Approved: February 1, 1999
Date

MINUTES OF THE HOUSE COMMITTEE ON AGRICULTURE.

The meeting was called to order by Chairperson Joann Flower at 3:30 p.m. on January 27, 1999 in Room 423-S of the Capitol.

All members were present except: Representative Compton - excused
Representative O'Brien - excused

Committee staff present: Raney Gilliland, Legislative Research Department
Gordon Self, Revisor of Statutes
Kay Scarlett, Committee Secretary

Conferees appearing before the committee:
Dr. Marc Johnson, Dean and Director, College of Agriculture, Kansas State University
Dr. Walter Fick, Professor of Range Management, Kansas State University

Others attending: See attached list

Chairperson Flower asked committee members to review the minutes of January 25. If there were corrections or additions, members were asked to contact the committee secretary before 10:00 a.m., January 28, or they will stand approved as presented.

Chairperson Flower asked for requests for introduction of committee bills. Kerri Ebert, Executive Secretary, Kansas Dairy Association, asked for legislation that would allow Kansas to join the Southeast Interstate Dairy Compact. Representative Dahl moved to introduce this request as a committee bill. Seconded by Representative Freeborn, the motion carried.

Doug Wareham, Vice President, Government Affairs, Kansas Grain and Feed Association, requested a concurrent resolution urging Congress to direct the Environmental Protection Agency (EPA) to cease implementation of new restrictions for aluminum/magnesium phosphide based grain fumigants and ensure that risk mitigation allowances for aluminum/magnesium phosphide based grain fumigants are based on sound science and reliable information. Representative Freeborn moved to introduce this request as a House Concurrent Resolution. The motion was seconded by Representative Dahl. Motion carried. (Attachment 1)

Representative Thimesch requested a concurrent resolution urging local units of government to be aware of water structure dam safety and liability issues when issuing new building permits. It was moved by Representative Light and seconded by Representative Tedder to introduce this request as a House Concurrent Resolution. The motion carried.

Dr. Marc Johnson, Dean of the College of Agriculture and Director of the Agricultural Experiment Station and Cooperative Extension Service at Kansas State University, spoke on the four core mission themes around which K-State Research and Extension's five-year work plan has been established. They are now launching the1999-2004 work plan designed to provide a safe, sustainable, competitive food and fiber system and strong, healthy communities, families, and youth through integrated research, analysis, and education. Dean Johnson reported on recent accomplishments in each of the four areas: Agricultural Industry Competitiveness; Natural Resources and Environmental Management; Youth, Family, and Community Development; and Food, Nutrition, Health, and Safety. He assured the committee that funds provided to carry on such work are returned manyfold to the state and its citizens. (Attachment 2)

Dr. Walter Fick, Professor of Range Management, Kansas State University, discussed the biology and control of sericea lespedeza research being conducted by K-State Research and Extension. Dr. Fick said that sericea lespedeza which was introduced into Kansas during the 1930's for erosion control occurs primarily in the

eastern one-third of the state. The Kansas State Board of Agriculture estimates that nearly 250,000 acres of land are infested with sericea lespedeza in Kansas causing a reduced grazing value of $1.3 million. The Legislature declared sericea lespedeza as a county-option noxious weed in 1988. Dr. Fick reported that since that time considerable research has been conducted to determine possible control measures. He said they have investigated the use of burning, mowing, and herbicides used alone and in combination for the control of sericea lespedeza. He reported that their plans for 1999-2000 include a seed bank study, repeat and monitor integrated control studies, a herbicide absorption/translocation study, and livestock grazing studies. He said that more research is needed to understand the biology of sericea lespedeza in order to develop sound management strategies to enhance the control of this species. (Attachment 3)

The meeting adjourned at 4:40 p.m. The next meeting is scheduled for February 1, 1999.

HOUSE AGRICULTURE COMMITTEE GUEST LIST

DATE: January 27, 1999

NAME	REPRESENTING
Steven Graham	K-State Research + Extension
Walter Fick	K-State Research + Extension
MARC JOHNSON	K-State Research & Extension
Steve Adams	Dept. of Wildlife + Parks
Chris Wilson	KS Dairy Ass'n
Kerri Ebert	KS Dairy Association
Rodney Biesenthal	County Weed Directors
Doug Wareham	KCFA / KFCA
JOHN KABUS	SHAWNEE Co. NOXIOUS WEED
Sarah Donegan	intern for Rep. Helgerson
James Williams	K.A.C. - Riley Co.
Don Cress	K-State Research & Extension
Tom Sim	Kansas Department of Agriculture
SUE PETERSON	K-STATE
Bill Spegel	Kansas Farmer magazine

KANSAS GRAIN & FEED Association

Resolution Request

of the

Kansas Grain and Feed Association

Presented to the

House Agriculture Committee

Representative Joann Flower, Chair

January 27, 1999

KGFA, promoting a viable business climate through sound public policy for more than a century.

House Agriculture Committee
January 27, 1999
Attachment 1

Aluminum/Magnesium Phosphide Based Grain Fumigants

A CONCURRENT RESOLUTION urging Congress to direct the Environmental Protection Agency (EPA) to cease implementation of new restrictions for aluminum/magnesium phosphide based grain fumigants and ensure that risk mitigation allowances for aluminum/magnesium phosphide based grain fumigants are based on sound science and reliable information.

WHEREAS, Kansas' agricultural heritage and economy is dependent upon the harvest, storage, and transportation of grain; and

WHEREAS, there are 785 grain elevators in Kansas and 65,000 farms in Kansas, many of which are family-owned operations; and

WHEREAS, Kansas grain elevators are valued neighbors to and located in close proximity to homes, schools, farms, and businesses in most of all Kansas' communities; and

WHEREAS, Kansas grain elevators, feed mills, processors, growers are committed to protecting the health and safety of applicators, workers and wellbeing of the public; and

WHEREAS, grain elevators are located in Kansas communities near railroads and highways to facilitate the transportation of grain; and

WHEREAS, Kansas is a leader in the Nation and in the World in grain production; and

WHEREAS, Kansas grain elevators, feed mills, processors, growers are committed to producing an adequate safe and high quality food supply for domestic and world consumers; and

WHEREAS, treaties and established trade relations may require pest-controlled grain before grain can be exported; and

WHEREAS, insect pests in grain without fumigation treatment could create health risks and reduce the quality of the grain marketed from Kansas;

WHEREAS, aluminum and magnesium phosphide gas are cost-effective fumigants used both by commercial elevators and farmers in the storage of grain in Kansas; and

WHEREAS, EPA acknowledges few, if any, viable alternatives to the use of aluminum and magnesium phosphide exist for fumigation to control pests in stored grain; and

WHEREAS, the current label restrictions for aluminum and magnesium phosphide gas provide for the safe and effective use of the product; and

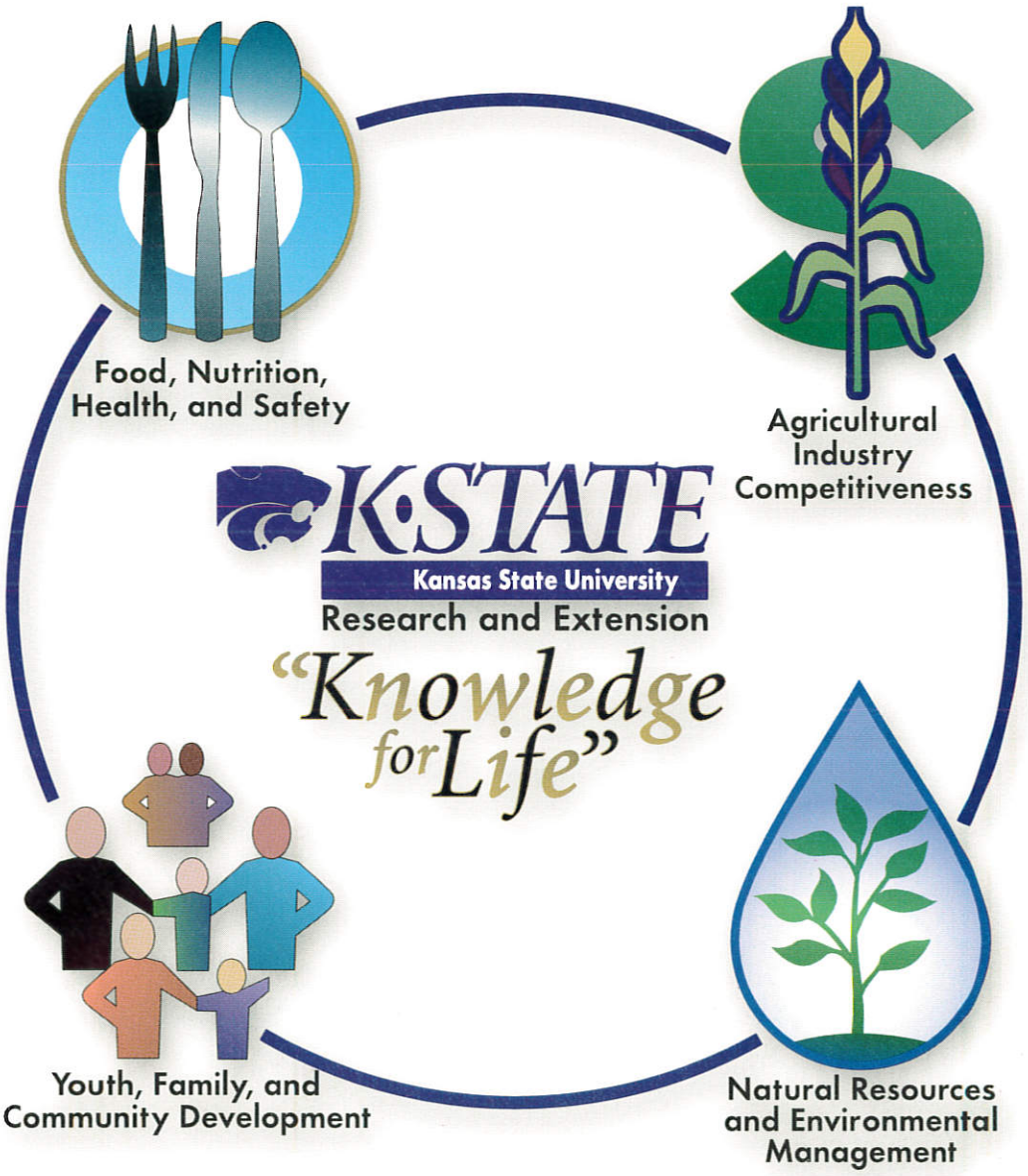
WHEREAS, the state of Kansas practices rigorous enforcement of the label restrictions on fumigants, ensures adequate training of certified applicators and conducts a fumigation and grain storage project to inspect the use of fumigants; and

WHEREAS, restrictions in the use of fumigants in grain storage and transportation should be based only on sound scientific reasoning, available technology, and accurate analysis of risk level and avoid raising undue public alarm over unsubstantiated or inconsequential risk: Now, therefore,

BE IT THEREFORE RESOLVED THAT THE HOUSE OF REPRESENTATIVES OF THE KANSAS, THE SENATE CONCURRING THEREIN: That Congress direct EPA to curtail implementation of new restrictions from its Reregistration Eligibility Decision (RED) on phosphine gas that would require a 500-foot buffer zone and other restrictions that effectively preclude the use of aluminum or magnesium phosphide in most Kansas grain storage facilities and grain transportation; and

BE IT FURTHER RESOLVED: That Congress direct EPA to ensure that Risk Mitigation allowances for aluminum/magnesium phosphides are clearly demonstrated as necessary to protect human health, are based upon sound science and reliable information, are economically and operationally reasonable and will permit the continued use of these products in accordance with the label.

FOCUSING ON FOUR MAJOR AREAS



AN INFORMAL REPORT TO THE KANSAS LEGISLATURE
by the Kansas State University Agricultural Experiment Station and Cooperative Extension Service

January 1999

House Agriculture Committee
January 27, 1999
Attachment 2

PREPARED TO MEET THE FUTURE'S CHALLENGES

In 1995, the Kansas Legislature requested that we examine the Kansas Agricultural Experiment Station and the Kansas Cooperative Extension Service at Kansas State University. We were asked to make sure their research and educational programs still meet the needs of Kansans.

Our review began by going to the people in the state and soliciting their views. The consensus was that much of what we do has been on track. Kansans like the fact that we produce and disseminate unbiased, research-based information. Citizens identified areas which are important to them and pointed out areas where more information is desired. Many Kansans could not distinguish how the two organizations differed or what those differences were. Many could not name the institution that serves as the headquarters of the Experiment Station or Extension Service.

As a result, we planned and initiated a number of important changes. We merged the two organizations into one (no other land-grant university in the nation has done this), now called the Kansas State University Agricultural Experiment Station and Cooperative Extension Service. We call ourselves "K-State Research and Extension" for short and are highlighting our tie to Kansas State University, one of the nation's first land-grant universities.

We created a mission statement which stresses that we are "dedicated to a safe, sustainable, competitive food and fiber system and to strong, healthy communities, families, and youth through integrated research, analysis, and education." Those areas of most importance to Kansans were grouped into four Core Mission Themes around which a new five-year plan of work was created. We further identified 16 key programming issues to address under the four Core Mission Themes.

Last January, we shared our **Five-Year Work Plan** with you. During 1998, we formed teams of K-State Research and Extension faculty to work on activities that will allow us to achieve goals set under the 16 program issue areas. This year we want to share results of recent work which provides a solid base for our new efforts to come.

This publication highlights many of K-State Research and Extension's accomplishments, and I believe Kansans will be very proud of them. Through the strong foundation of the land-grant system, we stand ready to meet the future's challenges and continue providing what our new motto promises: "Knowledge for Life."

Sincerely,

Marc A. Johnson
Dean and Director

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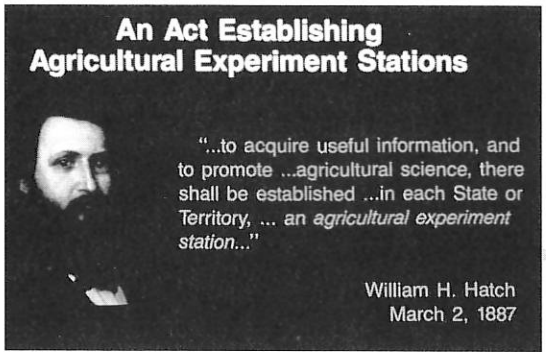
K-STATE RESEARCH AND EXTENSION

The Times Are Changing



In the early years, extension personnel rode trains around Kansas to take information to the people.

A Look Back

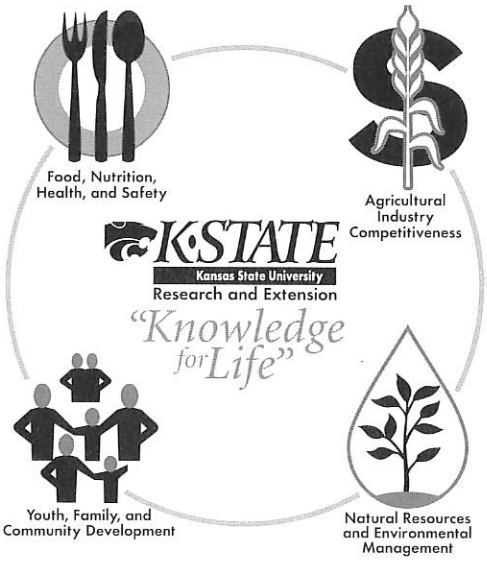
It was 111 years ago, in 1888, that the Agricultural Experiment Station at Kansas State University was established. Twenty-six years later, in 1914, the Cooperative Extension Service was created. Both derived from federal legislation; both were tied to the land-grant university concept of providing help to solve problems through research and dissemination of information; and both have touched the daily life of every person in Kansas.

Taking Care of Business

Throughout their existence, these two organizations have been involved in continual change and reassessment. The latest reevaluation of focus and programs came about when the Kansas Legislature asked K-State to make sure its research and extension programs were still relevant.

Are We Relevant?

To find out, Marc Johnson, Dean of the College of Agriculture and Director of the Agricultural Experiment Station and Cooperative Extension Service, set up 31 statewide focus groups and five public policy forums. Other fact-finding activities included a random, statewide telephone survey. What emerged from those inquiries was reassurancethat K-State was on the right track and has been providing services that are needed. However, many people didn't know how the two groups differed, nor did they care what those differences were—they just knew that the Ag Experiment Station and the Extension Service were part of K-State. Also, some internal problems were discovered, including communication difficulties between the two organizations as well as some jurisdictional disputes.



New Name

As a result, the two organizations were combined into one and named the Kansas State University Agricultural Experiment Station and Cooperative Extension Service—K-State Research and Extension, for short.

