.

Results showed that total legume density was higher in annually burned sites. Nine of the species either tolerated or were favored by annual burning. The increase in density could be interpreted as a positive response to fire or an inhibition of these species in the unburned pastures by environmental conditions. Leadplant, the most common legume, showed a clear positive response; fire stimulated vigorous resprouting that increased stem density.



Annual burning did not affect total legume biomass. However, two species did show increased biomass in burned pastures.

Legumes fare well in burned prairie because they can tolerate both the direct effects of fire and the chronic nitrogen deficiency in burned soils. They have the ability to fix atmospheric nitrogen and convert it to a usable form. Thus, they may play a major role in the nitrogen budget of annually burned, tallgrass prairie. Despite these advantages, they are not the most abundant forbs. Periodic drought and competition with grasses probably prevent them from dominating.

Nematodes in the Prairie

Nematodes are important constituents of prairie soils and can indicate ecosystem conditions. Root-feeding and fungal-feeding species are most common. As part of a long-term study on Konza Prairie, a plant pathologist evaluated the effects of annual burning, mowing, and fertilization on the nematode community.

Populations of obligate herbivores (plant feeders) tended to increase with annual burning and nitrogen fertilization, but the response varied with structure and composition



Several kinds of tiny worms called nematodes are abundant in prairie soils and show different responses to management regimes.

of the vegetation in those treatments. This group was reduced consistently by mowing. Populations of root/fungal-feeding nematodes showed short-term decreases after burning and long-term increases after mowing. Species feeding on microbes increased with burning and nitrogen fertilization. These results showed that the composition of the nematode community, especially the proportion of herbivores and the ratio of fungal-to microbe-feeders, was a good indicator of ecosystem responses to management practices.

■ ENVIRONMENTAL AND SAFETY ISSUES

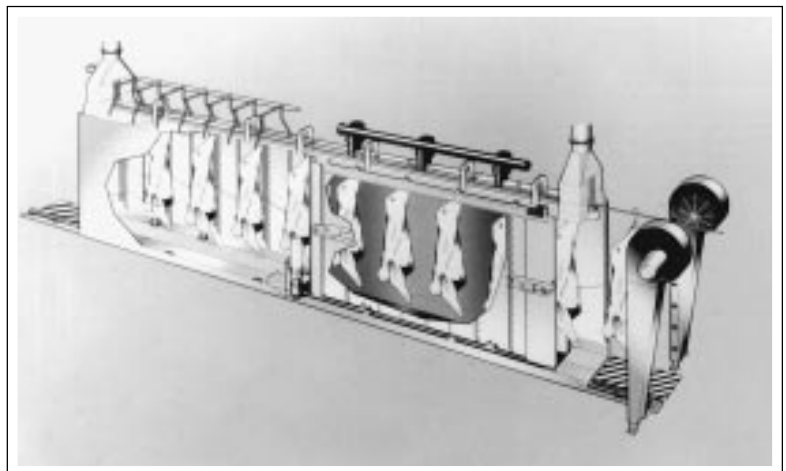
Steam Pasteurization

Bacterial contamination of beef carcass surfaces is an unavoidable consequence of processing cattle into meat for human consumption. This contamination can come from processing equipment, workers, and the environment, but the primary source is the animal. The hide, hooves, intestinal contents, and milk can harbor large numbers of bacteria, some of which are likely to be pathogenic. Therefore, all such visible contamination must be removed from the surfaces of beef carcasses. Several methods have been used with varying success. New technology includes high temperature vacuum and steam pasteurization.

Hot water/steam vacuum systems are designed to remove visible spots of contamination from small areas on the carcass and are used to augment the traditional knife trimming. Steam pasteurization is a process whereby beef carcasses are placed in a slightly pressurized, closed chamber at room temperature and sprayed with steam that blankets and condenses over the entire carcass. This raises the surface temperature to 195 or 200°F and kills nearly all pathogens. Carcasses then are sprayed with cold water.

The inventors of steam pasteurization contacted the Department of Animal Sciences and Industry for small-scale testing. The process effectively killed nearly 100 percent of pathogens deliberately introduced on the surface of meat, including *Escherichia coli*. Commercial testing at a meat-packing plant was equally successful. Other tests indicated an advantage to combining several methods. Knife trimming and/or steam spot vacuuming can be used to remove visible contamination before steam pasteurization.

Spraying beef carcasses with steam in a closed chamber kills nearly all pathogenic organisms on their surfaces.



This new technology already is being used by several packing companies and will greatly improve the safety of our meat supply.

Use of Low-Dose Irradiation for Meat Safety

Recent events involving contaminated meat products have increased consumer awareness of food safety. Irradiation is one way to reduce contamination, especially when combined with good manufacturing practices. Studies have shown that consuming food irradiated with up to 10 kilograys (kGy) presented no health hazard. Although the effects of irradiation on microorganisms are well known, few studies have considered effects on meat quality. A group of researchers in the Department of Animal Sciences and Industry decided to evaluate those effects as well as consumer acceptance of irradiated pork chops.

Center-cut, boneless, pork chops were vacuum-packaged or aerobically packaged

(with air), chilled or frozen, and shipped to an irradiation facility. They were divided into groups that were irradiated at different doses up to 3.85 kGy; the control group was exposed to the same conditions but not irradiated. Packages were shipped back to KSU and stored at refrigeration or freezing temperatures for 60 hours before analysis. Chops were cooked and presented to a consumer panel for evaluation of overall acceptance and quality and to a professional panel for evaluation of specific aroma and flavor attributes. Cooking loss and internal color also were measured. Raw packaged chops were displayed under lights for 3 to 21 days and tested for presence of microorganisms and rancidity.

Consumers noticed no difference in overall quality between irradiated and nonirradiated chops. A number of flavor and aroma notes were affected by irradiation, but they received very low scores on the 15-point scale. Cooking loss was not affected by irradiation or packaging. As expected, irradiation decreased numbers of microorganisms. Irradiated, vacuum-packaged chops had a more intense and stable red color. Rancidity during storage was greater in aerobic packaging, even with irradiation.

These results indicate that low-dose irradiation can be used to control microbial contamination of pork chops without affecting quality. Consumers' positive reactions in this study show a potential for market acceptance of this technology.

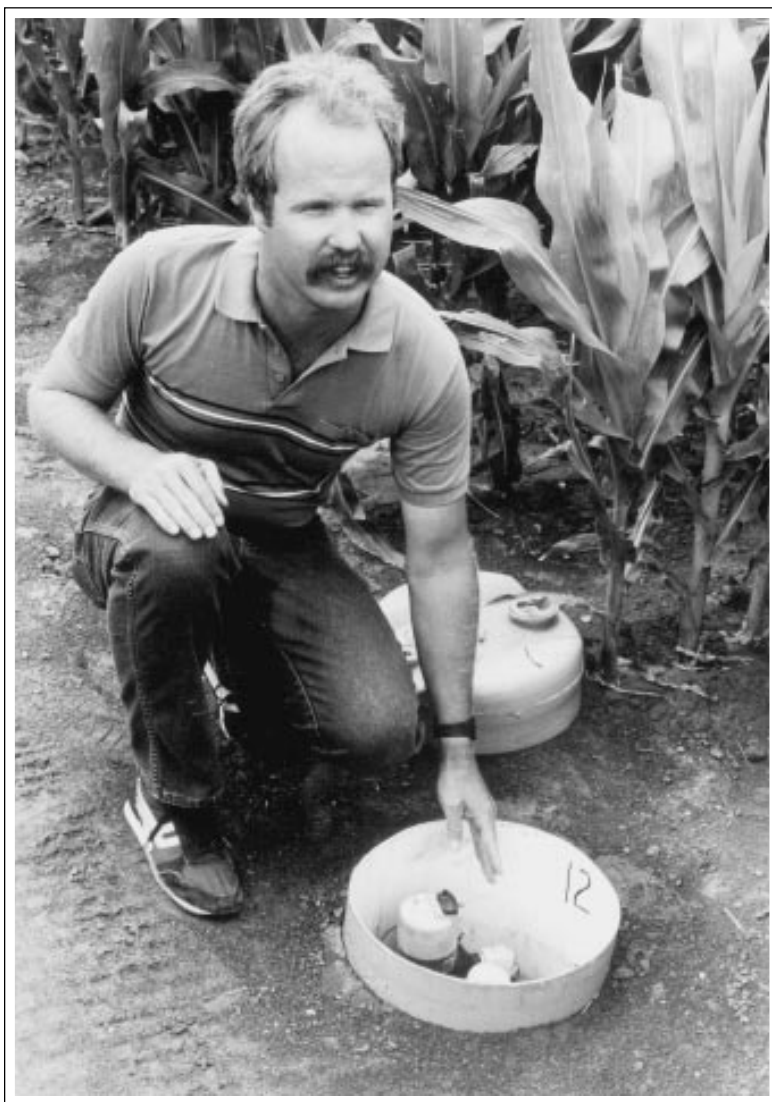
Subsurface Drip Irrigation for Corn

Subsurface drip irrigation (SDI) systems can uniformly apply very small amounts of water on a frequent basis and also prevent runoff. They can be used for deficit irrigation (applying less water than the plant normally uses) without greatly affecting crop yields. Deficit irrigation might have advantages in alleviating diurnal water stress with small amounts of water applied at a particular time of day.

A researcher at the Northwest Research-Extension Center designed a study with six deficit-irrigation treatments plus a fully irrigated control. Treatments were applied at 9 a.m., 1 p.m., and 5 p.m. daily every 3 days for different periods of time.

In 1994, yields tended to be lower for treatments irrigated later in the day. Yield was highest for the fully irrigated treatment but not significantly different from yields for the treatments deficit-irrigated at 9 a.m. In 1995, no statistically significant differences occurred in yields among treatments, but yields were low because of poor growing conditions.

Subsurface drip irrigation is controlled and monitored by units along the edges of fields.



Water use results showed that corn in the deficit treatments was able to slowly mine water from the soil profile as the season progressed. This is advantageous, because it reduces the potential for leaching and increases the potential for precipitation storage during winter.

Applying Fertilizer via Subsurface Drip Irrigation

Groundwater quality is a major concern in the United States. New fertilization practices are needed that reduce contamination of water by chemicals. A subsurface drip irrigation (SDI) system can apply both water and nutrients near the crop roots. A study at the Northwest Research-Extension Center evaluated effects of six levels of nitrogen (N) fertilizer (0 to 240 pounds per acre) applied through SDI on production and water use of corn.

With excellent growing conditions in 1994 and applying irrigation water at less than the full amount, corn yields were highest (250 bushels per acre) with 160 pounds of N per acre. Growing conditions were poor in 1995, but water was saved and the highest yield (208 bushels per acre) again was achieved with that amount of N. The yield plateaus coincided with plateaus for N uptake by plants and water use efficiency. These results showed that high-yielding corn production also can be efficient in nutrient and water use.

Low Pressure In-Canopy Irrigation

Low pressure in-canopy (LPIC) irrigation is gaining popularity in the central High Plains because it reduces evaporation loss and energy costs. However, runoff can be a problem when field slopes exceed 1 to 2 percent. A 20-year study was done at the Southwest Research-Extension Center to examine degradation of implanted reservoirs, irrigation frequency, and performance of various in-canopy application modes.

Corn was planted in fields with various slopes, and reservoir tillage was installed in all plots. Nozzles were placed about 2 feet above the ground, and four application modes were used. Soil water and volume of implanted reservoirs were measured, and yield of corn was determined.

The implanted reservoirs in the nozzle row had nearly no storage volume left by early August when the concentrated application modes of bubble or double-ended sock were used. Nozzles spaced 5 and 10 feet apart and operated in the flat-spray mode helped to retain 35 percent of the initial storage volume of the reservoirs at the end of August. Corn

yield was generally lower for the treatments where storage volume was reduced and greatest when field slope was low and the flat-spray mode was used.

Runoff Contaminants from Reduced-Tillage Systems

The Delaware River Pesticide Management Area was established to reduce the amount of atrazine in drinking water within the watershed and for downstream users. Because atrazine moves primarily in the solution phase, incorporation has been stressed heavily as a method to reduce concentrations in runoff water. However, other education efforts in the area have focused on reducing soil erosion by residue management utilizing no-till cropping systems. Surface-applied herbicides are susceptible to movement with surface water from untilled fields. Research has been done at the Cornbelt Experiment Field to compare runoff and contaminants from three tillage systems that vary in residue management and placement of chemicals.

Treatments were no-till, one pass with a tillage implement after chemical application, and conventional tillage (disking corn stubble in the spring and a pass with a disk and field cultivator after chemical application). Atrazine and two other herbicides were applied with liquid fertilizer. Runoff was measured with ultrasonic sensors, and samples were collected for analysis.

Sediment losses and soil losses were greatest from the conventional tillage treatment in both years. In 1994, runoff amounts did not differ among tillage treatments, but in 1995, the no-till system had less runoff. Atrazine concentrations were substantially greater in runoff from no-till fields. Herbicide concen-

Leaving crop residue on the ground can reduce runoff of water containing herbicides and fertilizers, which pollute ponds and streams.



trations declined with each successive runoff event from all tillage treatments. Phosphorus and nitrogen concentrations in runoff water also were higher from no-till fields where the fertilizer remained on the surface. Amounts were enough to have an impact on algal growth in streams, farm ponds, and lakes.

Farmers must reduce soil erosion and protect the environment from the chemicals that are necessary for crop production. Tillage equipment that incorporates herbicides and fertilizers while maintaining substantial residue amounts on the soil surface can reduce losses of both sediment and chemicals in runoff water from fields.

Wheat temperatures were lowered by an average of 19° F in 2 weeks following harvest in bins equipped with an aeration controller. Aerated bins had significantly fewer insects in July and September compared to nonaerated bins. By November, two thirds of the aerated bins had no insects. Wheat quality characteristics were maintained in the aerated bins at all sites. In addition, this IPM strategy using aeration controllers appeared to be more cost effective than controlling stored-grain insects with chemicals or using no control (and receiving a discount when wheat is sold).

Biodegradable Films Reduce Waste

Packaging materials represent 25 to 50 percent of total garbage from households. So biodegradable packaging materials would reduce landfill waste substantially and would provide new value-added products. A researcher in the Department of Foods and Nutrition has developed a film from wheat gluten.

The gluten was spray dried and flash dried under various conditions. Flash drying produced smaller particles that improved mechanical and barrier properties. Films prepared under acidic conditions were thinner but stronger. The gluten films were similar to plastic films in tensile energy, elasticity, and other important properties. Eggs coated with wheat gluten film maintained grade A quality for 28 days of storage at room temperature.

In addition to being biodegradable, these gluten films are edible. They could be used to extend the shelf life of perishable fruits, to separate sauce and crust in frozen pizza, or to wrap sandwiches for microwave heating. Other uses include garbage bags and shrink wrap. Research continues to vary the thickness, water solubility, and flavor of the wheat gluten films.



Automatically controlled aeration of storage bins (above) reduces insects in wheat and saves money.

Use of Aeration Controllers in Farm-Stored Wheat

For years, Cooperative Extension Service (CES) personnel have stressed a chemical-based management system for preserving the quality of farm-stored wheat. However, research performed by KAES scientists has documented that the use of aeration as the basis of an integrated pest management (IPM) strategy for controlling insects in farm-stored wheat is highly effective. Public concern about the presence of pesticide residues in the food supply and a commitment by the federal government for 75 percent adoption of IPM by the year 2000 heighten the need for Kansas farmers to adopt this technology. A project involving AES and CES personnel from the departments of Grain Science and Industry, Entomology, and Biological and Agricultural Engineering plus cooperating farmers demonstrated the use of aeration controllers to facilitate cooling of farm-stored wheat at 16 locations across Kansas. These controllers turn on the bin's fan when the outside air temperature reaches a predetermined set point.

Plastic wrap on food products (right) may be replaced by a biodegradable film.



■ NEW TECHNOLOGY

A New Tool for Cheese Making

The making of Cheddar cheese involves nine major steps. Except for two tests for acidity, cheese makers still rely on subjective judgment to determine the completion of each step. Near infrared reflectance spectroscopy (NIRS) has been used to analyze grains, feeds, meat, and other agricultural products. It can be applied for continuous monitoring of composition of materials. Researchers in the Department of Animal Sciences and Industry evaluated this new technology for determining the quality of curds during the making of Cheddar cheese.

Samples of curds were collected from three steps of cheese making, and each sample was divided into two subsamples for analysis by chemical methods and NIRS. Contents of moisture, protein, fat, and lactose were measured.

Correlations between the two methods were good. As the cheese making progressed towards the final step, moisture and lactose contents decreased, while protein and fat contents increased. Further refinements could identify critical levels of these components that indicate the termination of the three steps tested. The NIRS method could determine contents of the four components simultaneously and rapidly, so cheese makers would know exactly when to move on to the next step.

Improved Measurement of Sap Flow

Measurements of sap flow in intact stems of plants helps quantify biophysical relationships governing water transport in the crop-soil-atmosphere continuum. A single-heater gauge has been used to measure sap flow but requires calibration and further processing of the data collected. An agronomist has developed and tested a dual-heater gauge.

The new design was tested on corn plants grown in a greenhouse and compared to the single-heater gauge. Experimental conditions provided a wide range of sap flow and water flux over a 5-day period.

The dual-heater gauge determined sap flow more accurately and more rapidly. Measurements were obtained within 5 minutes after the gauge was attached to the plant stem. This time could be shortened by improvements in heater controllers and software. This gauge could be used as a hand-held instrument to measure many plants in the field. It also is easier to build and consumes less energy than the original gauge.

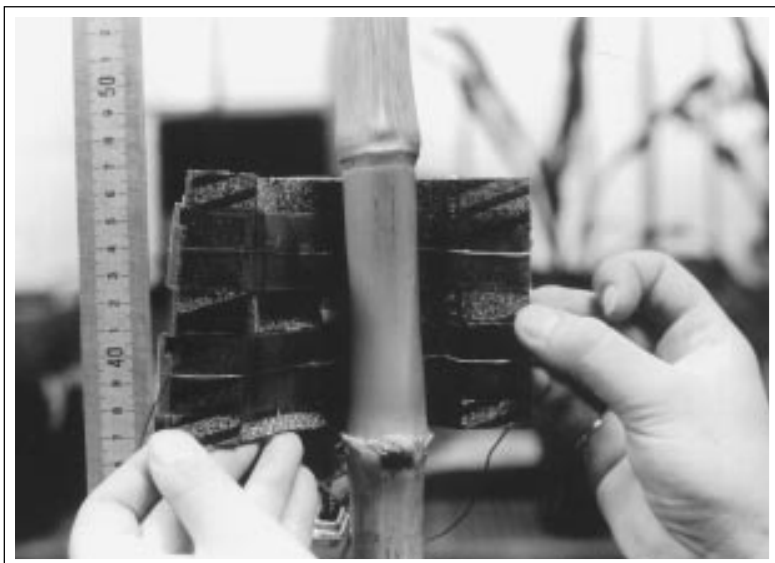


Software for Water Management

Increased competition for water, declining groundwater supplies, and possible contamination of groundwater by drainage of water and dissolved chemicals dictate a need for proper management of water in crop production. An understanding of interrelationships among soil water supply, drainage, evapotranspiration (ET), and crop yield is essential for efficient water management. Simulation models are useful for observing and understanding these interrelationships. Therefore, a group including agronomists, agricultural engineers, an agricultural economist, and a weather data librarian developed a water balance model and then a microcomputer software package to illustrate the effects of water conditions on drainage, ET, and crop yield.

New technology that can analyze samples simultaneously for major variables will improve cheese making.

A new dual-heater gauge can rapidly measure sap flow of individual plants in the field.





Measurement of forage production to determine stocking rates and range conditions can be done rapidly with a radiometer.

The Windows-compatible, microcomputer, software package (KS Water Budget v. T1) includes corn, grain sorghum, sunflower, and winter wheat. The software allows users to study the effects of irrigation system efficiency, water application timing and amount, and water conservation under dryland conditions. Daily crop ET, drainage, and available soil water are illustrated in graph form. Total drainage and ET for the crop and noncrop seasons and estimated seed yield are presented in a summary table.

The software was developed from data on climate, soil (Ulysses silt loam), and crop yield-ET collected near Tribune, KS. It is meant to be used as an educational tool for illustration of water's influence on crop production in the region of western Kansas-eastern Colorado with deep silt loam soils developed from loess.

Radiotelemetry to Detect Estrus in Heifers

Failure to detect estrus or misdiagnosis of estrus accounts for an estimated annual loss of \$300 million to the U.S. dairy industry. Insufficient time allocated to estrus detection contributes to lower efficiency and missed periods of estrus. Many detection aids have been developed and sometimes improve detection efficiency when used in conjunction with visual observation. One of the newer aids is a radiotelemetric, pressure-sensitive device that attaches to the rump of the female and interfaces with a microcomputer. Such a device was tested by animal scientists in several experiments and compared to visual observation.

Use of the device increased the efficiency of estrus detection in estrus-synchronized heifers. This was especially true for heifers that had fewer standing events and (or) shorter

duration of standing activity, in which estrus was missed by visual observation at specific periods. A radiotelemetric system provides around-the-clock monitoring of standing activity and also can increase the accuracy of detected estrus, depending on the skill of those making visual observations. Such a system would be useful and reliable in various applications where behavioral estrus is an important end point, as well as potentially increasing the occurrence of pregnancy per unit of time.

Radiometric Measurement of Forage Production

Measurement of pasture forage production (biomass) is essential for determining proper stocking rates and range condition. Current methods involve hand-harvesting of forage in some defined area. This procedure must be repeated many times to adequately characterize the amount of forage in an entire pasture and is extremely slow and laborious. A multispectral radiometer (MSR) has the potential to predict forage biomass much more rapidly. It is based on the principle that every substance absorbs and reflects various wavelengths of electromagnetic radiation (sunlight) in a manner characteristic of its physical and chemical structures. The amount of sunlight reflected by a substance is directly proportional to its mass.

Animal scientists tested this new technology in tallgrass prairie pastures, one ungrazed and three grazed by cattle. Three soil types were identified within each pasture. Biomass was sampled and measured with an MSR on each soil type in each pasture on six dates from late May to mid October. Biomass predicted by the MSR was compared with the actual weights of clipped samples. The procedure was repeated in 3 years.

The MSR predictions of biomass across all plant growth stages and seasons showed an error of 6 percent compared to measured biomass. Predictions were more accurate when lower amounts of standing forage dry matter were present. This may have been due partly to greater amounts of plant material shading the lower stems and leaves, so that reflected sunlight was not proportional to the entire surface area. However, the predictions were adequate for use in determining stocking rates or monitoring rangeland. Radiometers would allow rapid estimation of forage biomass.

■ ECONOMICS OF PRODUCTION

Efficiency of Beef Cow Farms

The beef sector of the agricultural industry is under pressure to cut production costs because of a recent decline in cattle prices and intense competition from the poultry and hog sectors. A major factor affecting the future structure of cow-calf production is the relative efficiency of different producers. Those that are inefficient will have to reduce costs or terminate production. Agricultural economists evaluated a sample of 195 beef cow farms in Kansas to determine efficiency.

Overall efficiency was divided into three categories. Pure technical efficiency measured the distance a farm was off the production function under variable returns to scale. Allocative efficiency measured whether a farm was using the optimal output mix. Scale efficiency measured whether the farm was at the most efficient size.

Results showed that technical inefficiency was the greatest problem. Both technical and scale efficiencies increased with herd size. However, technical efficiency decreased while scale efficiency increased with more specialization. Enterprise profitability was correlated positively with all measures of efficiency. Feed, labor, and capital costs were relatively more important in determining overall efficiency than utilities and fuel, veterinary expenses, and miscellaneous costs. Feed costs were particularly important to technical efficiency.

Most economies of scale are exhausted with a herd size of 48 beef cows, which is the average for Kansas farms. Therefore, producers should focus on using their inputs more efficiently rather than increasing herd size.

Given the current technology, increased concentration of the cow-calf sector will not result in large cost savings.

Economic Impact of Soil Erosion

The effects of soil erosion on agricultural sustainability and environmental quality have become major concerns. However, few studies have evaluated the economic impact of the crop yield loss associated with the reduced soil productivity caused by erosion. Such an economic evaluation requires a functional relationship between crop production and some measure of soil erosion. Topsoil depth usually is used. Agronomists and an agricultural economist collaborated to quantify the impact of soil erosion on yield and economic returns for wheat, grain sorghum, and soybean farms in Kansas, using data on topsoil depth collected by the Soil Conservation Service.

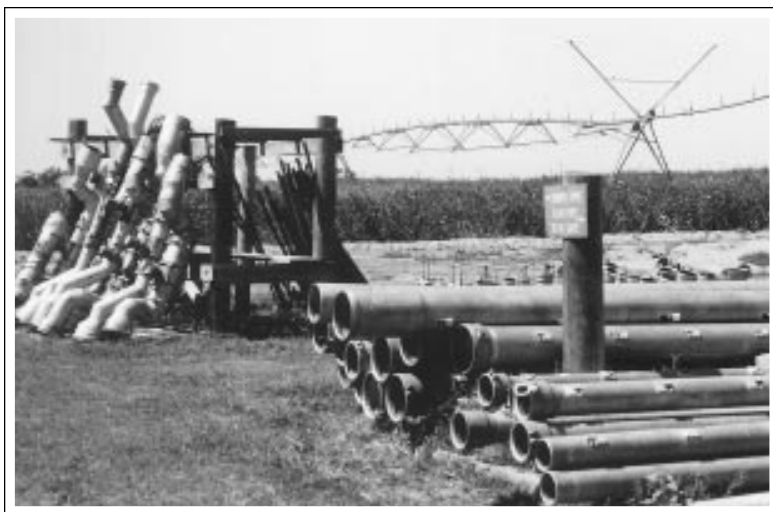
Study areas included five soil types, and each site had slightly, moderately, and severely eroded subsites. Chemical and physical properties of the soils were determined. Crops were planted and managed by producers. Samples were hand harvested on each erosion subsite, and grain yields were determined. A multiple regression model was used to relate average yield and topsoil depth.

Topsoil significantly influenced yield for all three crops. The relationship was similar across years for wheat, but differed significantly among years for sorghum and soybean. Analysis showed that for each inch of topsoil loss, average yields decreased by 1.14 bushels per acre for wheat, 2.20 bushels per acre for sorghum and 1.49 bushels per acre



Loss of topsoil by erosion reduces crop yields and profits.

for soybean. Assuming that 6 inches of topsoil have been lost over 40 years, the annual loss from soil erosion is 0.15 inches. This translates into yield losses of 0.17, 0.30, and 0.22 bushels per acre per year for wheat, sorghum, and soybean, respectively. The genetic improvement in Kansas wheat yields is estimated at 0.5 bushels per acre per year, so soil erosion can significantly reduce this yield improvement. The economic losses for each inch of topsoil erosion were \$2.98, \$4.30, and \$8.55 per acre for wheat, sorghum, and soybean, respectively. These losses emphasize the need for conservation measures to reduce the effect of soil erosion on productivity.



Research focuses on improving the efficiency of irrigation and reducing costs.

Estimating Irrigation Costs

To establish efficient farm irrigation practices, irrigators must be knowledgeable about both the economic and technological aspects of irrigation. Irrigators will incorporate conservation techniques only when an economic incentive exists. However, few irrigators have good estimates of their irrigation costs or the proper tools to economically evaluate water use strategies. Agricultural economists with the help of a graduate student in Industrial Engineering developed a computer model to estimate costs under a variety of operating conditions and to evaluate adjustments of irrigation systems for efficient and economical water use.

The Irrigation Economic Evaluation System (IEES) was developed for use on a microcomputer with data from a pumping-plant performance test. It can be used for any crop, soil, or climate and any size of system up to 160 acres. Seven types of irrigation systems that use four energy sources can be evaluated. The model estimates 11 operating costs and calculates total operating costs plus costs per acre, per hour, and per inch of water applied. Increased returns from production also

can be calculated. Six options are included to determine the effects of changes in the irrigation system. A separate option routine allows the user to calculate the investment costs of installing or replacing an irrigation system.

A pump test must be completed to obtain necessary input data. Other data from farm records, utility companies, and pump and well equipment dealers also are utilized. The model calculates fuel costs, total operating costs, net returns, and the net present value of making changes in an irrigation system. Results can be printed or saved. Results will be less accurate if the producer foregoes the pump test and guesses at the values or if the power unit is not operating efficiently.

This program is suitable for on-farm use by producers who are considering changes or want to evaluate the feasibility of switching to a more water-efficient system. It should make the transition easier and faster.

Irrigation Systems for Corn and Sorghum

Recent developments in the technology of irrigation distribution systems have resulted in a number of investment alternatives for western Kansas irrigators. Agricultural economists and an agricultural engineer evaluated seven irrigation systems for production of continuous corn and sorghum in the area. Estimates of after-tax, net present value (NPV) from investing in and using each system over a 10-year period to produce grain sorghum and corn were compared.

The system with the highest net returns under the typical conditions for irrigation of both grain sorghum and corn was surge flood. The system that generated the next highest net returns for both crops was furrow flood, followed by the center-pivot systems with low-drift-nozzles and low-energy-precision-application. The high-pressure center-pivot system was the least profitable for both crops. More efficient water-use systems, such as subsurface drip, should be more economical but have high investment costs. The results of a sensitivity analysis showed that the NPV estimates were most sensitive to the yield response to irrigation and the crop prices received. Therefore, the yield that an individual farm could produce under different systems could influence the selection of an irrigation system.

Returns to Land Investment

Financial information from farms enrolled in the Kansas Farm Management Association program was used by an agricultural economist to determine the relationship between land values and net farm income for 1974 through 1994. Kansas land prices increased



In recent years, land prices generally have increased and average rates of return to land investment have been variable but low.

annually during this period, except from 1983 to 1987. The total decline in land values was 40.6 percent for this 5-year period. Rates of return to land and building investments were derived for the six association regions for the 1974-94 period.

The high degree of variability in rates of return to land investment and the low average rate of return for this period were consistent with the results of previous studies. Rates of return to owned investment in land varied from a high of 18.59 percent in the southwest association in 1974 to a low of -7.98 percent in the same association in 1981. Rates of return to land investment were highest in the western associations (3.27 percent in the northwest and 3.53 percent in the southwest) and lowest in the northeast association (1.06 percent). These rates of return do not include the average appreciation in land values for each region over the 1974-94 period. Changes in cash rental rates tended to lag behind changes in land prices.

Crop Lease Arrangements

Over 90 percent of the agricultural producers in the Kansas Farm Management Associations (KFMA) lease part or all of their land, frequently from more than one landlord. Therefore, crop lease arrangements are important. A survey was conducted by agricultural economists in 1994 to obtain information on current lease arrangements. A total of 1,436 completed questionnaires was obtained, representing about 53.1 percent of KFMA farms (1,205 nonirrigated and 231 irrigated).

One-third sharing of the crop by the landlord was the primary arrangement, except for nonirrigated crops in the northeast and irrigated crops in south central, where 50 and 40 percent crop share arrangements were prevalent, respectively. Fertilizer was the most commonly shared input, with the shared percentage similar to that for crops. Costs for herbicides and insecticides and their application

were shared by the landlord at a lower percentage. For nonirrigated crops, only in the northeast region did the landlord share substantial percentages of variable costs, such as seed, harvesting, and hauling. Landlords shared a significant percentage of drying and irrigation fuel costs for irrigated crops. A basic principle of a good lease is the sharing of production in the same proportion as resources contributed. If sharing of crop production is not based on the relative value of the resources contributed by the landlord and tenant, then lease adjustments should be made related to the sharing of the variable costs.

Labor Requirements for Livestock Enterprises

When considering new facility investments, enterprise analyses, and cost-of-production budgets, managers need labor information on various livestock enterprises. The rapid changes in livestock facilities, equipment, and feeding systems call for up-to-date livestock labor standards. Livestock labor surveys were conducted by an agricultural economist to obtain labor information for 1994 from agricultural

Accurate estimates of labor requirements are essential for profitable management of livestock enterprises.



producers enrolled in the Kansas Farm Management Association (KFMA) program. A total of 398 completed questionnaires was obtained, including dairy cow herd—50, beef cow herd—139, beef-cattle growing and finishing—151, swine farrowing—32, swine finishing—11, and sheep—15.

Except for hours per month for the winter-grazing system for beef cattle, the “derived

hours” for all livestock enterprises were 24.7 percent lower than the standards currently being used in the KFMA program and 18.2 percent lower than those from previous research. Also, the total labor available to handle crop and livestock production on a representative farm in southeast Kansas was similar to the required labor computed from the derived standards.

■ PEOPLE AND COMMUNITIES

On-Farm Research in Kansas

Agricultural economists and sociologists collaborated to conduct a survey of Kansas farmers to elicit their opinions about on-farm research (OFR). In developing countries, experiment station-based research is complemented by OFR. This approach is particularly useful to address the needs of limited-resource farmers. Because of the increasingly limited resources available for research and problems that require location-specific solution, interest in OFR is growing in the United States. The Kansas survey included three groups: those on a list kept by the Kansas Agricultural Statistics (KAS) office, those subscribing to the Kansas Farm Management Association (KFMA), and those on the mailing list of the Kansas Rural Center (KRC). The response rate was 18 percent, and analysis was undertaken on the replies from 468 farmers who completed the questionnaire.

In general, the survey results indicated little difference between the KAS and KFMA farmers (viewed mainly as conventional farmers), but major differences did occur between the KAS/KFMA samples and the KRC sample (those with an expressed interest in sustainable agriculture). The KRC farmers were younger, had a higher level of formal education, had smaller farms, and also had a greater number of dependents working off the farm. They generally were more skeptical about commercial sources of information. In spite of having fairly positive views about KSU research and extension staff (like the KAS/KFMA farmers), they also were more skeptical about the value of university experiment station research.

Several results indicated that OFR in Kansas should be encouraged. Farmers placed considerable reliance on “own experience” and “other farmers’ experiences” as information sources in deciding what to do. Issues related to sustainability were mentioned often when farmers listed OFR concerns. These often required a whole-farm or system perspective and gave results for a specific location. OFR was practiced by most farmers, although to a greater extent by KRC farmers—either on their own initiative or in collaboration with outside groups. Therefore, anything that can improve the usefulness and impact of the effort and results should be encouraged. Farmers expressed a desire to cooperate in OFR and a willingness to contribute land, labor, and equipment.

Rural Kansans Aged 85 and Older

A study was conducted by researchers and an extension specialist in the Department of Foods and Nutrition and the School of Family Studies and Human Services to assess the functional characteristics of 142 persons aged 85 and older living independently in seven counties of northeastern and north central Kansas. Functional profiles were constructed for each of five subscales: social resources, mental health, physical health, activities of daily living, and economic resources. The five subscales were added to form a cumulative impairment score (CIS).

Many Kansas farmers are willing to participate in on-farm research, which can provide results for a specific location.





Approximately three-fourths of the subjects were classified in the most severely impaired group for mental health functioning or current economic resources. The mean CIS for the group was 11.8 on a scale of 5 (excellent functioning) to 30 (totally impaired in all areas). No significant gender differences occurred in mean scores for any of the subscales or the CIS, although some differences did occur in responses to specific questions. Overall, mean subscale scores were best (1.98) for mental health and worst (2.68) for physical health. Thus, poor functioning in physical health was balanced by high functioning in mental health. High social and economic resources also offset the impact of lower ratings in physical health and limitations of daily activities. The results of this study can be used to develop statewide programs and educational materials to help older Kansans adapt their lifestyles to maintain functional independence.

Rural Communities

Social, economic, cultural, environmental, and other forces of change constantly are reshaping our communities. Sociologists went back to an area of Kansas that had been studied in 1940 and 1965 to determine what changes had occurred. Haskell County, in the southwestern corner of the state, includes the two towns of Sublette and Satanta. Together with rural residents in the area, these were considered a “community.”

During the dust bowl in 1940, Haskell County showed social and economic instability. By 1965, significant changes (e.g., irrigation) had occurred and brought about relative stability. Like the previous studies, the 1993-94 study used secondary data analysis, case-study field research, and survey research.

Results showed that the county had maintained many of its “traditional” community characteristics. Family continued to be the primary social unit, and the school continued to be the dominant social institution. Churches had become more visible and active in community affairs. Women were once again active in leadership roles. Differences between Sublette and Satanta had become more pronounced. Satanta’s economy was based on energy resources, and the community showed more cultural diversity, yet had a higher degree of social interaction. Many residents of the county had negative attitudes toward federal and state government programs. The results also showed that water was still the defining resource of Haskell County. In 1993, the decline of the Ogallala Aquifer was changing agricultural practices and will continue to be the fundamental challenge facing this community. Although some residents speculated that the community had reached its peak of development, others recalled the accomplishments of their predecessors, who had overcome the desperate conditions of the Great Depression and the dust bowl. They had confidence that the community can meet the challenges that lie before it.

Rural Kansans aged 85 or older are living independently and rank high in mental functioning and social and economic resources, which offsets a lower ranking in physical health.

The harsh conditions in Haskell County during the dust bowl were overcome by the advent of irrigation.



■ EDITORIAL AND PUBLICATION ACTIVITIES

A total of 1,197 manuscripts received contribution numbers during the biennium, and 763 (about 65 percent) were edited. The average number processed per month was 50. The numbers of manuscripts in each of the eight accepted categories were:

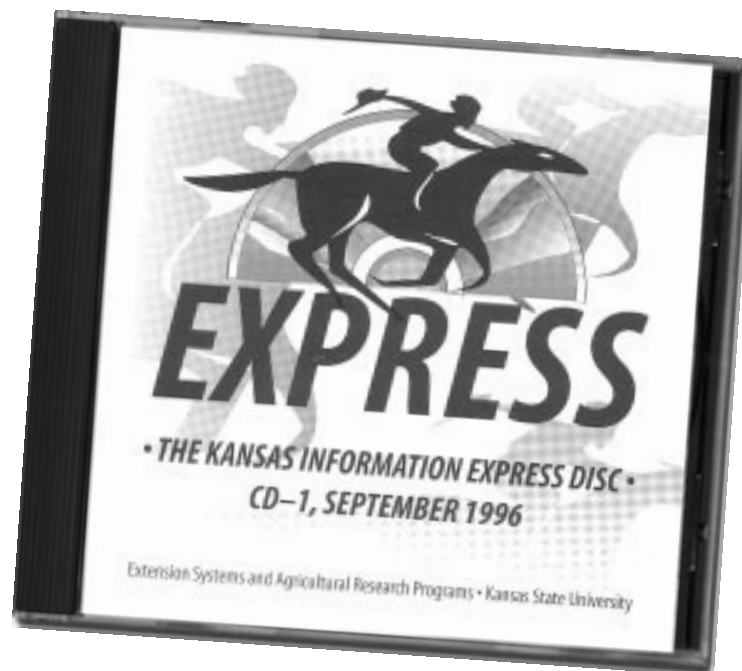
Journal articles	842
Proceedings of meetings	148
Books or chapters	75
Station publications (including two Bulletins)	68
Trade publications	33
Department reports	22
Extension publications	8
Computer programs	1

The category of department reports included two manuscripts over 300 pages in length and one over 450 pages in length. Lengthy manuscripts for a book, an external bulletin, and two KAES bulletins also were edited.

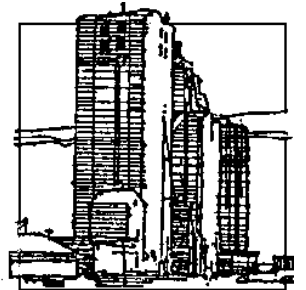
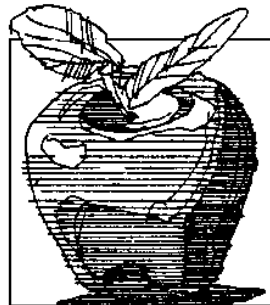
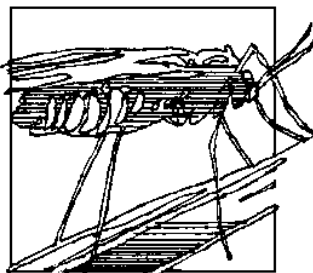
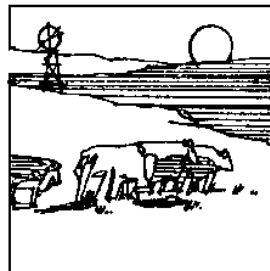
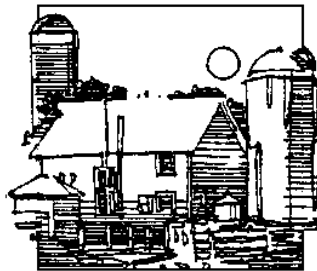
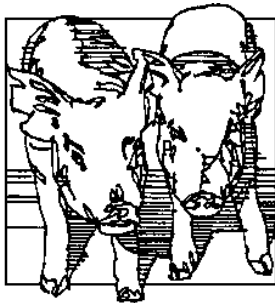
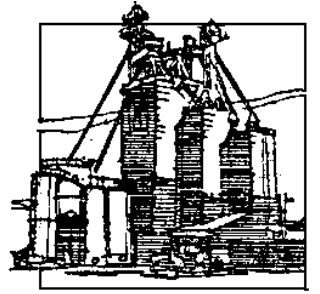
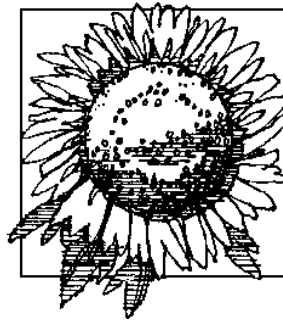
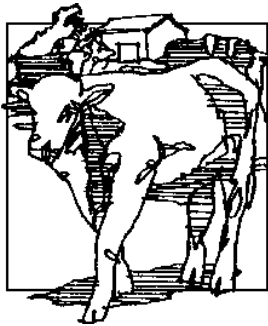
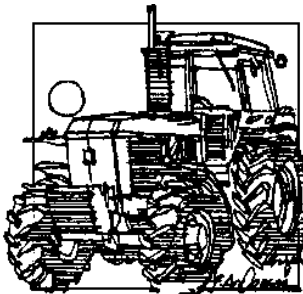
One of the long department reports was the Annual Wheat Newsletter, whose preparation and publication were taken over in 1995 by the Department of Plant Pathology. This report contains summaries of wheat research from around the world. About 100 printed copies and 150 diskettes are distributed, and it's also available on the Internet. Volume 42

in 1996 contained contributions from 10 private companies and from researchers at universities and research institutions in 32 countries. Local contributors included Kansas Agricultural Statistics, Topeka; faculty members in the departments of Agronomy, Biochemistry, and Plant Pathology (Wheat Genetics Resource Center) and at the Agricultural Research Center-Hays; and researchers at the Grain Marketing Production and Research Center. The newsletter also included minutes of meetings of various wheat committees and a report on the wheat database Grain Genes, which is an important means of communication among wheat researchers.

The Department of Communications made progress in its electronic publishing program. The first in a series of compact discs was distributed to county Extension offices, department offices, and faculty members. It included a list of all KAES publications that are available in the archives, including several series no longer published plus full text of some KAES publications; many Cooperative Extension Service publications; and publications from Colorado, Iowa, Illinois, Oklahoma, and Texas. More KAES publications are being scanned and included on the next compact disc, especially old reports related to forage and sustainable agriculture. Eventually, all KAES publications will be available electronically.



This compact disc produced in 1996 includes a list of all KAES publications available in the archives.



Personnel Changes

■ APPOINTMENTS

Richard Baybutt, foods and nutrition
Daniel Bernardo, head, agricultural economics
Kristina Boone, communications
Robert Borges, agricultural economics
John Brent, Jr., grain science and industry
Gary Clark, biological and agricultural engineering
Brad De Bey, diagnostic medicine/pathobiology
Alan Dowdy, USDA-ARS grain marketing and production research center
Steven Dritz, food animal health and management center
James Drouillard, animal sciences and industry
John Fox, agricultural economics
Karen Gast, horticulture, forestry and recreation resources

Steven Graham, dean's office
David Grieger, animal sciences and industry
Ekramul Haque, grain science and industry
Nick Huser, safety coordination
Rhonda Janke, agronomy
Rodney Jones, agricultural economics
Prasanta Kalita, biological and agricultural engineering
Terry Kastens, agricultural economics
Yi Li, biology
Karl Mannschreck, agronomy
James Marsden, animal sciences and industry
Patrick McCluskey, grain science and industry
Bonnie Moore, clinical sciences

Jeffrey Pontius, statistics
Yiping Qui, clothing, textiles, and interior design
Kent Rausch, biological and agricultural engineering
Donna Schenck-Hamlin, information support services for agriculture
Karen Schmidt, animal sciences and industry
George Stewart, diagnostic medicine and pathobiology
Susan Sun, grain science and industry
Kathryn Tilley, grain science and industry
Todd Trooien, southwest research-extension center
Kun Yan Zhu, entomology

■ RESIGNATIONS

Wayne Bailie, diagnostic medicine/pathobiology
Robert Brandt, animal sciences and industry
Kenneth Coffey, southeast agricultural research center
Laura Ann Coulson, family studies and human services
Steven Curran, grain science and industry
Penelope Diebel, agricultural economics
Thomas Eck, southwest research-extension center
Joseph Gaines, clinical sciences

Edward Hellman, horticulture, forestry and recreation services
Jimmy Hoover, animal sciences and industry
Hyde Jacobs, dean's office
Kenneth Marcum, horticulture, forestry and recreation services
D. Scott McVey, diagnostic medicine/pathobiology
John Pedersen, grain science and industry
Richard Phillips agricultural economics
Joseph Ponte, Jr., grain science and industry

O. James Reichman, biology
William Rooney, agronomy
Sheri Smithey, biological and agricultural engineering
William Spurgeon, southwest research-extension center
Richard White, northwest research-extension center
Brooks Wilson, agricultural economics

■ RETIREMENTS

Derrick Blocker, entomology
Orlan Buller, agricultural economics

James Morrill, animal sciences and industry
Robert Phillips, diagnostic medicine/pathobiology

Bert Pulaski, business and finance office
Clarence Swallow, agronomy

■ DEATHS

Horst Leipold, diagnostic medicine/pathobiology

Joseph Zayas, foods and nutrition

■ TITLE CHANGES

Richad DeBowes
from: professor, clinical sciences
to: head, clinical sciences
Jerry Gillespie
from: head, clinical sciences
to: director, food animal health and management center

James Higgins
from: head, statistics
to: professor, statistics
Dallas Johnson
from: professor, statistics
to: head, statistics

C. Michael Smith
from: head, entomology
to: professor, entomology
Joesph Smith
from: head, pathology and microbiology
to: professor, diagnostic medicine/pathobiology

■ DEPARTMENT CHANGES

Department of human development and family studies changed to school of family studies and human services

Department of veterinary diagnostic investigations and department of pathology and microbiology merged into department of diagnostic medicine/pathobiology

Food animal health and management center established in the college of veterinary medicine.

Station Publications

■ BULLETINS

- 661 A Glossary of Agriculture, Environment, and Sustainable Development
- 662 From Dust Bowl to Green Circles—A Case Study of Haskell County, Kansas

■ REPORTS OF PROGRESS

- 711 1994 Turfgrass Research
- 712 1994 Field Day Report. Southwest Research—Extension Center
- 713 1994 Kansas Performance Tests with Winter Wheat Varieties
- 714 1994 Kansas Performance Tests with Spring Oat Varieties
- 715 1994 Woody Ornamental Evaluations
- 716 Dairy Day 1994
- 717 Swine Day 1994
- 718 Chemical Weed Control for Field Crops, Pastures, Rangeland, and Noncropland, 1995
- 719 Kansas Fertilizer Research 1994
- 720 On-Farm Research in Kansas, 1993: Survey of Farmers' Opinions
- 721 1994 Kansas Performance Tests with Corn Hybrids
- 722 1994 Kansas Performance Tests with Grain and Forage Sorghum Hybrids
- 723 1994 Kansas Performance Tests with Soybean Varieties
- 724 Cancer Morbidity among Kansas Farmers
- 725 1994 Kansas Performance Tests with Sunflower Hybrids
- 726 1994 Kansas Performance Tests with Alfalfa Varieties
- 727 1995 Cattlemen's Day
- 728 Kansas Sheep Research 1995
- 729 Milling and Baking Test Results for Hard Winter Wheats Harvested in 1994
- 730 Selection of Wheat Varieties in Kansas: Does Quality Matter?
- 731 Roundup 1995
- 732 Derived Labor Requirements for Kansas Livestock Enterprises
- 733 1995 Agricultural Research. Southeast Agricultural Research Center
- 734 Field Research 1995. Agronomy and Biological & Agricultural Engineering Experiment Fields
- 735 1994 Bedding Plant Field Trials
- 736 1994 Vegetable Investigations
- 737 Integrated Pest Management in Kansas Farm-Stored Wheat Using Aeration Controllers
- 738 1995 Turfgrass Research
- 739 Field Day 1995. Southwest Research—Extension Center
- 740 1995 Kansas Performance Tests with Winter Wheat Varieties
- 741 1995 Agricultural Research. Northwest Research—Extension Center
- 742 Dairy Day 1995
- 743 1995 Kansas Performance Tests with Spring Oat Varieties
- 744 Tall Fescue Cultivars in Southeastern Kansas
- 745 Cattle Feeder's Day 1995
- 746 Swine Day 1995
- 747 1995 Kansas Performance Tests with Corn Hybrids
- 748 Chemical Weed Control for Field Crops, Pastures, Rangeland, and Noncropland, 1996
- 749 Kansas Fertilizer Research 1995
- 750 1995 Kansas Performance Tests with Grain and Forage Sorghum Hybrids
- 751 1995 Production and Postharvest Evaluations of Fresh-Cut Sunflowers

- 752 1995 Kansas Performance Tests with Soybean Varieties
- 753 1995 Kansas Performance Tests with Alfalfa Varieties
- 754 Coping Strategies of Successful Rural Communities
- 755 1995 Kansas Performance Tests with Sunflower Hybrids
- 756 1996 Cattlemen's Day
- 757 Crop Lease Arrangements on Kansas Farm Management Association Farms
- 758 Returns to Land Investment
- 759 Functional Characteristics and Status of Rural Kansans Aged 85 and Older
- 760 Roundup 1996
- 761 1996 Agricultural Research. Southeast Agricultural Research Center
- 762 Field Research 1996. Agronomy and Biological & Agricultural Engineering Experiment Fields
- 763 1995 Great Plains Canola Research
- 764 1996 Agricultural Research. Northwest Research—Extension Center
- 765 1996 Turfgrass Research

■ KEEPING UP WITH RESEARCH

- 107 Evaluation of Late Planting Opportunities for Winter Wheat
- 108 Soybean Choices for Iron-Deficient Soils
- 109 Interseeding Alfalfa into Declining Alfalfa Stands
- 110 Field Symptom-Response of Sorghum Hybrids Infected by Maize Dwarf Mosaic Virus
- 111 Soybean Response to Row Spacing and Seeding Rates in Northeast Kansas

■ SPECIAL PUBLICATIONS

- Agricultural Research in Kansas: Thirty-Seventh Biennial Report of the Agricultural Experiment Station, 1992-1994
- 1995 Report on Grains Research and Educational Programs Supported by Corn, Grain Sorghum, Soybean, and Wheat Commissions
- UNN20 Canola Production Guide

SUFFIX LETTERS FOR CONTRIBUTION NUMBERS *(pages 34–83)*

- A** Proceedings of Meeting or Symposium
- B** Bulletin published by KAES; Book or Chapter for Book
- C** Computer Program
- D** Department Report
- E** Extension Publication (co-authored by a KAES researcher but published by Cooperative Extension or externally as educational material) or research by an Extension person to be published in a refereed journal.
- J** Journal
- S** Station Publication: Report of Progress, Keeping Up With Research, Special Publication
- T** Trade Publication

Categories are based on information received before manuscripts are published. Place of publication sometimes changes later. Numbers are deleted if authors cannot supply publication data.

Station publications including Bulletins are available from KAES Editorial Office. Department Reports are available only from the appropriate department office. Copies of journal articles or other outside publications must be obtained from the authors.