Focusing on Four Major Areas

From surveys, those areas of most importance to Kansans were identified and grouped into four core mission themes around

which a five-year work plan has been established. K-State Research and Extension now is launching the 1999-2004 work plan designed to provide a safe, sustainable, competitive food and fiber system and strong, healthy communities, families, and youth through integrated research, analysis, and education. What follows are some of the recent accomplishments in each of the four areas, starting with:

1. AGRICULTURAL INDUSTRY COMPETITIVENESS

The focus in this area involves developing efficient, integrated crop production systems; developing efficient, coordinated livestock and poultry production systems; enhancing the value of Kansas agricultural goods; developing agricultural risk-management strategies; and developing agricultural technologies and information systems.

Emphasis has been placed on realigning research and educational programming to reflect agriculture's need for synthesized information that affects the entire farm business—from tillage and harvest to on-farm and elevator grain storage; from cattle nutrition through carcass evaluation; from input selection to marketing; from starting a home-based business or farm recreational enterprise to developing markets for fruits and vegetables or other alternative crops. Help also is given on assessing ever-changing governmental programs that affect Kansas agriculture.

A team working together in a plant pathology lab to develop higher yielding crops that are more resistant to disease and pests.

INTERDISCIPLINARY TEAMS TACKLE PROBLEMS

Teamwork by highly qualified scientists in different disciplines is one reason why K-State can boast of a long list of accomplishments that include new and better crop varieties, leaner and meatier beef and pork, improved soil and water use, effective pest controls, improved management programs, better economic analyses, and added-value for ag products. But no institution can rest on past achievements. Agriculture and agricultural industries are continually changing and facing new problems, and they depend heavily on public agricultural research and information that will take them into the 21st century and beyond.

FROM BASIC RESEARCH TO DEVELOPMENT OF NEW PRODUCTS

K-State Research and Extension is well-positioned to be a leader for progress because of the depth of its programs—from small to big:

Getting Down to Basics

It starts with basic scientific inquiry in such areas as genetic engineering, where K-State biochemists, biologists, agronomists, plant pathologists, entomologists, and grain scientists are exploring the secrets of the tiny building blocks of matter. Gene transfer, recombinant DNA, gene cloning, and cell and tissue culture hold tremendous potential.

Engineering Genes

Genetic engineering allows scientists to make specific or targeted changes in organisms. By altering genes that do specific tasks, scientists can produce plants and animals that are more nutritious and more resistant to diseases, pests, or environmental stresses.

By fingerprinting wheat DNA, researchers can identify specific genes for breeding.

Gene Transfer

The transfer of genes controlling specific desirable plant and animal characteristics has been accomplished by breeders for several decades, but genetic engineering now provides a more controlled method of transferring genetic information.

Plant Biotechnology Center

A profitable agriculture will depend more and more on the ability of scientists to utilize biotechnology, which is the science of modifying the genes of organisms through molecular biology and cell and tissue culture. Because Kansas agriculture depends on plants, a Plant Biotechnology Center has been established at K-State.

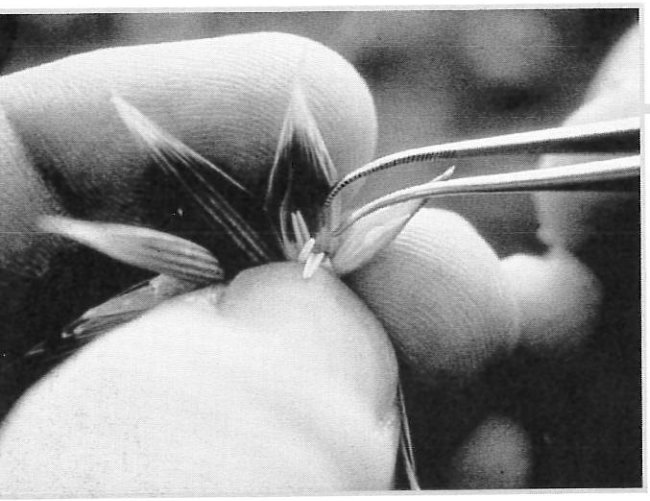
Initial emphasis of the researchers affiliated with the Plant Biotechnology Center will be to build on K-State's current strengths in wheat research. The goals will be to enhance yield and product quality of wheat for traditional uses and to explore value-added uses for new products and markets.

Other thrusts include developing wheat resistant to viral and fungal diseases, especially streak mosaic and scab; cloning genes that govern susceptibility to insects, focusing on Hessian fly; and developing wheat that produces pharmaceuticals, including antibiotics, for human and animal use.

Eventually research will be done on all Kansas crops and plant products that could be designed to better meet the demands of national and international markets.

The Plant Biotechnology Center builds on strengths of several KSU departments and is headquartered in the Throckmorton Plant Sciences Center, which is a state-of-the-art facility and one of the largest buildings on campus.

The new Plant Sciences Center where the Wheat Genetics Resource Center is housed.



Examining a wheat flower in one of the many K-State experiments to improve wheat.

Wheat Genetics Resource Center

Wheat's ancestry can be traced to wild grasses of the Middle East. After being domesticated, those grasses flourished and provided a food supply for the world. Today, the wild grasses that remain are crucial to future advances in wheat breeding. The KSU Department of Plant Pathology holds the nation's largest collection of germplasm from wheat's wild relatives in its Wheat Genetics Resource Center (WGRC).

It currently has more than 5,000 accessions of species and genetic stocks of *Triticum* and *Aegilops*, the two primary ancestral lines of modern wheat. Many are from Turkey, Israel, Lebanon, Syria, Iran, and Iraq.

The wild wheats in the collection are important reservoirs of useful genetic diversity that can be used against biological pests and environmental stresses that affect the yield potential, the yield stability, and the quality of wheat. The Center's primary tasks are to conserve the wild wheat plants and transfer the genes to wheat crop germplasm that can be used by plant breeders.

The scientists involved with the Center conduct fundamental research in genetics, plant breeding, biotechnology, and genetic engineering. They develop molecular genetic maps, and they explore the usefulness of modern approaches in gene transfer, including tissue culture and recombinant DNA technology.

To date, 39 germplasm releases have been announced by the WGRC. These germplasm lines contain new genes for resistance to many diseases and pests, including Hessian fly, greenbug, leaf rust, soilborne mosaic virus, and wheat streak mosaic virus. The genes were derived from rye and goatgrass, a plant related to bread wheat. This new germplasm will provide potentially inexpensive and environmentally safe control of these pests in the high-yield wheat varieties of tomorrow.

Another achievement has been to use molecular markers consisting of wheat DNA fragments cloned in bacteria to construct the first working map of the wheat genome. When the precise locations of specific genes are identified, better wheat varieties can be developed more quickly.

The DNA road map of wheat is 16 billion base pairs long, and the Center has mapped more than 2,000 molecular markers. By comparison, the equivalent road map in humans is much smaller—3 billion base pairs.

Another impact of the Center is that numerous scientists from other states and countries have been coming to learn gene transfer and chromosome identification techniques. They often stay from six months to a year, usually with all of their salaries paid by their own governments. They work on projects of the Center, develop new knowledge and skills, and leave behind a wealth of research data.

Wheat Research Center

This center for excellence in wheat research and technology encompasses wheat breeding and genetics, wheat production, wheat harvesting and storage, marketing, grain quality and processing, human and animal nutrition, pest management, wheat utilization for food and nonfood products, and worldwide data dissemination. It is not a place but an alliance of programs to enhance the value of U. S. wheat to the producer, processor, and consumer. Core scientists in the center are from K-State. Scientists from other agencies, other states, and industry participate in the alliance within appropriate projects.

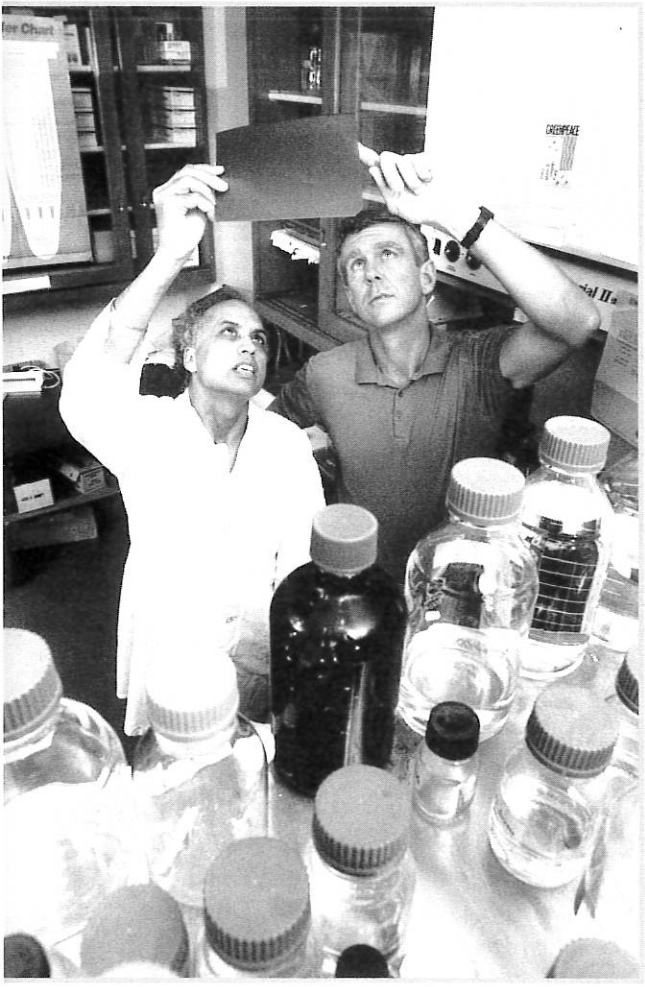
Current programs address issues essential to production efficiency and profitability, value-added product development, food safety, biotechnology, and environmental quality.

The goals of the Center are to:

- Create and disseminate a scientific information base in support of wheat production, processing, and utilization for traditional and innovative nontraditional produces and processes.
- Improve the competitiveness and profitability of the U.S. wheat industry by emphasizing added value for producers, processors, and consumers in domestic and foreign markets.
- Enhance environmental quality and utilization of natural resources in the production, marketing, processing, and utilization of U.S. wheat.

The Center cooperates with the American Institute of Baking, the USDA Grain Marketing and Production Research Center, other land-grant universities, wheat producer groups, wheat merchandising and processing firms, seed and other input supply firms, and international research institutes.

A plant pathologist and a wheat geneticist working together to develop better wheat varieties.



PLANT BREEDING AND IMPROVEMENT PROGRAMS

Among the many ways K-State Research and Extension utilizes biotechnology is to develop new and better varieties of wheat, sorghum, soybean, alfalfa, and such alternative cash crops as sunflowers and canola. Biotechnology is not replacing traditional methods of plant breeding. They complement each other. Both are needed to improve food production while reducing costs to producers, consumers, and the environment. Some examples follow:

Wheat

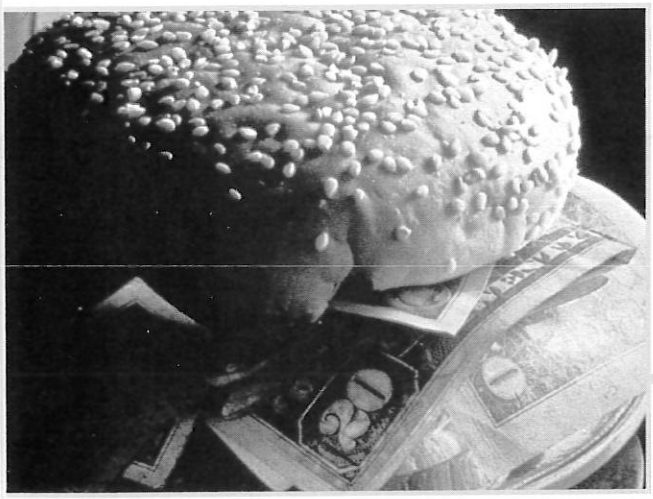
New varieties released by K-State Research and Extension have been rapidly accepted by Kansas wheat producers. The increases in yield, end-use quality, and disease or insect resistance all add

significantly to the state's economy. **The 1998 Kansas wheat crop of 495 million bushes is 2 percent smaller than the 1997 crop but was grown on 8 percent fewer acres. The 1998 record high yield of 49 bushels per acre surpassed the previous record high of 46 bushels in 1997.** Karl wheat (and its replacement Karl 92) has been the state's leading variety for the past three years. Karl has contributed an estimated $25 million per year to the state's economy over the past four years. In 1998, the top two wheat varieties planted in the state are Jagger (20.2 percent) and 2137 (13.5 percent), both developed at K-State. All of the wheat varieties that K-State has developed and that producers are using provide a return to the state of $54 million per year. Over the past 25 years, K-State has increased the yield potential of wheat cultivars by about one-half bushel per acre per year through plant breeding. If this trend continues, tremendous economic returns can be expected. If the rate of improvement remains constant, the breeding efforts could be adding at least $15 million to the Kansas economy each year. Improvements in disease and insect resistance alone have the potential of adding millions per year to the state's economy.

A wheat breeder examines a field of experimental wheat.

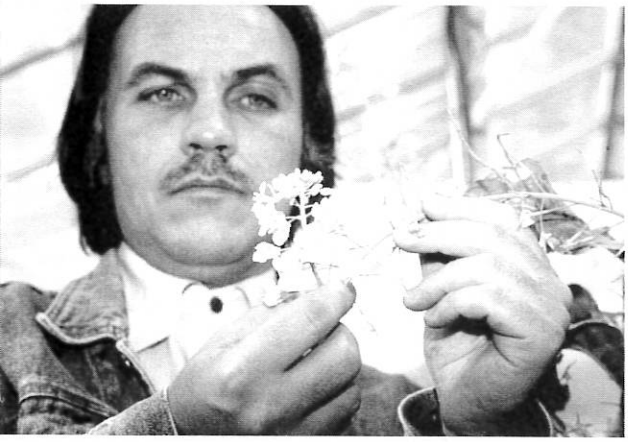
White Wheat—It Could Change Kansas Wheat Production

For 25 years, K-State scientists have been investigating and developing hard white wheats for Kansas. In fall of 1998, K-State released two hard white wheat varieties that may reshape the future of Kansas wheat production and speed the shift away from the hard red wheat that has made Kansas the breadbasket of the world. About 98 percent of the wheat harvested in Kansas last year was hard red varieties. But hard white wheat increasingly has been preferred in the global market, particularly in Asia. White wheat's greater market could expand exports from Kansas. One of the new white wheats has been named Heyne after Elmer Heyne, former plant breeder at K-State. Adapted to central Kansas, it is a medium maturity wheat with good disease resistance, good grazing characteristics, aluminum tolerance, good straw strength, and good yields. The other white wheat, Betty, named after Betty Goertzen, is adapted primarily to central and western Kansas growing conditions. It has good disease resistance, winter hardiness, white chaff, and yields comparable to Jagger's. Betty Goertzen was research director at Goertzen Seed and a pioneer in developing some of the germplasm that is used today for white wheat varieties.



The Economic Benefits of Wheat Research

An impact study by a K-State agricultural economist concluded that **the university's wheat-breeding program generates almost $12 for each $1 spent—an 11.95 to 1.0 ratio.** The wheat-breeding program cost $3.8 million a year from 1979 to 1994, including all research costs and overhead expenses. During that same time



A scientist holds a flowering canola plant.

Checking new kinds of canola growing in a K-State greenhouse.

K-State is developing an adhesive made from soybean.

period, the new semidwarf varieties developed by K-State Research and Extension increased wheat production 1 percent a year and added $52.7 million a year. The research project took into account the long time—some 15 years—needed to develop and release a new variety.

Canola

Canola seeds are sources of a healthful cooking oil and a high-protein meal for livestock. The United States now must import canola. Canola production would fit well into Kansas agriculture, but poor winter survival has been a problem. However, cold-tolerant varieties are being developed, and one named Plainsman was released by K-State in 1998. Four K-State researchers, in cooperation with scientists from other Great Plains states, have developed detailed guidelines for growing, harvesting, and storing canola. Cost-return projections for canola in a rotation with sorghum and fallow in western Kansas showed returns up to $150 per acre. Another aspect of this cooperative research program includes establishment of two regional nurseries to breed new varieties and determine their potential use and value. As a result of this work by K-State Research and Extension, producers can add this profitable crop to their rotations.

Soybean

Soybean production in Kansas in 1997 set a record at 88.8 million bushels. Yield per acre was 37 bushels, equalling the record high yields of 1992 and 1996. In addition to improving plants, K-State researchers are focusing on ways to add value to those plants, including experiments at the molecular level. For example, a soy-based, formaldehyde-free adhesive that is water resistant and strong has been developed recently. The adhesive was produced by chemically modifying the soy protein molecular structure. During the research, it was found that one group of chemicals will unfold the soy protein in such a way that hydrophobic amino acids come to the surface. That promotes water resistance, and the unfolded molecules increased the contact area resulting in adhesive strength. This could lead to a new use for the soybean, that would be environmentally safe as well as further reducing petroleum use. Formaldehyde is a toxic chemical used in petroleum-based adhesives as a cross-linking agent to increase water resistance. The modified soy protein developed at K-State performed well in two standard tests for adhesives. It remained strong after eight weeks in a chamber at 90 percent relative humidity, indicating its suitability for interior uses in the furniture industry and for package labeling uses.