Publications of Station Scientists (By Department and Station Contribution Number)

■ 1. Agricultural Economics

- 92-475-J Economic Analysis of Grazing and Subsequent Feeding of Steers from Three Fescue Pasture Alternatives
R.O. Burton, Jr., P.T. Berends, J.L. Moyer, K.P. Coffey, and L.W. Lomas
J. Prod. Agric. 7(4):409-410, 482-289, 1994
- 93-185-J Substitution of Hard Red Winter Wheat for Dark Northern Spring Wheat: An Analysis for the Cost Rican Milling Industry
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- 93-507-A The Farming Systems Perspective: The Key to Building Sustainable Agriculture in Southern Africa
D.W. Norman
In: *The Proc. of the Southern African Farming Systems Research-Extension Conf.*, pp. 4-23, Ezulweni, Swaziland, 1995
- 93-508-B Sustainable Dryland Cropping in Relation to Soil Productivity
J.C. Pearson, D.W. Norman, and J. Dixon
FAO Soils Bulletin 72, 146 pgs., Food and Agriculture Organization of the United Nations, Rome, 1995
- 93-535-J An Economic Comparison of Conventional and Alternative Cropping Systems for a Representative Northeast Kansas Farm
P.L. Diebel, J.R. Williams, and R.V. Llewelyn
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- 94-16-J A Cross-National Investigation of the Relationship between the Price and Quality of Consumer Products: 1970-1990
D.J. Faulds, O. Grunewald, and D. Johnson
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- 94-278-J A Model of the Economic Theory of Regulation for Undergraduates
B. Wilson
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- 94-394-A Experiences of Some African Countries with the Unification of Their Extension Services since Independence: Lessons for South Africa
D.W. Norman, N. Mollel, M. Mangheni, and P. Paradza
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- 94-434-J Farm-Level Nonparametric Analysis of Cost-Minimization and Profit-Maximization Behavior
A.M. Featherstone, G.A. Moghnieh, and B.K. Goodwin
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- 94-488-J Human Capital, Producer Education Programs, and the Adoption of Forward Pricing Methods
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J. Prod. Agric. 8:307-309, 373-379, 1995
- 94-578-J Structural Change in Factor Demand Relationships in the U.S. Food and Kindred Products Industry
B.K. Goodwin and G.W. Brester
Am. J. Agric. Econ. 77:69-79, 1995
- 95-8-D Farm Management Data Bank Documentation
L.N. Langemeier
Agric. Econ. Dept. Rep. (Staff Pap. 95-1):1-54, 1994
(available from dept. only)
- 95-33-D Quick Guide to Quattro Pro for Windows: For Mouse Users
D. Delano, J. Williams, and B. Schurle
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- 95-34-D Experiential Learning through Trading Agricultural Commodities
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- 95-37-A An Economic Evaluation of Soil Erosion and Productivity
J.L. Havlin, A.P. Barkley, H. Kok, and W. Wehmuller
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- 95-163-A Institutional Dimensions of Development Research
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- 95-172-J Factor-Input Demand Subject to Economic and Environmental Risk: Nitrogen Fertilizer in Kansas Dryland Corn Production
G.L. Carriker
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- 95-175-S Swine Day 1994
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- 95-189-J An Empirical Analysis of Participation in U.S. Government Farm Programs
B.K. Goodwin and A.M. Featherstone
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- 95-225-S On-Farm Research in Kansas, 1993: A Survey of Farmers' Opinions
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- 95-286-D Basebook: Kansas Farm Operator's Opinions Concerning Farm and Food Policy. Spring, 1994
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- 95-327-D A Target MOTAD Analysis of Double-Cropping and Alternative Crop Rotations
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- 95-351-B The Farming Systems Approach to Development and Appropriate Technology Generation
D.W. Norman, F.D. Worman, J.D. Siebert, and E. Modiakgotla
In: *Farming Management Series, Number 10, AGSP, Food and Agricultural Organization, United Nations, Rome, 1995*
- 95-357-S 1995 Cattlemen's Day
Kans. Agric. Exp. Sta. Rep. Prog. 727:1-121, 1995
- 95-370-D Alternative Use-Value Yield-Estimation Techniques
M.L. Albright, A.M. Featherstone, and C.A. Cole
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- 95-389-D Enterprise Data Bank Documentation
L.N. Langemeier
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- 95-412-S Selection of Wheat Varieties in Kansas: Does Quality Matter?
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- 95-421-S Derived Labor Requirements for Kansas Livestock Enterprises
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- 95-422-J Debt and Input Misallocation of Agricultural Supply and Marketing Cooperatives
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- 95-433-J A Comparative Evaluation of the Population Impact and Economic Potential of Biological Suppression Tactics vs. Chemical Control for Squash Bug, *Anasa tristis* (Heteroptera: Coreidae), Management on Pumpkins
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- 95-443-D A Review of Economic Analyses of Alternative Cropping Systems in Kansas
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- 95-459-A Future Priorities and Agenda for Farm Management Research: A Case Study of a Conference in the USA
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Proc. Tenth Intl. Farm Manag. Cong., pp. 19-29, Intl. Farm Manag. Assoc., Univ. of Reading, UK, 1995
- 95-461-J Dynamic Relationships in the Market for Grain Ocean-Freighting Services
J.L. Hsu and B.K. Goodwin
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- 95-489-D Staff, Programs, and Publications in Agricultural Economics, Kansas State University, 1994
D. Foster
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- 95-500-J An Analysis of Used Combine Pricing in the Great Plains
Z. Alem, A.M. Featherstone, and O.H. Buller
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- 95-501-D Incorporating Abandoned Acreage into the Income Capitalization Method for Valuation of Agricultural Land
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- 95-517-J Experiential Learning through Trading Agricultural Commodities
T.C. Schroeder, W.I. Tierney, Jr., and H.L. Kiser
Agric. Finan. Rev. 55:89-99, 1995
- 95-525-J Income Growth and International Meat Consumption
T.C. Schroeder, A.P. Barkley, and K.C. Schroeder
J. Intl. Food and Agribus. Mktg. 7:15-30, 1995
- 95-539-J Economic Evaluation of Topsoil Loss in Spring Wheat Production in the Northern Great Plains
J.R. Williams and D.L. Tanaka
J. Soil and Tillage Res. 37:95-112, 1996
- 95-588-J Estimation of the U.S. Import Demand Elasticity for Beef: The Importance of Disaggregation
G.W. Brester
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- 95-589-J The Impacts of Brand and Generic Advertising on Meat Demand
G.W. Brester and T.C. Schroeder
Am. J. Ag. Econ. 77:969-979, 1995
- 96-4-J Nonparametric Analysis of the Optimizing Behavior of Midwestern Cooperatives
A.M. Featherstone and Md. Habibur Rahman
Rev. Agric. Econ. 18:265-273, 1996
- 96-106-S Dairy Day 1995
Kans. Agric. Exp. Sta. Rep. Prog. 742:1-50, 1995
- 96-124-J Blending Computer Skill Development into an Undergraduate Orientation Course
B.W. Schurle
Natl. Assoc. Coll. Teachers Agric. J. 39(4):6-8, 1995
- 96-139-S Cattle Feeders' Day 1995
Kans. Agric. Exp. Sta. Rep. Prog. 745:1-32, 1995
- 96-140-S Swine Day 1995
Kans. Agric. Exp. Sta. Rep. Prog. 746:1-156, 1995
- 96-145-B An Introduction to the Farming Systems Approach to Development (FSD) for the South Pacific
D. Norman, M. Tofinga, M. Umar, and H. Bammann
Inst. for Res., Ext., Training in Ag., Univ. of the S. Pacific, Apia, Western Samoa and The Food and Agricultural Organization of the United Nations, 119 pgs., 1995
- 96-176-J Feedforward Backpropagation Neural Networks in Prediction of Farmer Risk Preferences
T. Kastens and A. Featherstone
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- 96-188-D Protein Quantity and Quality: A Characteristic Demand Analysis of Japanese Wheat Imports
K. Stiegert and J.P. Blanc
Agric. Econ. Dept. Rep. (Staff Pap. 96-1):1-27, 1995
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- 96-277-S Coping Strategies of Rural Communities
Kans. Agric. Exp. Sta. Rep. Prog. 754:1-9, 1996
- 96-296-C Description and Use of Kansas Water Budget v. T1 Software
L.R. Stone, O.H. Buller, A.J. Schlegel, M.C. Knapp, J.-I. Perng, A.H. Khan, H.L. Manges, and D.H. Rogers
Dept. Rep., pp. 1-20, 1996
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- 96-297-J Educational Software for Illustration of Drainage, Evapotranspiration, and Crop Yield
A.H. Khan, L.R. Stone, O.H. Buller, A. Schlegel, M.C. Knapp, J.-I. Perng, H.L. Manges, and D.H. Rogers
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- 96-319-J Model Selection and Forecasting Ability of Theory-Constrained Food Demand Systems
T. Kastens and G.W. Brester
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- 96-334-S 1996 Cattlemen's Day
Kans. Agric. Exp. Sta. Rep. Prog. 756:1-140, 1996
- 96-337-S Crop Lease Arrangements on Kansas Farm Management Association Farms
Kans. Agric. Exp. Sta. Rep. Prog. 757:1-36, 1996
- 96-338-S Returns to Land Investment in Kansas
Kans. Agric. Exp. Sta. Rep. Prog. 758: 1-12, 1996
- 96-371-D Net Returns for Grain Sorghum and Corn under Alternative Irrigation Systems in Western Kansas
J.R. Williams, R.V. Llewelyn, M.S. Reed, F.R. Lamm, and D.R. DeLano
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- 96-473-S Economic Analysis of Alternative Irrigation Systems for Continuous Corn and Grain Sorghum in Western Kansas
Kans. Agric. Exp. Sta. Rep. Prog. 766:1-46, 1996

Publications of Station Scientists (Continued)

- 96-480-D Asset/Liability Management in Kansas Banks
C.A. Cole, A.M. Featherstone, and M.L. Albright
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- 96-482-D Irrigation Cost Estimation Procedures Used in the Irrigation Economics Evaluation System (IEES)
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- 96-540-D Landowners' Erosion-Control Costs in Eastern Kansas: A Five-Year Study, 1991-1995
M.L. Albright and E.K. Tophoj
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- 96-545-D Rainfed Rice Production in Western Kenya: Productivity and Profitability
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- 96-547-D Staff Programs and Publications in Agricultural Economics, Kansas State University, 1995
D. Foster
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- **2. Agronomy**
- 88-258-J Wild Jujube (*Ziziphus lotus*) Control in Morocco
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- 91-120-J Simulating Shattercane (*Sorghum bicolor*) Growth Using SORKAM and a Combination Model
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- 91-222-B Application of Chemical Equilibrium Modeling to Leachates from Coal Ash
A.P. Schwab
Spec. Publ. 42, pp. 143-161, Soil Sci. Soc. Am., Madison, WI, 1995
- 91-372-J Assessing Climatic Risk to Crop Production in Water-Limited Subtropical Environments. I. Occurrence of Planting Opportunities
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Q. Xu, A.Q. Paulsen, J.A. Guikema, and G.M. Paulsen
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- 91-461-B Sorghum and Millets for Forage and Feed
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- 91-471-J Association of High-Temperature Injury with Increased Sensitivity of Photosynthesis to Abscisic Acid in Wheat
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- 91-544-A High Temperature Responses of Crop Plants
G.M. Paulsen
Proc. Intl. Symp., Physiology and Determination of Crop Yield, pp. 365-389, ASA/CSSA/SSSA, Madison, WI, 1994
- 92-18-B Mendel's Discovery of Genetic Laws
G.H. Liang, Y. Sun, E.L. Sorensen, and J. Guo
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- 92-92-B Carbon and Nitrogen Dynamics in Range Plants
P.I. Coyne, M.J. Trlica, and C.E. Owensby
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Most Reports of Progress have too many authors to list here. Contribution numbers of these reports are included after authors' names in Publication Record of Scientists.

Publication Record of Scientists

(Number after scientist's name indicates department as listed under "Publications of Station Scientists," pages 34-79)

Adams, A.W. (4)	94-290-J	Brown, A. (13)	94-198-J, 94-199-J, 94-247-J, 95-160-J	Davis, L.C. (5)	92-656-J, 93-366-J, 94-253-B, 95-52-J, 95-53-J, 95-134-J, 95-135-B
Albrecht, M.L. (21)	96-22-T, 96-91-J, 95-464-S, 96-550-S	Burton, R.O., Jr. (1)	92-475-J, 94-518-J, 95-327-D, 95-328-J, 95-459-A	DeBowes, R.W. (10)	94-142-J, 94-548-J
Andersson, L.A. (5)	93-489-J, 95-455-J, 96-13-J	Buschman, L.L. (16, 29)	94-474-J, 95-12-S, 95-256-A, 95-257-A, 95-258-A, 95-603-S, 96-58-J, 96-525-S	Denell, R. (7)	95-462-J
Armbrust, D.V. (2)	93-438-J, 94-421-J, 95-343-J, 95-592-A	Cable, T.T. (21)	93-375-J	Deyoe, C.W. (20)	93-478-J, 94-510-B, 94-598-A, 95-535-J
Arns, M. (4)	95-118-J	Carriker, G.L. (1)	95-172-J	Dick, G. (16, 29)	94-474-J
Babcock, M.W. (15)	93-483-J	Chambers, E. IV (19)	92-241-J, 93-553-J, 95-36-J, 95-143-A, 95-202-J, 95-380-B	Diebel, P.L. (1)	93-535-J, 95-105-J
Banks, M.K. (9)	93-483-J, 94-47-B, 94-56-J, 94-387-J, 95-52-J, 95-135-B	Chapes, S.K. (7)	94-162-J, 94-283-J, 94-534-J, 94-550-J, 95-45-J, 95-129-J, 95-275-J, 95-303-J	Dikeman, M.E. (4)	92-604-J, 94-6-J, 95-82-J, 96-334-S
Barkley, A.P. (1)	95-37-A, 95-286-D, 95-412-S, 95-525-J	Chengappa, M.M. (13)	93-123-J, 93-506-J, 94-38-J, 94-40-J, 94-329-J, 95-42-J, 95-64-J, 95-113-J, 95-114-J, 95-139-J, 95-175-S, 95-282-J, 95-322-J, 95-353-J, 95-417-J, 95-580-J, 95-606-J, 96-5-J, 96-44-J, 96-140-S, 96-334-S	Dodds, W.K. (7)	91-585-J, 93-172-J, 94-559-J, 94-560-J, 94-579-J, 94-608-J, 95-83-J
Barkley, T.M. (7)	95-153-A, 95-549-J, 96-294-J, 96-397-J	Chitnis, P. R. (7)	94-486-J, 94-583-J, 94-547-J, 94-580-J, 95-388-J, 95-484-J, 96-37-A, 96-38-A, 96-286-J, 96-287-J	Dover, B. (16)	95-110-J, 95-349-J, 95-385-J
Barnes, P.L. (6)	95-446-S, 96-199-S, 96-215-S	Choi, H.M. (11)	94-567-J, 94-568-J, 94-569-J, 94-570-J	Dritz, S. (18)	96-140-S, 96-235-A
Basaraba, R. (13)	95-160-J, 96-46-J, 96-334-S	Chowdhury, S. (13)	94-482-J, 95-276-J	Dryden, M. (13)	95-131-J, 95-416-T, 95-543-J, 95-555-T
Baybutt, R. (19)	95-462-J	Chung, D.S. (6)	91-105-J, 92-328-J, 93-467-J, 93-495-J, 94-357-J, 94-358-J, 94-359-J, 94-460-J, 94-461-J, 94-519-J	Dunn, J. (3)	94-210-J
Beeman, R.W. (16)	93-540-J, 94-4-J, 94-84-J, 94-84-J, 94-84-J, 94-84-J, 94-572-J, 95-214-A, 95-215-A, 95-216-A, 96-166-T	Chung, O.K. (6)	93-478-J	Elzinga, R.J. (15)	94-29-J, 94-65-J, 94-433-J
Behnke, K.C. (20)	94-232-J, 94-242-J, 94-243-J, 95-319-J	Claassen, M. (2)	94-315-J, 95-26-S, 95-243-A, 95-262-S, 95-284-S, 95-446-S, 96-35-S, 96-207-A, 96-220-S, 96-236-S, 96-248-A, 96-254-A, 96-450-S	Erickson, H.H. (3)	94-451-J, 95-148-J, 95-217-T, 95-573-T
Bequette, R.K. (19)	94-362-J, 94-379-J, 95-166-J, 96-118-J	Clark, G. (6)	96-290-J, 96-291-J	Eustace, D. (20)	94-510-B, 95-383-S, 96-42-J, 95-26-S, 95-74-S, 95-262-S, 95-267-S, 95-267-S, 95-284-S, 95-294-S, 96-35-S, 96-119-S, 96-199-S, 96-220-S, 96-236-S, 96-280-S
Black, W.C. IV (16)	94-429-B	Clark, S. (6)	94-18-J, 95-14-J, 96-462-A	Evans, P.M. (27)	94-37-J, 94-563-J, 94-582-J
Blair, J. M. (7)	93-266-J, 94-38-J, 94-73-J, 94-550-J, 94-575-J, 95-10-J, 95-42-J, 95-299-J, 95-322-J, 95-408-J, 95-580-J, 96-44-J, 96-140-S, 96-202-J	Cochran, R.C. (4)	94-164-J, 94-250-J, 94-449-J, 94-574-J, 94-594-J, 95-56-J, 95-340-J, 95-357-S, 95-537-J, 95-579-J, 96-386-S	Eversmeyer, M.G. (23)	94-300-J, 96-81-J
Blecha, F. (3)	95-225-S, 96-472-B	Coffey, K.P. (28)	92-475-J, 93-4-J, 95-158-J, 95-159-J, 95-454-S, 96-9-J, 96-334-S, 96-422-S	Fan, L.T. (8)	94-300-J, 96-81-J
Blocker, H.D. (16)	94-491-J, 95-239-A, 95-240-A, 95-243-A, 95-244-A, 95-248-A, 95-249-A, 95-538-J, 95-545-J, 96-207-A, 96-208-A, 96-222-A, 96-242-A	Consigli, R.A. (7)	94-524-J, 96-64-J	Faubion J.M. (20)	93-23-B, 94-133-J, 95-285-B
Bloomquist, L. (24)	93-377-B, 94-129-J, 94-154-B, 94-164-J, 94-597-B, 95-340-J, 95-357-S, 95-425-S, 95-466-J, 96-106-S, 96-139-S, 96-334-S	Converse, H.H. (6)	91-105-J	Featherstone, A.M. (1)	94-434-J, 95-175-S, 95-189-J, 95-357-S, 95-370-D, 95-422-J, 95-500-J, 96-4-J, 96-176-J, 96-480-D
Bockus, W.W. (23)	93-464-J	Corah, L.R. (4)	92-427-J, 93-73-J, 94-574-J, 94-575-J, 95-130-J, 95-203-J, 95-395-J, 95-408-J, 95-494-J, 96-334-S	Fedde, M.R. (3)	92-362-J, 93-60-B, 95-82-J, 95-217-T
Bolsen, K.K. (4)	95-202-J, 95-334-J, 95-597-J	Coulson, L.A. (17)	96-277-S	Fenwick, B.W. (13)	93-123-J, 94-557-J
Bolte, L.C. (20)	94-526-J	Coyne, P.I. (26)	92-92-B, 94-256-J, 94-371-J	Feyerherm, A.M. (25)	93-351-J, 93-415-J
Bowden, R.L. (23)	91-461-B, 93-499-J, 95-446-S, 96-450-S, 95-446-S	Cox, T.S. (2)	93-353-A, 94-95-J, 94-232-J, 94-242-J, 94-243-J, 94-304-A, 94-490-J, 95-11-J, 95-31-J, 95-32-J, 95-38-A, 95-47-J, 95-88-J, 95-545-J	Fick, W.H. (2)	95-219-S, 96-206-S
Bowers, J.A. (19)	92-658-J, 94-250-J, 94-449-J, 94-594-J, 95-56-J, 95-357-S	Craig, J.A. (4)	93-30-J, 95-334-J	Flores, R. (6, 20)	93-185-J, 93-467-J, 93-478-J, 93-478-J, 94-116-J, 94-324-J, 94-459-J
Boyer, J.E., Jr. (25)	95-141-S, 95-357-S, 96-334-S	Curran, S.P. (20)	94-232-J, 94-556-J, 95-383-S, 96-42-J	Frey, R.S. (24)	95-471-J, 96-241-J, 96-262-B
Bramel-Cox, P. (2)	94-578-J, 95-588-J, 95-589-J, 96-319-J	Currie, R.S. (29)	95-165-J, 95-233-J, 95-603-S, 96-525-S	Fritz, J. (2)	93-122-J, 94-129-J, 94-164-J, 95-340-J, 95-537-J
Brethour, J.R. (26)	95-425-S, 96-48-J, 96-49-J, 96-386-S	Davis, D.L. (4)	96-322-J	Fry, J.D. (21)	94-277-A, 94-476-J, 95-331-T, 95-339-J, 96-16-J, 96-404-T, 95-513-S, 96-479-S
Broce, A.B. (16)	93-100-J, 95-166-J, 95-255-J, 95-555-T			Fung, D.Y.C. (4)	93-30-J, 94-294-J, 94-389-A, 94-392-A, 94-427-B, 95-81-B, 95-106-J, 95-116-J, 95-117-J, 95-140-J, 95-149-J, 95-231-J, 95-268-J, 95-269-J, 95-278-J, 95-288-A, 95-345-J, 95-350-J, 95-357-S, 95-467-J, 95-468-J, 95-481-A, 95-496-A, 95-526-J, 96-349-J, 96-399-J, 96-400-J, 96-401-J, 96-402-J, 96-447-A

Gill, B.S. (23)	93-353-A, 93-371-A, 93-378-A, 94-43-J, 94-95-J, 94-293-J, 94-304-A, 94-349-J, 94-364-J, 94-375-J, 94-406-J, 94-439-J, 94-455-J, 94-509-J, 95-11-J, 95-27-J, 95-31-J, 95-32-J, 95-44-J, 95-47-J, 95-51-J, 95-61-J, 95-72-J, 95-84-B, 95-88-J, 95-157-J, 95-178-J, 95-187-J, 95-190-J, 95-201-J, 95-248-A, 95-260-J, 95-336-J, 95-352-D, 95-369-J, 95-402-J, 95-413-A, 95-449-J, 95-490-J, 95-520-J, 95-541-J, 95-545-J, 95-605-J, 96-26-J, 96-27-J, 96-45-J, 96-53-J, 96-65-A, 96-68-J, 96-70-B, 96-83-J, 96-84-J, 96-485-J	Hazelton, J.L. (20)	94-499-J, 94-554-J, 94-562-J, 94-605-J, 94-607-J, 95-29-J, 95-62-J, 95-65-J, 96-183-J	Kastner, C.L. (4)	92-604-J, 94-82-A, 94-294-J, 94-485-J, 94-515-J, 95-106-J, 95-140-J, 95-231-J, 95-278-J, 95-345-J, 95-350-J, 95-357-S, 95-467-J, 95-468-J, 96-40-J, 96-75-J, 96-140-S, 96-334-S, 96-400-J
		Heaton, L. (23)	93-337-J, 94-591-J, 95-7-J		
		Heer, W. (2)	95-26-S, 95-74-S, 95-241-S, 95-267-S, 95-284-S, 95-329-S, 95-446-S, 96-35-S, 96-110-S, 96-119-S, 96-199-S, 96-207-A, 96-215-S, 96-220-S, 96-242-A, 96-392-S, 96-450-S, 96-455-S	Kaufman, D.W. (7)	94-470-J, 94-551-J, 95-24-J, 95-35-J, 95-58-J, 95-127-J, 95-128-J, 95-404-J, 95-536-J, 95-561-A, 95-562-A, 95-563-A, 95-564-A
		Hedgcoth, C. (5)	93-299-J, 93-312-J		
		Herald, T.J. (19)	95-137-J, 95-194-J, 95-487-J, 95-597-J	Kelley, K. (28)	94-147-J, 94-405-J, 95-284-S, 95-327-D, 95-454-S, 96-215-S, 96-220-S, 96-422-S
		Herrman, T. (20)	94-572-J, 95-319-J, 95-492-S		
		Hetrick, B.A.D. (23)	92-666-J, 93-117-J, 94-56-J, 94-245-J, 94-273-J, 94-402-J, 95-11-J, 95-377-J, 95-560-J	Kemp, K.E. (25)	93-22-J, 93-519-J, 94-151-J, 95-69-J, 95-606-J, 96-334-S
Goodband, R.D. (4)	94-38-J, 94-287-J, 94-606-J, 95-40-J, 95-63-J, 95-121-J, 95-139-J, 95-322-J, 95-497-J, 95-515-J, 95-607-J, 95-614-J, 96-44-J, 96-61-J	Higgins, J.J. (25)	95-141-S, 95-185-J, 95-325-J, 95-346-J	Kenney, P.B. (4)	94-294-J, 94-515-J
		Higgins, R.A. (16)	91-120-J, 94-214-J, 94-347-J, 95-492-S, 96-525-S	Khatamian, H. (21)	95-111-S
Goodwin, B.K. (1)	93-185-J, 94-434-J, 94-488-J, 94-578-J, 95-189-J	Hines, R.H. (4)	93-540-J, 94-4-J, 94-84-J, 96-140-S, 96-166-T	Kiracofe, G.H. (4)	95-85-J, 95-86-J
				Kirkham, M.B. (2)	94-306-B, 94-351-J, 95-79-J, 95-133-J, 95-245-J, 95-454-S, 95-458-J, 95-510-J, 95-529-J, 95-581-A
Gordon, W.B. (2)	93-414-J, 94-443-J, 94-487-J, 95-26-S, 95-210-A, 95-241-S, 95-262-S, 95-267-S, 95-284-S, 95-329-S, 95-446-S, 96-35-S, 96-199-S, 96-207-A, 96-215-S, 96-220-S, 96-236-S, 96-267-S, 96-280-S	Holcomb, C.A. (19)	94-284-J	Kiser, H.L. (1)	95-34-D, 95-517-J
		Hopkins, T.L. (16)	94-205-J, 94-222-J, 94-433-J, 94-450-J, 95-247-J, 95-415-J, 95-621-J, 96-126-J	Klopfenstein, C.F. (20)	91-400-B, 93-241-J, 93-242-J, 94-114-J, 94-372-J, 95-253-J
				Kluitenberg, G. (2)	93-430-J, 93-446-J, 94-463-J, 94-535-J, 94-595-J, 95-236-J, 95-241-S, 95-463-J
Greene, G.L. (29)	96-57-J, 96-139-S	Horak, M. (2)	94-526-J, 95-17-J	Knapp, A.K. (7)	95-23-J, 95-193-J, 95-242-J, 95-293-J, 95-396-J, 95-486-J, 95-544-J, 95-565-A, 95-566-A, 96-1-J, 96-334-S
Grunewald, K. (19)	94-24-J	Hoseney, R.C. (20)	91-400-B, 93-187-J, 94-20-J, 94-33-J, 94-34-J, 94-66-J, 94-123-J, 94-133-J, 94-286-J, 94-352-J, 94-353-J, 94-431-J, 94-432-J, 94-503-J, 94-521-J, 95-94-J, 95-98-J, 95-192-J, 95-295-J, 95-399-J, 96-298-J	Knapp, M. (12)	95-111-S, 96-296-C, 96-297-J, 96-422-S
Grunewald, O. (1)	94-16-J			Kofoid, K.D. (26)	95-222-J, 95-284-S, 95-473-S, 95-478-J, 96-220-S
Guikema, J.A. (7)	91-437-J, 91-471-J, 93-537-B, 93-538-B, 94-486-J, 94-538-J, 94-547-J, 94-580-J, 94-591-J, 95-177-J, 95-484-J, 95-622-J, 95-623-J, 95-624-J, 95-625-J, 95-626-J	Hulbert, S.H. (23)	94-43-J, 94-182-J, 94-374-J, 95-22-B, 95-187-J, 95-200-J, 95-361-J, 95-362-J, 95-369-J, 95-460-J	Koo, S. (19)	95-107-J, 95-108-J, 95-109-J, 96-97-J
				Kramer, C.L. (7)	94-37-J, 94-563-J, 94-582-J
Gwartz, J. (20)	95-30-J, 96-42-J	Hunt, M.C. (4)	94-424-J, 94-515-J, 95-341-J, 95-447-A, 96-103-A, 96-140-S, 96-334-S	Kramer, K.J. (5)	94-205-J, 94-222-J, 94-416-J, 94-436-J, 94-450-J, 95-174-J, 95-247-J, 95-415-J, 95-621-J, 96-108-J, 96-126-J, 96-154-J
Hagen, L.J. (2, 6)	94-124-A, 94-506-J, 95-41-J, 95-343-J, 95-593-A, 95-594-A, 95-613-A, 96-210-A	Iandolo J.J. (7)	94-162-J, 95-275-J	Kreikemeier, K. (29)	95-357-S, 96-139-S
		Janssen, K.A. (2)	95-26-S, 95-74-S, 95-241-S, 95-267-S, 95-284-S, 95-446-S, 96-35-S, 96-119-S, 96-199-S, 96-215-S, 96-220-S, 96-236-S, 96-249-A, 96-450-S	Krishnamoorthi, R. (5)	95-167-J, 95-254-J, 95-355-J, 95-432-J, 95-585-J, 96-36-J, 96-224-J, 96-363-J
Ham, J.M. (2)	93-446-J, 94-167-J, 94-371-J, 94-498-J, 95-133-J, 95-152-J, 95-445-J	Jardine, D.J. (23)	95-251-A, 95-252-A, 95-266-A, 96-215-S, 96-248-A, 96-249-A, 96-255-A, 96-280-S, 96-422-S	Kropf, D.H. (4)	94-515-J, 95-40-J, 95-341-J, 95-357-S, 96-103-A, 96-140-S, 96-334-S
				Kuhl, G.L. (4)	95-56-J, 96-334-S
Harcbers, L.H. (4)	95-357-S, 96-334-S			Lamm, F.R. (27)	92-302-J, 94-288-J, 96-110-S, 96-371-D, 96-473-S, 96-476-S
Hartnett, D.C. (7)	93-568-J, 95-196-J, 95-560-J, 95-561-A, 95-562-A, 95-563-A, 95-564-A, 95-565-A, 95-566-A, 96-1-J, 96-24-J	Jeon, I.J. (4)	93-511-B, 94-87-B, 94-134-B, 94-241-J, 95-209-J, 95-532-J, 96-97-J, 96-106-S	Lamond, R.E. (2)	94-356-J, 95-66-J, 95-241-S, 96-215-S
				Lamont, W.J., Jr. (21)	93-50-J, 95-25-A, 95-162-T, 95-223-J, 95-310-A, 95-311-A, 95-527-A, 96-43-A, 96-144-T, 96-152-A, 96-153-A, 96-196-A, 96-197-A, 96-211-A, 96-250-T, 96-252-A, 96-263-A, 96-284-A, 96-285-A, 96-301-A, 96-302-A, 96-303-A, 96-317-J, 96-323-A, 96-324-A, 96-440-E
Harvey, T.L. (16, 26)	93-400-J, 94-196-J, 94-232-J, 94-239-J, 94-385-J, 95-212-J, 95-222-J, 95-260-J, 95-386-J, 95-478-J	Johnson, D.E. (25)	94-250-J, 95-357-S		
		Johnson, L.B. (23)	96-11-J		
		Johnson, T.C. (7)	93-395-J, 94-237-J, 94-268-J, 94-384-J, 94-468-J, 95-129-J		
Hatchett, J.H. (20)	94-232-J, 95-187-J, 95-545-J, 95-577-J, 96-118-J	Kambhampati, S. (16)	94-540-J, 95-385-J, 95-426-J		
		Kanost, M. (5)	93-489-J, 94-193-J, 94-462-J, 95-1-J, 95-374-J, 95-375-J, 95-519-J, 95-546-B, 96-18-J		
Havlin, J.L. (2)	94-326-B, 94-479-B, 94-480-J, 94-512-J, 94-577-J, 95-37-A, 95-241-S, 95-342-J, 95-603-S, 96-215-S, 96-450-S, 96-525-S	Kapil, S. (13)	95-296-J, 95-297-J, 95-356-J		

Publication Record of Scientists (Continued)

Langemeier, L.N. (1)	95-8-D, 95-141-S, 95-389-D, 95-421-S, 96-106-S, 96-337-S, 96-338-S	Martin, T.J. (26)	93-400-J, 94-196-J, 94-232-J, 94-239-J, 94-243-J, 95-31-J, 95-260-J, 95-386-J, 96-35-S, 96-209-A	Pair, J.C. (21)	95-111-S, 95-464-S, 95-495-T, 95-506-T, 95-507-T, 95-508-T, 95-509-T, 95-513-S, 96-327-T, 96-328-T, 96-329-T, 96-330-T, 96-331-T, 96-347-T, 96-348-T, 96-479-S
Langemeier, M.R. (1)	95-175-S, 95-357-S, 96-106-S, 96-139-S, 96-140-S, 96-334-S, 96-545-D	Martin, V.L. (2)	94-443-J, 95-241-S, 95-262-S, 95-267-S, 95-284-S, 95-329-S, 95-446-S, 96-35-S, 96-199-S, 96-209-A, 96-215-S, 96-220-S, 96-236-S, 96-267-S, 96-450-S, 96-525-S	Paulsen, G.M. (2)	91-437-J, 91-471-J, 91-544-A
Leach, J.E. (23)	93-120-B, 93-250-A, 94-410-J, 94-475-J, 94-564-J, 94-591-J, 95-95-J, 95-177-J, 95-180-J, 95-344-J, 95-604-J, 96-39-B, 96-162-J, 96-345-B	Miller, J.L. (22)	94-600-J, 95-71-J, 95-274-J, 95-360-J	Pedersen, J.R. (20)	94-556-J, 95-535-J
LeDuc, F. (21)	96-91-J	Milliken, G.A. (25)	94-347-J, 94-451-J	Peters, P. (19)	95-438-J
Leedle, J.A.Z. (10)	94-3-J	Minocha, H.C. (13)	93-462-J, 94-403-A, 94-404-J, 94-482-J, 95-220-J	Pfender, W.F. (23)	93-401-J
Leipold, H.W. (13)	93-328-J, 93-491-J, 93-493-J, 93-516-J, 94-75-J, 94-106-J	Mintert, J. (1)	95-357-S, 96-139-S	Phebus, R. (4)	94-285-B, 94-485-J, 94-537-J, 95-140-J, 95-288-A, 95-345-J, 95-357-S, 95-467-J, 95-468-J, 95-481-A, 95-496-A, 96-40-J, 96-75-J, 96-334-S, 96-400-J
Leland, S.E. (13)	94-336-J, 94-532-J, 95-22-B, 95-96-J, 95-97-B, 95-218-B, 95-314-B, 95-315-B, 95-406-J, 95-407-J, 95-491-B, 95-498-J, 95-548-J, 95-610-J, 95-627-A, 96-114-J	Minton, J.E. (4)	95-10-J, 95-82-J, 95-221-J, 95-357-S, 95-590-J, 96-334-S	Phillips, R. (1)	93-185-J
Leslie, J.F. (23)	94-336-J, 94-532-J, 95-22-B, 95-96-J, 95-97-B, 95-218-B, 95-314-B, 95-315-B, 95-406-J, 95-407-J, 95-491-B, 95-498-J, 95-548-J, 95-610-J, 95-627-A, 96-114-J	Morrill, J.L. (4)	93-415-J, 94-145-J, 94-250-J, 95-141-S, 95-185-J, 95-186-J, 95-325-J, 95-346-J, 95-434-T	Phillips, R.M. (13)	95-161-J
Liang, G.H. (2)	92-18-B, 94-182-J, 94-355-B	Moshier, L.J. (2)	91-120-J, 96-21-J	Pickrell, J. (10)	94-198-J
Lomas, L.W. (28)	92-475-J, 95-454-S, 96-120-S, 96-334-S	Mosier, D. (13)	93-548-J, 94-346-J, 94-531-J, 94-548-J, 95-16-J, 95-100-J, 95-101-J, 95-102-J, 95-103-J, 95-474-J, 96-135-J	Pierzynski, G.M. (2)	94-96-J, 94-200-A, 94-512-J, 94-535-J, 95-241-S, 95-454-S, 96-215-S, 96-422-S, 96-450-S
Long, C.E. (21)	96-211-A, 96-303-A	Moyer, J.L. (28)	92-475-J, 93-4-J, 93-522-J, 93-523-J, 94-147-J, 95-66-J, 95-158-J, 95-159-J, 95-235-A, 95-241-S, 95-329-S, 95-454-S, 96-9-J, 96-120-S, 96-215-S, 96-267-S, 96-378-A, 96-422-S	Ponte, J.G. Jr. (20)	94-598-A, 95-132-J, 95-164-B, 95-383-S, 96-17-J, 96-374-J
Long, J.H. (28)	95-26-S, 95-74-S, 95-251-A, 95-252-A, 95-262-S, 95-267-S, 95-329-S, 95-454-S, 96-35-S, 96-119-S, 96-199-S, 94-315-J, 96-236-S, 96-422-S	Mueller, D. (5)	94-222-J, 95-50-J	Posner, E.S. (20)	91-105-J
Lookhart, G.L. (20)	94-576-J, 95-150-J, 95-151-J, 95-204-J, 95-358-J, 95-534-5J	Murray, J.S. (7)	93-144-J	Prakash, O. (5)	94-569-B, 95-585-J, 96-36-J, 96-154-J, 96-224-J, 96-363-J
Loughin, T. (25)	94-498-J, 94-572-J, 96-140-S	Muthukrishnan, S. (5)	94-184-J, 94-436-J, 95-176-J, 96-108-J, 96-239-J	Qarooni, J. (20)	93-23-B, 94-188-J, 94-415-J, 94-603-J, 95-9-B
McVey, D.S. (13)	93-266-J, 94-38-J, 94-73-J, 94-464-J, 94-469-T, 94-550-J, 95-113-J, 95-161-J, 95-353-J, 95-580-J	Nagaraja, T. G. (4)	93-506-J, 93-518-J, 93-519-J, 93-520-J, 94-145-J, 94-201-B, 95-114-J, 95-228-A, 95-229-A, 95-357-S, 95-417-J, 95-606-J, 96-5-J, 96-334-S	Rajashekar, C. (21)	94-495-J, 96-104-J
Maddux, L.D. (2)	94-443-J, 95-210-A, 96-21-J, 96-199-S, 96-215-S, 96-236-S, 96-268-A, 96-450-S	Nechols, J.R. (16)	94-418-J, 94-497-J, 95-317-J, 95-433-J	Ransom, M.D. (2)	92-634-J, 94-246-J
Maghirang, R.G.(6)	95-452-J	Nelssen, J.L. (4)	94-38-J, 94-287-J, 94-606-J, 95-40-J, 95-63-J, 95-121-J, 95-139-J, 95-175-S, 95-322-J, 95-497-J, 95-515-J, 95-607-J, 95-614-J, 96-44-J, 96-61-J, 96-140-S	Raub, R.H. (4)	95-28-J
Manges, H.L. (6)	92-302-J, 92-594-J, 93-351-J, 94-288-J, 95-144-A, 96-296-C, 96-297-J	Nichols, D.A. (4)	95-175-S, 95-357-S, 96-334-S	Raup, W.J. (23)	95-352-D, 95-554-D, 96-496-D
Marcum, K.B. (21)	95-513-S	Nietfeld, J. (13)	95-139-J, 95-146-J, 96-140-S	Reddi, L. (9)	95-387-B
Margolies, D.C. (16)	92-293-J, 92-384-J, 92-538-J, 94-418-J, 94-473-J, 94-592-J, 96-194-J	Norman, D.W. (1)	93-507-A, 93-508-B, 94-394-A, 94-483-J, 95-163-A, 95-225-S, 95-351-B, 96-145-B, 96-545-D	Reeck, G.R. (5)	94-416-J, 95-174-J, 95-479-J, 96-11-J
Marr, C.W. (21)	93-50-J, 94-230-A, 94-231-A, 95-317-J, 95-365-E, 95-469-S, 96-282-A, 96-422-S, 96-440-E	Norwood, C.A. (29)	94-456-J, 95-12-S, 95-603-S, 96-525-S	Reed, C. (20)	95-492-S
Marsden, J. (4)	96-40-J, 96-400-J	Oberst, R.D. (13, 18)	95-113-J, 96-135-J	Reese, J.C. (16)	94-126-J, 94-176-J, 95-479-J
Marsh, B.H. (2)	94-315-J, 94-356-J, 94-443-J, 95-26-S, 95-74-S, 95-251-A, 95-262-S, 95-267-S, 95-284-S, 95-294-S, 95-446-S, 95-531-J, 96-35-S, 96-119-S, 96-199-S, 96-215-S, 96-220-S, 96-236-S, 96-248-A, 96-249-A, 96-267-S, 96-450-S	Ohlenbusch, P.D. (2)	95-219-S, 96-206-S	Regehr, D.L. (2)	88-258-J, 95-219-S, 95-225-S, 95-233-J
Martin, C. (6)	94-510-B	Olson, K.C. (26)	93-73-J, 95-579-J	Reichman, O.J. (7)	96-24-A
Martin, L.C. (4)	95-382-S, 95-504-A	Owensby, C.E. (2)	92-92-B, 94-98-J, 94-256-J, 94-371-J, 94-449-J, 95-357-S, 95-445-J	Reid, W. (21)	94-414-J, 95-60-A, 95-197-A, 95-198-A, 95-199-A, 96-562-T
				Rice, C.W. (2)	92-140-J, 94-98-J, 94-146-J, 94-326-B, 94-577-J, 95-210-A, 95-241-S, 95-604-J, 96-56-B, 96-215-S
				Ridley, R.K. (13)	94-67-J, 95-416-T
				Rife, C.L. (2)	96-272-A, 96-273-A, 96-392-S, 96-455-S
				Robel, R.J. (7)	93-22-J, 94-21-J, 94-151-J, 94-412-J, 95-69-J
				Roche, T.E. (5)	93-303-J, 95-3-J, 95-4-J, 95-5-J, 95-6-J, 95-465-J, 95-477-B,
				Rooney, W. (2)	94-517-J, 95-451-S, 95-603-S
				Roozeboom, K. (2)	95-26-S, 95-74-S, 95-262-S, 95-265-A, 95-267-S, 95-284-S, 95-294-S, 95-329-S, 95-446-S, 96-35-S, 96-119-S, 96-199-S, 96-220-S, 96-236-S, 96-254-A, 96-267-S, 96-280-S, 96-450-S
				Ross, C. (3)	92-400-J, 94-550-J, 95-42-J, 95-580-J, 96-202-J

Roufa, D.J. (7)	94-318-J, 94-342-J, 95-171-J, 95-552-J, 96-3-J	Stahlman, P.W. (26)	94-376-J, 94-513-J, 94-564-J, 95-219-S, 96-21-J, 96-168-A, 96-169-A, 96-170-A, 96-171-A, 96-172-A, 96-173-A, 96-175-A, 96-206-S, 96-232-A, 96-233-A	Walker, C.E. (20)	90-576-J, 92-557-J, 92-633-J, 94-71-T, 94-108-J, 94-372-J, 94-415-J, 94-499-J, 94-523-J, 94-553-J, 94-554-J, 94-562-J, 94-583-J, 94-603-J, 94-605-J, 94-607-J, 95-29-J, 95-62-A, 95-65-J, 95-505-J, 96-183-J, 96-260-J, 96-374-J
Schaffer, J.A. (29)	95-12-S	Steele, J.L. (6)	93-495-J	Wang, X. (5)	94-529-J, 95-208-J, 95-518-J, 95-608-J, 96-113-J, 96-162-J
Schalles, R.R. (4)	95-357-S, 96-334-S	Stegmeier, W. (26)	96-280-S, 96-392-S, 96-455-S	Welch, S. (2)	94-428-A, 94-595-J
Schapaugh, W.T., Jr. (2)	93-445-J, 95-424-J, 96-138-S, 96-422-S	Steichen, J.M. (6)	95-59-A	Westfall, J.A. (3)	95-224-J, 95-570-J
Schlegel, A.J. (29)	94-480-J, 95-12-S, 95-26-S, 95-241-S, 95-267-S, 95-284-S, 95-294-S, 95-342-J, 95-465-J, 95-603-S, 96-35-S, 96-119-S, 96-199-S, 96-215-S, 96-220-S, 96-280-S, 96-232-A, 96-296-C, 96-297-J, 96-525-S	Stevens, A.B. (21)	95-513-S	Wetzel, D.L. (20)	93-278-B, 95-70-B, 95-273-J, 96-77-J, 96-78-J, 96-79-J, 96-80-J, 96-325-B, 96-396-J, 96-407-J, 96-408-J, 96-409-J, 96-497-J, 96-498-A, 96-499-A
Schoning, P.R. (13)	93-541-J, 94-121-J, 94-122-J, 94-451-J, 94-484-J, 94-557-J, 95-416-T, 95-442-J	Stevenson, J.S. (4)	94-539-A, 94-541-A, 95-141-S, 95-221-J, 95-357-S, 95-381-J, 95-494-J, 95-567-J, 95-615-A, 96-106-S, 96-334-S	White, F.F. (23)	93-120-B, 93-250-A, 93-252-B, 94-312-J, 94-410-J, 94-591-J, 95-177-J, 96-11-J, 96-39-B, 96-345-B
Schrock, M.D. (6)	94-561-J	Stiegert, K. (1)	95-283-D, 96-188-D	Whitney, D.A. (2)	94-356-J, 94-487-J, 95-241-S, 95-446-S, 95-454-S, 96-215-S, 96-422-S, 96-450-S
Schroeder, T.C. (1)	94-488-J, 95-34-D, 95-175-S, 95-517-J, 95-525-J, 95-589-J	Stone, L.R. (2)	92-302-J, 93-414-J, 95-211-A, 95-465-J, 96-296-C, 96-297-J, 96-462-A	Wiest, S.C. (21)	95-339-J, 95-393-J, 95-513-S, 96-479-S
Schumm, W.R. (17)	95-304-J, 95-313-J, 95-414-J, 95-480-J, 96-382-J, 96-410-J, 96-411-J	Stuteville, D.L. (23)	93-62-J, 94-454-J, 94-602-J	Wilde, G.E. (16)	93-35-J, 94-126-J, 94-385-J, 94-397-J, 95-324-J, 95-577-J, 96-83-J, 96-525-S
Schurle, B. (1)	95-33-D, 95-225-S, 95-433-J, 96-124-J	Sunderman, H.D. (27)	96-110-S, 96-392-S, 96-422-S, 96-455-S, 96-476-S	Wilken, C. (17)	96-359-S
Schwab, A.P. (2)	91-222-B, 92-666-J, 93-117-J, 94-47-B, 94-56-J, 94-58-J, 94-245-J, 94-387-J, 95-52-J, 95-135-B, 95-560-J	Sweeney, D.W. (28)	93-522-J, 93-523-J, 94-518-J, 95-66-J, 95-235-A, 95-241-S, 95-454-S, 96-215-S, 96-422-S	Williams, J.R. (1)	93-535-J, 95-33-D, 95-443-D, 95-539-J, 96-371-D, 96-473-S, 96-482-D
Schwenke, J.R. (25)	92-604-J, 94-176-J, 94-485-J, 96-74-A	TenEyck, G. (6)	95-446-S	Wilson, B. (1)	94-278-J
Schwulst, F.J. (27)	95-57-J, 95-504-A	Thien, S.J. (2)	94-96-J, 95-77-T	Witt, M.D. (29)	93-499-J, 94-232-J, 94-502-J, 95-12-S, 95-26-S, 95-74-S, 95-179-S, 95-250-A, 95-256-A, 95-262-S, 95-267-S, 95-284-S, 95-329-S, 95-390-A, 95-450-S, 95-603-S, 96-35-S, 96-58-J, 96-119-S, 96-199-S, 96-220-S, 96-236-S, 96-267-S, 96-455-S, 96-525-S
Sears, R.G. (2)	93-353-A, 94-232-J, 94-242-J, 94-243-J, 95-26-S, 96-35-S, 95-47-J, 95-88-J	Thierstein, G.E. (6)	94-309-J	Wong, P. (7)	95-537-B, 93-538-B, 95-13-J
Seib, P.A. (20)	92-328-J, 93-187-J, 94-249-J, 94-333-J, 94-500-J, 94-519-J, 95-234-J, 95-334-J, 95-372-J, 95-522-J, 95-569-J, 95-571-J	Thompson, C.A. (26)	95-241-S, 95-357-S, 95-603-S, 96-386-S	Zayas, J.F. (19)	91-250-J, 93-497-J, 94-590-J, 95-90-J, 95-91-Jm 95-278-J, 95-350-J
Seifers, D.L. (23, 26)	93-400-J, 94-232-J, 94-239-J, 95-212-J, 95-222-J, 95-260-J, 95-265-A, 95-386-J, 95-473-S, 95-478-J	Tisserat, N. (23)	94-368-J, 95-111-S, 95-365-E, 95-469-S, 95-513-S, 96-243-A, 96-244-A, 96-245-A, 96-246-A, 96-247-A 96-479-S	Zhang, N. (6)	94-18-J, 94-19-J, 94-309-J, 95-14-J
Seitz, L. (20)	93-553-J	Titgemeyer, E. (4)	95-141-S, 95-579-J, 96-106-S, 96-334-S		
Setser, C.S. (19)	94-171-J, 95-368-B, 95-435-J	Todd, T.C. (23)	94-402-J, 95-262-S, 95-377-J, 95-424-J, 95-454-S, 95-485-J, 96-209-A, 96-236-S, 96-422-S		
Shanklin, C. (22)	93-183-J, 93-184-J, 94-417-J, 94-511-J, 95-274-J, 96-93-J, 96-299-B	Tomich, J. (5)	95-553-J, 95-553-J		
Shirley, J.E. (4)	95-141-S, 96-106-S	Tracy, J.C. (9)	95-52-J, 95-135-B		
Skidmore, E.L. (2)	93-157-J, 94-506-J, 95-582-A, 95-583-A	Troyer, D.L. (3)	92-400-J, 95-2-J, 94-91-J, 95-363-J, 95-584-J, 96-204-J		
Skinner, D.Z. (2)	93-62-J, 93-122-J, 93-417-J, 94-164-J, 94-182-J, 94-454-J, 94-602-J, 95-604-J	Ulug, E. (7)	96-102-J		
Slocombe, J. (6)	94-309-J, 96-462-A	Unruh, J.A. (4)	95-40-J, 95-82-J, 95-175-S, 95-607-J, 96-48-J, 96-49-J, 96-203-J, 96-334-S		
Smith, J.E. (13)	92-658-J, 93-78-J, 93-484-B, 94-27-J, 94-311-J, 95-322-J	Upton, S.J. (7)	94-21-J, 94-161-J, 94-419-J, 94-452-J, 94-453-J, 94-457-J, 94-555-J, 95-46-J, 95-49-J, 95-75-J, 95-126-J, 95-326-J, 95-332-J, 95-457-J, 95-542-J, 95-576-J		
Smith, J.S. (4)	94-134-B, 94-241-J, 94-367-J, 94-442-J, 94-447-J, 94-537-J, 95-418-B, 95-568-J, 96-334-S	Vanderlip, R.L. (2)	91-120-J, 91-372-J, 92-272-J, 93-133-J, 93-515-J, 94-428-A, 95-205-A, 95-446-S, 96-450-S		
Spaeth, C.S. (4)	95-504-A	Vanzant, E.S. (26)	94-250-J, 94-449-J, 94-594-J, 95-56-J, 95-357-S, 95-425-S, 95-537-J, 96-334-S, 96-386-S		
Spillman, C.K. (6)	91-105-J, 93-495-J	Wagner, L.E. (6)	92-317-J, 94-279-J, 95-582-A, 95-593-A, 96-23-A, 96-205-A		
Spire, M.F. (10)	92-658-J, 94-574-J	Walawender, W.P. (8)	94-300-J		
Spurgeon, W.E. (29)	92-594-J, 93-351-J, 95-12-S, 95-144-A				
St. Jean, G. (10)	93-327-J, 93-328-J, 94-102-J, 94-142-J, 94-380-B, 94-423-B, 94-494-J, 94-594-J, 95-80-J, 95-120-J, 95-123-J, 95-170-B, 95-400-B, 95-488-B				

Research Projects Active June 30, 1996

■ Agricultural Economics

- 520005 Studies in Professional Farm Management and Rural Appraisals (Training, Practices, Fees)
 520462 Impacts of Federal Farm Policies on the Great Plains States
 520476 Pricing and Pooling of Kansas and U.S. Wheat
 520478 Optimal Capital Structure of Grain Marketing/ Farm Supply Co-ops
 520479 Financial Analysis of Alternative Agriculture Systems
 520480 White Wheat Producers Attitude toward Growing Wheat
 520482 Consumer Willingness to Pay for Irradiated Meat
 520483 Analysis of Small Game Harvest Survey Data
 520484 Price Discovery in the Beef Industry: Projection for the Next Decade
 522955 Value-Added Wheat Products
 F003 Regulatory, Efficiency, and Management Issues Affecting Rural Financial Markets
 R014 Successful Coping Strategies of Rural Communities
 H073 An Economic Analysis of Farm Management Issues and Resource Use of Kansas Farms
 H119 (number applies to title above)
 H122 The Impact of Agricultural Commodity Programs on Food and Feed Grain Markets
 F214 Economic and Environmental Implications of Expiring Conservation Reserve Contracts
 H303 Economics of the Hog Industry in Kansas
 H317 Economic Evaluation of Post-CRP Land Use Options
 H340 Livestock and Meat Prices under Structural Change
 H358 A Cost/Benefit/Risk Analysis of Various Soil-Improving Practices
 H415 Competitiveness of Kansas Agribusiness Industries
 H472 Whole-Farm Economic Analysis of Crop Rotations and Short-Season Crop Varieties
 F634 Policy Implications for Farm Household and Rural Community Responses to Economic Change
 F691 Domestic and International Marketing Strategies for U.S. Beef
 H698 Innovative Red Meat Production and Processing Systems for the Modern Consumer
 R700 Analysis of Consumer Preference and Meat Processor Development of HACCP Systems
 R702 Deriving Farmer-Friendly Sustainability Indicators for the Kansas Farmer
 R703 Measuring Tax Policy Changes on the Well-Being of Kansas Farmers
 F707 Performance of the U.S. Grain Marketing System
 R754 Use of a Legume-Grain Sorghum Rotation in a Crop-Livestock System
 F835 Changing Patterns of Food Demand and Consumption Behavior
 H997 Commercial Greenhouse Crops to Complement Spring-Grown Bedding Plants

■ Agronomy

- 520035 Crop Physiology—Production Research
 520040 Crop Performance
 520044 Range and Pasture Brush and Weed Control
 520046 Corn and Grain Sorghum Production and Management
 520050 Seed and Plant Parts Certification
 520052 Field Herbicidal Evaluations
 520663 Breeding Grain Sorghum for Improved Dryland Production
 520665 Grazingland Establishment and Renovation
 520669 Breeding Soybeans for Increased Productivity
 520706 Digitization of the Kansas Soil Survey

- 520708 Digitization of Soil Surveys
 520713 Development of Hard White Winter Wheat for Kansas
 520721 Development of a New Heterotic Group in Wheat
 520723 Alfalfa Research
 520726 Variable Nitrogen Management for Improving Groundwater Quality
 520743 Evaluation of *Tyta luctuosa* for Biological Control of Field Bindweed
 520747 Assessing the Potential for Biological Control of Field Bindweed with the Gall Mite and a Moth
 520748 Water Quality Use of Nitrogen Mineralization in Spatially Variable Nitrogen Recommendations
 520752 Development of Commercial Soybean Varieties for Kansas
 520755 Double-Crop Soybean Performance
 520756 Foundation Seed Maintenance
 520762 Development of an Alfalfa Genome Database
 520763 Canola Research
 520764 Improvement of Hard Red Winter Wheat
 520765 Management of the Soybean Cyst Nematode and Charcoal Rot in Soybeans
 520766 Carbon and Water Fluxes from Irrigated Corn: A Field-Scale Full-Season Study
 520767 Effect of Corn Hybrid Maturity and Planting Population on Grain Yields of No-Till Dryland Corn
 520768 Effect of Hybrid Maturity, Planting Date, and Weed Infestations in Grain Sorghum
 520769 Water-Efficient Practices for Corn Production
 520770 Identification of Tolerance to Autotoxicity in Alfalfa
 520771 Biological Control of Field Bindweed
 520772 Nitrogen Fertilizer Effects on Soybean Yield and Seed Protein and Oil Contents
 520773 Digestibility and Feeding Value of Grain Sorghum: Manipulating Genotype to Improve Value
 520774 Improving Atrazine Management for Weed Control in Grain Sorghum
 520775 Atrazine Management: Efficacy, Formulations, Alternatives, Runoff Losses, and Buffer Zones
 520777 Simulation of Erosion-Induced Plant Stresses and PM-10 Production
 520778 Work Station for Soil-Plant-Atmosphere Continuum Studies
 520779 (number applies to title above)
 520780 Acquisition of High Performance Liquid Chromatograph, Gas Chromatograph, Mass Spectrometer
 520782 Carbon Water and Energy Fluxes from a Tallgrass Prairie: An Investigation of Environmental/Biological Factors
 520783 Enhancement of Bioremediation
 520785 A Survey of Winter Annual Grass Distribution and Severity in Kansas
 520787 Kansas EPA EPSCOR: Enhancement of Bioremediation Research in Kansas
 520788 Providing Soil Sample Analyses for Soil Survey Activities
 520789 Soybean Plot Combine
 520790 Biolistic Gametophyte Transformation of Alfalfa
 520791 Screening Alfalfa Genotypes for Reduced Autotoxicity
 520792 Managing Corn Planting Decisions to Reduce Risks
 520793 Agronomic and Physiological Traits from Wild Relatives for Developing Improved Wheat Cultivars
 520794 Recurrent Selection for Reduced Autotoxicity in Alfalfa
 520796 Improvement of Yield and Quality of Hybrid Wheat