Another project—managing the soybean cyst nematode in southeast Kansas— involves plant pathologists and agronomists working together to alleviate the soybean nematode cyst problem. The cyst nematode prunes the roots of soybeans,

Kansas ranks first in the nation in sorghum grain production.

Kansas ranks eighth in the nation in corn grain produced.

and yield losses can be up to 50 percent. Because the pest is in the soil, it is extremely difficult to control or eliminate. An extension agent first discovered the soybean cyst nematode in Kansas in 1989; since then, it has spread across the eastern half of the state and has been found now in south-central and northeast Kansas. The primary long-range goal is to assist in the development of soybean cyst nematode resistant cultivars through a cooperative effort with the K-State soybean breeding program. K-State conducts annual performance trials on soybeans that provide information to producers on varieties that are resistant to the pest. It is considered one of the most reliable cyst nematode resistance screening trials. One soybean producer stated that the K-State variety testing program has provided an extra $20,000 per year for him. Resistant soybeans produce 35 percent more grain than susceptible soybeans. If yield increased by five bushels an acre over 50,000 acres, the economic benefit would be about $1.5 million.

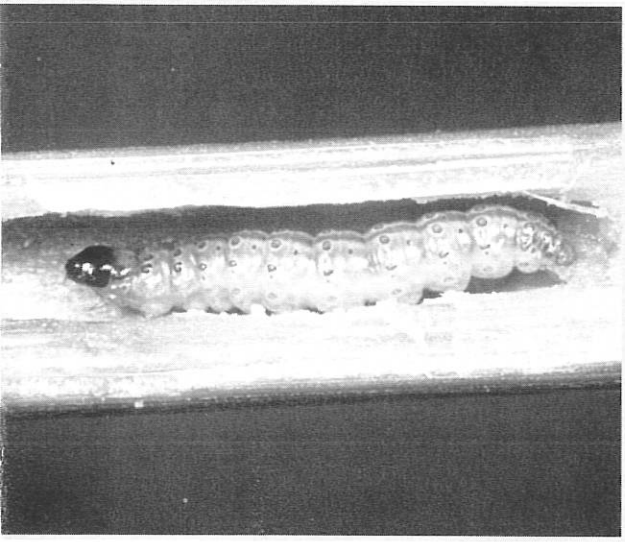
Sorghum

In 1997, Kansas ranked first in the United States in sorghum grain production with 273 million bushels. Kansas produced 42 percent of the U.S. total in 1997. At the same time that agronomists are working to develop new and better varieties of sorghum, K-State entomologists are working to increase the level of insect resistance in sorghum germplasm. One project is being done collaboratively with biochemists to better understand the molecular genetics of the enzymes in insect salivary secretions, which then will help to understand how plants and insects interact at the molecular level. Increased resistance in sorghum will help to decrease pesticide usage, improve integrated pest management systems, and reduce inputs, all of which will increase the sustainability of sorghum production. Another project, in collaboration with a sorghum geneticist, involves screening germplasm for increased levels of resistance to the worst sorghum pest in Kansas: the greenbug. Progress has been steady, and the scientists can now use molecular probes to pull out greenbug genes. This molecular approach make significant contributions to new methods of developing wheat resistance to the Hessian fly. The combined efforts of all researchers who have helped to develop greenbug-resistant sorghum varieties across the state are estimated to be saving growers from $3 million to $30 million each year. Those savings could be greater as a result of the new projects.

Corn

Corn production for grain in Kansas totaled a record 386 million bushels in 1997 and 8 percent above the 1996 crop. One of the most common plant pathogens in the world is the fungus *Fusarium*. A plant pathology project involves distinguishing the most common *Fusarium* species on corn from the species most common on sorghum. These two very different organisms have

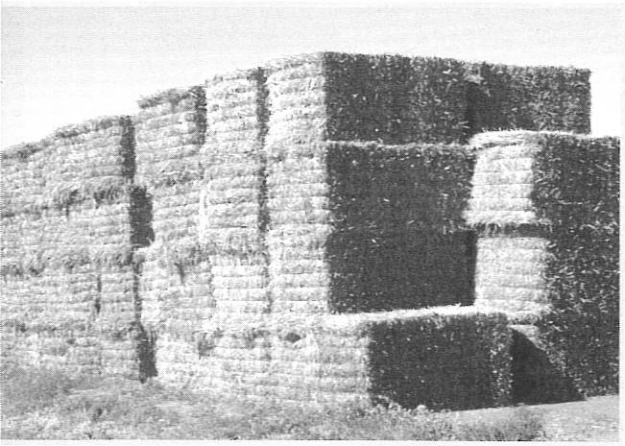
shared a common name for more than 50 years. By dividing the species based on their abilities to cross sexually with each other, the K-State researchers found that the strains that appear identical in morphology may or may not be the same. By distinguishing between them, regulatory measures such as quarantines can be done more accurately, breeding trials can be managed more efficiently, and results from different researchers can be compared better. The species definitions being developed at K-State will become the standard definitions and will be used as an example of the way in which fungal taxonomy should be approached in the future. In addition to corn and sorghum, work is being done internationally by surveying collections of *Fusarium* from around the United States and from Uganda, Uruguay, Kenya, Egypt, Malaysia, and Thailand to determine if the species found there on corn and sorghum are the same as those found in Kansas. One result has been the discovery of new species.



The corn borer causes millions of dollars in losses in Kansas.

Corn Borer Management Using *Bt* Corn. Seed companies have been introducing genetically altered corn hybrids that produce a protein toxic to corn borers. These hybrids contain a gene from the bacterium *Bacillus thuringiensis* (*Bt*) that has been merged with other corn genes to produce pest-fighting biochemicals not previously present in corn. In Kansas, losses and control costs associated with the European corn borer alone exceed several million dollars each year. K-State Research and Extension faculty have been studying the efficacy of *Bt* corn against the European and southwestern corn borers. They found that *Bt* corn provides more effective and consistent control of European corn borer than insecticides. Yield stability has been enhanced because the impact of these insects has been lessened. Also, *Bt* corn has fewer logistical, health, or environmental concerns than many traditional insecticides. Work is continuing on the potential for corn borers to develop resistance to the *Bt* toxins. The Environmental Protection Agency is considering regulations on *Bt* corn, including mandating that areas (called refuges) be planted with non-*Bt* corn to produce nonresistant corn borers that can intermate with any resistant borers from the *Bt* corn. Currently, K-State is supporting the recommendation that 20% to 30% of a farmer's corn acreage should be planted to non-*Bt* corn in areas where corn borers are not regularly sprayed with insecticides (40% if the refuge is sprayed).

Kansas produces more than 3.5 million tons of alfalfa hay each year.



Alfalfa

Breeding programs in alfalfa represent an increase in farm value of nearly $1 million per year for Kansas growers, and the acreage of alfalfa is expected to continue increasing in Kansas. Kansas has been involved in alfalfa genetics and breeding for 115 years. Varieties from K-State have provided the alfalfa industry with many of the disease and insect resistance genes in use today. Breeding research for host resistance is vital, because estimates of alfalfa yield loss from disease and insects are as high as 40 percent. One

current research focus in the Agronomy Department is to understand and develop breeding and genetic procedures and strategies for the improvement of genetically complex plants such as alfalfa by using both traditional and molecular approaches. This genetic engineering work should soon add an array of new genes to alfalfa.

Foundation Seed Project

The K-State Research and Extension Foundation Seed Project supports the Kansas field seed industry by maintaining a genetically pure seed source for research and commercial purposes. Potential new varieties of field crops are increased to quantities needed to release to the public. Seed of new and existing varieties are distributed to growers throughout the state. For example, the amount of Foundation seed that was produced, conditioned, and distributed last year included 16 varieties of wheat (13,481 bushels); 28 varieties of soybeans (5,234 bushels); 4 varieties of spring oats (1,186 bushels); 1 variety of sorghum (750 pounds); 1 variety of barley (75 bushels); and 1 variety of canola (2,000 pounds). In anticipation of variety releases, 4 soybean lines and 7 wheat lines were multiplied for the first time.

Researchers prepare to receive information from a satellite on growing conditions.

A SAMPLING OF ALLIED PROJECTS

Farming by Satellite

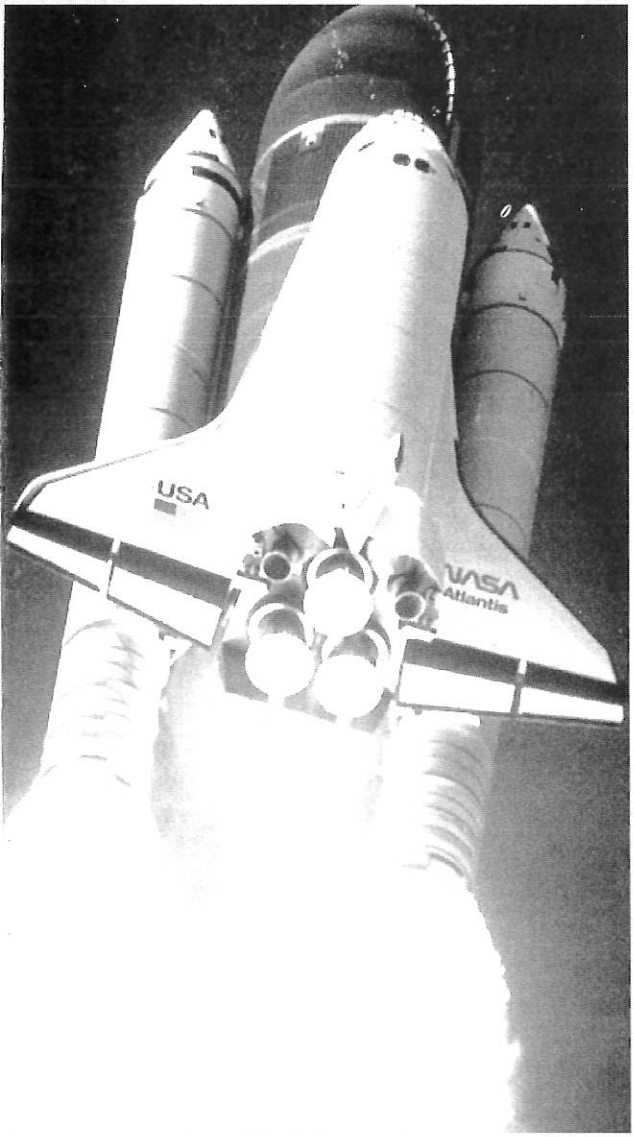
More producers are becoming interested in precision agriculture technology, a satellite technology that is a direct outgrowth of the U.S. space program. K-State scientists are studying this new technology, and extension personnel are providing information on it. They believe it represents the future of farming, pointing out that it can help farmers use chemicals and fertilizers far more wisely and manage crop yields much more efficiently. In precision agriculture, tractors and combines equipped with Global Positioning Systems (GPS) enable producers to map and analyze their fields for characteristics such as acidity and soil type. They then can feed the data into computers and pick up signals from space that calibrate where inputs should be applied in their fields. By applying fertilizers and other chemicals only where needed, producers can save money, reduce pesticide use, and protect surface water and groundwater. K-State scientists predict that eventually most farmers will use site-specific management systems linked to satellites to plant, fertilize, control pests, irrigate, and harvest crops.

One example of a project utilizing GPS involves varying the rate of nitrogen on fields of irrigated corn. The aim is to accurately adjust the amount of nitrogen applied to designated areas in each field. By applying more nitrogen in areas with greater yield potential, and less nitrogen in areas with lower yield potential, producers can 1) minimize the economic risk of under- application and 2) reduce the environmental risk of

overapplication. In one of the fields being studied, for example, nitrogen was applied using regular anhydrous equipment retrofitted with a field computer and GPS. The corn was harvested by using a combine equipped with a yield monitor, GPS, and field computer, which provided localized yield information for the entire field. K-State agronomists are implementing this study at five different sites in Kansas in cooperation with private producers.

Teaching Risk Management to Kansas Producers

Being knowledgeable about economics is vital to our well-being as Kansans and citizens of the world. One project that is helping Kansans to know more about risks and their management is becoming popular around the state as a result of a federal grant and the insight of K-State extension agricultural economist. It involves setting up Risk Management Clubs that will be in reach of all counties. The participants are producers of all kinds. Last spring, four pilot clubs were started as a result of a $62,500 USDA grant. Further funding in the amount of $150,000 has been received, and the goal is to have a total of 25 clubs before the end of the year. Tremendous interest has been shown in these clubs, which have been patterned after the old marketing clubs. Participants are provided with an Agricultural Risk Management Training Handbook. The clubs can choose the subjects they want to cover in more depth. And other resources are provided such as local speakers and facilitators, including bankers and insurance and farm credit representatives.



K-State wheat has been grown aboard the space shuttle.

Wheat in Space

K-State researchers recently grew wheat on board the Space Shuttle Columbia, an experiment designed to help develop a new kind of wheat that fixes its own nitrogen instead of needing fertilizer to supply it. Applying nitrogen fertilizer to crops is a very large investment for farmers. If nitrogen use could be reduced, it would save money for farmers and help the environment. Another shuttle experiment involved how tomatoes are altered under microgravity. In addition to increasing our knowledge about plants, the experiments may have applications for future space exploration, including developing plants that have a better growth rate in space so that astronauts can carry them on board long missions for better oxygen recycling. These experiments are part of the BioServe Space Technologies program, a NASA Commercial Space Center established in 1987. The program focuses on performing research in microgravity. Each year, more than 100 undergraduate, graduate, and postdoctoral students at K-State and the University of Colorado participate in the BioServe program.

A couple goes over a farm marketing plan with an extension specialist.

Farm Business and Financial Management

Producers have a better chance of increasing their income when they become part of the Kansas Extension Farm Management Association. The goal of the program is to provide members with information about business and family costs that can help them to improve their farm business organization, decisions, and profitability, as well as minimize risk. A farm business and enterprise analysis showed that 85 percent of the more than 3,000 Farm Management Association families, and 45 percent of the farms, utilized an improved marketing plan, resulting in an average increase of almost $800 per farm. Seventy percent of the members developed financial records, including income statements, balance sheets, and cash-flow sheets. More than 55 percent increased their equity. Of the 40 percent of members over age 50, 80 percent implemented retirement or estate plans that provided for continuation of the farming operation.

Horticulture

K-State researchers annually evaluate the performance of a variety of turfgrass species.

Horticulture plays a significant role in the state's economy and employment, generating $300 million annually and employing some 30,000 people. It involves many different vegetables and fruits as well as nut and Christmas trees and turfgrass for golf courses, lawn-care firms and homeowners, and sod producers. Kansas is one of the most difficult areas of the country to maintain quality turf. Current K-State research is focusing on performance of various grasses during drought and the influence of irrigation on turf performance. Investigations also involve evaluations of environmentally safe pesticides that provide satisfactory pest control; best methods for establishing turfgrass; and general cultural practices on turfgrass performance. One project has focused on two areas crucial to the golf industry: 1. conservation of water, and 2. reducing pesticides for environmentally friendly golf course management.

ANIMAL AGRICULTURE

Because livestock and livestock products are vital to the Kansas economy, they are major components of K-State Research and Extension efforts.

Range

Range comprises 40 percent of Kansas agricultural land. Making sure that Kansas cattle perform their best and finding ways to improve the plant life on rangeland are goals of K-State Research and Extension.

Burning the prairie rejuvenates the grass and provides better forage for cattle.

The Effects of Prescribed Burning

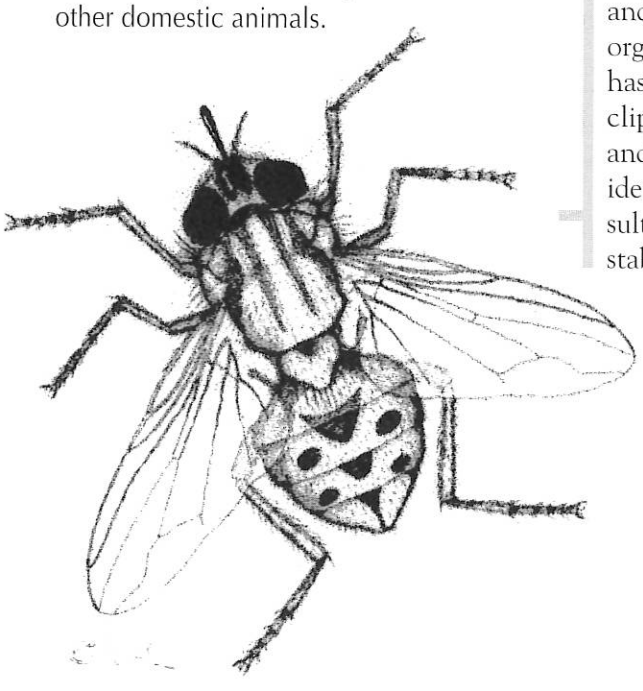
Scientists working on one long-term project have demonstrated that prescribed burning of tallgrass prairie will enhance cattle gain by 32 pounds a head per year, resulting in an annual increase in income of more than $16 million for producers.