- 520797 Improving Soybean Profitability and Reducing Risks of Environmental Effects: Decision Support Systems
 520798 Predicting Potential Mineralizable Nitrogen by Remote Sensing
 520799 Influence of Planting Date, Plant Population, and Hybrid Maturity on Corn Yields for Irrigated Sandy Soil
 520800 Providing Soil Sample Analyses for Soil Survey Activities
 520803 Monitoring and Modeling Nitrogen Management in Conservation Tillage Production Systems
 520804 Water-Efficient Practices for Corn Production
 520805 Development of Sorghum Germplasm Tolerant to Greenbug-, Aphid-, and Mite-Transmitted Potyviruses and Drought
 520806 The Effect of Hybrid Maturity, Planting Date, Plant Population, and Row Spacing on Grain Yields, Weed Infestations, and Diseases of Grain Sorghum
 520807 Terrestrial Carbon Processes, II
 520808 Kansas EPA EPSCOR: Enhancement of Bioremediation Research in Kansas
 520809 Agronomic Effect of Corn Hybrid Maturity, Planting Date, and Plant Population on Grain
 520810 Ammonia Volatilization from Experimental Nitrogen Sources
 520812 Sequestration of Carbon Dioxide into Soil Organic Carbon Pools under Elevated Carbon Dioxide Environment
 520813 Farmer-to-Farmer Cover Crop Network Complementing On-Farm and On-Station Trial Alfalfa Research
 520814 Instrument Combining Computerized 3D Plant Photogrammetry with Automated Physiological Monitoring
 520816 Remodeling Instrument Combining Computerized 3D Plant Photogrammetry with Automated Physiological Monitoring
 520817 Corn and Sorghum Hybrid Responsiveness to Starter Fertilizers
 520818 Enhancing the Role of Fluid Fertilizers in Precision Farming
 520819 Variable Nitrogen Management for Protecting Groundwater Quality
 522330 Assessing the Potential for Biological Control of Field Bindweed
 522347 Bacterial Volatiles Attractive to Stable Flies
 522353 Transgenic Corn for Pest Management—Research and Extension Needs
 524470 Breeding Soybeans for Increased Productivity Using Cultural Practices to Reduce Soybean Cyst Nematode and Charcoal Rot Damage in Soybeans
 524521
 524550 Characterization Mapping of Five New Leaf Rust Resistant Genes
 524582 Use of *Fusarium* Subglutinins as a Seed Treatment and Growth Promoter of Corn
 525754 Canola Research
 525757 Tillage, Irrigation, and Hybrid Maturity Class Effects on Corn Production
 525765 Water-Efficient Practices for Corn Production
 525767 (number applies to title above)
 525958 Canola Research
 525981 Alternative Weed Control Methods for Grain Sorghum Production
 525982 Development of Sorghum Germplasm Tolerant to Greenbug-, Aphid-, and Mite-Transmitted Potyviruses and Drought
 526167 Tillage, Irrigation, and Hybrid Maturity Class Effects on Corn Production
 526183 Water-Efficient Practices for Corn Production Using Cultural Practices to Reduce Soybean Cyst Nematode and Charcoal Rot Damage in Soybeans
 526396
 527608 Assessing the Potential for Biological Control of Field Bindweed with the Gall Mite and a Moth

527954	Bioremediation of Hydrocarbon-Contaminated Soils Using Vegetation: A Field and Greenhouse Study	R727	Use of Nitrogen Mineralization in Spatially Variable Nitrogen Recommendations	H075	Mechanisms of Capillary Stress Failure in Exercise-Induced Pulmonary Hemorrhage
529140	Rangeland-Plant Response to Elevated CO ₂	H741	Mechanisms of Insect-Plant Interactions: Sorghum Resistance to Insect Pests	F076	Mapping the Pig Genome
529351	Processes Affecting Carbon Fluxes of Grassland Ecosystems	F779	Variables in Agriculture-Weather Information Systems	H077	Intestinal Cellular Immunity: Cytokine Interactions
529352	(number applies to title above)	F838	Chemistry and Bioavailability of Waste Constituents in Soils	H120	Cell-Surface Attachment Proteins for Bovine Herpes Virus-1
H040	Prediction and Correction of Zinc Deficiency in Sorghum in Kansas	F932	Pesticides and Other Toxic Organics in Soil and Their Potential for Groundwater Contamination	H356	Morphometry of the Blood-Gas Barrier in Exercise-Stressed and Pneumonic Calves
H056	Use of Crop Models in Sorghum and Corn Management	F935	Environmental and Genotypic Control of Assimilate Allocation in Grain Crops	F579	Stress Factors of Farm Animals and Their Effects on Performance
H064	Effect of Previous Crop on Ammonium Nutrition of Corn	H946	Effects of Soil Compaction on Soil Physical Properties and Crop Growth	F704	Metabolic Relationships in Supply of Nutrients for Lactating Cows
F079	Integrated Systems for Improved Water and Nitrogen Management in Irrigation Environments	R957	Phosphorus, Potassium, and Chloride Effects on Alfalfa and Birdsfoot Trefoil Establishment, Yield, and Quality	■ Animal Sciences and Industry	
R086	Tillage and P Fertilizer Management Effects on Surface P Runoff and Crop Yield	H961	Genetic Investigations of Pest Resistance in Alfalfa	481878	Regulation of Porcine Mucosal Immunity
H092	Physiological Control of Crop Productivity	H976	Crop Responses in Stressful Environments	481893	Function of Ovine Pituitary Stellate Cells in Endotoxemia
H093	Alfalfa Breeding and Genetics	R993	Agronomy/Agricultural Engineering Experiment Fields Research	520773	Digestibility and Feeding Value of Grain Sorghum: Manipulating Genotype to Improve Value
H096	The Biology and Ecology of Weeds in Crop Ecosystems	■ Anatomy and Physiology		520814	Alfalfa Research
H103	Crop Sequence and Tillage Interaction Effects on Crop Yield and Soil Environment	481887	Mapping and Microdissecting the Porcine Genome for Disease Resistance Loci	521743	(number applies to title above)
H106	The Impact of Fertilizers and Herbicides on Water Quality	481889	Distribution of Blood Flow during Rest and Exercise in the Equine Lung	521747	International Livestock Program-International Trade Development
F143	Forage Crop Genetics and Breeding to Improve Yield and Quality	481890	Porcine Antibacterial Peptides: Novel Agents for Porcine Enteric Diseases	521751	KSU Technical Assistance to Kansas Meat Processors
F188	Improved Characterization and Quantification of Flow and Transport Processes in Soils	528257	Anti-Idiotypic Immunity and Receptor Interactions in Bovine Respiratory Disease	521752	The Effect of Biological Inoculants and Enzymes on the Preservation and Nutritive Value of Corn Silage
F193	Spatial Dynamics of Leafhopper Pests and Their Management on Alfalfa	528575	Neurons and Neuropeptides in Sea Anemones	521761	An Evaluation of a Calf-Starter Protein Source
F218	Characterizing Nitrogen Mineralization and Availability in Crop Systems to Protect Water Resources	528578	Sequence Tagged Site Mapping of the Pig Genome by PCR	521765	Induced Hepatic Abscesses in Cattle Immunized with Leukotoxin of <i>Fusobacterium necrophorum</i>
H271	Improvement of Hard Winter Wheats and Other Small Cereal Grains for Kansas	528580	Mechanisms of Limbic Forebrain Control of ACTH Release	521766	Animal Science Food Safety Consortium-Kansas State University
F287	Introduction, Maintenance, Evaluation, and Utilization of Plant Germplasm	528581	REU Supplement to: Neurons and Neuropeptides in Sea Anemones	521776	Kansas Horse Industry Economic Impact Survey
H302	Improving Forage Quality and Production in the Central Great Plains	528584	Development and Regulation of Porcine Neonatal Neutrophil Function	521778	Shelf-Stable Pumpkin Pies
H305	Legumes as a Nitrogen Source in No-Till Rotations for the Eastern Great Plains	528589	Mechanisms of Prolonged Sympathetic Nerve Inhibition	521779	Palatability, Color, and Shelf Life of Beef Subjected to Low-Dose Irradiation
H306	Effects of Long-Term Crop Residue Removal and Fertilizer Application on Soil and Crop Yield	528290	Limiting Neurological Damage from Stroke	521780	Biological Detoxification of Aflatoxin and Fumonisin in Corn Products and Metabolites
H307	Development and Evaluation of Commercial Soybean Cultivars for Kansas	528591	Expression of Heparin Sulfate Proteoglycans and Interleukin following Myocardial Infarction	521781	Effects of Wheat Gluten and Spray-Dried Protein on Growth Performance
H308	Plant Nutrient Cycling in Soil	528592	Sequence Tagged Site (STS) Mapping of the Pig Genome by Rapid on-Slide PCR	521782	Soy Concentrates for Baby Pigs
H309	Plant Tissue Culture, Stability of Organellar Genomes, Chromosome Mapping, and Plant Transformation	528593	Redistribution of Pulmonary Blood Flow during Exercise	521783	Evaluation of Heated Soybean Meal Products Containing Levels of Lipid in Lactating Dairy Cows
H310	Production, Quality, and Physiology of Eastern Gamagrass	528594	(number applies to title above)	521784	Roasting Grain Sorghum to Improve Digestibility and Nutritional Value in Dairy Cattle Diets
H320	Development of Hard White Winter Wheat Varieties for Kansas	528595	Expression of Heparin Sulfate Proteoglycans following Myocardial Infarction	521785	Digestibility and Feeding Value of Grain Sorghum and Techniques to Improve Nutritive Value
H322	Sorghum Breeding and Genetics	528596	Limiting Neurological Damage from Stroke	521786	Microbiological Baseline Tracking for Beef
H328	Enhancing Nutrient Efficiency for Western Kansas	528597	Mechanisms of Prolonged Sympathetic Nerve Inhibition	521787	Support of Value-Added Workshop for Food Processors
H358	A Cost, Benefit, and Risk Analysis of Various Soil-Improving Practices	528598	Porcine Antibacterial Peptides	521789	Evaluation of the Effectiveness of Monensin in Controlling Bloat in Cattle
H377	Soil Acidification and Amelioration in Controlled Traffic Fertilizer Bands	528599	Expression of Inflammatory Cytokines in Equine Tendon Injury	521790	Novel Milk Products Produced through High Hydrostatic Pressure Processing
R378	Coordination of Crop Variety Testing	528600	Porcine Antibacterial Peptides: A New Concept for Prevention and Treatment of Disease	521791	Virginiamycin Effects on Rumen Metabolism in Cattle during Adaptation on High Concentrate Diets
H411	Field-Scale Fluxes of Carbon, Water, and Energy from Irrigated Corn (<i>Zea mays</i>)	528601	Interleukin-1 Receptor Antagonist in Swine	521792	Quality Study of Whole Muscle Pork Subjected to Two Types of Low-Dose Irradiation
H431	Measuring and Modeling Three-Dimensional Canopy Structure in Soybeans	528602	Neurons and Neuropeptides in Sea Anemones	521793	Effects of Potato Protein on Starter Pig Growth Performance
R550	Field Crop Variety Identification and Pure Seed Maintenance	529292	Mechanism of Exercise Inhibition during Lung Congestion	521794	Forage Preservation Additives Trials
H681	Genesis, Classification, and Mineralogy of Kansas Soils	529293	(number applies to title above)	521795	Effect of a Continuous Flow Roasting and Processing Method on the Nutritional Quality and Value of Ground Whole Spent Fowl
H687	Nutritional Management and Grazing Behavior of Beef Cattle on Bluestem Range	529294	(number applies to title above)	521796	Extrusion of Grain Sorghum to Improve Digestibility and Enhance Nutritional Value in Lactating Dairy Cattle Diets
R722	Starter Fertilizer Interactions with Corn Hybrids	529302	Coronary Collateral Function in the Conscious Pony	521797	Zen-Noh Growth Trial (Pigs)
R723	Evaluation of Time of Nitrogen Application in No-Till Production Systems	529303	(number applies to title above)	521798	Evaluation of Films for Use in a Modified Atmosphere System for Fresh Beef and Pork
H724	Range Improvement Investigations	529312	Control of Rhythmic Sympathetic Activity Acute Stress		
R725	Incorporating Nitrogen Response into SORKAM	529313	(number applies to title above)		
		529381	The Pig Granulosa Cell Slow K ⁺ Channel: A Mink Protein		

Research Projects Active June 30, 1996 (Continued)

521799	Scale-up Process Optimization for the New Method of Manufacturing Imitation Mozzarella Cheese Using Soy Proteins	H446	Enhancing Utilization of Carbohydrates and Soybean Proteins in Weanling Pigs	529322	NMR Studies of a Blood-Coagulation Factors Inhibitor
521800	Decontamination of Meat Carcasses Using Low Pressure Steam in a Commercial Beef Processing Facility	H455	Protein and Nonprotein Nitrogen Utilization by Growing-Finishing Cattle	529323	(number applies to title above)
521801	Effect of Ground Mustard on Microorganisms in Laboratory Medium	F579	Stress Factors of Farm Animals and Their Effects on Performance	529342	Regulation of Mammalian Pyruvate Dehydrogenase
521802	Comparative Value of Suncured Alfalfa and Alfalfa/Onion By-product for Growing Beef Cattle	F588	Dairy Herd Management Strategies for Improved Decision Making and Profitability	H013	Serine Proteinase Inhibitors in Insects
521803	Evaluation of Tenneco Packaging System on Shelf Life of Beef, Pork, and Lamb	F628	Development of New Processes and Technologies for the Processing of Poultry Products	H045	Identification of Hormone-Responsive DNA Elements in Barley-Amylase Genetics
521804	Supplemental Carnitine during Lactation for High Producing Sows	H687	Nutritional Management and Grazing Behavior of Beef Cattle on Bluestem Range	H100	Detection and Characterization of Inhibitory Allosteric Sites on RUBISCO
521805	Alfalfa Research	F691	Domestic and International Marketing Strategies for U.S. Beef	H104	Chromosomal Regions Involving Genes for Gliadins and Glutenins
521806	Verifying Purity of Mycotoxin Samples	H698	Innovative Red Meat Production and Processing Systems for the Modern Consumer	H311	Structures and Dynamics of Blood Coagulation Factor Inhibitors by NMR Spectroscopy
521807	Evolutionary Conservation of the Molecular Mechanisms of Development	F704	Metabolic Relationships in Supply of Nutrients for Lactating Cows	H321	Enzymatic Control of Membrane Deterioration in Plant Senescence
521808	(number applies to title above)	F748	Forage Protein Characterization and Utilization for Beef Cattle	H477	Mammalian Heme Proteins
521809	New Manufacturing Technology for Mozzarella Cheese Analogs	H765	Pelvic Area of Bulls as a Predictor of Maternal Calving Ease	H541	Biochemistry of Cyclic GMP
521810	Quantification and Factors Affecting <i>Fusobacterium necrophorum</i> on Ruminal Wall	F865	Increased Prolificacy in Sheep and Its Impact on Nutritional Needs	H744	Biochemistry of Genetic Systems
521811	Effects of Choline and Betain on Finisher Pig Growth Performance and Carcass Characteristics	H897	Management Systems for Optimizing Beef Production	H906	Efficiency of Nitrogen Fixation
526179	Increasing the Use of Grain Sorghum in Kansas Feedlot Cattle Rations	F937	Modeling Responses of Growing Pigs	H918	Function and Regulation of Mammalian α -Keto Acid Dehydrogenase
526180	Influence of Various Ratios of Steam-Flaked Rations on Steer Finishing	Biochemistry			
526182	Influence of Feeding Combinations of Steam-Flaked Sorghum with High-Moisture Corn or Dry-Rolled Corn on Finishing Steer Performance	520780	Acquisition of High Performance Liquid Chromatograph, Gas Chromatograph, Mass Spectrometer	520716	Row Crop Pollution-Control Demonstration Project: Atrazine Analyses
526659	Evolutionary Conservation of the Molecular Mechanisms of Development	527177	Sheath Blight and Expression of Chitinase and B-Glucanase Genes in Resistant and Sensitive Cultivars of Rice	520726	Variable Nitrogen Management for Improving Groundwater
528780	Biological Detoxification of Aflatoxin and Fumonisin in Corn	527179	2D NMR of Protein-Inhibitors of Blood-Coagulation Factor	520729	Effect of Row Width, Planting Population, Planting Date, Variety, and Different Weed Control Levels on Soybean
H016	Nutrition of Developing, Gestating, and Lactating Swine	527190	The Role of $Na^+ K^+$ ATPase in Diabetic Retinopathy	520774	Improving Atrazine Management for Weed Control
H018	Optimum Processing to Maximize Utilization of Cereal Grains in Swine Feeding	527207	Structure/Function Analysis of Engineered Mutants of Human Myoglobin	520803	Monitoring and Modeling Nitrogen Management in Conservation Tillage Production Systems
F026	Reproductive Performance in Domestic Ruminants	527210	Improvement of Soybean via Biotechnological Approach	522899	Single-Kernel Physical Properties and Wheat Millability Hardness
H043	Ruminal Microflora in Relation to Function and Dysfunction of the Rumen	527214	An Inhibitor-Phage Library against Enzymes of the Contact System	522906	Utilization of Corn, Grain Sorghum, and Wheat in the Production of Plastic Goods
H084	Management of Beef Cattle Grazing Tallgrass Prairie	527215	Wheat Mitochondrial DNA and Cytoplasmic Male Sterility	522907	(number applies to title above)
H090	Process Optimization for Value-Added Dairy Products	527216	Protein Kinase C and Signal Transduction	522918	Starch Thermoplastic Project, Kansas Value-Added Center
H091	Optimum Use of Harvested Forage Crops for Ruminant Livestock Production	527218	Function of Phosphatidylcholine Hydrolysis in Plants	522948	Utilization of Wheat in Starch Thermoplastics Technology
H111	Sterilization of Beef Cattle Using Recombinant Peptide Vaccines	527219	Glucose Studies of Human Lysosomal Glucocerebrosidase	522962	Process to Isolate Readily Accessible Starch
H112	Sulfur Amino Acid Utilization by Cattle	527221	Isolation and Promoter Analysis of Phospholipase D Gene	527667	Effects of Prime Mover Soil Compaction on Soil Physical Properties and Winter Wheat and Grain Sorghum Yields
H114	Biodegradation of Aflatoxins in Agricultural Products and Culture Media	527222	(number applies to title above)	527676	Effect of Single-Kernel Physical Properties of Wheat on Milling and Energy Requirements
H126	NIR Analysis of Forage and Grain Sorghum	527223	Aphid Pectinases in Insect-Plant Interactions	527698	Water Conservation-Increased Efficiency in Usage
F207	Methods for Improvement of Fertility in Cows Postpartum	527224	Stored Grain Insect Control by Inhibition of Digestive Enzymes	527699	Value-Added Thermal Processing Laboratory
H300	Improving Poultry Nutrition and By-Product Utilization	527225	Thermodynamics of Hydrolysis of Blood-Coagulation Factor	527703	Thermal Processing Lab/Wet Grain Processing
H301	Processing of Novel Dairy-Based Products	527226	Protein Kinase C and Signal Transduction	527705	Cover Crop and Crop Rotation Used to Meet Conservation Compliance on Soybeans
H323	Assisted Reproductive Technologies in Horses	527228	Regulation of Membrane Lipid Hydrolysis in Lipid-Based Signalling of Plants	527706	Development of Small-Scale Wet-Processing Lab Facility for Wheat and Other Kansas Grains, Phase III
H325	Studies of Pituitary Folliculostellate Cell Function	527229	Role of Phospholipase D in Plant Membrane Deterioration and Senescence	527710	Small-Scale Study of Corn In-Bin Drying and Aeration with a Desiccant System
H337	The Prepubertal Pig Uterus: Responses to Progesterone	527231	Biochemical Isolation and Promoter Analysis of Phospholipase D Gene from Castor Bean	527712	Evaluating Field-Scale Atrazine and Alachlor Movement in Surface Water in Northeast Kansas
H348	Beef Cow/Calf Nutrition and Management in Kansas	529217	Serine Proteinsae Inhibitors in Insects	527713	Monitoring and Modeling Nitrogen Management in Conservation Tillage Production Systems
H354	Osteochondrosis and Local Growth Factor Concentration in the Horse	529253	Immunoglobulin-Related Proteins in Insect Hemolymph	527714	Thermal Processing Laboratory and Wet Milling Laboratory
H404	Rapid Methods for the Detection and Prediction of Off-Flavors in Dairy Products	529254	Biochemistry of Insect Hemocytes	527717	Development of a Uniform Wheat Dockage and Shrunken and Broken Kernel Determination Procedure
H408	Innovative Uses of Spray-Dried Proteins and Carbohydrate Sources in Nursery Pig Diets	529282	NMR Studies of Protein-Inhibitors of a Blood Coagulation Factor	527718	Evaluating Field-Scale Atrazine and Alachlor Movement in Surface Water in Northeast Kansas
H419	Identification and Quantitative Analysis of Fumoninsins in Beef Products	529283	(number applies to title above)		

Biological and Agricultural Engineering

527719	Reclamation of Abandoned Livestock Production Sites in Herington Lake Water District	526615	Topology and Assembly of the Photosystem 1 Reaction Core	529361	Densely Methylated DNA and Mammalian Replication Origins
527720	(number applies to title above)	526618	Evaluation of Wildlife Management Practices on Fort Riley	529371	Structure and Organization of the Photosystem I Complex
527721	Spray Drying of Pet Food Flavors	526624	Mycorrhizal Mediation of Grassland Biotic Interactions	529531	Processes Affecting Carbon Fluxes of Grassland Ecosystems under Elevated Atmospheric CO ₂
H007	Irrigation Water Movement in Silty Clay Loam Soil	526628	(number applies to title above)	H084	Management of Beef Cattle Grazing Tallgrass Prairie
H053	Bioenvironmental Control System for Enclosed Spaces	526629	Mutational Analysis of Interactions of Ferredoxin	H105	Vegetation Responses to Cattle and Bison Grazing on Tallgrass Prairie
H066	Quantifying the Spatial Variation of Yield for Kansas Crops	526630	Research on Iodinated Resins in Air and Water	R170	Studies on the Flora of the Grasslands
H123	Spatially Variable-Rate Herbicide Application in Kansas Winter Wheat Fields	526631	Molecular Analysis of Homeotic Genes in <i>Tribolium</i>	F280	Regulation of Photosynthetic Processes
F195	Improvement of Thermal Processes for Foods	526632	Characterization of Receptors for Shock-Inducing Toxins	H313	Membrane Lipid Interaction with the EGF Receptor
H316	Wet Processing of Kansas Wheat and Grain Sorghum	526633	Starch Concentration Metabolism in Space-Grown Soybean Seedlings	H324	Application of Iodinated Resins to Potable Water and Clean Air Production
H362	Sustainability of Tillage Systems in an Irrigated Corn-Soybean Crop Rotation	526634	Function and Organization of Photosystem I	H327	Studies on <i>Staphylococcus aureus</i> Exotoxin-Mediated Macrophage Activation
H422	Efficient Surface Irrigation Systems	526635	Enhancement of Research Capacity on Konza Prairie, Phase II	H342	Molecular Mechanisms in Photosynthesis
H469	Laboratory Mill for Wheat Grinding Tests	526636	Nonclinical Research Studies of Geltex Prop Polymers	H343	Genomic Sequences of Sporozoite Surface Molecules of <i>Cryptosporidium parvum</i>
H721	Gathering, Cleaning, and Yield Mapping Processes in Grain Harvesting	526637	Use of Remotely Sensed Data on Phenological Changes in Grass	H355	D-3 Phosphoinositide Metabolism in PDGF-Treated Cells
R728	Monitoring and Modeling Nitrogen Management in Conservation Tillage Production Systems	526638	Bacterial Volatiles Attractive to Stable Flies	H360	<i>Tribolium castaneum</i> as a Model Genetic System for the Coleoptera
R847	Forestry Investigations in the Great Plains of Kansas	526639	Effects of Altered Soil Moisture and Temperature on Soil in Grassland	H401	Densely Methylated DNA Islands and the Control of Eukaryotic Cell Division
H896	Crop Sequences, Fertilizer N, and Weed Control Effects on Corn and Soybean	526641	Relationships in the Native Great Plains Grasslands	H429	Glutamine Synthetase from Legumes
H899	Evaluating Practices for Water Quality Enhancement	526644	Reconstitution of the EGF Receptor	H433	The Ecology of <i>Puccinia recondita</i> and <i>P. graminis</i> on Wheat
R993	Agronomy/Agricultural Engineering Experiment Fields Research	526645	Grazing Systems Effects on Plant Community Stability	H440	Molecular Requirements of MHC-Restricted TH1 and TH2 Selection in Vivo
■ Biology					
481865	Epizootic Potential of Lyme Disease in Kansas	526646	Identification of Great Plains Invertebrates	F849	Pathogenesis, Epizootiology, and Control of Avian Respiratory Diseases
481895	Role of LPS and MHCII Genes In Staphylococcal Pathogenesis	526648	Wild Turkey Damage to Corn Seedlings in the Flint Hills of Kansas	H863	Crayfish Culture in Kansas
481897	Evaluating Disease Potential of <i>Cryptosporidium</i> in Ecosystems Impacted by Livestock	526649	Characterization of Receptors for Shock Toxins	F940	Avian Species in Diverted Farmland
481898	Virulence Signal Transduction in <i>Staphylococcus aureus</i>	526650	Coccidia of the World	■ Chemical Engineering	
481899	In Vitro Cultivation of <i>Cryptosporidium</i>	526651	High Performance Liquid Chromatography for Plant Molecular Research	520783	Enhancement of Bioremediation Research in Kansas
520780	Acquisition of High Performance Liquid Chromatograph, Gas Chromatograph, Mass Spectrometer	526652	Fermentor for Recombinant Protein Expression	520808	Kansas EPA EPSCOR: Enhancement of Bioremediation Research in Kansas
520782	Carbon Water and Energy Fluxes from a Tallgrass Prairie. An Investigation of Environmental/Biological Factors	526653	Cross-Site Dynamics of Canopy and Soil Moisture Linking Synthetic Aperture Radar Image Phenomenology with Ecosystem Processes	H113	Gasification/Pyrolysis of Wood and Grain
521807	Evolutionary Conservation of the Molecular Mechanisms of Development	526655	Evolutionary Conservation of the Molecular Mechanisms of Development	H898	Modern Systems Techniques for Value-Added Processes of Grain and Grain Products
521808	(number applies to title above)	526656	REU in Grassland Ecology at Konza Prairie Research Natural Area	■ Civil Engineering	
522360	Role of Flies in Spread of <i>Salmonella</i> in Greyhound Kennels and Formulation of Control	526657	Plant Molecular Responses to External Stimuli	520787	Kansas EPA EPSCOR: Enhancement of Bioremediation Research in Kansas
522347	Bacterial Volatiles Attractive to Stable Flies	526658	(number applies to title above)	520808	(number applies to title above)
526579	Mycorrhizal Mediation of Plant Competition and Community Structure	526659	Evolutionary Conservation of the Molecular Mechanisms of Development	527954	Bioremediation of Hydrocarbon-Contaminated Soils Using Vegetation: A Field and Greenhouse Study
526580	Fire, Grazing, and Climatic Interactions in Tallgrass Prairie	526660	Genetic Control of T Helper Subset Selection	527955	Water Quality Assessment of Banner Creek Watershed
526583	Establishment and Operation of the Kansas Cooperative Fish and Wildlife Research Unit	526661	Role of Amino Acid Uptake by Mycorrhizal Ericaceous Shrubs in Nitrogen Economy	527956	Inspection of Principal Spillway Conduits in Wisconsin
526594	An Evaluation of Low-Input Sustainable Agriculture for Wildlife Habitat	526662	Characterization of <i>Arabidopsis</i> Mutants with Enhanced Expression of Auxin	H132	Effect of Vegetation on Leaching of Heavy Metals from Mine Tailings
526595	Influence of Animal-Generated Disturbances on Multi-Scale Patterns of Resources and Vegetation	526663	(number applies to title above)	H314	Impact of Colloid-Associated Transport of Pesticides on Groundwater Quality
526596	Synchrocell Project for the Commercial Development of Biologicals	526664	(number applies to title above)	■ Clinical Sciences	
526602	Mutational Analysis of Interactions and Function of Ferredoxin	526665	Effects of Micro-G on Gene Expression in Higher Plants	481864	Pharmaceutical Inactivation of Endotoxin from Gram-Negative Bacteria
526610	Molecular Requirements of Type-IV Human Collagen-Induced Interferon- γ Production	526667	Role of Amino Acid Uptake by Mycorrhizal Ericaceous Shrubs in Nitrogen Economy	481876	Bovine Pneumonic Pasteurellosis: Immunity and Pathogenesis
526611	Role of the HSP70 Homologue from Chloroplasts in the Assembly of the Photosynthetic Apparatus	529016	Molecular Genetics of Human Ribosomal Proteins	481892	Pathogenesis of Cilia-Associated Respiratory <i>Bacillus</i> Infection in Pigs
526613	Lipid Metabolism in the Hibernating Marmot	529046	Lens Membrane in Relation to Human Cataractogenesis	528260	Virulence Factors of Salmonellas in Greyhound Dogs
526614	The Genetic Control of Developmental Decision	529047	(number applies to title above)	528365	Bald Thigh Syndrome in Greyhounds
		529048	(number applies to title above)	528756	A Safety Study of Formula I in Dogs
		529060	Studies in Polyoma Transformed Cells-Virion Proteins		
		529242	Proteins of <i>Cryptosporidium</i> , an Opportunistic Infector of AIDS Patients		
		529243	(number applies to title above)		
		529269	Bioserve Space Technologies—A NASA Center for the Commercialization of Space		
		529331	Cell Transformation by Polyomavirus		
		529322	(number applies to title above)		
		529333	(number applies to title above)		