Improving the Efficiency of Forage Utilization by Beef Cattle

Another project involves improving profitability of western Kansas beef cattle production by identifying plant and animal factors that limit forage conversion efficiency and by evaluating strategies to overcome those limitations. The project also focuses on developing an understanding of forage-based systems and assessing the impact of forage management on animal and rangeland productivity. The work includes analyzing plant physical and chemical characteristics associated with forage intake, digestion, and metabolism and how they affect animal performance and utilization. Improving forage utilization efficiency has tremendous potential impact in Kansas as well as worldwide. Forage resources within the state consist of roughly 17.5 million acres of rangeland and pasture and 2.5 million acres of hay. Forage harvested from them have a farm value of about $700 million. This forage base supports about 1.35 million beef cows and 1.7 million stocker cattle annually.

Controlling Insects and Disease—Long-term research is being done on nonchemical control of insect pests. Biologically controlling pests employs natural methods of control. If harmful bugs are destroying crops, then good bugs can be released that will eat them. If good bugs can't be found, then maybe good viruses, fungi, worms, or bacteria would work. It involves using a biological system against a biological system. One example of K-State work in this area involves the stable fly, which is a serious pest of cattle and other domestic animals. The stable fly is attracted to decaying organic matter for oviposition and larval development. Research has shown that two bacterial species growing in decomposing grass clippings produce volatile chemicals that attract stable fly females and appear to stimulate egg laying. Scientists are isolating and identifying the attractive odor compounds for field trials. The result may be a selective and nonhazardous control technique for the stable fly.

The stable fly is a serious pest of cattle and other domestic animals.



New meat products developed at K-State increase the value of agricultural commodities.

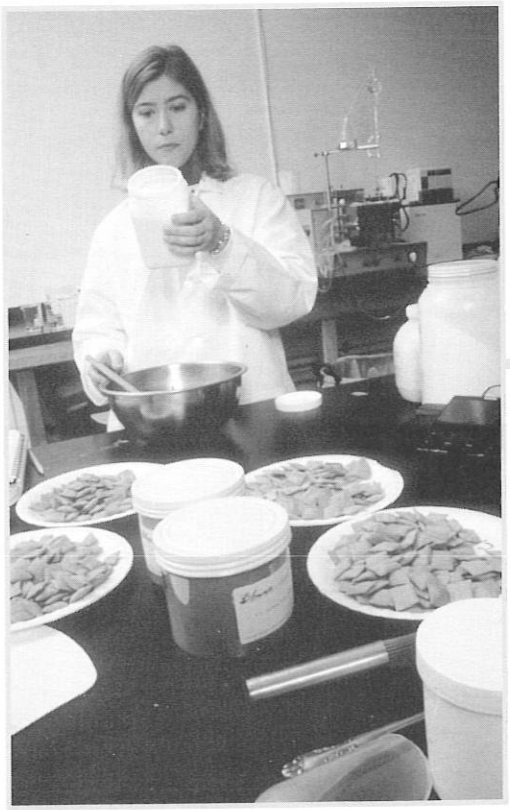
ADDING VALUE TO AGRICULTURAL PRODUCTS

The Agricultural Product Utilization Forum includes more than 80 faculty and administrators from three colleges and 11 departments. Members of the Forum support or are involved in research, teaching, and extension activities related to value-added agriculture. 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, and they increase income, create jobs, and encourage rural development.

Faculty members are working on evaluating and improving existing or raw agricultural materials and products at all stages of development. Some of the projects include developing new apple varieties, low-fat meat products, and white wheat as a specialty crop; improving wet milling of sorghum, cold-storage methods, and sausage preblending processes. Others involve making fish food from animal and food wastes and developing biodegradable films from soybean products.

In addition to facilitating and promoting agriculturally related value-added activities, the organization fosters collaborative efforts among KSU faculty and partnerships between KSU and representatives from industry, commodity groups, or government agencies.

Creating a nutritious chocolate snack from soy fiber.



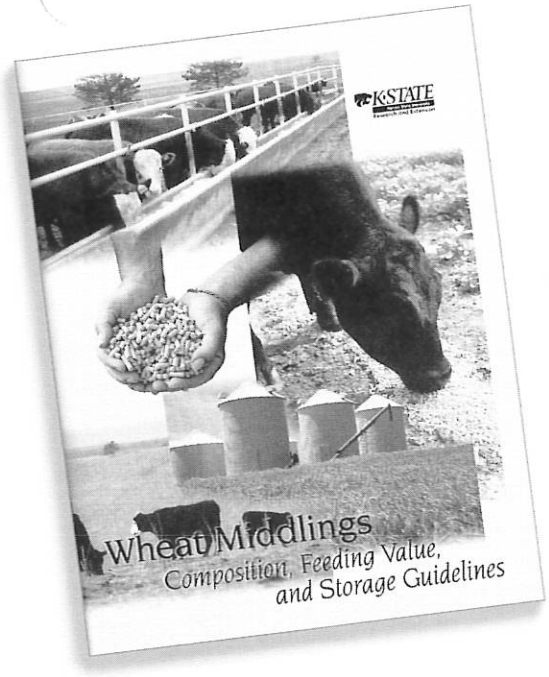
Adding value to livestock and their products has been one focus. For example, the KSU Value-Added Meats Program assists meat processors and entrepreneurs to develop new meat products or improve existing ones. A number of new products have been marketed as a result.

Making Snacks Good for You

Using new extrusion technology, grain scientists are developing new snack foods and ready-to-eat breakfast cereals. The sensory attributes of the extruded products are enhanced at the same time their nutritional value is improved. For example, a chocolate-filled snack with a crispy cereal shell shows promise for commercial development. It contains 15 percent soy fiber. Studies have shown that products rich in fiber can have cholesterol-lowering activity. In the past, residual fiber was used almost exclusively for animal feed. In addition to utilizing soybeans, other new and tasty products are being developed by K-State from the residual fiber of corn, wheat, and oats. If these new products are sold commercially, it should increase the market and value of Kansas grains.

Wheat Middlings in Cattle Feed

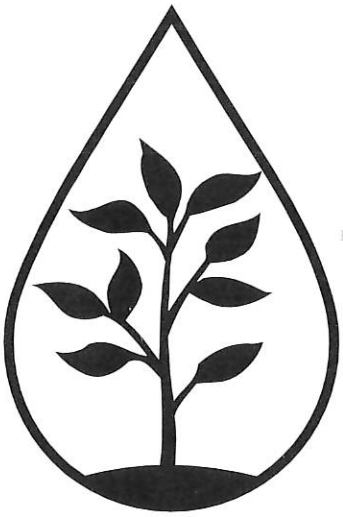
A by-product of flour milling, wheat middlings have been used commonly in livestock feed, but not much was known about their nutritive value. Animal scientists in K-State Research and Exten-



sion evaluated the effects of wheat middlings on cattle performance, nutrient digestibility, and ruminal metabolism. The results showed that wheat middlings could replace only five percent of the concentrate in finishing rations without reducing performance. However, 50 percent to 100 percent replacement of roughage had no adverse effects on cattle performance. Thus, wheat middlings can be used as a nutritious feed for finishing cattle but will be most effective when they replace roughage in the diet.

New Program Could Boost Meat Industry

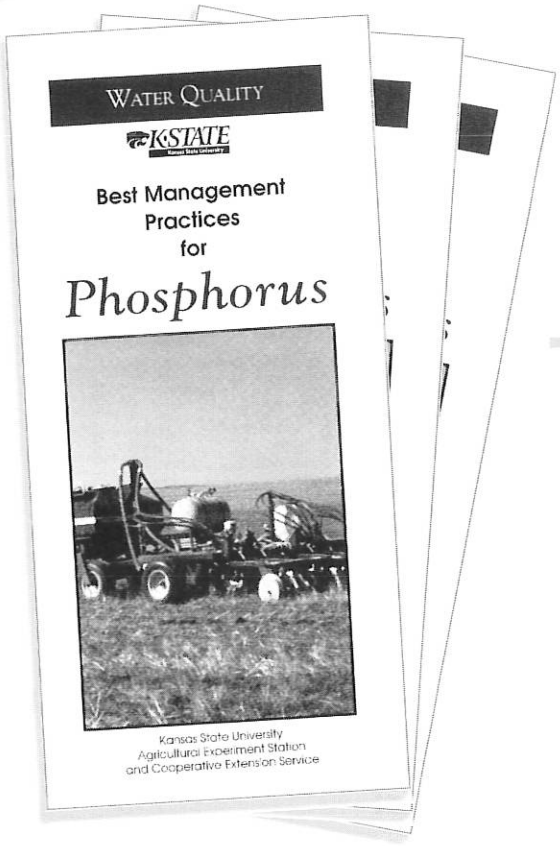
K-State is involved in a cooperative program that could produce cattle with more desirable meat. It involves identifying bulls that provide, through genetics, more tenderness in steaks. The aim of the research is to develop Expected Progeny Difference ratings for tenderness. Such ratings are routine now for such characteristics as birth weight, weaning weight, and rate of gain. Tenderness is an inheritable trait, with genetics accounting for up to 30 percent of the tenderness in a given cut of meat. It would be a tremendous boost to the cattle industry if tenderness becomes a uniform trait that restaurants and supermarkets can rely on. K-State's first task will be to cut the rib eyes from carcasses of 11,000 or more cattle to measure toughness or tenderness. The project is expected to take three and a half years and involves 12 main cattle breeds. The project won't compare breeds but will identify bulls or blood lines that offer more tenderness than others. The work is funded by the USDA, with several other land-grant universities participating.



2. NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT

Protecting the environment and conserving natural resources, particularly soil and water, are essential if Kansas is to continue to grow and prosper. K-State Research and Extension is providing information and know-how about many conservation techniques and ways to protect the land and water and other natural resources. Across the state, researchers and extension faculty are meeting with producers, industry representatives, town leaders, homeowners, and others from all walks of life who are interested in preserving and enhancing the environment and natural resources and assuring a better quality of life for themselves and future generations. The emphases in these areas include:

- **Ensuring quality and conservation of surface water and groundwater.**
- **Promoting community and residential environmental management.**
- **Developing systems for improved soil and air quality.**



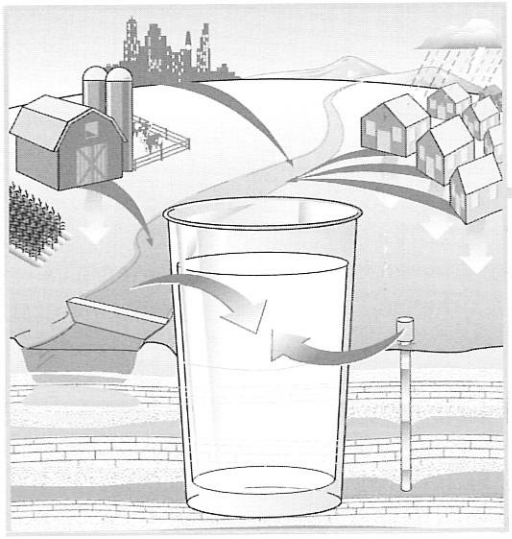
Decreasing Herbicide Concentrations

In the mid-1980s, concerns arose about atrazine herbicide concentrations running off fields and entering streams, rivers, and lakes, especially in eastern Kansas. These surface waters are the major drinking water sources for many local communities. A research program was initiated to determine how atrazine is lost from cropland and to develop Best Management Practices (BMPs) for using atrazine and reducing its impact on surface water. A nationally recognized research and demonstration field, The Foster Farm's Water Quality Demonstration Program, was established near Rossville. This site is used to train farmers, government agencies, legislators, and private industry about atrazine and water quality. It also is used to develop BMPs for atrazine. A research project at the Cornbelt Experiment Field near Powhattan found that soil incorporation of atrazine could reduce atrazine runoff by 60 percent to 75 percent.

Training Leaders to Solve Water Problems

One of the latest efforts of K-State Research and Extension is the Kansas Environmental Leadership program. This joint project with the Kansas Department of Health and Environment, which helps communities improve drinking water resources, began last November. The pilot class involves a yearlong series of training sessions, mainly for such local leaders as mayors, council persons, county commissioners, and chamber of commerce presidents.

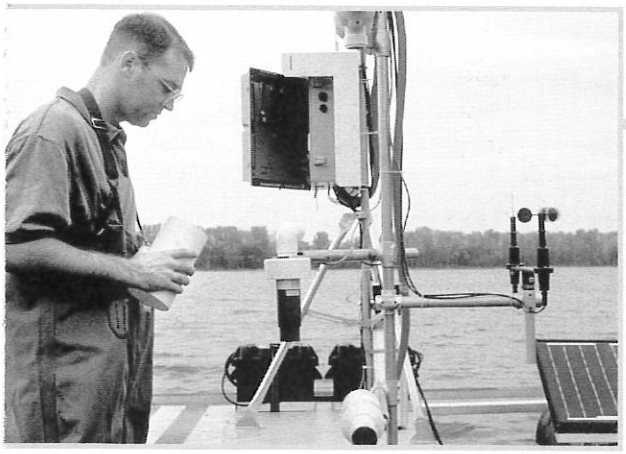
The participants focus on personal and group leadership skills, conflict resolution techniques, and methods of developing local water-management plans. When they graduate, they will have the background and skills to involve more people in finding solutions to water problems, and they can provide leadership and build consensus to guide a community toward improving the water standards citizens want to achieve. This is essential because about 50 percent of the state's river-drained watersheds have been assessed with water quality problems, including positive tests for fecal coliform bacteria.



K-State is helping to improve water quality for everyone.

Studying the Impact of Animal Waste Lagoons

Concerns are growing about how animal waste lagoons affect the environment, especially groundwater. K-State Research and Extension has been studying the amount and effects of seepage from animal waste containment lagoons. The research focuses on helping to 1. determine if current guidelines are adequate and 2. identify ways to safeguard groundwater quality. The latest report holds encouraging news about the environment and good news for the state's growing livestock industry. It shows that lagoons built in accordance with current Kansas guidelines have average seepage



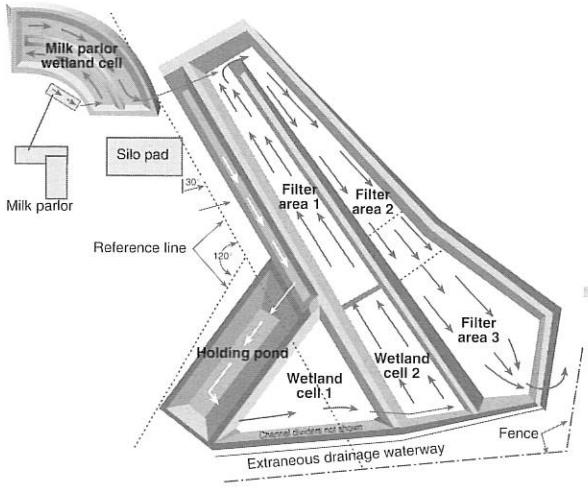
A device developed at K-State measures seepage in waste lagoons.

rates of less than .25 inches per day, the state regulatory standard. The report noted that very low seepage rates—less than .10 inches per day—are achievable if waste lagoons are built with a thick (12-incs to 18-inch), compacted, soil liner made from readily available Kansas soils. Further studies are ongoing, including determining how lagoon seepage moves in the soil and if other sources of nitrogen contribute to well-water contamination.

Improving Waste Management Systems in Dairies

K-State Research and Extension is working on three projects to improve waste management system designs and BMPs in Kansas dairies. The projects—Black Vermillion Watershed Dairy Environmental Cooperative, Nichols Dairy Ecological Pollution Control Demonstration, and Sextro Dairy Parlor Wetland Cell Demonstration—are funded by the Nonpoint Source Pollution Control Program of the Kansas Department of Health and Environment.

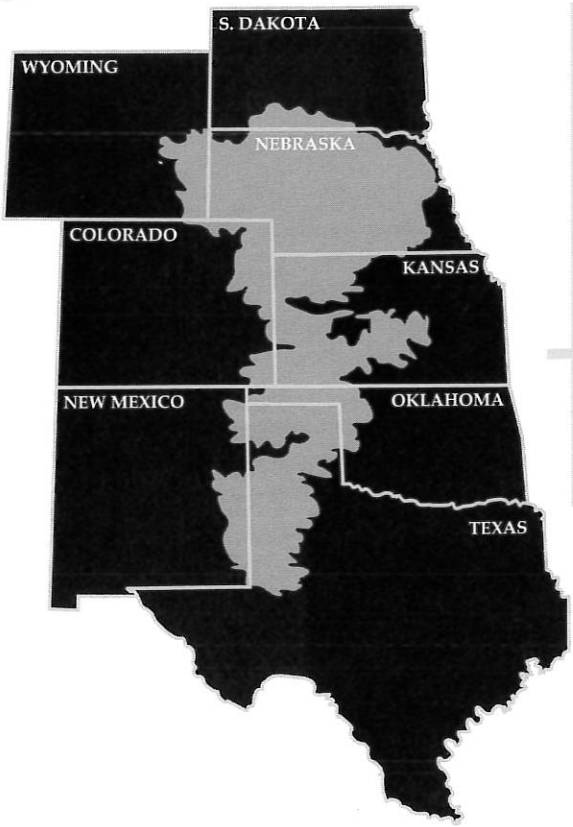
Black Vermillion Project—Involving dairy farmers and local agribusinesses in Nemaha County, this project includes installation of wetland cells and lagoons and solid storage for waste. The goals are to 1) reduce nutrient runoff, fecal coliform, and sediment through proper storage of dairy manure and effluent; 2) establish educational programs to assist dairy farmers with land application of nutrients from lagoons or storage basins; and 3) set up local dairy environmental cooperatives to provide diary farmers with assistance in designing, building, and understanding operation of a complete waste management system.



A dairy pollution control project developed by K-State Research and Extension.

Nichols Dairy Project—In Anderson County, K-State is developing a complex pollution control system that has the potential to reduce water contamination and support wildlife. The system includes a holding pond, three wetland cells, and three filter strips to prevent nutrient runoff from a 200-cow dairy. Parlor runoff will pass through a concrete basin and enter a wetland cell, then proceed into second and third vegetative filter strips. Feedlot runoff moves first to a sediment basin where solids separate from liquids. It then moves into a holding pond and advances through two wetland cells (separate from parlor wetland cell). The runoff then flows through three vegetative filter strips before entering a waterway.

Sextro Dairy Project—Similar to the Nichols Project, this study involves building a wetland cell and a vegetative filter strip to treat milk parlor wash water in a 100-cow dairy. A concrete basin with 120-day storage capacity was installed last year, trees and grass were planted in a vegetative filter to reduce nutrient runoff, and a wetland cell was built. Data collection over the next several years will determine whether the wetland cell is capable of reducing the nutrient load from milk parlor effluent.



The Ogallala Aquifer, which underlies much of western Kansas, is essential for farmers and communities.

The Western Kansas Irrigation Research Project

The economy of western Kansas is tied intricately to the Ogallala Aquifer. In the western three crop-reporting districts of Kansas, gross receipts from irrigated crop production exceed $600 million annually. Fed cattle sales from this region exceed $2.5 billion for three million head (75 percent of the state's total). Those numbers are increasing at a rate of 70,000 head per year. Every year, western Kansas packing plants slaughter more than 7 million cattle. That's equal to a wholesale value of $5.2 billion. In addition, current indications suggest that dairy and swine production and processing will continue to increase in the region and add significantly to the value generated by beef cattle.

The success of the beef industry, and ultimately the dairy and swine industries, depends on climate, water, and adequate and stable supplies of grain and roughage. On average, more than 160 million bushels of feed grains are produced in western Kansas to support the local demand of 190 million bushels. If the Ogallala Aquifer were depleted and all the irrigated acres converted to dryland wheat or sorghum, feed grain production would drop to about 70 million bushels within the region. Grain producers then would lose $300 million in gross revenue annually.

Recognizing the precarious dependence of the western Kansas economy on the Ogallala Aquifer and the need to prolong its economic life, a diverse group of private citizens and government and industry stakeholders appointed by the Kansas Secretary of Agriculture created a task force that recommended that K-State Research and Extension provide technical assistance and leadership to enhance research and educational efforts for the purpose of reducing the rate of aquifer depletion by increasing the efficiency of water use. On this recommendation, K-State Research and Extension developed The Western Kansas Irrigation Research Project. The focus of K-State's efforts will be to:

Develop innovative irrigation systems and strategies to maximize water efficiencies and conserve groundwater.

Develop profitable cultural practices that optimize chemical inputs, utilize waste water when available, protect groundwater from contamination, and prevent surface water runoff under irrigation.

Determine the economic feasibility of nontraditional crops and develop production systems for those with market potential.

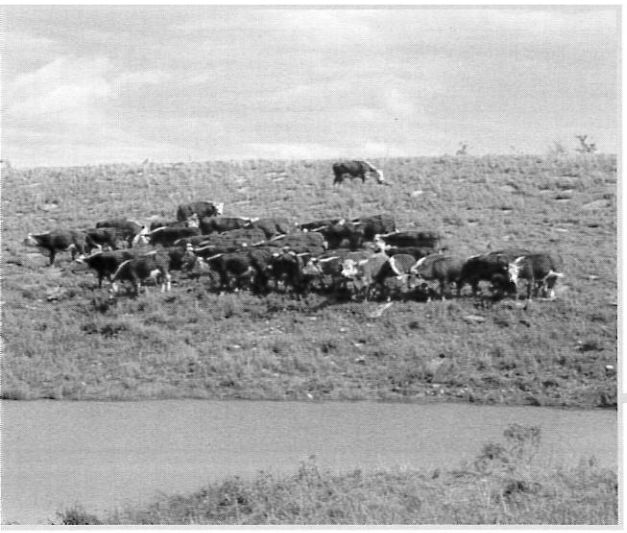
Develop management strategies for optimal use of limited irrigation water during the transition from full irrigation to dryland agriculture.

Develop computer models to understand and predict the effects of irrigation by simulating and testing irrigation system designs, operations, and management, thereby reducing expensive field research.

OTHER ENVIRONMENTAL PROJECTS AT K-STATE

Atrazine Studies

K-State faculty members have examined the effects of atrazine application timing, reduced atrazine rates, and different application methods on weed control in corn and grain sorghum. Researchers have concluded that with proper management atrazine can be used to provide economically acceptable weed control with few adverse effects on water quality. Extension faculty have been helping to educate people about Best Management Practices (BMPs) to reduce atrazine runoff from crop fields, utilizing news releases, surveys, newsletters, farmer and dealer schools, field demonstrations, radio, and one-on-one visits. One result has been that a significant number of farmers have adopted atrazine BMPs—81 percent in the Delaware River sub-basins, according to a recent survey.



K-State is finding ways to more effectively manage livestock waste.

Livestock Waste Management

Managing livestock waste to prevent water pollution has been a priority of K-State Research and Extension, which has teamed with the Kansas Department of Health and Environment, the Environmental Protection Agency, and a number of other government agencies to deal with livestock waste. Among the many successful projects has been the Herington watershed project. Livestock producers in that area installed four total containment structures and two grass filters. Two producers relocated feeding sites; one installed a stream bank water point; and one installed a pasture feeding pen. KSU Research and Extension also has been involved heavily in educational meetings on livestock waste regulations related to Kansas Senate Bill 800. For example, more than 1,000 people attended an educational meeting on management and livestock waste. Also, extension agricultural engineers have made hundreds of farm visits related to livestock waste control.

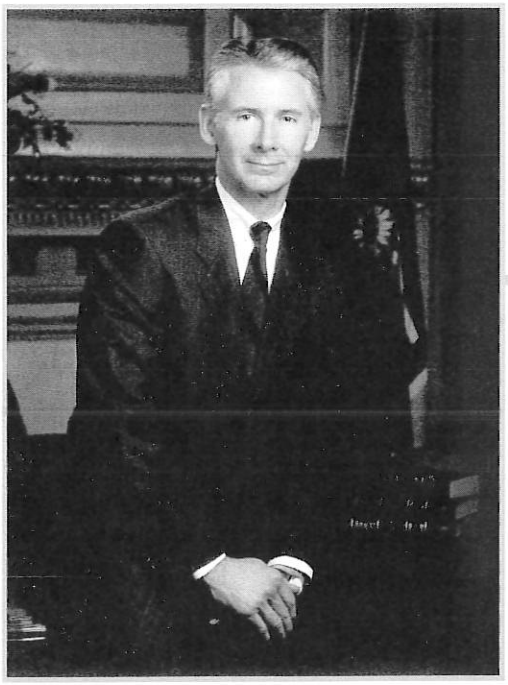
Caring for the Environment through KCARE

A director of the newly established Kansas Center for Agricultural Resources and the Environment (KCARE) has been appointed. Bill Hargrove is leading the efforts of scientists from different departments and disciplines. They are focusing on sustainable agriculture and environmental issues, especially those related to conservation of soil and water. Through research and education, this Center works to develop mutually beneficial relationships be-

tween agriculture, natural resources, the environment, and consumers. For example, KCARE is involved in a three-year project with the University of Nebraska involving surface water quality in the Blue River Basin.

Extending Know-How across the State

Field days across the state explain new techniques for building and maintaining terraces that prevent run-off water from carrying away topsoil. Demonstrations, workshops, and schools help private and commercial pesticide applicators to choose alternative control methods and learn about improved application techniques and sprayer calibrations. Information and know-how are provided on filter strips near creek banks, alternative crops that conserve soil, proper cattle-stocking rates, new irrigation techniques, waterways, watershed development, wildlife protection, and recycling waste.



The Honorable Bill Graves, Governor of Kansas

Governor's Water Quality Initiative

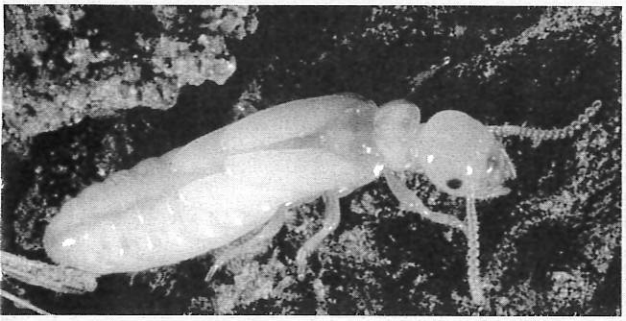
K-State Research and Extension is a key player in the multi-agency thrust to protect and restore the quality of Kansas surface waters. Governor Bill Graves' Water Quality Initiative involves large-scale research and educational programs that rely on objective evaluations of existing water quality and the effects of new or different land-management practices. Five state agencies were requested originally to work together on the plan. After their first meeting, a call was made to K-State to provide both research and extension expertise. K-State's primary roles are to monitor water from streams and rivers and help farmers adopt BMPs that reduce sediment, livestock waste, and atrazine runoff. Commenting on the task ahead, Graves said, "Clean water is the foundation of our future. Each and every Kansan, whether rural or urban dweller, has a stake in ensuring the success of this initiative."

Controlling Fecal Coliform Bacteria Contamination

K-State Research and Extension personnel are identifying sources of fecal coliform bacteria and BMPs for control. The bacteria are present in high concentrations throughout the 12 major river basins in Kansas. Runoff from animal feedlots, grazing lands, wildlife and waterfowl excrement, home septic systems, and other waste handling systems contribute to the levels of fecal contamination in surface waters. This three-year project has four objectives: 1) to monitor water quality in the state and pinpoint primary sources of contamination; 2) to evaluate the effectiveness of grass filter strips in reducing fecal coliforms at three sites near livestock operations; 3) to develop and demonstrate new BMPs to control fecal coliforms in four regions of Kansas; and 4) to identify economic costs associated with implementation of BMPs.

Using Telephone Books as a Soil Supplement

Old telephone books are being shredded and combined with the soil on a test tract in Sedgwick County. Extension agents want to determine the cost and benefits of large-scale application of such a technique. They also will be checking to see whether erosion can be reduced and the productivity of the soil increased. In the spring, a crop of grain sorghum will be planted on the land and studied. Old telephone books can be supplied easily if the process proves feasible and catches on.



New techniques for eliminating termites are being tested at K-State.

Eliminating Termites with Fewer Chemicals

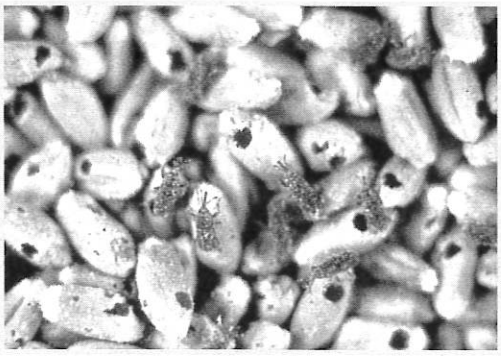
Termite-baiting methods are being developed by private industry. K-State Research and Extension is evaluating this new technology, which utilizes an insect growth regulator that can reduce the amount of insecticide applied. For example, the label rate for a conventional termite barrier treatment of a 1,900-square-foot house with a full basement and attached garage requires 500 to 600 gallons of termiticide containing 40 to 48 pounds of insecticide. The new termite-baiting technology requires an average range of 0.0012 to 0.012 ounces of dry insect growth regulator to protect the same house. When termites are found, tubes containing the chemical are inserted in the soil around the house. The growth regulator is spread by the feeding termites throughout the colony. The growth regulating chemical is not applied to the soil, which virtually eliminates soil, water, or structural contamination.

K-State encourages people to utilize recycling centers.

A Comparison of Household Waste Management Practices

Increased federal regulations on landfill operations are causing local units of government to make some hard decisions about waste disposal issues. K-State research may help guide those decisions. Residents in five states were surveyed about their household waste management practices. Successful programs that reduce household waste going to landfills include curbside pick up of recyclable material, beverage container deposit programs, and hazardous waste collection sites. Households with the most knowledge about the programs available are most likely to recycle. The results are being distributed to the public through extension. The target audience is local decision-makers charged with the responsibility for waste management.

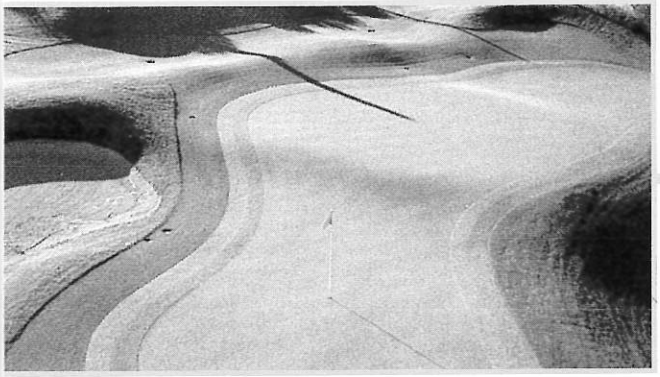
Insect damage to stored wheat.



Reducing Pesticide Residues in Stored Wheat

Chemical-based pest management systems have been used to preserve the quality of farm-stored wheat. However, K-State research shows that aeration techniques are highly effective when used in an integrated pest management (IPM) program for controlling

insects in farm-stored wheat. Concern about pesticides and a commitment by the U.S. government for 75 percent adoption of IPM by the year 2000 heighten the need for Kansas farmers to adopt this technology. K-State Research and Extension has demonstrated how aeration controllers facilitate grain cooling and reduce insect pests in farm-stored wheat. The IPM strategy was approximately 40 percent less expensive than traditional storage pest management practices.



K-State researchers are monitoring irrigation needs of golf courses to conserve water.

Irrigation Management for Golf Courses

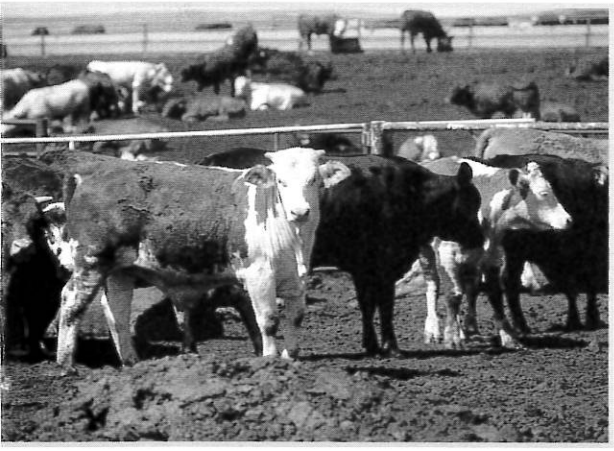
Heavy water usage on golf courses has been a concern, especially during summer drought periods. Also of concern has been the environmental impact of pesticides used on those golf courses. K-State horticulturists and plant pathologists have been evaluating potential water savings that result from monitoring golf course turf evapotranspiration and adjusting irrigation accordingly. They found that monitoring irrigation needs, versus a set schedule, results in water savings of more than 30 percent. They also have been comparing pesticide control measures for diseases and weeds. They found that fungicides can be reduced by 50 percent by employing a curative rather than a preventive application strategy. These and other findings may result in more efficient water application to golf course turf and more careful use of fungicides.

Getting the Lead Out of Contaminated Soils

Large areas in southeast Kansas need to be remediated because of previous lead and zinc mining. Remediation—removing large amounts of contaminated soil—is expensive. K-State agronomists and biological and agricultural engineers have been looking at how the contaminated soil can be amended with phosphorus, which converts the lead to an insoluble form. A standard technique of removing contaminated soil from residential yards has proven to be impractical because of the volume of material that must be removed, stored, and replaced. Also, it is expensive, averaging about $15,000 per home as compared to an estimated cost of $5,000 per home when the soil is treated where it is. The researchers have made a major advance in methodology for the treatment. Using a mine waste material with a high lead concentration, they can now qualitatively measure the amount of pyromorphite produced upon reaction with phosphorus. The method will allow them to fine-tune the remediation technology, including identifying optimum conditions for the conversion of lead to pyromorphite and identifying the management practices that will be necessary to ensure that the lead remains in their insoluble form.