Research Projects Active June 30, 1996 (Continued)

- 528757 Dermal Safety Study in Dogs and Cats on Carpet Deodorizer
- 528759 Role of the Equine Pancreas in the Pathogenesis of Colic in Quarter Horses
- 528760 Safety Study of Flea Carpet Powder Product in Dogs and Cats
- 528762 Dermal Safety Study in Dogs and Cats on Carpet Deodorizer (Pet Fresh)
- 528768 Contract to Conduct Statistical Analysis Activities for the Metal Multi-Site Study Cherokee County Subsite in Galena, KS
- 528769 Safety Study of Ceramic Superconductors with Rats
- 528770 A Dermal Irritation and Sensitization Study in Cats on Cat Litter Deodorizer
- 528774 A Safety Study of Glade Carpet and Rug Deodorizer (Formula 2)
- 528775 A Safety Study of Glade Carpet and Rug Deodorizer in Cats and Dogs
- 528776 Effects of Intravenous Sodium Hyaluronate on Tendon Healing in Horses
- 528777 Safety Study of a Benzyl Product in Cats
- 528779 Comparisons of DTPA in Greyhounds
- 528780 Biological Detoxification of Aflatoxin and Fumonisin in Corn
- 528781 Emergence and Spread of Antibiotic-Resistant Bacteria in Cattle Feed Yards
- 528782 Plasma and Synovial Fluid Concentrations and Effect of Synovium of Ceftiofur Sodium after Intraarticular Injection in Horses
- 528785 Determination of Pulmonary Inflammation and Function after Administration of Inhaled Beclomethasone and Injectable Dexamethasone in Horses with Chronic Obstructive Pulmonary Diseases
- H080 Advancement in Bovine Orthopedics
- H082 On-Farm Computer Program for Monitoring the Use of Livestock Production Chemicals
- H116 Epidemiology of Reproductive Performance of Kansas Dairy Herds
- H353 Odor, Masks, Particles, and Animal-Human Health in Confinement Facilities
- H356 Morphometry of the Blood-Gas Barrier in Exercise-Stressed and Pneumonic Calves
- H739 Cow/Calf Nutrition and Management in Kansas
- H765 Pelvic Area of Bulls as a Predictor of Maternal Calving Ease
- H769 Determination of the Inheritability of Episodic Weakness due to Hyperkalemia
- H897 Management Systems for Optimizing Beef Production
- F990 Prevention and Control of Enteric Diseases of Swine

■ Clothing, Textiles and Interior Design

- 528006 High Tenacity Biogenic Fibers and Films from Products of Corn, Grain Sorghum, and Soybean
- 528008 Tensile Testing Instrument for Studying Textiles and Related Polymeric Materials
- 528010 Nonfood Uses of Soybean Derivatives in the Manufacturing of Textiles and Other Polymer Materials with Unique Properties
- H012 Solid Waste Management in the Foodservice and Hospitality Industry
- F025 Assessment of the Environmental Compatibility of Textiles and Other Polymeric Materials
- H326 Development of Biogenic Polymers from Agricultural-Based Carbohydrates and Polypeptides by Solvent Spinning Techniques Enhancing Health and Safety through Textile Systems
- F708

■ Dean of Agriculture

- 525063 Feasibility Study for Establishment of Ethanol Testing
- 525068 Great Plains Regional Canola Research Program
- H466 High Erucic Acid Development Effort-Crambe and Rapeseed

■ Diagnostic Medicine and Pathobiology

- 481868 Vaccine Potential of *Pasteurella haemolytica* Growth Condition-Dependent Antigens
- 481872 Immunologic Intervention against *Streptococcus suis* Infections
- 481874 Eradication of Economically Important Swine Diseases by Medicated Early Weaning
- 481877 Mediation of Bovine Herpes Virus I Infection by Growth Factor Binding Proteins
- 481886 Interaction of *Pasteurella haemolytica* with Bovine Nasal Mucus
- 481888 Is C-Reactive Protein the Best Indicator of Stress in Pigs?
- 481891 Pathogenesis of Chronic Bovine Coronavirus Infections
- 481892 Pathogenesis of Cilia-Associated Respiratory *Bacillus* Infection in Pigs
- 481894 Distribution of Extracellular Actin in Pneumonic Pasteurellosis
- 481896 Biological and Genetic Significance of *Streptococcus suis* Type 2 Hemolysin 481897
- 481898 Virulence Signal Transduction in *Staphylococcus aureus*
- 520321 Pathogenesis and Diagnosis of Congenital Defects in Cattle
- 528255 Characterization of *Salmonella*, *C. jejuni*, and *E. coli* Recovered from Greyhounds and Greyhound Diets
- 528257 Anti-Idiotypic Immunity and Receptor Interactions in Bovine Respiratory Disease
- 528261 Confirm Efficacy of MK-324 as (MPA) Parasites in Dogs
- 528263 Evaluate the Effects of Pitman Moore Insecticides for Cat Fleas
- 528265 Confirming Cause of "Alabama Rot" in Greyhounds
- 528266 Application of a DNA Technique for Identification of Greyhounds
- 528365 Bald Thigh Syndrome in Greyhounds
- 528366 Greyhound Race Track Deaths
- 528370 Amplification of *Cryptosporidium* DNA for Assessing Agricultural Waste
- 528373 Investigations of the Impact of Pupae on a Flea Control Program
- 528374 L-653,648/Cattle/Clinical/Dose Confirmation Endo Parasites/Induced
- 528375 Molecular Studies on BIV and BHV Interactions
- 528376 Investigate the Effectiveness of BT Toxins and Chitin Inhibitors of Roundworm and Hookworm Eggs
- 528377 Conduct a Trial to Evaluate the Efficacy of MK-324 against Somatic Ascarids in Greyhounds
- 528378 Investigate the Effectiveness of BT Toxins and Chitin Inhibitors of Roundworm and Hookworm Eggs
- 528379 (number applies to title above)
- 528380 Role of *Staphylococcus aureus* Teichuronic Acid in Vivo
- 528381 Cell Division Gene Products of *Bacillus subtilis*
- 528382 Disease Causing Potential of Shiga-Like Toxin-Producing Bacteria in Greyhounds: Is a Vaccine Justified?
- 528283 Development of a DNA-Based Identity Registration System in Greyhounds
- 528284 Molecular Studies on BIV and BHI Interactions

- 528385 *Cryptosporidium parvum* -Enterocyte Interactions
- 528386 Role of BHV-1 and Five Glycoproteins in Pathogenesis
- 528387 Aerosolized Vaccines for Protective Immunity against Respiratory Infections
- 528388 Influence of Belly Buster P and Ironvite on Growth Performance and *Salmonella choleraesuis* Shedding in Nursery Pigs
- 528389 Attempt to Prevent Transplacental and Latogenic Transmission of Gastrointestinal Parasites in Greyhound Pups with Milbemycin Oxime
- 528390 *Pasteurella haemolytica* Vaccination Trial
- 528391 Construction and in Vitro Characterization of Multi- Gene-Deleted Recombination
- 528392 Effect of Pyriproxyfen and Imidacloprid on Flea Population in Naturally Infested Pets and Residences
- 528784 Ecology of *E. coli* O157:H7 in Beef Cow-Calf Operations from Ranch through Feedlot
- 528900 Eradication of Swine Respiratory Pathogens by Medicated Weaning
- 528902 Vitamin E Adjuncted Vaccination Immune Response in Racing Greyhounds
- H018 Optimum Processing to Maximize Utilization of Cereal Grains in Swine Feeding
- H059 Temperature Regulation of Virulence of *Salmonella typhimurium*
- H060 Transmission and Control of Nematode Parasites in Kansas Greyhounds
- H125 Microsatellite Mapping of Deleterious Genes in the Bovine Genome
- F285 Improving Dairy Cattle Genetically
- H345 Bovine Herpesvirus Types 1 and 5: Molecular Pathogenesis and BHV-5 Seroprevalence
- H418 Respiratory Immunity in Large Animals with Propellant- Driven Aerosol Vaccines
- H439 Role of Iron Acquisition in the Virulence of *Actinobacillus pleuropneumoniae*
- H450 Serum Amyloid A as an Acute-Phase Response in Food-Producing Animals
- H463 Assessing Watershed Contamination due to Agricultural Waste: Amplifying *Cryptosporidium* DNA
- F644 Integrated Methods of Parasite Control for Improved Livestock Production
- H739 Cow/Calf Nutrition and Management in Kansas
- H769 Determination of the Inheritability of Episodic Weakness due to Hyperkalemia
- H777 Immunological Expression of Proteins Pertinent to Bovine Respiratory Syncytial Virus
- H794 A Search for Restrictive Fragment Length Polymorphisms (RFLP) in the Bovine Genome
- H799 Respiratory Disease and Environmental Stress in Food Animals
- F831 Bovine Respiratory Diseases: Risk Factors, Pathogens, Diagnosis, and Management
- F990 Prevention and Control of Enteric Diseases of Swine

■ Director of Research

- 520208 Cooperative Educational Preceptorship Program for University Students to Gain Specialized on-the-Job Knowledge and Experience in Various Research Projects in the Agricultural Sciences
- 520209 Agricultural Research Activities
- 525053 Mid-America World Trade Center Support for Agricultural Products
- H397 Planning and Coordination of Cooperative Research
- R403 Agricultural Research Publications
- F573 The Planning and Coordination of Cooperative Regional Research

■ Entomology

- 520100 Insecticide Management of Foliar and Stalk-Boring Insects Affecting Alfalfa, Corn, and Soybeans in Northeastern Kansas
- 520103 Chemical Control of Insect Pests of Corn and Other Field Crops, Small Grains, and Forages
- 520342 Insecticide Management of Field Crop Insects at Hays, Kansas
- 520347 Insecticide Management of Field Crop Insects in Southwestern Kansas
- 520709 A Geographical Information System Procedure for Pesticide Impact Assessment
- 520747 Assessing the Potential for Biological Control of Field Bindweed with the Gall Mite and a Moth
- 520805 Development of Sorghum Germplasm Tolerant to Greenbug-, Aphid-, and Mite-Transmitted Potyviruses and Drought
- 522293 Genetics and Bionomics of Organophosphate Resistance Mediated by Two Esterase Systems in the Greenbug
- 522307 Density and Origin of Urban Flies which Threaten Livestock Operations
- 522308 Testing for Greenbug Biotype and Resistance
- 522316 Ecology of Screwworms in Panama
- 522317 Insect Genetics
- 522318 Methods for Control of Livestock Insects
- 522320 A Geographical Information System for Pesticide Impact Assessment
- 522321 Aphid Biological Control for Greenhouse and Cut Flower Crops
- 522324 Evaluation of *Tyta luctuosa* for Biological Control of Field Bindweed
- 522325 Evaluate the Efficacy of Ecogen's *Bacillus thuringiensis*-Based Products
- 522326 Chemical Signal Interception by Insect Antennae
- 522327 Elucidating the Mechanisms of Mating Disruption for the Artichoke Plume Moth
- 522330 Assessing the Potential for Biological Control of Field Bindweed (*Convolvulus arvensis*) with the Gall Mite *Aceria*
- 522336 Insect Physiology and Biochemistry
- 522338 Management of Corn Insect Pests by Changing Corn Maturity and Planting Dates
- 522339 Evaluation of European Corn Borer Injury and Yield Effects in Corn
- 522340 Development of Sorghum Germplasm with Enhanced Tolerance to Greenbug, Sugarcane Mosaic Virus, and Drought
- 522341 Molecular Phylogenetics, Speciation, and Evolution of Host Range in Aphidiid Wasps
- 522342 Suppression of JH Esterase during Parasitism
- 522344 Biological Control of Field Bindweed
- 522345 Management of Corn Insect Pests by Changing Corn Maturity and Planting Date
- 522347 Bacterial Volatiles Attractive to Stable Flies
- 522348 Insect Cuticle Sclerotization: Interactions of Structural Proteins with Catecholamine Metabolites
- 522349 Dispersal of Insecticide Pour-on Formulations over the Animal's Body
- 522350 A Geographic Information System for Pesticide Impact Assessment
- 522352 Development of Sorghum Germplasm Tolerant to Greenbug, Aphid-, and Mite-Transmitted Potyviruses and Drought
- 522353 Transgenic Corn for Pest Management—Research and Extension Needs
- 522354 Lipid Utilization during Flight of Female Asian Gypsy Moth
- 522355 Use of Gaucho Seed Treatments for Control of Chinch Bug, Greenbug, MDM, Black Cutworm, Wireworm, and Other Pests of Sorghum
- 522357 Biological Control of Insect Pests on Field Crops and Feedlots in Kansas
- 522358 Kansas Pesticide Impact Assessment Program

- 522359 Breeding for Greenbug and Virus Resistance, Drought Tolerance, and Development of Transgenic Plants in Sorghum
- 522360 Role of Flies in Spread of *Salmonella* in Greyhound Kennels and Formulation of Control
- 525982 Development of Sorghum Germplasm Tolerant to Greenbug-, Aphid-, and Mite-Transmitted Potyviruses and Drought
- 526638 Bacterial Volatiles Attractive to Stable Flies
- 527608 Assessing the Potential for Biological Control of Field Bindweed with the Gall Mite and a Moth
- 527223 Aphid Pectinases in Insect-Plant Interactions
- 528373 Investigations of the Impact of Pupae on a Flea Control Program
- H036 Corn, Sorghum, and Wheat Arthropod Pests and Their Management
- F083 Biological Control in Pest Management Systems of Plants
- H101 Biology and Control of Arthropod Pests on Corn in Southwestern Kansas
- H118 Evaluation of *Gryon pennsylvanicum* for Biological Control of the Squash Bug
- H128 Molecular Systematics of the Hymenopteran Family Aphidiidae
- H304 Systematics, Distribution, and Biology of Insects and Arachnids
- H334 Insect Cuticle and Egg Shell Sclerotization and Pigmentation
- H363 Dispersal Biology and Seriochemically Medicated Orientation Behaviors of Moths
- H432 Effect of Host Plant on Susceptibility of Spider Mites to Acaricides
- H436 Insect-Plant Interaction: Resistance to Aphid in Grain Crops
- H448 Biology, Ecology, and Control of Insects Affecting Man and Animals
- H454 Resistance to Greenbug and Wheat Curl Mite in Wheat and to Greenbug in Sorghum
- H468 Physiological Interaction between Parasitoids and Their Hosts
- H766 Genetics of Biotypes in the Hessian Fly (*Mayetiola destructor*)
- H797 Evaluation of Factors Affecting Biological Control of the Squash Bug
- R826 Scanning Electron Microscope Service
- F942 Integrated Crop Management Effects on Stalk-Boring Lepidoptera

■ Family Studies and Human Services

- 528055 Evaluation Proposal for the Head Start Family Service Center Demonstration Project
- R014 Successful Coping Strategies of Rural Communities
- H365 Rural Access to Health Care Systems in Times of Stress
- H462 Relationship Competencies of Rural Adolescents and Young Adults
- H915 Ecological Factors Affecting Rural Children's Mental and Social Development
- H930 Monitoring the Pulse of Kansas Families

■ Food Animal Health and Management Center

- 528388 Influence of Belly Buster P and Ironvite on Growth Performance and *Salmonella choleraesuis* Shedding in Nursery Pigs
- 528784 Ecology of *E. coli* O157:H7 in Beef Cow-Calf Operations from Ranch through Feedlot

■ Foods and Nutrition

- 521792 Quality Study of Whole Muscle Pork Subjected to Two Types of Low-Dose Irradiation
- 528124 Effect of Copper on Cholesterol Metabolism in Ovariectomized Rats
- 528133 Preparation of Degradable Films and Coating from Corn Protein
- 528135 Expert Evaluation of Products for Kansas Processors
- 528136 Epidermal Growth Factor and Preservation in Lung Injury
- 528137 Estrogen Replacement: Its Effect on Fat Absorption
- 528138 Thermal and Rheological Properties and Textural Attributes of Reduced-Fat Meat Batter Systems Prepared with Corn Starch
- 528139 Screening for Flavor of Waxy, Red, Tan, and White Sorghum Varieties for Food Uses
- 528140 Evaluation of Grain Odor
- 528141 Screening for Flavor of Waxy, Red, Tan, and White Sorghum Varieties
- 528142 Preparation and Properties of an Extruded Corn Zein Film
- 528143 Antioxidative Effect of Selected Antioxidants Obtained from Natural Sources for Soybean Oil
- 521844 Effects of Honey in Heat Processed and Fresh Salsa
- 528145 Dietary Recall Research
- 528146 Trained Descriptive Apple Pie Flavor and Texture Profiling Panel
- 528147 Development of Extrusion Technology for Novel, Extruded Healthy Foods from Grain
- 521849 Leco System of Nitrogen Determination
- 521850 Epidermal Growth Factor and Surfactant Preservation in Lung Injury
- 528151 Estrogen Replacement: Its Effect on Intestinal Fat Absorption
- F072 Behavioral and Health Factors that Influence Food Consumption in Young Adults
- H130 Sensory/Physical Assessments of High-Fiber Snack Foods to Improve Oral Health
- F136 Improvement of Thermal Processes for Food
- H333 Dietary Intake of Antioxidants and Age-Related Macular Degeneration
- H335 Vitamin A, Polyamines, and Type II Pneumocyte Repair
- H351 Effect of Estrogen Replacement on the Metabolism of Dietary Fat in a Rat Model
- H406 Nutritional Determinants of Muscular Hypertrophy
- F628 Development of New Processes and Technologies for the Processing of Poultry Products
- H698 Innovative Red Meat Production and Processing Systems for the Modern Consumer
- R701 Barriers to Participation in a WIC/Extension Nutrition Education Program
- F945 Health Maintenance Aspects of Dietary Recommendations Designed to Modify Lipid Metabolism

■ Grain Science and Industry

- 521783 Evaluation of Heated Soybean Meal Products Containing Levels of Lipid in Lactating Dairy Cows
- 521784 Roasting Grain Sorghum to Improve Digestibility and Nutritional Value in Dairy Cattle Diets
- 521796 Extrusion of Grain Sorghum to Improve Digestibility and Enhance Nutritional Value in Lactating Dairy Cattle Diets
- 522877 Computer Interface to the Mixograph
- 522885 Evaluation of End-Use Properties of Hard Winter Wheat Breeder's Progenies
- 522896 International Grains Program Support Project
- 522906 Utilization of Corn, Grain Sorghum, and Wheat in the Production of Plastic Goods

- 525423 Existing and Economic Aspects of Kansas Water Markets
 525424 Role of Methanotrophic Bacteria in Kansas Reservoirs
 525425 Effects of Soil Variability on Nitrate Transport

■ Plant Pathology

- 520199 Soybean Foliar Fungicide and Seed Treatment Tests
 520201 Evaluations and Testing of Fungicides and Nematicides on Horticultural Crops
 520202 Seed Treatment
 520205 Chemical Control of Phytoparasitic Nematodes
 520412 Breeding Sorghum for Tolerance to *Fusarium* Stalk Rot
 520669 Breeding Soybeans for Increased Productivity
 520776 Improvement of Soybean via Biotechnological Approaches
 520789 Soybean Plot Combine
 520806 The Effect of Hybrid Maturity, Planting Date, Plant Population, and Row Spacing on Grain Yields, Weed Infestations, and Diseases of Grain Sorghum
 524460 Use of Oligonucleotide Synthesizer
 524470 Breeding Soybeans for Increased Productivity
 524475 Non-Conventional Plant Improvement Technology
 524478 *Fusarium* Research
 524489 North Central Soybean Research Program
 524491 Ash Yellow in the Great Plains: Determination of Incidence and Damage
 524492 Wheat Genetics Resource Center and Its Contributions to Kansas Wheat Industry
 524498 Identification and Quantification of Nematodes in Interaction with Bacterial and Fungal Incitants in Stalk Rot Complexes of Millet
 524502 Winter Wheat Seed Treatment Tests
 524519 Molecular Basis of Production of Fumonisin in Corn Infected with *Fusarium moniliforme*
 524522 Gene Tagging and QTL Mapping in Hexaploid/Diploid Wheat Crosses
 524532 Novel Strategies for Disease Resistant Rice: Physiological Basis for Resistance to Bacterial Blight
 524533 Tracking and Identification of Genetic Diversity within Populations of *Fusarium* Section *Liseola* from Corn
 524540 North Central Soybean Cyst Nematode Research Project
 524542 Mechanisms in the Biocontrol of Grass Weeds with Rhizobacteria
 524548 Myco-Pharmaceuticals
 524550 Characterization Mapping of Five New Leaf Rust Resistant Genes
 524554 Molecular Mapping in Wheat
 524555 Molecular Cytogenetics and Plant Genome Mapping
 524556 Role of Avrxa10 and HRP Genes of *Xanthomonas oryzae* pv. *oryzae*
 524557 Role of Peroxidases in Resistance Pathogens in Rice
 524558 Management of the Soybean Cyst Nematode
 524561 Impacts of Introduced Bioremediation Agents on Plant Productivity
 524562 (number applies to title above)
 524563 Biology and Control of Seed Smut of Switchgrass
 524564 Genetic Diversity of *Xanthomonas oryzae* in Nepal
 524565 Nematode and Soybean Research
 524569 Study of the Genetics of Fumonisin Production
 524570 (number applies to title above)
 524573 Application of Rhizobacteria to Weeds in Wheat
 524574 Enhancing the Duration of Popularity of Winter Wheat
 524575 Analysis of the RP1 and RP3 Loci of Maize

- 524576 Genetics of Vegetative Compatibility in *Fusarium moniliforme*
 524580 North Central Soybean Research Program
 524581 Disarming of Monsanto's Wildtype Strains of *Agrobacterium* to Create an Efficacious Plant Transformation Vector
 524582 Use of *Fusarium* Subglutinans as a Seed Treatment and Growth Promoter of Corn
 524585 Development of DNA Probes and Stocks and Coordination of Wheat Genome Mapping
 524586 Development cDNA Probes for *Xanthomonas campestris* pv. *nolicola* and Determine the Incidence and Severity of Corn Diseases in Central America
 526396 Using Cultural Practices to Reduce Soybean Cyst Nematode and Charcoal Rot Damage in Soybeans
 527954 Bioremediation of Hydrocarbon-Contaminated Soils Using Vegetation: A Field and Greenhouse Study
 H021 Development of Productive, Disease-Resistant Soybean Varieties
 H022 Crop Improvement through Cell Culture and Genetic Engineering
 H081 Genetic Analysis of the Mechanisms of Weed and Pathogen Biocontrol by *Rhizobacteria*
 H093 Alfalfa Breeding and Genetics
 H107 Genome Mapping and Tagging of Useful Genes in Wheat
 F215 Overwinter Survival of *Heterodera*, *Paratylenchus*, and Associated Nematodes in the North Central Region
 F216 The Adoption of Sustainable Farming Systems: Implications to Agricultural Education
 H331 Mycorrhizal Hyphal Networks in Soil: Relationship to Sustainability
 H339 Molecular and Genetic Characterization of the HRP Region of *Xanthomonas oryzae* pv. *oryzae*
 H413 Characterization of Rust Resistance Genes in Cereals
 H423 Host-Pathogen Interactions of Turnip Crinkle and Tomato Bushy Stunts Viruses
 H426 Use of Rapid Marker Analysis to Differentiated Isolates of *Ramulis pora sorghi*
 H438 Population Genetic Structure of the Wheat Scab Fungus, *Gibberella zeae*
 H453 The Biology and Control of Winter Wheat Diseases
 H460 Nutrient-Amended Bioremediation of Pesticide-Polluted Soils
 H547 Genetics and Physiology of *Fusarium* spp.
 R705 Oral Immunization against Bovine Coronavirus
 R732 Adaptation, Propagation, and Stress of Ornamentals and Turfgrass in South-Central Kansas
 H895 Etiology, Epidemiology, and Control of Sorghum Diseases
 F923 Biocontrol of Soil-Borne Plant Pathogens
 H961 Genetic Investigations of Pest Resistance in Alfalfa
 H971 Interaction of Wheat Fungal Diseases on Yield Determinations

■ Sociology, Anthropology, and Social Work

- 527624 Consequences of Rural Population Decline in the Great Plains
 527625 The Effects of Economic and Social Restructuring on Rural Localities
 R020 Potential for Incorporating the Kansas Farmer in the Agricultural Research Process
 H034 Cancer Morbidity among Kansas Farmers
 H115 The Effects of Economic and Social Restructuring on Well-Being in Nonmetropolitan Kansas
 H129 New Kansans: Immigrant Minority Students and School Adaptation Patterns

- F259 Rural Labor Markets in the Global Economy
 F939 Community Change and Resistance: A Restudy of the Rural Life Study Series

■ Statistics

- 522330 Assessing the Potential for Biological Control of Field Bindweed
 527606 Analysis and Interpretation of Insect Ecology and Control
 527608 Assessing the Potential for Biological Control of Field Bindweed with the Gall Mite and a Moth
 527610 Mixed Models Used in the Semiconductor Industry
 527611 (number applies to title above)
 R825 Statistical Laboratory

■ Veterinary Medicine

- 528950 Determination of the Immunoenhancing Effects of Recombinant Bovine Interleukin-1B in Cattle Utilizing *Pasteurella haemolytica* Challenge Model
 R650 Exploratory Research in Animal Health and Disease