Using Vegetation to Remediate Contaminated Soils

Several departments at K-State have combined their expertise to study the use of vegetation to clean up soils contaminated with heavy metals or petroleum products. Researchers from Agronomy, Civil Engineering, Biochemistry, and Chemical Engineering are investigating the impacts of vegetation on contaminated sites. Significant progress has been made in stabilizing contamination by seeding plants directly into mine tailings. Mixtures of native and introduced prairie plants are now well established on several sites and are beginning to resemble the original landscape. The benefits include preventing further contamination of soils, air, and surface water as well as the curtailment of surface erosion. The monetary savings directly resulting from this research are considerable. The normal technique of covering mine tailings with up to five feet of topsoil would cost millions of dollars. Revegetation costs far less. Also, where soils have been contaminated by petroleum leakage from underground storage tanks, spills, pipeline breaks, and industrial processing, a process called phytoremediation is being tested. Here the roots of plants promote very high levels of microbial activity, which then helps to degrade contaminants. This technique, too, has great economic benefit. Traditional engineering solutions to petroleum contamination can cost up to $2 million per acre. Phytoremediation costs about $15,000 per acre.



Feedlots require careful management to not cause water pollution.

Reclamation of Feedlots by Vegetation

Before feedlots were required to be located away from streams, many were near streams to allow animals ready access to water. Accumulated nutrients in abandoned feedlots may pose a hazard to water quality, particularly after rainfall. K-State researchers have found that scraping the manure pack and introducing vegetation suited to the soil and climate significantly reduces nutrient levels.

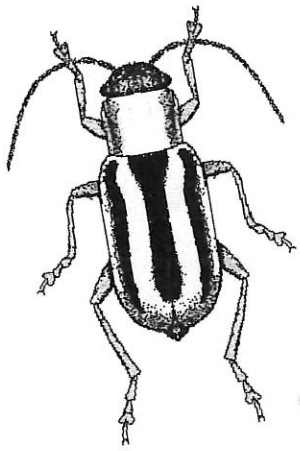
Reducing Phosphorus and Nitrogen from Animal Feedlots

Vegetative filter strips were shown to reduce concentrations of phosphorus and nitrogen from animal feedlots at K-State research sites in Herington and near Cheney Lake. The strips removed sediments and nutrients through filtration, absorption, volatization, plant uptake, and decomposition from microbial activity. Established grasses, particularly bromegrass and tall fescue, were most effective.

Using Microbes to Clean Up the Environment

K-State scientists also are using microbes—bacteria and fungi—to break down pollutants in a process known as bioremediation of toxins. Bioremediation technology has the potential to clean up excessive levels of pesticides caused by spills at distribution points and to prevent agricultural and industrial chemical spills from percolating through the soil into groundwater sources. The primary targets for bioremediation are wastewater from pesticide manufacturing plants, accidental spills, and soil polluted by industrial and military activities. Modifying the organisms through genetic engineering involves taking a single gene out of an organism that can degrade a toxin and putting it into bacteria better suited to survive in the field. Another example is to use bacteria that can detoxify a pollutant down to a point and then employ another better suited to carry the process to completion.

The Western corn rootworm beetle, which is the primary insect of concern for corn growers in Kansas.



Economically Feasible and Environmentally Sound Pest Management Systems

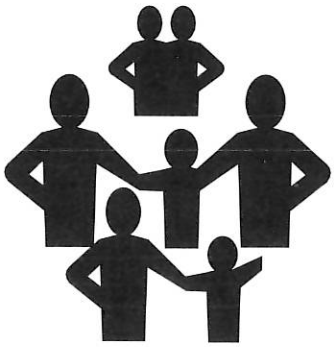
The K-State Department of Entomology is conducting research on corn, sorghum, wheat, and sunflower insect pests to develop economically feasible and environmentally sound pest management systems. The research includes studies of insect pest biology; insecticide evaluations; and the effectiveness of cultural practices, natural control agents, and insect resistant germplasm in regulating pest populations. Related research determines economic thresholds, economic injury levels, and the effect insects have on crop yields. Recommendations based on research are provided on soil insecticide use and for a variety of pests in corn but especially corn rootworms, the primary soil insect of concern in Kansas. An insecticide used only where it is needed could increase the average yield potential of corn by 5 bushels an acre. At $4 a bushel on 1 million acres of infested corn, the potential benefit to Kansas agriculture is $20 million annually. If an insecticide is used where it is not needed, on 100,000 acres at a cost of $12 an acre for the insecticide, the savings from not having to use that insecticide would be from $620,000 to $1 million annually.

Native big bluestem.

Konza Prairie Research Natural Area

The Konza Prairie near Manhattan is one of the largest tracts of native tallgrass prairie in the United States. It stretches across 8,600 acres and is the pre-eminent prairie research facility in the world for studying ecological processes in native tallgrass prairie. Biologists, agronomists, and other researchers are utilizing this valuable resource as a unique outdoor laboratory. Long-term investigations are being done to record how the prairie changes and adapts. Observation of these changes, coupled with an understanding of how this ecosystem has evolved into an efficient system, may lead to better management of land in the future. One example of ongoing research involves watersheds. Use of water-

shed units allows measurement of the effect of burning and grazing on amounts of water, nutrients, and soil lost from watersheds. As part of its National Hydrologic Benchmark Network, the U.S. Geological Survey has installed hydrologic instrumentation on Kings Creek, a major watershed on Konza Prairie. Other studies include the effects of fire; comparisons of mowed and burned areas; productivity of grazed and ungrazed plots; genetic variability of plants and animals; decomposition of plant materials and rate of replacement of humus; population dynamics of mammals; nutrient cycling; composition of prairie streams; wildlife populations; and water quality regulation.



3. YOUTH, FAMILY, AND COMMUNITY DEVELOPMENT

An educated and knowledgeable citizenry is the foundation of our state's economic productivity, democratic character and social system, and quality of life. K-State programs inform and help people through research and education, including:

- **Building strong, healthy communities.**
- **Improving parenting skills and family relationships.**
- **Preparing youth to be responsible citizens.**
- **Balancing demands of work, family community, and time for self.**
- **Developing consumer and financial management skills.**

STRENGTHENING COMMUNITY PROGRAMS FOR YOUTH

Targeting Education and Early Intervention to Reduce Juvenile Crime

OPEN-K
K-State Research and Extension

Kansas is one of four states to receive federal funds for its OPEN-K program. OPEN-K stands for Offender Prevention and Education Network for Kansas. The funds will exceed $200,000 in the first year and offer renewals of up to $150,000 for each of four subsequent years. Kansas has been credited with innovative approaches in juvenile justice reform and drug and alcohol prevention programs. The grant funds are targeting education and early intervention, which are thought to improve the quality of life for youth and their communities and, at the same time, reduce crime. OPEN-K is funding statewide professional development programs for extension faculty and community-based programs such as after-school programs, mentoring, and parent education.

After-school programs are important because a majority of crimes committed by juveniles occur from 3 p.m. to 6 p.m., when students are left to fend for themselves. One 9-millimeter bullet costs only a few pennies, but when a juvenile uses it to take a life, the U.S. Department of Justice estimates the crime will cost taxpayers close to $2 million. The costs of the personal losses are immeasurable. One of the first programs for several counties involves adding access to the Internet and training people how to use it to expand the resources available to them. Adding informational skills should help counties feel less isolated. In addition to information, access should provide a way for agents and community partners to interact and share ideas that are working successfully in their communities.

Through a network of trained individuals, OPEN-K is increasing the capacity of Kansas communities to:

1. Assess the risks to Kansas youth and the resources available to them.

2. Build competency within communities, schools, families, and youth to conduct out-of-school prevention programs.

3. Help communities implement prevention programs to identify and address the risk factors.

4. Evaluate the short- and long-term impacts of out-of-school prevention programs on communities, families, and youth (ages 6-12).

5. Foster a perspective of youth as resources and leaders in their communities and Kansas by placing them on state and local advisory teams and involving them in the OPEN-K Institutes.

6. Develop information for a statewide prevention awareness campaign.

Youth at Risk

The family is the nurturing ground for young lives, where roots are formed and values and self-esteem are developed. Significant economic and social pressures on families have caused changes that can leave young people at risk to such problems as teen pregnancy, illiteracy, unemployment, delinquency, and drug and alcohol abuse. One of K-State's responses to these problems has been to develop comprehensive educational material for Youth-at-Risk programs. While researchers probe into the underlying causes of escalating problems of youths, extension professionals are designing and implementing programs based on that research, including working with individuals and groups to provide a network in communities that ultimately benefits families.

The Importance of 4–H

4–H has helped youths throughout most of this century and continues to provide them with positive, family-based activities and leadership experience. The program is equally strong in urban and rural areas and in clubs and schools. 4–H has been reaching out to Hispanics and other minorities, at-risk-youth, and latch-key children. In one year, it will involve more than 100,000 youngsters from ages 7 through 19 or about one-third of all Kansans of this age group. More than 20,000 volunteers support 4–H, and about half give an average of 22 hours a year to the program. Here's ann example of how new communication delivery methods have been used successfully to expand the opportunities: 4–H'ers developed a questionnaire and delivered it on the Internet to 4–H'ers in other countries. They reached beyond the boundaries of their own county, state, and country to youth in other countries and without travel expenses.

Interview judging at county fairs allows 4-H'ers to learn firsthand how their projects are judged.

4–H is more than going to a meeting or choosing a project. 4–H involves children and families learning to live and work together and also learning to create a happy, productive lifestyle that can make each day a better day.

There are countless numbers of Kansans who can credit 4–H with giving them direction in life and experiences they will never forget. Here are some examples.

- Karna S. Peterson of Lindsborg was a member of the Falun 4–H Club. Her career choice in foods, nutrition, and dietetics was nurtured in 4–H programs. She was honored as the outstanding senior in dietetics at K-State in 1989 and has since earned a master's degree in public health nutrition at the University of Minnesota. Peterson has worked with public and private nutrition programs and as contributing food columnist for Best Recipes magazine. Although she also completed 4–H projects in sewing, citizenship, horses, and rabbits, the foods and nutrition projects interested her the most.
- Kansas Sen. Janis Lee of Kensington, who represents the 36th district and serves as assistant minority leader in the Kansas Senate, credits her success as a public speaker to skills learned in 4–H. Her son, David, who is an aeronautical engineer with NASA, said making business presentations before a group is easier for him than it seems for some of his coworkers. He learned the basics of public speaking in 4–H.
- According to Cindy Johnson of Leonardville, the effect of 4–H programs is evident almost immediately. She teaches fourth grade and has been a 4–H member and a 4–H parent; together, her family members have logged 36 years of participation at the Riley County Fair. She notes that in the classroom 4–H members always can be spotted because they are resourceful, work well as members of a team, and accept responsibility.

Examples of Some Special 4–H Programs

4–H CARES—An acronym for Chemical Abuse Resistance Education Series, 4–H CARES is a youth program developed by K-State Research and Extension. It is designed to improve self-esteem and family interaction, promote life skills, and teach about chemical abuse. Many youth organizations have included 4–H CARES into their educational campaigns, including the Scouts, Big Brothers/Big Sisters, schools, and church groups. Nearly all the other states and a number of school systems and provinces in Canada have requested the 4–H CARES educational material. The program has won national awards, including being named one of 20 exemplary prevention programs in the nation by the National Association of State Alcohol and Drug Abuse Directors and the National Prevention Network.

The Kansas City Conference—This annual conference attracts delegates from seven states: more than 600 young people can take advantage of the opportunity to explore new ideas, new environments, and new concerns and also to meet new friends. Service learning, a way to explore civic and community responsibilities, has been added to the program. Although 4–H attracts members from rural, urban, and suburban environments, delegates have first-hand opportunities to complete such service projects as working in a food pantry, beautifying a park, or cleaning up a day care center. They also can learn about career choices and even get help looking for their first summer jobs.

Discovery Days—Each June, Discovery Days attracts more than 600 young 4–H'ers to K-State for an opportunity to explore new interests and career opportunities and sample college life. Delegates can choose from more than 90 workshops that range from fashion design to veterinary medicine. Extracurricular activities such as golf and swing dancing are included, too.

Other 4-H Programs—About 5,000 4–H'ers enjoy the picturesque Rock Springs Center each year. Members also are eligible to travel to Washington, D.C., or the National 4–H Congress, which is held in different large cities. High Adventure, a two-week backpacking and mountaineering trip to Philmont Scout Ranch in New Mexico, was offered for the first time in 1998.

STRENGTHENING FAMILIES AND COMMUNITIES

Parents University

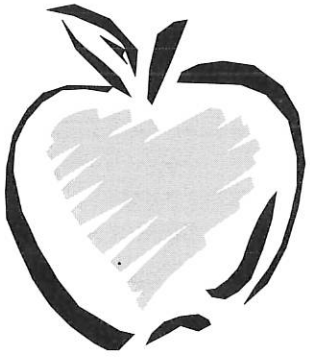
Parents University is an informal conference held at locations around the state and designed to provide educational opportunities for parents to enhance their skills, gain support from other parents, and learn more about the resources available within the

community that support parents and families. The conference combines educational sessions with a showcase of community resources, including free child care. A fringe benefit of joining with other community organizations to plan and present Parents University and similar programming is the development of strong partnerships that provide ongoing benefits to county residents. For example, in Sedgwick County, 23 agencies partner to provide parent education.

K-State helps those growing older who have special needs.

Families

Many families must deal with the stress of managing farm and homes and debts while also facing such problems as marital discord, women in the work force, single-parent families, blended families, low income, and care for elderly parents. K-State Research and Extension has been developing family management programs that address these issues, including such topics as food and nutrition, clothing and shelter, stress management, money management, do-it-yourself skills, communication skills, child care, family wellness, legal services, and career placement



The Expanded Food and Nutrition Education Program (EFNEP) is designed to help limited-resource families with children and is available in Sedgwick, Shawnee, Crawford, Riley, and Atchison counties. All Kansas county family and consumer science extension agents have been trained on the special curriculum developed for this program. In the program, paraprofessional nutrition assistants work with parents individually or in small groups to improve knowledge and skills in basic nutrition, food preparation, food buying, money management, and food safety. Other nutrition assistants provide nutrition classes at schools. The goal of the program is to help individuals and families make simple changes in eating behaviors so that, over time, healthy choices become healthy habits.

The Expanded Food and Nutrition Education Program Profile in 1996:

- 1,689 families with 3,282 children enrolled.
- 12,070 youth participated in the youth program.
- 76 percent of participants have incomes below the poverty line.

In 1996, EFNEP networked with 69 different social service agencies and food assistance programs, including Head Start, the Food Stamp Program; WIC (Special Supplemental Food Program for Women, Infants, and Children); the School Lunch Program; food banks; and prenatal clinics.

In 1997, more than 700 volunteers donated approximately 3,536 hours of work to EFNEP. The dollar value of volunteer work (estimated at $6.00 an hour) totaled $21,216.

EFNEP participants improved many food behavior practices. As a result of their participation:

- 94 percent of participants who completed the 8 to 10 lesson series improved their diets.
- 43 percent more often compared prices while shopping.
- 68 percent more often read labels to select foods with less fat.
- 49 percent more often planned meals in advance.
- 33 percent more often used a grocery list.
- 49 percent less often ran out of money before the end of the month.
- 20 percent reported their children ate breakfast more often.

Financial Programming Impacts

Money management programming is available in more than 70 Kansas counties for men and women of all ages as well as high school students, senior citizens, and those with limited resources. One example of impact occurred in Neosho County after a presentation to more than 800 men and women on planning for transfer of nontitled property. Program leaders estimated that if participants reduced by one hour the time spent with a lawyer (at $100 per hour) it would be equal to $80,000 in savings. Another example: As a result of K-State Research and Extension Family and Consumer Sciences programming, women ranging in ages from 18 to 75 with incomes from $5,000 to more than $40,000 are preparing net worth statements, checking names on titled property, making appointments to write wills, comparing costs of insurance benefits, planning for retirement, and figuring payments before applying for a loan.

Community Economic Development

Social, economic, cultural, environmental, and other forces of change constantly are reshaping our communities. In the midst of such rapid change, people need help based on research and provided to them through statewide educational programs, many of which focus on developing, inspiring, and guiding efforts for economic growth, including the following areas:

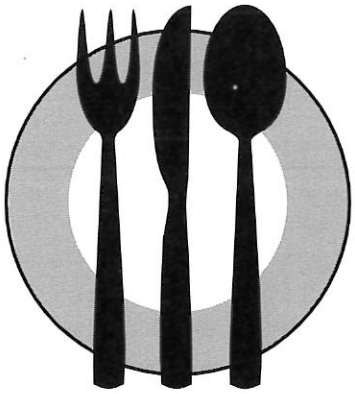
Working with Pride—For more than 25 years, the Kansas PRIDE Community Improvement program has encouraged communities to upgrade facilities and services, increase economic vitality, and renew a sense of civic pride. This joint program with the Kansas Department of Commerce and Housing also involves developing more effective leaders and providing access to resources and information. Statewide recognition is given to PRIDE communities that have made significant community improvements.