■ Agricultural Research Center-Hays

- 520239 Breeding for Wheat Improvement and Wheat Pest Control in South-Central Kansas
 520785 A Survey of Winter Annual Grass Distribution and Severity in Kansas
 520805 Development of Sorghum Germplasm Tolerant to Greenbug-, Aphid-, and Mite-Transmitted Potyviruses and Drought
 522347 Bacterial Volatiles Attractive to Stable Flies
 524573 Application of Rhizobacteria to Weeds in Wheat
 525953 An Alternative to Landfills for Disposal of Yard Waste and Newspaper
 525954 Genetic Development of Higher Disease Resistance and Grain Protein in New Wheat Varieties
 525966 Canola Research
 525968 Genetic Development of Higher Disease Resistance and Grain Protein in New Wheat Varieties
 525969 Biological Control of Winter Annual Grass Weeds
 525970 Development of Sorghum Germplasm with Tolerance to Greenbug Mosaic Virus, Maize Dwarf Mosaic Virus, and Drought
 525972 Biocontrol Project for Weed Control
 525973 Effect of Synthetic Protein and Aspartic Acid on Winter Wheat Grown in a 22.5-Inch Precipitation Area
 525974 Jointed Goatgrass Competition and Management in Western U.S. Winter Wheat
 525976 Range Research
 525978 Field and Growth Chamber Testing of Wheat Lines
 525979 Sorghum Research
 525980 Effect of Polyaspartic Acid on 1996 Dryland Winter Wheat Grown in a 22.5-Inch Precipitation Area
 525981 Alternative Weed Control Methods for Grain Sorghum Production
 525982 Development of Sorghum Germplasm Tolerant to Greenbug-, Aphid-, and Mite-Transmitted Potyviruses and Drought
 525983 Jointed Goatgrass Competition and Integrated Management in Western United States Winter Wheat
 525985 Field and Growth Chamber Testing of Wheat Lines
 H318 Management of Soil in Dryland Regions
 H319 Genetics and Breeding of Sorghum

Research Projects Active June 30, 1996 (Continued)

H336 Improved Efficiency of Forage-Based Beef Cattle Production Systems
 H341 Weed Management Investigations
 H350 Beef Cattle Investigations-ANS Ultrasonic Cattle Sorting Machine
 H359 Improvement of Pearl Millet, Rape, and Sunflower
 H739 Cow/Calf Nutrition and Management in Kansas
 H846 Genetic Improvement of Wheat
 R847 Forestry Investigations in the Great Plains of Kansas
 H869 Pathogen-Host Investigations in Wheat, Sorghum, and Sunflower

■ Northwest Research-Extension Center

520365 Sunflower Performance Testing Program
 520722 Canola Research
 520727 Tillage, Irrigation, and Hybrid Maturity Class Effects on Corn Production
 520769 Water-Efficient Practices for Corn Production
 520804 (number applies to title above)
 525752 Winter Rape Testing Project
 525758 Water Conservation-Increased Efficiency in Usage
 525762 Canola Research
 525763 Increasing Yield and Water-Use Efficiency of Soybeans with Foliar-Applied Methanol
 525764 Increasing Yield, Seed Quality, and Water-Use Efficiency of Wheat with Foliar-Applied Methanol
 525765 Water-Efficient Practices for Corn Production
 525766 Sunflower Investigations
 525767 Water-Efficient Practices for Corn Production
 525768 Increasing Yield and Water-Use Efficiency of Soybeans with Foliar-Applied Methanol
 526177 Water-Efficient Practices for Corn Production
 526183 (number applies to title above)
 F094 Micro-Irrigation for Optimum Crop Productivity and Minimum Groundwater Contamination
 H095 Water and Nitrogen Management Using Sprinkler and Subsurface Drip Irrigation
 R294 Soil Management in Northwestern Kansas
 R721 Irrigation and Fertigation for Corn Using SDI
 R847 Forestry Investigations in the Great Plains of Kansas
 F865 Increased Prolificacy in Sheep and Its Impact on Nutritional Needs
 H911 Production Methods for Increased Efficiency of Ewe-Lamb Enterprises
 R956 Improving N Fertilization for a WSF Rotation in a Reduced-Tillage Environment

■ Southeast Agricultural Research Center

520254 Weed Control in Farm Crops
 520789 Soybean Plot Combine
 525768 Increasing Yield and Water-Use Efficiency of Soybeans with Foliar-Applied Methanol
 526367 Soil Fertility and Management Investigations in Southeastern Kansas
 526398 Southeast Kansas Warm-Season Annual Grass Trials
 526399 Double-Crop Soybean Performance Test
 526402 Development and Evaluation of Commercial Soybean Varieties for Kansas
 526403 Performance by Grazing Cattle Offered Magnesium-Mica
 526406 Management of the Soybean Cyst Nematode and Charcoal Rot in Soybeans
 526407 Increasing Yield and Water-Use Efficiency of Soybeans with Foliar-Applied Methanol
 526409 Effect of Magnesium-Mica on Performance and Carcass Characteristics of Feedlot Cattle

526410 The Effect of Fastrack Probiotic Pack on the Performance of Receiving Calves
 526411 Effect of Monensin with Magnesium-Mica on Performance of Grazing Cattle
 526412 Increasing Yield and Water-Use Efficiency of Soybeans with Foliar-Applied Methanol
 H015 Evaluation of Cropping Systems for Southeastern Kansas
 H109 Cultivar Evaluation and Cultural Practices for Soybeans in Southeastern Kansas
 R174 Beef Cattle Production and Management in Southeast Kansas
 H312 Soil and Water Management for Crop Production in Southeastern Kansas
 H332 Forage Management in Southeastern Kansas
 R706 Grain Sorghum Response to Legume Residual as Affected by P and K
 H914 Use of a Tall Fescue with Different Rates of *Acremonium coenophialum* Infections

■ Southwest Research-Extension Center

520249 Evaluation of New Products to Improve the Efficiency of Production in Feedlot Cattle
 520251 Herbicides for Weed Control on Fallow Ground
 520769 Water-Efficient Practices for Corn Production
 520804 (number applies to title above)
 522357 Biological Control of Insect Pests on Field Crops and Feedlots in Kansas
 525765 Water-Efficient Practices for Corn Production
 525767 (number applies to title above)
 526151 Weed Control Research in Southwest Kansas
 526152 Quality Testing of Fly Parasites for Cattle Feedlots
 526154 Variety Testing of Alternative Crops
 526155 Soil Fertility and Soil Management Research for Western Kansas
 526156 Yield Appraisal of Crops for Southwest Kansas
 526157 Water Management for Southwest Kansas
 526161 Frost-Damaged Grain Sorghum-An Evaluation of Varying Grain Test Weight Sorghums as Livestock Feed
 526177 Water-Efficient Practices for Corn Production
 526178 Adapted Woody Plant Materials and Establishment and Growth Technology for Kansas, Colorado, and New Mexico
 526179 Increasing the Use of Grain Sorghum in Kansas Feedlot Cattle Rations
 526180 Influence of Various Ratios of Steam-Flaked Rations on Steer Finishing
 526181 Management Strategies to Maximize and Prolong the Profitability of a Declining Water Supply for Corn and Sorghum Production
 526182 Influence of Feeding Combinations of Steam-Flaked Sorghum with High-Moisture Corn or Dry-Rolled Corn on Finishing Steer Performance
 526183 Water-Efficient Practices for Corn Production
 526184 Adapted Woody Plant Materials and Establishment/Growth Technology for Western Kansas, Eastern Colorado, and Northern New Mexico
 526185 Dispersal of Adult Stable Flies: Phenology of Dispersing Flies
 H101 Biology and Control of Arthropod Pests on Corn in Southwestern Kansas
 H346 Fertility and Water Management for Western Kansas
 H352 Improving the Health of Stressed Feeder Cattle and Improving Grain Sorghum Utilization in Kansas
 R721 Irrigation and Fertigation for Corn Using SDI
 R726 Impact of Conservation Compliance on Nitrogen Recommendations for Dryland Winter Wheat
 R729 Short-Season Corn Growth and Yield Response to N Fertilization and Tillage
 R834 Irrigation Management for Southwest Kansas

R847 Forestry Investigations in the Great Plains of Kansas
 H967 Dryland Cropping Systems for Southwest Kansas
 H969 Crop Improvement for Southwest Kansas
 H973 Developing Weed Management Systems for Southwest Kansas
 H981 Pest Management of Livestock Insects in Western Kansas

F = Regional projects
 H = Hatch projects
 M = McIntire-Stennis projects
 R = State projects
 Numbers = Sponsored projects

Research Projects Terminated

■ Agricultural Economics

- 520464 Optimal Capital Structure of Local Grain Marketing
 520468 Definition of Regional Cattle Procurement Markets and Role of Captive Supplies in Beef Packing
 520469 (number applies to title above)
 520471 Water Conservation-Increased Efficiency in Usage
 520473 Economic Impact of Zero Depletion in Northwest Kansas
 520474 Credit Accessibility to Low Income Women in Uganda
 520475 Value-Added Wheat Products
 520477 Wheat Producer Survey
 520480 White Wheat Producers' Attitude toward Growing Wheat
 520482 Consumer Willingness to Pay for Irradiated Meat
 R020 Potential for Incorporating the Kansas Farmer in the Agricultural Research Process
 F767 Quantifying Long-Run Agricultural Risks and Evaluating Farmer Responses to Risk
 H887 Economic Analysis of Alternative Production Practices for Soybeans and Beef
 H900 Irrigation Management to Conserve Water and Maintain Income
 H943 Measuring Economic Impacts of Groundwater Protection Policies on the Great Plains States
 H950 Pricing and Marketing in the Livestock Sector under Structural Change

■ Agronomy

- 520412 Breeding Sorghum for Tolerance to *Fusarium* Stalk Rot
 520681 Simultaneous Selection for Drought and Heat Resistance in Wheat
 520685 Breeding Sorghum for Improved Digestibility and Feed Efficiency
 520688 Simulation of Soil Stability, Wetness, and Range Vegetation for WEPS
 520694 Increasing Soybean Production through the Use of Cyst Nematode-Resistant Cultivars
 520696 Testing and Adapting a Decision Model for Postemergence Weed Control
 520697 Introducing Soybeans into Crop Rotation in South Central Kansas
 520698 Support for the Development of Pioneer Germplasm and Varieties at KSU
 520701 Technical Support for the Acquisition of Pioneer Germplasm and Varieties
 520707 Row Crop Nonpoint Source Pollution Control Demonstration Project
 520711 Phosphorus Bioavailability in Cultivated Soils
 520716 Row Crop Pollution Control Demonstration Project: Atrazine Analyses
 520720 Denitrifier Ecology in Stratified Soil Profiles: Implications for Water Quality
 520722 Canola Research
 520725 Contribution of Soybean Residue N for Corn Products in Corn-Soybean Rotations
 520727 Tillage, Irrigation, and Hybrid Maturity Class Effects on Corn Production
 520728 Yield Effects of Double- and Intercropping Soybeans into Wheat Stubble on Irrigated Sandy Soils
 520729 Effect of Row Width, Planting Population, Planting Date, Variety, and Different Weed Control Levels on Soybean
 520730 Improving Atrazine Management for Weed Control in Grain Sorghum: Evaluating Field-Scale Atrazine and Alachlor Movement in Surface Water in Northeast Kansas
 520731 Improving Atrazine Management for Weed Control in Corn: Evaluating Field-Scale Atrazine and Alachlor Movement in Northeast Kansas
 520732 Improvement of Hard Winter Wheat

- 520736 Biotic and Abiotic Factors Controlling Nitrogen Flux in Pristine and Agricultural Subsurface Systems
 520737 (number applies to title above)
 520738 Soil Respiration in Prairie Ecosystems Exposed to Ambient and Elevated CO₂
 520740 Effect of Catalytically Conditioned Water on Soil Microbial Activities
 520741 Water Conservation-Increased Efficiency in Usage
 520742 Substituting Legumes for Fallow in U.S. Great Plains Wheat Production
 520744 Crambe: Evaluation of Swathing Time Practices in Kansas
 520745 Improving Atrazine Management for Weed Control in Corn
 520751 Providing Soil Sample Analysis for Soil Survey Activities
 520753 The Effect of Conditioning and Seed Size on Soybean Seed Quality
 520754 RH-1965 Application Timing for Cheat Control in Hard Red Winter Wheat
 520757 Workshop on Heat Tolerance in Temperate Cereals
 520758 Crambe Germplasm/Cultivar Adaptation to the Central Great Plains
 520759 Postemergence IVM Weed Control with XCE-570 and XDE 564
 520760 Evaluation of Starter Fertilizer Materials on Corn, Grain Sorghum, and Soybeans
 520765 Management of the Soybean Cyst Nematode and Charcoal Rot in Soybeans
 520769 Water-Efficient Practices for Corn Production
 520770 Identification of Tolerance to Autotoxicity in Alfalfa
 520773 Digestibility and Feeding Value of Grain Sorghum: Manipulating Genotype to Improve Value
 520780 Acquisition of High Performance Liquid Chromatography, Gas Chromatograph, Mass Spectrometer
 520778 Work Station for Soil-Plant-Atmosphere Continuum Studies
 520787 Kansas EPA EPSCOR: Enhancement of Bioremediation Research in Kansas
 520791 Screening Alfalfa Genotypes for Reduced Autotoxicity
 522266 Development of Grain and Forage Sorghums Resistant to Chinch Bug
 525754 Canola Research
 525757 Tillage, Irrigation, and Hybrid Maturity Class Effects on Corn Production
 525765 Water-Efficient Practices for Corn Production
 526167 Tillage, Irrigation, and Hybrid Maturity Class Effects on Corn Production
 526396 Using Cultural Practices to Reduce Soybean Cyst Nematode and Charcoal Rot Damage in Soybeans
 527684 Evaluating Field-Scale Atrazine and Alachlor Movement in Surface Water in Northeast Kansas
 527685 (number applies to title above)
 529351 Processes Affecting Carbon Fluxes of Grassland Rangeland Plant Response to Elevated CO₂
 529140 (number applies to title above)
 529149 (number applies to title above)
 H019 Development, Production, and Quality of Forage Crops in the Central Great Plains
 R020 Potential for Incorporating the Kansas Farmer in the Agricultural Research Process
 H021 Development of Productive, Disease-Resistant Soybean Varieties
 H035 Plant Nutrient Cycling in Soils
 H052 Organelle Analysis, Chromosome Banding, and Tissue Culture of Crop Species
 H061 Production, Quality, and Physiology of Eastern Gamagrass
 H063 Development of Hard White Winter Wheat Varieties for Kansas
 R087 Effects of Phosphorus Application Method and Rate on Furrow-Irrigated, Ridge-Tilled Grain Sorghum

- R088 Variable Nitrogen Management for Improving Groundwater Quality
 R089 Nitrogen Management in Conservation Systems
 F162 Water and Carbon Economy of Plants in Relation to Rhizospheric and Atmospheric Dynamics
 H488 The Absorption, Solubility, and Kinetics of Reaction of Phosphorus in Soils
 H603 Genetic Improvement of Sorghum
 H669 Fertilizer Management Technology for Western Kansas
 H833 No-Till Wheat-Sorghum-Corn Rotation for South Central Kansas
 F838 Chemistry and Bioavailability of Waste Constituents in Soils
 H881 Planting Wheat in a Ridge-Till Crop System
 H882 Winter Annual Legume and Grass Adaptation and Use in Eastern Kansas
 H884 Reduced Tillage and Crop Rotation Systems for Winter Wheat and Grain Sorghum in Central Kansas
 H946 Effects of Soil Compaction on Soil Physical Properties and Crop Growth
 F933 Characterization and Management of Soil Water and Solutes in Field Soils
 F936 Biological and Ecological Basis for a Weed Management Model to Reduce Herbicide Use in Corn
 F941 Nutrient Management to Sustain Productivity while Protecting Surface and Groundwater Quality
 H984 Diversification and Specialization Benefits for Livestock Producers

■ Anatomy and Physiology

- 481878 Regulation of Porcine Mucosal Immunity
 481884 Requirement of Bovine Herpesvirus-1 for Specific Heparin Sulfate Proteoglycans
 481889 Distribution of Blood Flow during Rest and Exercise in the Equine Lung
 528575 Neurons and Neuropeptides in Sea Anemones
 528577 Limbic Sites Involved in Cardiovascular Dynamics
 528580 Mechanisms of Limbic Forebrain Control of ACTH Release
 528581 REU Supplement to: Neurons and Neuropeptides in Sea Anemones
 528582 Myocardial Membrane Proteoglycan Expression after Ischemia
 528583 Immunohistochemical Localization of Heparin Sulfate in the Myocardium
 528585 Immune Enhancement and Medicated Early Weaning
 528586 Mechanisms of Capillary Stress Failure in Exercise-Induced Pulmonary Hemorrhage
 528587 Influence of B-1,3-Glucan on Nonspecific Immunity in Pigs
 528588 Pharmacological Analysis of Neurotransmitter Neurotoxicity
 529293 Mechanism of Exercise Inhibition during Lung Congestion
 529302 Coronary Collateral Function in the Conscious Pony
 529303 (number applies to title above)
 529311 Control of Rhythmic Sympathetic Activity Acute Stress
 H004 Ultrastructure of Lung with Experimentally Induced Pneumonic Pasteurellosis

■ Animal Sciences and Industry

- 481882 Cloning of *Fusobacterium* Leukotoxin Gene for Potential Recombinant Vaccine
 521718 Animal Science Food Safety Consortium
 521721 The Utilization of Solubilized Wheat Protein in Diets for Early-Weaned Pigs
 521729 Influence of Amaferm on Ruminant Fermentation
 521731 A Study of the Effect of Lysocellin on Legume Bloat

Research Projects Terminated (Continued)

- 521732 The Determination of Metabolizable Energy Values for Extruded Soybeans in Pigs of Various Ages
- 521737 Determination of Available Amino Acids in Extruded Feedstuffs for Growing and Finishing Pigs
- 521738 Inheritance of "Rat-Tail" Condition in Cattle
- 521740 Feedlot Cattle Liver Abscess Microbial Survey
- 521745 The Effects of Three Levels of Dietary Lysine and Two Litter Sizes during Lactation on Sow and Litter Performance
- 521748 Effect of Nutrition on Timing of Puberty Onset in Beef Heifers
- 521749 Beef Curry Product Development
- 521750 The Effect of Bacterial Inoculants on Preservation and Nutritive Value of High Moisture Corn
- 521753 Effects of a Microbial Food Additive on Nutrient Digestibility in Greyhound Dogs
- 521754 Use of Wheat Gluten in Phase 2 Nursery Pig Diets
- 521755 The Effect of Bacterial Inoculants on the Preservation and Nutritive Value of Whole-Plant Corn Silage
- 521756 Use of Enzymes and Bacteria to Improve the Nutritional Value of Sorghum Grain for Finishing Pigs
- 521757 Gluconic Acid as a Fresh Meat Decontaminant
- 521762 Vacuum Packager and Equipment for Animal Sciences Meat-Processing Lab
- 521763 National Animal Health Monitoring System Beef Survey-Nutrition Portion
- 521764 Determining the Efficacy of Calf-Oid Implants Used at Birth
- 521768 Investigation of Microbiological Safety and Shelf Life of Tofu Products
- 521770 Development of Educational Material for the Kansas Feedlot Industry
- 521771 Breeding Sorghum for Improved Digestibility and Feed Efficiency
- 521772 Evaluation of Norwegian Fishmeal as a Protein Source for Starter Pig Diets
- 521773 Evaluation of Trace Mineral Complexes Supplemented for Wheat Pasture Cows
- 521774 The Effect of Amino Acid Chelated Minerals on Starter Pig Performance
- 521775 Beef Cattle Copper Proteinate/Immune Response Research Study
- 521779 Palatability, Color, and Shelf Life of Beef Subjected to Low-Dose Irradiation
- 521781 Effects of Wheat Gluten and Spray-Dried Protein on Pig Growth and Performance
- 521785 Digestibility and Feeding Value of Grain Sorghum Techniques to Improve Nutritive Value
- 521786 Microbiological Baseline Tracking for Beef
- 521790 Novel Milk Products Produced through High Hydrostatic Pressure Processing
- 521792 Quality Study of Whole Muscle Pork Subjected to Two Types of Low-Dose Irradiation
- 521793 Effects of Potato Protein on Starter Pig Growth Performance
- 521797 Zen-Noh Growth Trial (Pigs)
- 521800 Decontamination of Meat Carcasses Using Low Pressure Steam in a Commercial Beef Processing Facility
- 521801 Effect of Ground Mustard on Microorganisms in Laboratory Medium
- 521802 Comparative Value of Suncured Alfalfa and Alfalfa/Onion By-product for Growing Beef Cattle
- 526179 Increasing the Use of Grain Sorghum in Kansas Feedlot Cattle Rations
- 526180 Influence of Various Ratios of Steam-Flaked Rations on Steer Finishing
- 529233 Embryo-Uterine Interactions during Early Pregnancy
- H024 Neuroendocrine Regulation of Adrenocorticotrophic Hormone in Swine
- H739 Cow/Calf Nutrition and Management in Kansas
- F771 The Genetics of Body Composition in Beef Cattle
- H799 Respiratory Disease and Environmental Stress in Food Animals
- H854 Nonenzymatic Browning Products as Antioxidants in Restructured Beef
- H860 Enhancing Digestion and Metabolism of Fats and Soybean Proteins in Weanling Pigs
- H890 Cause and Control of Flavor Deterioration during Aseptic Storage of Ultra-High Temperature Sterilized Milk
- H920 Utilization and Metabolism of Fats by Ruminants Fed High-Grain Diets
- H968 Reproductive Efficiency of Sows
- H985 Influence of Exercise on Proliferation/Differentiation of Equine Satellite Cells in Vitro
- H998 Improving Reproductive Efficiency in the Equine
- **Biochemistry**
- 527191 Pest Control by Manipulation of Insect Chitinolytic Enzymes and Their Genes
- 527192 Structure of Cyclic Nucleotide Phosphodiesterase
- 527195 Structure/Function Analysis of Mutant Human Myoglobins
- 527196 Structural Studies of Pumpkin Seed Inhibitors of a Blood-Coagulation Factor by 2D NMR
- 527197 Insulin Activation of Pyruvate Dehydrogenase Phosphatase
- 527200 Mutations Affecting the Fe Protein of *Klebsiella pneumoniae* Nitrogenase
- 527201 Function of Phosphatidylcholine Hydrolysis by Phospholipases D and C in Plants
- 527202 Metabolic Control of Mammalian Pyruvate Dehydrogenase Complex
- 527203 Peptide Synthesis Studies
- 527204 Protein Structure and Dynamics by High Field NMR
- 527206 Structure/Function Analysis of Engineered Mutants of Human Myoglobin
- 527208 Structure of Recombinant and Mutant Cyclic Nucleotide Phosphodiesterase
- 527209 (*number applies to title above*)
- 527210 Improvement of Soybean via Biotechnological Approach
- 527211 Insulin Activation of Pyruvate Dehydrogenase Phosphatase
- 527212 Studies of Human Lysosomal Glucocerebrosidase
- 527213 Corn Rootworm Proteinases and Their Inhibitors
- 527218 Function of Phosphatidylcholine Hydrolysis in Plants
- 527219 Glucose Studies of Human Lysosomal Glucocerebrosidase
- 529087 Regulation of Mammalian Pyruvate Dehydrogenase
- 529215 (*number applies to title above*)
- 529216 Serine Proteinase Inhibitors in Insects
- 529252 Immunoglobulin-Related Proteins in Insect Hemolymph
- 529275 Role of Ordered Helical Segments in Membrane Proteins
- 529276 (*number applies to title above*)
- 529281 NMR Studies of Protein-Inhibitors of a Blood Coagulation Factor
- 529282 (*number applies to title above*)
- 529321 NMR Studies of a Blood-Coagulation Factors Inhibitor
- 529341 Regulation of Mammalian Pyruvate Dehydrogenase
- 538550 Construction of Male Sterile Wheat
- 538730 (*number applies to title above*)
- H946 Effects of Soil Compaction on Soil Physical Properties and Crop Growth
- 527686 (*number applies to title above*)
- 527694 Value-Added Thermal Processing Laboratory
- 527699 (*number applies to title above*)
- 527700 Development of Small-Scale Wet-Processing Lab Facility for Wheat and Other Kansas Grains for Food and Nonfood Uses, Phase II
- 527703 Thermal Processing Lab/Wet Grain Processing
- 527704 Evaluating Field-Scale Atrazine and Alachlor Movement in Surface Water in Northeast Kansas
- 527712 (*number applies to title above*)
- 529216 Serine Proteinase Inhibitors in Insects
- H006 Regulation and Function of Phosphatidylcholine Hydrolysis in Plants
- H047 2D NMR Studies of Protein Inhibitors of a Blood Coagulation Factor
- H862 Efficient Irrigation and Drainage Systems
- H893 Single-Kernel Physical Properties and Wheat Millability Hardness
- H946 Effects of Soil Compaction on Soil Physical Properties and Crop Growth
- H962 Analysis of Soybean Meal Flow Characteristics
- H982 Structure/Function Correlations for Mammalian Heme Proteins
- **Biology**
- 481881 Molecular Requirements of T Helper TH-1 and TH-2 Antigen Recognition in Vivo
- 520736 Biotic and Abiotic Factors Controlling Nitrogen Flux in Pristine and Agricultural Subsurface Systems
- 520737 (*number applies to title above*)
- 526589 Stomatal and Photosynthetic Responses in Crop Species to Variable Sunlight
- 526591 Mechanisms of Persistence in Tallgrass Prairie Forbs: An Experimental Approach Coupled with a Retrospective Analysis of Long-Term Patterns
- 526597 Productivity of Avian Species in Diverted Farmland
- 526598 REU Supplement to Fire, Grazing, and Climatic Interactions in Tallgrass Prairie
- 526599 REU Supplement in Conservation Biology: Mechanisms of Persistence in Tallgrass Prairie Forbs
- 526601 Function and Assembly of the Accessory Subunits of Photosystem I
- 526603 Regulation of Glutamine Synthetase in Legumes
- 526604 Culture of Crayfish in the North Central Region
- 526606 Effects of Earthworms on Nitrogen Cycling Processes and Decomposer Community Structure in Organic-Based and Conventional Agroecosystems
- 526607 Molecular Analysis of Homeotic Genes in *Tribolium*
- 526608 Effects of Altered Soil Moisture and Temperature on Soil Communities, Primary Producers, and Ecological Processes in Grassland Ecosystems
- 526609 Molecular Requirements on Type-IV Human Collagen-Induced Interferon- γ Production
- 526610 (*number applies to title above*)
- 526612 Lipid Metabolism in the Hibernating Marmot
- 526616 Ultracentrifuge for Molecular Plant Biology Research
- 526617 Transgenic Technology Applied to Basic Science in Agriculture
- 526619 Effects of Record Precipitation Inputs on Soil-Plant Relationships in Tallgrass Prairie
- 526621 Use of Conservation Research Program (CRP) Land by Pheasants
- 526622 The Cultivation of *Cryptosporidium parvum* in Vitro
- 526623 MHC Control of DC4 T-Cell Function
- 526625 Effects of Earthworms on Nitrogen Cycling
- 526626 REU Supplement—Effects of Record Precipitation on the Prairie
- 526627 Estimating Effects of Ultraviolet Irradiance in Streams
- 526632 Characterization of Receptors of Shock-Inducing Toxins
- 526636 Nonclinical Research Studies of Geltax Prop Polymers
- **Biological and Agricultural Engineering**
- 520716 Row-Crop Pollution Control Demonstration Project: Atrazine Analyses
- 527684 Evaluating Field-Scale Atrazine and Alachlor Movement in Surface Water in Northeast Kansas
- 527685 (*number applies to title above*)