OFFICE OF **Local Government**

Developing Community Leadership—This program offers opportunities for county or communities to develop leaders. Workshops are offered on leadership skills. Recruiting volunteers is emphasized. And assistance is provided in issues identification and analysis, community dialogue, and decision making.

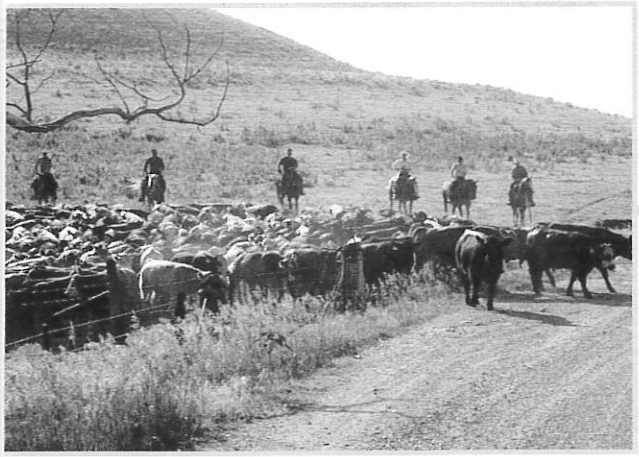
Other programs—The Office of Local Government helps increase the efficiency and effectiveness of local governments, and Community Technical Assistance provides facts and information resources to help people make informed decisions on critical issues.

An example of community assistance through K-State Research and Extension is the publication **Building Healthy Communities**, which helps small communities identify their retail strengths and weaknesses and map out plans for economic development. Many small communities lose retail business and sales tax revenue because residents travel to larger, nearby towns for shopping; therefore, a town has to have major anchor stores and service businesses to capture local trade and to attract customers from a wider secondary trade area. Other organizations needed in small communities include restaurants, vehicles sales and service, competing grocery stores, and medical services. The K-State publication provides information on key components of economic prosperity, including how to determine the strengths, weaknesses, opportunities, and threats to a community.



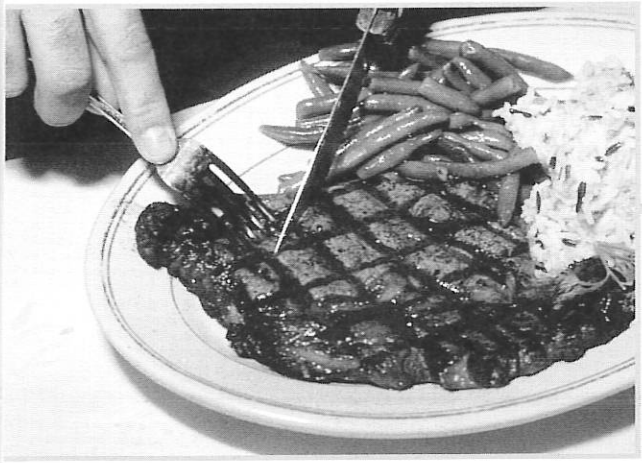
4. FOOD, NUTRITION, HEALTH, AND SAFETY

Kansas is the nation's number-one meat processor, number-one producer of hard red wheat, number-one flour miller, and number-one producer of grain sorghum. The state also is a national leader in producing many other agricultural commodities. Such an important industry relies heavily on food safety and nutrition research and expertise at K-State. Many people are asking questions about food additives, livestock drugs, and crop and vegetable pesticides. The potential for food handling and processing errors has increased. As lifestyles become more urban, people are separated further from the food production system. Fewer citizens than ever understand how food is produced and processed. Nor do people understand the safeguards the government has in place to maintain a safe food supply. Many do not know what constitutes a balanced diet. Such lack of knowledge makes it easy to choose on the basis of emotion instead of fact, which is why the need is greater than ever for reliable information from K-State Research and Extension. Its scientists and extension personnel are working to (a) ensure a safe food supply from production to consumption; (b) promote healthier and safer lives; and (c) develop new, appealing food products.



From the farm...

...to the table.



CENTER FOR FOOD ANIMAL HEALTH AND MANAGEMENT

Food safety as it relates to animal agriculture starts at the farm and moves from there to feedlots to processors to the grocery stores and to the consumers. The Center for Food Animal Health and Management focuses on applied, on-farm research to meet the needs of producers, allied health industries, government agencies, and the public. Food animal health and management includes all aspects of preventative medicine and management measures that affect the health and well-being of food animals and the wholesomeness and profitability of foods of animal origin from conception to consumption.

Success in animal agriculture requires continued development of sophisticated management techniques and scientific data to assist producers in making decisions. To be useful, data must be current and integrated rapidly into production management programs. The Food Animal Health and Management Center can provide the quick turnaround in research that is needed.

Collaborative efforts in teaching and research are contributing to the expertise and success of the Center. In addition to working with faculty in other K-State departments, the Center has agreements to share knowledge and expertise with other institutions across the country, including the University of Nebraska-Lincoln with its facilities at the USDA Meat Animal Research Center and with several universities comprising the Food Animal Production Medicine Consortium.

Prevalence of *E. coli* 0157:H7 in beef cattle herds from farm to feedlot. One example of the work of the Center is the on-farm survey of the incidence and prevalence of the foodborne human pathogen *E. coli* 0157:H7 in large (more than 200 cows) and small (fewer than 100 cows) beef cow-calf herds in the Flint Hills. Fecal samples are collected from at least 10 percent of each of the cow herds at regular intervals throughout a complete production cycle (three-year period). Preliminary results suggest that this pathogen is shed by a small percentage of cattle in several of the 22 herds being studied. There would appear to be some circumstances on farms, including the calving period, when the incidence of the shedding of the pathogen increases. Comprehensive management data are being collected for each farm operation so that a correlation can be made between management practices and incidence of *E. coli* 0157:H7. The aim is to find economical management practices that will decrease or eliminate the incidence of this pathogen in cattle going into the food chain.

A genetic Test for *E. coli* 0157:H7—Another example of work accomplished by the Center is the development of an improved genetic test that gives the beef industry clearer insight into the prevalence of *E. coli* 0157:H7 in cow-calf herds.

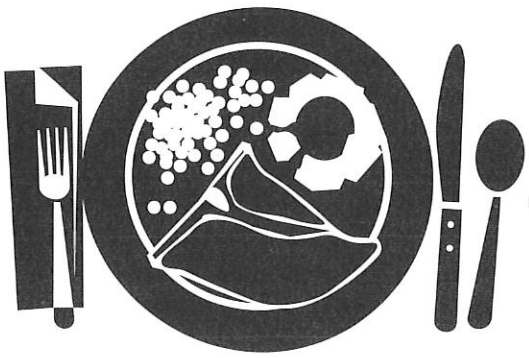
Safe drinking water is essential.

Researchers believe it will better measure the effectiveness of future efforts to eliminate many foodborne pathogens. The test—called Polymerase Chain Reaction (PCR)—is similar to technology currently used in DNA testing of humans and in the search for an AIDS cure. Scientists with the Center can use PCR to identify the presence of *E. coli* 0157:H7 in cow-calf herds by looking for the bacteria's DNA. Because PCR tests are faster and more accurate, the researchers thought they would find a higher prevalence of *E. coli* in their studies. They were right. In some herds, the prevalence of *E. coli* was as high as 3 percent. Understanding the breadth of the problem enables researchers to build a comprehensive plan for on-farm control programs. For example, PCR testing is giving the K-State team information on potential effects of cross-contamination by wildlife, drinking water, and human-to-human contact. The goal is to build a management plan for ranchers that is economically sound, protects public health and their own health, and produces a safe product.

FOOD SAFETY

Foodborne illnesses generally cause temporary disorders of the digestive tract, but they also can lead to serious long-term health consequences. In a small percentage of cases, foodborne infections spread through the bloodstream to other organs, resulting in serious long-term disability or death. For example, *E. coli* 0157:H7 can cause kidney failure. *Salmonella* can lead to reactive arthritis, serious infections, and deaths. *Listeria* can cause meningitis and stillbirths. *Campylobacter* may be the most common factor leading to Guillain-Barre syndrome, which is now one of the leading causes of paralysis from disease in the United States. Estimates of the cost of foodborne illnesses range from over $5 billion to $22 billion annually. At least 30 pathogens (harmful organisms) are associated with foodborne illnesses.

Bacterial pathogens are the most commonly identified causes of outbreaks of foodborne illnesses. They can be transmitted and can multiply rapidly in food.



The Food Safety Forum

Food safety is of paramount concern. Consumers expect the food they purchase at supermarkets and foodservice establishments to be safe, wholesome, and nutritious. Because of the complexity of the food system and food safety, and because an interdisciplinary approach is needed to address all the issues, The Food Safety Forum was established by K-State Research and Extension. Some 60 faculty members from several departments are involved in this Forum and are committed to improving all activities related to preharvest of crops and animals; postharvest and food manufacturing, storage, processing, and distribution; and consumer, foodservice, and retail issues.

Making Meat Safer

Domestic and international wholesale buyers, consumers, producers, and sellers face significant market pressures for safe meat products produced under well-controlled hygiene. All indications are that these market pressures will intensify. K-State Research and Extension has changed the nation's entire beef industry, propelling it into an era of safety that looked impossible just 10 years ago. Important advances that can be credited to K-State include:

- Research showing that the internal color of ground beef is not a safe way to judge whether cooking has killed illness-causing *E. coli* 0157:H7 bacteria. Beef patties' color can oxidize and turn brown at temperatures as low as 130° F. That's why USDA Food Safety and Inspection Service standards now focus only on ground beef's "end point" temperature.

Testing a side of beef—K-State is making important advances in meat safety.

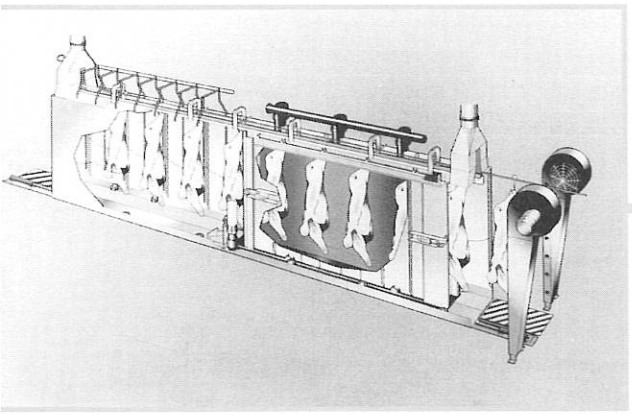
- Research that was the basis for USDA's approval of a two-stage approach to removing carcass contaminants and meeting government's new "zero-tolerance" policy: 1) knife trimming to remove large deposits and 2) hot water/steam vacuuming to eliminate smaller ones.

- Development by K-State and an industry partner of steam pasteurization technology to kill microscopic disease-causing organisms is being used or considered being used by the four big U.S. meat packers.

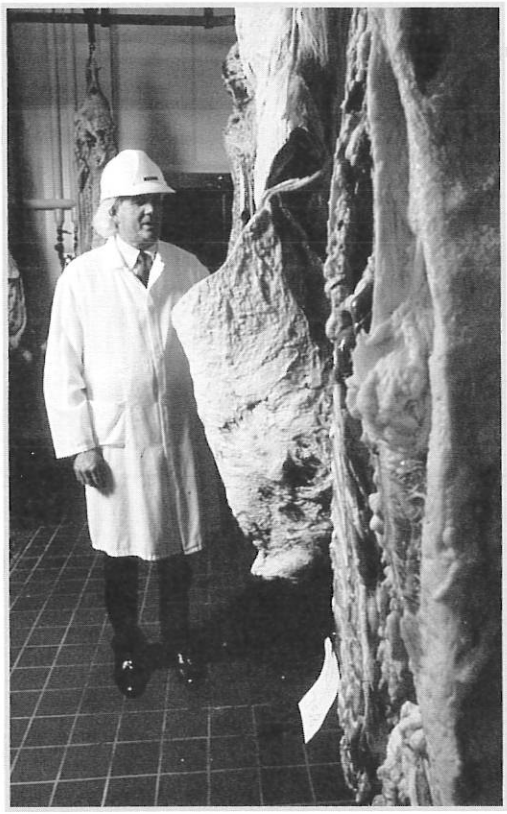
Meat and poultry products are primary sources of foodborne illness worldwide. Several highly publicized foodborne illness outbreaks associated with meat-based products have prompted the USDA to totally change its meat inspection system, relying for the first time on scientific information, especially microbiology. This new system imposes microbiological guidelines for meat processors, including steps to be taken for antimicrobial intervention that will meet government standards for processing. Many types of interventions have been researched and even utilized, with varying and inconsistent degrees of success in reducing associated pathogens. Industry and consumers are demanding better methods of reducing pathogens on meat carcasses and in finished meat products.

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.

Hot Water/Steam Vacuum Systems —are designed to remove visible spots of contamination from small areas on the carcass and are



A cutaway of a steam pasteurization unit.



Kansas is one of the leading states in red meat production.

used to augment the traditional knife trimming. Steam pasteurization is the final step in the beef slaughter 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°F or 200°F and kills nearly all pathogens. Carcasses then are sprayed with cold water as they enter the holding cooler.

The commercial Steam Pasteurization System (SPS) provides beef processors with the most effective bacterial reduction technology available and will help them to meet newly established governmental microbiological standards. It also will provide an accurate, effective, and true critical control point to reduce microbiological risks in the beef slaughter process. Consumer groups are currently advocating SPS technology to improve meat safety.

The process effectively killed nearly 100 percent of pathogens deliberately introduced on the surface of meat, including *E. coli*. testing in meat-packing plants has been equally successful. Other tests indicated an advantage to combining several methods. For example, knife trimming and/or steam spot vacuuming can be used to remove visible contamination before steam pasteurization.

Four of the largest domestic meat-packing companies are using, have ordered, or are thinking about using SPS units. Projections are that 70 percent to 80 percent of all processed meat will be pasteurized within a few years.

Significant market pressures are influencing domestic and international wholesale buyers to develop meat products from steam-pasteurized carcasses, and all indications are that these market pressures will intensify. To date, 17 units have been installed in some of the nation's largest beef-slaughter facilities, with several additional large SPS units on order. Several other countries are evaluating or seeking approval for SPS incorporation into beef-slaughter operations.

Additional Information—Working with engineers from the Frigoscandia company, K-State Research and Extension is developing and verifying the small-scale SPS units for low-volume slaughter operations. A prototype unit has been installed, and microbiological testing carried out. The system has demonstrated good antimicrobial capabilities and industrial applicability. Smaller slaughter operations must meet microbiological standards, but they tend to have fewer intervention technologies at their disposal. As larger processors invest in sophisticated technologies, and as markets request products produced with those technologies to assure higher levels of food safety, smaller processors face stiff competition. A less costly semi-manual version of SPS can be obtained by smaller processors to allow them to effectively compete. Additionally, the international market is comprised predominantly of smaller processors who would utilize the smaller SPS version. Another steam delivery system is being designed to decontaminate

raw meat trimmings destined for grinding operations. A significant percentage of meatborne bacterial illness can be traced to comminuted meat products, which makes this research critical to further reducing consumer risks. Preliminary studies have shown the efficacy of the process, and more studies are planned.

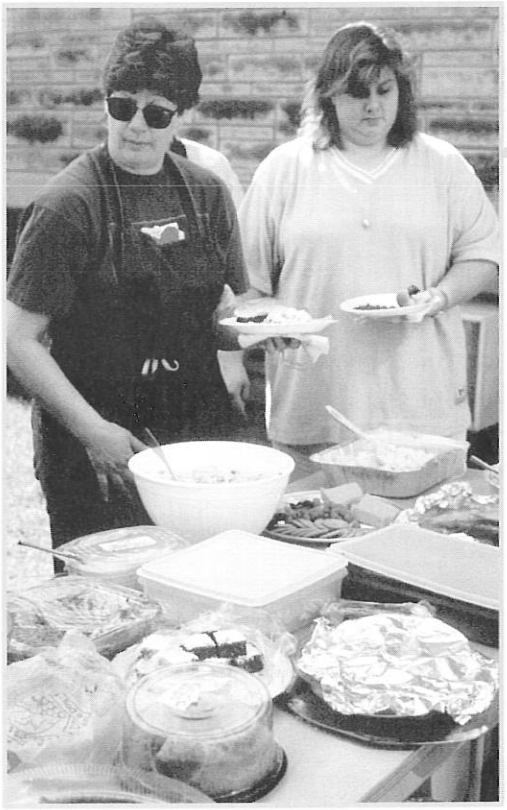
Testing the temperature of spaghetti on a school lunch tray.