- 526640 ELISA Titers on Serum and Stool Samples
529331 Cell Transformation by Polyomavirus
529223 In Vitro Studies on *Cryptosporidium*, an Opportunistic Infecter of AIDS Patients
529267 Bioserve Space Technologies—A NASA Center for the Commercialization of Space
(number applies to title above)
529268 (number applies to title above)
529322 (number applies to title above)
H001 Regulations of Animal Cell Proliferation
H002 Glutamine Synthetase from Root Nodules of Legumes
H008 In Vivo Analysis of Functional CD4 T-Cell Subsets
H011 Regulation of Mammalian Protein Gene Expression
H048 Konza Prairie Research Natural Area Vegetation Research
H049 Function, Assembly, and Regulation of the Photosynthetic Apparatus
H054 Use of Iodinated Resins to Disinfect Water Supplies in Poultry and Swine Production
H057 Membrane Lipid Interactions with the EGF Receptor
H078 *Tribolium castaneum* as a Model Genetic System for the Coleoptera
H788 Electrophoretic Characterization of *Cryptosporidium parvum*
H852 In Situ Immunity in Infectious Diseases
H971 Interaction of Wheat Fungal Diseases on Yield Determinations
H996 Cell Killing by Sindbis Virus

■ **Civil Engineering**

- 520736 Biotic and Abiotic Factors Controlling Nitrogen Flux in Pristine and Agricultural Subsurface Systems
520737 (number applies to title above)

■ **Clinical Sciences**

- 481875 Can RRNA Probes Diagnose Ruminant Dysfunction before Health Is Affected?
481883 On-Farm Food Safety and Environmental Monitor
481889 Distribution of Blood Flow during Rest and Exercise in the Equine Lung
528761 Respirable Particle Concentrations in Swine Confinement Operations
528763 Dermal Irritation and Sensitization Study of Pet Fresh II Carpet Deodorizer in Dogs and Cats
528764 In Vitro and in Vivo Identification of Polysulfated Glycosaminoglycan in Serum and Synovial Fluid of the Racing Greyhound
528765 The Influence of Intratendinous Sodium Hyaluronate on Tendon Healing in Horses
528766 Dermal Safety Study of Improved Pet Fresh in Dogs and Cats
528767 Comparison of Sensitivities to Various Ionophores of Strains of Lactic Acid-Producing Bacteria from the Bovine Rumen
528778 A Cattle Feeding Trial with DDG
H074 Dust, Ammonia, and Dust-Associated Ammonia in Swine Confinement Buildings

■ **Clothing, Textiles and Interior Design**

- 528044 Use of Natural Sorbent Materials for Pesticide Spill Cleanup
528005 GIS Technology: A New Approach to Modeling Rural Trade Area Capture
R014 Successful Coping Strategies of Rural Communities
F768 Rural Retailing: Impact of Change on Consumer and Community

■ **Dean of Agriculture**

- 525056 High Erucic Acid Development Effort—Crambe and Rapeseed
525057 Agricultural Research Activities (Research Apprenticeship in High School Studies)

■ **Dean of Human Ecology**

- R770 Advances in Human Ecology Research

■ **Dean of Veterinary Medicine**

- 528951 Pivotal Dose Confirmation of U-64279 Ceftiofur Crystalline Free Acid-Sterile Suspension Compared to a Control for the Treatment of Bovine Respiratory Disease

■ **Diagnostic Medicine and Pathobiology**

- 481873 Molecular Biological Investigations of Bovine Herpesvirus Type 1 Pathogenesis
481874 Eradication of Economically Important Swine Diseases by Medicated Early Weaning
481876 Bovine Pneumonic Pasteurellosis: Immunity and Pathogenesis
481879 Molecular Approaches to Identify RSV and Study Cell-Mediated Responses in Cattle
481880 Is C-Reactive Protein the Best Indicator of Stress in Pigs?
481885 Mediators of *Actinobacillus pleuropneumonia*-Induced Permeability in Porcine Pulmonary Endothelium
481888 Is C-Reactive Protein the Best Indicator of Stress in Pigs?
528262 Molecular Studies on BIV and BHV Interactions
528359 Purification of Bovine Neutrophil Acylloxacyl Hydrolase
528367 Babesiosis in Kansas Greyhounds
523872 *Cryptosporidium parvum*-Enterocyte Interactions
528374 L-653 648/Cattle/Clinical/Dose Confirmation Endo Parasites/Induced
528375 Molecular Studies on BIV and BHV Interactions
528385 *Cryptosporidium parvum*-Enterocyte Interactions
528900 Eradication of Swine Respiratory Pathogens by Medicated Weaning
528901 The Use of Acid-Stable Interferon to Augment the Immune System of Racing Greyhounds
H010 Bovine Herpesvirus Type 1 Molecular Pathogenesis
H050 Identifying BRSV by RNA Polymerase Chain Reactions and Hybridizations
H055 Resistance to Bacterial Respiratory Diseases: Efficacy of Local Immunization
F068 Genetic Enhancement of Health and Survival for Dairy Cattle
H907 Development of an Assay for Porcine Transferrin Receptors
H958 Antigens Responsible for Infection-Acquired Immunity to Porcine Pleuropneumonia
H994 Serotype-Specific Antigens of *Rhodococcus corynebacterium equi*

■ **Economics**

- 527572 State Short-Line Railroads and the Rural Economy

■ **Entomology**

- 522266 Development of Grain and Forage Sorghums Resistant to Chinch Bug
522284 A Recombinant Map of Virulence Genes in the Hessian Fly
522289 Endogenous Factors and Chemical Cues Influencing Behavior of Hessian Fly

- 522290 The Role of Parasitoid Factors in Developmental Disruption of Multiple Hosts
522292 Catecholamine Metabolism for Insect Cuticle Tanning
522310 Assessing the Integration of Several Control Tactics to Manage Spider Mites in Corn
522312 Bacteria in Filth Flies in Greyhound Kennels and in Airborne Insect Particles Generated by Insect Traps
522314 Evaluation of Insecticide Alternatives for Control of Cutworms, Aphids, and Other Pests of Wheat
522320 A Geographical Information System for Pesticide Impact Assessment
522323 Assessing the Integration of Several Control Tactics to Manage Spider Mites in Corn
522328 Development of Sorghum Germplasm with Enhanced Tolerance to Greenbug Sugarcane Mosaic Virus and MDMV
522329 Assessing the Integration of Several Control Tactics to Manage Spider Mites in Corn
522331 Monitoring the Distribution and Testing of Insecticides for Control of Insecticide-Resistant Greenbugs
522332 Control of the Corn Rootworm in Experiments with Ecogen Products
522335 Response of Cat Flea Larvae to the KSU Flea Trap
522337 Arboviral Surveillance in 1993 Flood-Affected Areas
522340 Development of Sorghum Germplasm with Enhanced Tolerance to Greenbug, Sugarcane Mosaic Virus, and Drought
522343 Genetic and Molecular Analysis of Anterior Development in *Tribolium castaneum*
522345 Management of Corn Insect Pests by Changing Corn Maturity and Planting Date
522349 Dispersal of Insecticide Pour-on Formulations over the Animal's Body
525963 Development of Sorghum Germplasm with Enhanced Tolerance to Greenbug Sugarcane Mosaic Virus and MDMV
525964 Biocontrol Project for Downy Brome Control in Wheat
H033 Biosystematics of Insects and Arachnids
F144 Biology, Ecology, and Population Management Strategies for Muscoid Flies Affecting Cattle
H548 Grasshopper Feeding and Plant Chemistry
H564 Biology, Distribution, and Control of Insects Affecting Man and Animals
H613 Within-Plant Distribution and Sampling of Two Mite Species on Corn in Kansas
H741 Mechanisms of Insect-Plant Interactions: Sorghum Resistance to Insect Pests
H776 Resistance of Wheat and Sorghum Arthropod Pests and the Control of Horn Flies
H789 Reproductive Strategies in the Hessian Fly

■ **Family Studies and Human Services**

- 528056 Arboviral Surveillance in 1993 Flood-Affected Areas
R017 Factors Affecting Functional Independence of the Oldest-Old in Rural Kansas
H028 Identification and Assessment of a Rural Helping Network
H110 Parent Development, Home Environment, and Young Children's Development
H931 Factors Affecting the Transition to Adulthood in Contemporary Rural Settings

■ **Foods and Nutrition**

- 528108 Food Product Development
528111 Zinc Deficiency: Its Effect on Vitamin A Transport
528129 Antioxidative Effect of Selected Antioxidants Obtained from Natural Sources for Soybean Oil
528130 Odor Evaluation of Pet Foods
528132 Consumers' Perceptions of Pan Bread Quality

Research Projects Terminated (Continued)

- 528133 Preparation of Degradable Films and Coating from Corn Protein
 528951 Pivotal Dose Confirmation of U-64279 Ceftiofur Crystalline Free Acid-Sterile Suspension Compared to a Control for the Treatment of Bovine Respiratory Disease
 R017 Factors Affecting Functional Independence of the Oldest-Old in Rural Kansas
 H070 Sucrose Loading Effects on Cognitive Function in Young Adults
 F195 Improvement of Thermal Processes for Foods
 H851 Nutritional Status and Physical Activity of Older Rural Women Living Alone
 H934 Effect of Zinc Deficiency on the Metabolism of Retinol

■ Grain Science and Industry

- 520150 Large-Scale Milling and Baking Trials of New Wheat Varieties
 522861 Factors Controlling the Viscosity of Batter Systems
 522894 Extrusion Technology for Food Applications of Soybeans
 522898 Prediction of Wheat Milling Performance
 522899 Single-Kernel Physical Properties and Wheat Millability Hardness
 522902 Optimization of Technical Parameters for Milling of Debranned Wheat
 522907 Utilization of Corn, Grain Sorghum, and Wheat in the Production of Plastic Goods
 522911 Removal of Bran from Wheat Flour
 522918 Starch Thermoplastic Project, Kansas Value-Added Center
 522920 Chlorine Replacement of Cake Flour
 522924 Effect of a Fat Replacer on Bread Firming
 522928 Development of Mechanisms for the Rapid Loss of Mixing Tolerance
 522929 Wheat Starch Modification
 522935 Use of Kansas Wheat in Chinese-Style Noodles: Heat-Moisture Treatment of Wheat
 522939 Research and Product Development on Grain-Based Foods
 522942 Factors Affecting the Extrusion of Cereal-Based Foods
 522947 Equipment Acquisition for Research on Variety Flat Breads
 522951 Application in Flour Milling of Shenango Die Cast Rolls
 522952 Microbial and Yeast Feed Additive Survivability during Pelleting
 522953 Comparative Study of Pellet Binders in Turkey and Swine Production
 522954 Fluorescence Microchemical Analysis of Fiber Alignment
 522956 Development of a Bromate Replacement System
 522958 Wheat as a Source of Nonfunctional Food Protein
 522963 Extrusion Technology for Healthy Foods from Grains
 522964 (number applies to title above)
 522969 Determination Factors Controlling Crumb Grain of Bread
 522973 Optimization of Technical Parameters for Debranned Wheat
 525173 Postharvest Grain Systems Research and Development
 525186 Southeast Consortium for International Development-Haiti: Productive Land Use Systems Project
 525187 El Salvador Private Basic Grains and Edible Bean Markets
 525194 Technical Assistance for Famine Mitigation Relief/Iraq
 525195 Research on Latin-American Grain-Based Food Companies
 525199 Crop Postharvest Handling Analysis
 525200 Research on Latin-American Grain-Based Food Companies

- 525202 Location, Condition of Parts, and Grain Storage in Kazakhstan
 525205 Western Kenya Project Research and Extension
 525206 International Farming Systems Consultancy
 526180 Influence of Various Ratios of Steam-Flaked Rations on Steer Finishing
 H668 Functional Properties of Certain Components from Cereals in Baked Products
 H822 Kansas Wheat Quality Profile
 H823 Large-Scale Milling and Baking Evaluation
 H883 New and Nutritionally Improved Food Products from Wheat and Other Cereal Grains
 H888 Factors Affecting the Baking Quality of Whole Wheat Bread
 H893 Single-Kernel Physical Properties and Wheat Millability Hardness
 H960 Utilization of Cereal Co-Products in Animal Feed Processing

■ Horticulture, Forestry and Recreation Resources

- 520166 Great Plains Energy Forest
 523869 Turfgrass Water Conservation in Kansas
 523871 Stress Tolerance and Tatter Resistance of Sugar Maple Cultivars
 523878 Fuelwood Consumption Survey
 523880 Pecan Cultivar Evaluation in Kansas
 523881 Rails to Trails Survey
 523882 Blueberry Germplasm Evaluation on Mineral Soils
 524057 The Evaluation and/or Assessment for Turfgrass—1992 Official Tall Fescue National Test
 H023 A Study of Chilling Injury in Susceptible Plant Species
 H044 Climate and Weather Effects on Woody Plant Growth and Development
 M876 Woody Biomass Energy Plantations: Seedling Production, Establishment, and Growth
 M892 Kansas Landowner's Rationale for Windbreak Establishment, Maintenance, or Removal
 H901 In Vitro Propagation and Culture of Ornamental Plants
 H979 Overcoming Iron Chlorosis and Planting Shock in Oak Species Using Polyacrylamide
 H997 Commercial Greenhouse Crops to Complement Spring-Grown Bedding Plants

■ Hotel, Restaurant, Institution Management and Dietetics

- H012 Solid Waste Management in the Foodservice and Hospitality Industry

■ Kansas Water Resources Research Institute

- 525419 The Economic Impacts of Water Supply Reductions
 525420 Development of a Watershed Scale Flow Model
 525421 Water-Use Efficiency of a New Warm-Season Turfgrass
 525422 Narrow Corn Row Spacing for Cost-Effective Water
 525423 Existing and Economic Aspects of Kansas Water Markets
 525424 Role of Methanotrophic Bacteria in Kansas Reservoirs
 525425 Effects of Soil Variability on Nitrate Transport
 525427 Water Research Program
 525428 (number applies to title above)
 525429 (number applies to title above)
 525430 (number applies to title above)
 525431 (number applies to title above)
 525432 (number applies to title above)
 525433 (number applies to title above)

■ Plant Pathology

- 520194 Characterization of *Fusarium moniliforme* Populations Isolated from Corn in Kansas
 520412 Breeding Sorghum for Tolerance to *Fusarium* Stalk Rot
 520776 Improvement of Soybean via Biotechnological Approaches
 524490 Increasing Soybean Production through the Use of Cyst Nematode-Resistant Cultivars
 524504 Molecular Diagnostics for *Xanthomonas campestris* pv. *oryzicola*
 524505 Analysis of the RPL Locus of Maize
 524506 Ecological Effects of Microorganisms Applied to Crop Residues
 524508 Sorghum/Millet Collaborative Research Program with the Egyptian National Ag Research Program (NARP)
 524510 Molecular Cytogenetic Analysis in Wheat
 524516 The Turnip Crinkle Virus Capsid Protein as a Plant Pathogenic Determinant
 524521 Using Cultural Practices to Reduce Soybean Cyst Nematode and Charcoal Rot Damage in Soybeans
 524523 Cytogenetically Based Physical Map of Wheat Genome
 524524 Development of a High Density Chromosome Map Using Region-Specific Libraries
 524525 Development of an RFLP Linkage Map for Cultivated Wheat
 524529 The Role of AVRXA10 in Host Recognition of a Bacterial Pathogen of Rice
 524530 Compilation of a Wheat Cytogenetic Mapping Database
 524536 Ecological Effects of Microorganisms on Crops
 524537 Analysis of Antifungal and Herbicide Activities of a Biocontrol Bacterium
 524538 Improvement of Soybean via Biotechnological Approaches
 524541 Inheritance of Mycorrhizal Dependence in Wheat
 524544 Application of Rhizobacteria for the Biocontrol of Weeds
 524549 Effects of Timing of Foliar Fungicides and Winter Wheat/Product
 524551 Gene Tagging and QTL Mapping in Hexaploid/Diploid Wheat Crosses
 524552 North Central Soybean Research Program
 524558 Management of the Soybean Cyst Nematode
 524559 Collaborative Crop Research Program
 524560 Molecular Genetic Methods for Plant Pathogenic Bacteria
 524563 Biology and Control of Seed Smut of Switchgrass
 524573 Application of Rhizobacteria to Weeds in Wheat
 524580 North Central Soybean Research Program
 524581 Disarming of Monsanto's Wildtype Strains of *Agrobacterium* to Create an Efficacious Plant Transformation Vector
 526396 Using Cultural Practices to Reduce Soybean Cyst Nematode and Charcoal Rot Damage in Soybeans
 F005 Interaction of Nematode-Host Variability and Abiotic Factors on Crop Losses
 H058 Molecular and Genetic Characterization of a Gene Controlling Avirulence
 H331 Mycorrhizal Hyphal Networks in Soil: Relationship to Sustainability
 H772 Fungal Diseases of Wheat and Their Control
 H858 Genetic Analysis of Disease Resistance in Maize
 H975 Mycorrhizal Symbiosis: Potential for Bioremediation of Heavy Metal-Contaminated Soil
 H977 Assessment of Yield Losses to Multiple Diseases of Winter Wheat
 H986 Assessment of Grain Sorghum Yield Loss by Sooty Stripe (*Ramulispora sorghi*)
 H989 Pathogenicity Determinants Carried by TCV and WSMV Capsid Proteins
 H992 Reduction of Straw-Borne Tan Spot Inoculum in Conservation Tillage

■ **Sociology, Anthropology, and Social Work**

- 527623 From Research Knowledge to Community Action: Toward the Application of Research Knowledge to Effective Community Action

■ **Statistics**

- 527609 Design and Analysis of Experiments that Involve Multiple Processing Steps
527610 Mixed Models Used in the Semiconductor Industry

■ **Agricultural Research Center—Hays**

- 520701 Technical Support for the Acquisition of Pioneer Germplasm and Varieties
520722 Canola Research
520731 Improving Atrazine Management for Weed Control in Corn: Evaluating Field-Scale Atrazine and Alachlor Movement in Northeast Kansas
520732 Improvement of Hard Winter Wheat
524573 Application of Rhizobacteria to Weeds in Wheat
525754 Canola Research
525955 Pearl Millet Breeding
525956 Triasulfuron in Winter Wheat in Kansas
525957 Broadleaf Weed Interference in Winter Wheat
525958 Canola Research
525959 Native Soil Bacteria as Selective Weed Control Agents in Wheat
525961 Biological Control of Winter Annual Grass Weeds in Winter Wheat
525962 Crambe: Evaluation of Swathing Practices in Kansas
525963 Development of Sorghum Germplasm with Enhanced Tolerance to Greenbug Sugarcane Mosaic Virus and MDMV
525964 Biocontrol Project for Downy Brome Control in Wheat
525967 Consumption of Chlortetracycline by Grazing Beef Heifers Offered Free-Choice Feed Blocks
525968 Genetic Development of Higher Disease Resistance and Grain Protein in New Wheat Varieties
525969 Biological Control of Winter Annual Grass Weeds
525970 Development of Sorghum Germplasm with Tolerance to Greenbug Mosaic Virus, Maize Dwarf Mosaic Virus, and Drought
525972 Biocontrol Project for Weed Control
525973 Effect of Synthetic Protein, Aspartic Acid on Winter Wheat Grown in a 22.5-Inch Precipitation Area
525983 Jointed Goatgrass Competition and Integrated Management in Western United States Winter Wheat
H046 Genetics and Breeding of Sorghum
H062 Improvement of Pearl Millet, Sunflower, and Rape
R252 Beef Cattle Feeding Investigations
R255 Beef Cow Herd Management
R291 Management of Soil in Dryland Regions
R645 Managing Range to Increase Forage Conversion Efficiency
H978 Weed Management and Control Investigations

■ **Northwest Research— Extension Center**

- 520722 Canola Research
520727 Tillage, Irrigation, and Hybrid Maturity Class Effects on Corn Production
525754 Canola Research
525755 Characterization of Overwinter Nitrate Nitrogen Leaching Potential in Northwest Kansas

- 525756 Sunflower Date of Planting and Plant Population Studies
525757 Tillage, Irrigation, and Hybrid Maturity Class Effects on Corn Production
525759 Integrated LEPA Sprinkler Irrigation and Fertigation Management to Preserve Water Quality
525760 Increasing Subsurface Dripline Aeration with the Mazzei Differential Pressure Injector
525763 Increasing Yield and Water-Use Efficiency of Soybeans with Foliar-Applied Methanol
525765 Water-Efficient Practices for Corn Production
R293 Crop Improvement in Northwest Kansas

■ **Southeast Agricultural Research Center**

- 520694 Increasing Soybean Production through the Use of Cyst Nematode-Resistant Cultivars
526396 Using Cultural Practices to Reduce Soybean Cyst Nematode and Charcoal Rot Damage in Soybeans
526397 Effect of Yeast Supplementation on Ruminant Fermentation Patterns
526401 Effect of Supplementation with Levucell SC20 on Ruminant Fermentation Patterns
526406 Management of the Soybean Cyst Nematode and Charcoal Rot in Soybeans
526407 Increasing Yield and Water-Use Efficiency of Soybeans with Foliar-Applied Methanol
526408 Consumption of Lasalocid from Free-Choice Molasses Blocks
526409 Effect of Magnesium-Mica on Performance and Carcass Characteristics of Feedlot Cattle
H030 Forage Production and Use in Southeastern Kansas
H031 Evaluations of Alternatives in Soil and Water Management Practices in Southeast Kansas
R706 Grain Sorghum Response to Legume Residual as Affected by P and K
R754 Use of a Legume-Grain Sorghum Rotation in a Crop-Livestock System
R957 Phosphorus, Potassium, and Chloride Effects on Alfalfa and Birdsfoot Trefoil Establishment, Yield, and Quality

■ **Southwest Research—Extension Center**

- 520727 Tillage, Irrigation, and Hybrid Maturity Class Effects on Corn Production
525757 (*number applies to title above*)
525765 Water-Efficient Practices for Corn Production
526165 Cattle Feedlot Management Program
526164 Effect of a Previous Soybean Crop and Nitrogen Fertilizer on Irrigated Corn and Grain Sorghum Production and Profitability
526166 Integrated Management of Stable Flies in Cattle Feedlots
526167 Tillage, Irrigation, and Hybrid Maturity Class Effects on Corn Production
526170 Water Conservation-Increased Efficiency in Usage
526171 Effect of a Previous Soybean Crop and Nitrogen Fertilizer on Irrigated Corn and Grain Sorghum Production and Profitability
526172 Low Pressure and Canopy Sprinkler Management for Corn on Slopes over One Percent
526173 Evaluation of New Products to Improve the Efficiency of Production in Feedlot Cattle
526176 Potential Sting Rate of Searching *Spalangia nigroaenea*
526178 Adapted Woody Plant Materials and Establishment/Growth Technology for Kansas, Colorado, and New Mexico
526179 Increasing the Use of Grain Sorghum in Kansas Feedlot Cattle Rations

- 526180 Influence of Various Ratios of Steam-Flaked Rations on Steer Finishing
H029 Efficient Resource Management for Dryland and Irrigated Soils
R085 Fertilizer Management for Reduced Tillage Dryland Winter Wheat

FY95 and FY96 Income and Disbursement Statement, Kansas Agricultural Experiment Station

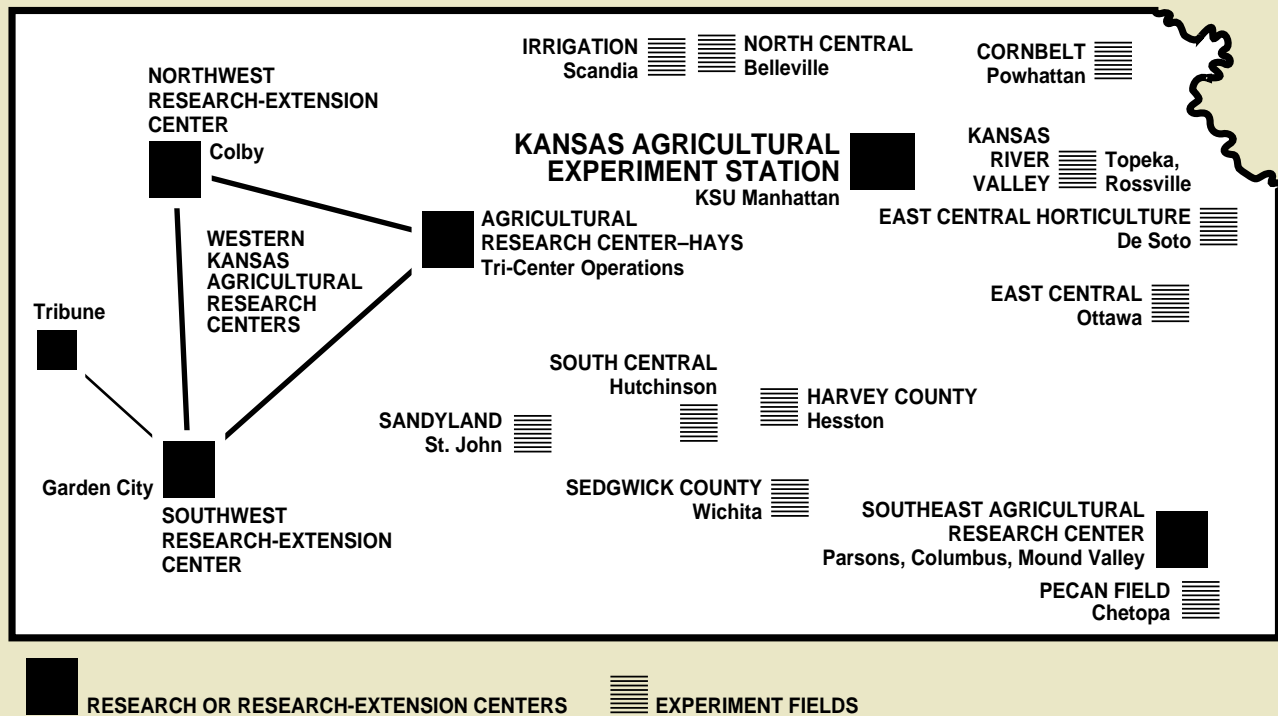
	7.15%	50.52%	14.65%	27.68%		
FY95 FUNDING	\$3,263,711	\$23,076,901	\$6,692,767	\$12,642,972	\$45,676,351	
	Federal	State*	Fees	Sponsors	Total	
FY95 EXPENDITURES						
Faculty & Administrative Salaries	\$2,454,634	\$13,741,483	\$539,401	\$6,383,770	\$23,119,288	50.62%
Classified & Student Salaries	\$209,019	\$5,542,657	\$1,060,714	\$1,224,623	\$8,037,013	17.60%
Contract Services & Travel	\$205,724	\$1,598,532	\$1,319,425	\$2,074,008	\$5,197,689	11.38%
Supplies & Materials	\$213,470	\$1,176,146	\$2,355,504	\$1,594,655	\$5,339,775	11.69%
Equipment	\$180,864	\$1,018,083	\$1,417,723	\$1,365,916	\$3,982,586	8.72%
Other	\$0	\$0	\$0	\$0	\$0	0.00%
Totals	\$3,263,711	\$23,076,901	\$6,692,767	\$12,642,972	\$45,676,351	100%

	6.85%	51.38%	13.63%	28.14%		
FY96 FUNDING	\$3,166,784	\$23,741,773	\$6,299,721	\$13,002,651	\$46,210,929	
	Federal	State*	Fees	Sponsors	Total	
FY96 EXPENDITURES						
Faculty & Administrative Salaries	\$2,339,527	\$14,179,205	\$382,154	\$6,434,019	\$23,334,905	50.50%
Classified & Student Salaries	\$236,384	\$5,658,453	\$950,258	\$1,149,465	\$7,994,560	17.30%
Contract Services & Travel	\$210,066	\$1,622,043	\$1,279,056	\$2,258,430	\$5,369,595	11.62%
Supplies & Materials	\$260,661	\$1,574,755	\$3,081,244	\$1,727,563	\$6,644,223	14.38%
Equipment	\$120,146	\$707,317	\$607,009	\$1,433,174	\$2,867,646	6.21%
Other	\$0	\$50	\$0	\$0	\$0	0.00%
Totals	\$3,166,784	\$23,741,773	\$6,299,721	\$13,002,651	\$46,210,929	100%

*Includes IGP and ILP

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