Hazard Analysis and/or at Critical Control Points (HACCP)—This is a food-safety system that can be applied across the food system: in food production, food processing/manufacturing, distribution, retail markets, foodservice operations, and in the home. HACCP focuses on preventing hazards, relies on a scientific base, permits more efficient and effective government oversight, and places responsibility for ensuring food safety on the various food operations.

HACCP calls for a science-based analysis of potential hazards (microbiological, physical, and chemical), determinations of where problems can occur, taking measures to prevent them, and taking corrective actions if they do occur. Detailed HACCP records allow the food operation and government inspectors to monitor how well the operation is performing on a continual basis. In Kansas, HACCP training programs are in progress for meat processors and foodservice people.

Microorganisms are everywhere and often contaminate raw agricultural food products. Some microbes survive preservation treatments. Humans also may contaminate foods during production, processing, distribution, and preparation. Any food, whether raw or processed, may carry some level of risk for foodborne illness if not handled properly before consumption.

Picnics require safe food-handling practices.



Everyone in the food system—from the production of raw commodities to the consumption of food in foodservice operations or homes—must take responsibility for proper food handling to control microorganisms and prevent foodborne illnesses. Each part of the system and each individual has a significant role in food safety during acquisition, storage, preparation, and servicing and handling.

Getting a Jumpstart on HACCP—Five one-day introductory HACCP training workshops were conducted throughout Kansas for foodservice operators and for meat and food processors, with 175 participants attending. They learned basic food safety behaviors and evaluated their knowledge of HACCP principles and ability to implement HACCP. They also rated their level of intended implementation of a HACCP system (from 1—will not implement to 5—will implement immediately). Mean scores ranged from 3.8 for monitoring critical control points to 3.3 for implementing a complete HACCP system. Reasons for not implementing the HACCP system were lack of time, lack of training, and cost. Significant differences were found between foodservice scores and processor

scores for all phases of intended implementation, with processors scoring higher.

Consumer Perceptions of HACCP and the Price of Meat—Four consumer focus groups have been conducted by K-State Research and Extension. Consumers completed a questionnaire to assess their overall food safety knowledge, then they were asked questions about meat quality and safety, including their reactions to meat safe-handling labels. Consumers viewed a 12-minute video segment that briefly described HACCP in food processing. Then, the focus group participants responded to a "willingness to pay" simulation activity that included choosing and determining the price of ground beef prepared with or without a HACCP system in place. Eighty percent of participants were willing to pay more for the HACCP-processed meat, but many questioned why meat was not already being processed utilizing that system. They reacted positively to information about HACCP and perceived it to add to the safety of meat. They indicated that current meat-handling labels are vague.

Meat cuts in the supermarket and on the grill are safer to eat because of research and education programs at K-State and other land-grant universities.

Improved Technologies for Slaughter, Processing, and Microbiological and Chemical Residue Testing

Color and Safety of Cooked Ground Beef—Premature browning occurs when the interior of ground beef patties appears thoroughly cooked but the internal end-point temperature is below that necessary to ensure destruction of any potentially pathogenic microorganisms. Normally, the cooked color of ground beef patties progresses from red to pink to brown as end-point temperature increases. With premature browning, patties appear cooked at temperatures as low as 55°C (130°F). This phenomenon is of critical importance given recent *E. coli* 0157:H7 outbreaks.

Researchers analyzed the chemical and physical properties of normal and prematurely browned ground beef. They found that premature browning is related to the form of the pigment in the raw ground beef when cooked.

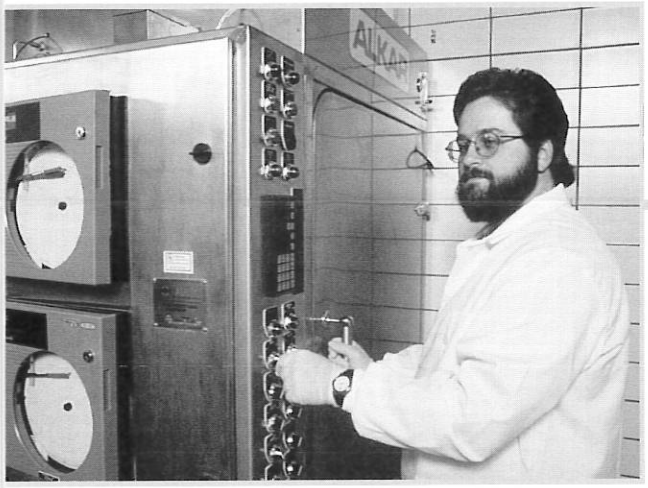
The findings of this research have influenced the Food Safety and Inspection Service (FSIS) to significantly alter its recommendations to the public about cooking ground beef. The new statement contains nothing about internal color and focuses on end-point temperature. Premature browning may not be as important an issue in the fast-food industry or in USDA-inspected establishments where specific time-temperature heating is used, but it is extremely critical in home and institutional preparation of ground beef patties.

Color and Oxidative Properties of Irradiated Beef—The effectiveness of irradiation in controlling microorganisms in beef is well known, but additional studies have been necessary on the effects of

Symbol for irradiation.

low- to medium-dose irradiation combined with freezing, precooking, and packaging on pork, ground beef, and beef muscle. K-State Research and Extension has conducted tests on the reaction of these meats to irradiation. The findings concluded that irradiated beef responded extremely well when vacuum-packed. Bacterial counts remained low, and color and taste were unaffected. Irradiation is an economical way of safely treating meat products. Irradiation could provide an extra margin of safety from foodborne pathogens. If processors build irradiation facilities next to their processing or distribution centers, the costs could be as low as about 1cent per pound. If the irradiation has to be contracted out, it could cost 5 cents to 7 cents per pound.

Validation of Dry, Fermented Sausages—In 1994, an *E. coli* 0157:H7 foodborne disease outbreak associated with dry, fermented sausage occurred in the Pacific Northwest. Dry, fermented sausage products rely on the natural production of acid by starter cultures and on drying to control pathogens. Typically, heat is not involved in the process. The safety of those products was questioned by consumers and the USDA. The USDA-FSIS has called for complete process validation of those products to assure that they can eliminate *E. coli* 0157:H7.



A K-State animal scientist operates state-of-the-art equipment for testing meat products.

The meat microbiology processing laboratory at K-State Research and Extension has been equipped with state-of-the-art dry, fermented sausage production units to perform process validation studies. This unique facility for sausage research allows a replication of any standard industry process. Products also can be inoculated with pathogens. Validation studies have been performed successfully on Lebanon bologna, pepperoni, and summer sausage. Various antimicrobial agents have been inserted into the products to test the production processes, and steps have been taken to enhance pathogen destruction effectiveness during the production processes.

Validation studies of most commercially utilized dry, fermented sausage production processes will provide industry and USDA answers on how current systems can achieve adequate pathogen reductions to assure consumer safety. K-State Research and Extension will additionally provide processors, currently using protocols that are shown to be inadequate, an alternative process to meet USDA standards for *E. coli* 0157:H7 elimination.

Slaughter Process Validation Studies—KSU is planning a dedicated slaughter facility to allow intentional inoculation of carcasses for the purpose of evaluating emerging technologies. If a particular technology is shown to be effective in a controlled inoculation study, then it would be verified in full-scale plant trials under normal processing conditions. This approach would provide scientific validation that:

1) the technology is effective in controlling specific pathogens,

2) the technology works well in a commercial plant environment, and

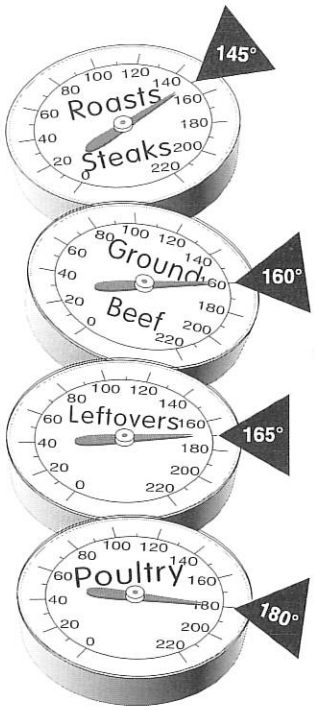
3) the technology does not result in adulteration or misbranding.

This comprehensive approach, with support from consumer groups, labor groups, and industry trade associations, will help to facilitate the USDA regulatory approval process.

Microbiological and Chemical Testing—On several occasions in recent years, the National Academy of Sciences (NAS) has recommended that the Food Safety and Inspection Service "intensify its current efforts to control and eliminate contamination with microorganisms that cause disease in humans." The NAS has further advised that "scientifically valid microbiological data must be the foundation of a 'sound...scientifically based'" inspection program. Microbiological testing, therefore, will play an increasingly important role in meat inspection and in the future implementation of HACCP. K-State has been actively engaged for many years in research on Rapid Methods and Automation in Microbiology, working to improve methods in the isolation, early detection, characterization, and enumeration of microorganisms and their products in clinical, food, industrial, and environmental samples. Such methods can greatly reduce the time, money, space, and labor in performing routine microbiological tests, thus making an impact on food safety evaluations and improvement of quality of food supplies. The most recent studies of chemical residue detection have focused on *Fusarium* mycotoxins, dioxins, and heterocyclic amines in beef tissues. K-State is evaluating the impact of processing on these compounds and the formation of other compounds during processing.

The dairy industry is important to the total agricultural economy of Kansas.

Inter-Institutional Study of the Prevalence of *Salmonella* Human Pathogens in Cull Dairy Cattle at Slaughter Sites in Four Regions in the United States—The first phase of this study has been completed. Fecal samples were collected from cull dairy cattle just prior to their entering slaughter plants in five states, and carcass swabs were collected from these same animals in the slaughter plants. The samples and swabs were cultured for *Salmonella* pathogens. Preliminary data show widespread *Salmonella* pathogens in both the fecal samples and on the carcasses of these animals in the slaughter plant. Results from this investigation suggest that changes in plant management and inspection procedures could reduce the incidence of these pathogens on the cull-cow carcasses. There was no correlation between body-condition score and incidence of *Salmonella* pathogens collected from these cows. The dairy industry is very interested in expanding this investigation to develop an Industry-Wide Total Quality Assurance Program.



Extension Training andTesting in Food Safety

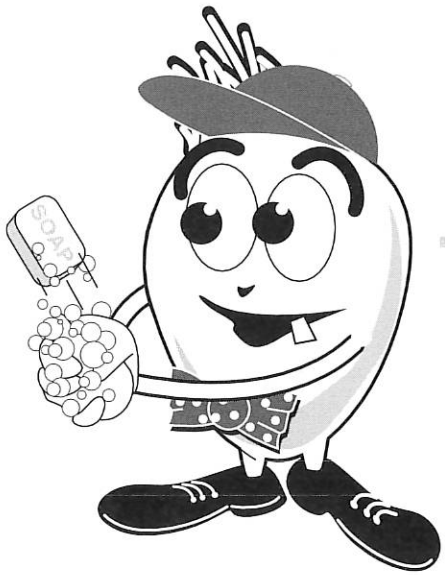
Food safety checklist for training and evaluation—The one-page, easy-to-use Food Safety Checklist is a guide to improving food-safety practices in a foodservice operation. The checklist can be used in training foodservice employees and in evaluating food-safety practices before and after training. The checklist incorporates HACCP principles and Food Code temperatures. Extension agents, sanitarians, and foodservice directors in commercial and noncommercial foodservice operations have used the checklist in a variety of ways. Extension agents used the checklist with food-safety training programs of school foodservice, health care, and retail operations. Sanitarians utilized the checklist during routine inspections to educate foodservice operators about new food-safety actions/behaviors. Foodservice directors used it to train employees and to evaluate food-safety procedures within the operation. Those who have used it state that it is easy to read, concise, and applicable to HACCP practices, and that it is an excellent tool for training and monitoring day-to-day food-safety practices in a foodservice operation.

http://www.oznet.ksu.edu/foodsafety/

Food Safety on the Web—A nationally broadcast satellite video conference was produced by K-State Research and Extension in cooperation with Michigan State University and the University of Wisconsin to promote awareness and use of USDA's Food Safety Education Databases as critical resources in food-safety educational programming. Three databases were featured. Targeted audiences were extension educators, public health educators, classroom teachers, foodservice personnel, and others who provide food-safety education. Program marketing was via the Internet and through the development of a special Website and listserv. Two hundred fifty sites in 43 states were registered and down-linked to the video conference. Forty-eight site coordinator evaluations and 176 participant evaluations were received and analyzed. Response was favorable concerning content and presentation of the video conference and knowledge gained from the conference. Mean scores were higher than average on all questions. Two questions determined site coordinator and participant knowledge about and use of the databases before the video conference. Fifty percent of the site coordinators knew about the databases, but only 10 percent to 15 percent had used them. Only 20 percent of participants knew about the databases, and only 10 percent had used them. Respondents indicated that they would use the databases, and use of all three databases did increase in the months following the video conference.

Food service establishments like McDonald's Restaurants benefit from safe-food handling techniques taught in K-State workshops.

Serving Safe Food Program—SERVSAFE—A component of the overall statewide K-State Research and Extension interdisciplinary farm-to-table food safety effort, SERVSAFE provides manager certification in safe food handling and sanitation. It is required by many national food operations such as MacDonald's Restaurants. Participants learn the principles and practices of food safety in



This character helps children learn about safe food handling.

foodservice establishments, including food safety hazards; how to serve food safely; the safe food handler; HACCP; keeping food safe from purchasing and receiving through preparation and service; and maintaining sanitary facilities and equipment. The course concludes with an 80-question certification examination. Forty-seven (63 percent) Extension agents who had received SERVSAFE certification training responded to a survey about their local teaching/training activities. Sixty-two percent had conducted follow-up training in their communities. Programs had been conducted with community groups (29 percent), 4-H clubs (22 percent), foodservice operators (28 percent), and other groups (21 percent). Each agent had conducted 3.4 food safety training programs, with a mean time of 51 hours. Approximately 3,400 persons had attended these programs. Examples include a Kids Safety Fair at a local hospital where 300 youth and 75 parents learned correct hand-washing procedures; safe food seminars for churches and community meals that targeted groups serving congregate meals; 10-hour to 12-hour short courses for school district foodservice personnel; elementary school classroom instruction using the Glo-Germ kit; and a 16-hour SERVSAFE certification course for university foodservice managers and supervisors. Extension agents indicated that approximately 55 percent of participants had made behavioral changes (based on follow-up and observation). These included better hand-washing and food-handling practices (thawing and cooling of foods and taking internal temperatures of cooked foods). An agent who had presented hand-washing demonstrations in schools returned and found hand-washing signs posted. Child-care providers became concerned about their own food-safety practices and changed them by placing thermometers in refrigerators, using clean dish cloths and towels, keeping foods safer by reducing the time spent in the temperature danger zone, and not serving reheated leftovers. Through observation, extension agents determined that 4-H groups were using better sanitary practices at county fair food stands.

Food Safety Training for KanWork—This pilot project was conducted in seven counties to provide food-safety and job-skills training to KanWork (public assistance recipients) by the Kansas Department of Social and Rehabilitative Service (SRS) in cooperation with K-State Research and Extension. Local employment staff and county agents conducted food-safety and job-skills training. KanWork participants received 12 hours of food-safety training and 30 hours to 40 hours of job-skills training. A total of 31 participants received jobs, nine in foodservice. Participants increased their self-confidence and their knowledge of safe-food handling to apply at home as well as at work, and they had positive group experiences. Cooperation between the two agencies also was enhanced.

Shelf-life Studies—A K-State Research and Extension laboratory offers the only comprehensive shelf-life studies for FDA-regulated products and includes chemical, physical, microbiological, and sensory testing during the shelf-life study. The shelf life of a product determines how long it will retain minimum quality characteristics before flavor, odor, visual, or other properties become less than satisfactory and prevent a customer from repeat purchases or from buying the product at all. Products with a short shelf life can limit production and storage capacities, distribution capabilities, and retail display time and eventually lead to increased economic loss with throwaways. In the laboratory, parameters for individual products are discussed with clients, and recommendations are made for lengthening a product's shelf life.

Processing Authority for Testing Acidified Foods—This service was developed in response to the need by Kansas manufacturers of condiments, pickles, salsas, sauces (including barbecue sauces), and/or salad dressings to provide proof of testing tothe FDA for products entering interstate commerce. The FDA closed down several Kansas companies in the spring of 1996 until testing could be completed by a Processing Authority to show that the product characteristics or processing techniques would not support food pathogens. The laboratory investigated the regulations, potential risks, and liabilities associated with becoming a Processing Authority and began offering acidified food testing for Kansas companies in late spring 1996.

NUTRITION PROGRAMS FOR YOUNG FAMILIES

Good nutrition is important to the health of all Americans but especially critical for limited-resource families. Families living in poverty are at risk of inadequate diets and tend to have high intakes of fat. Diet is a factor in the development of heart disease and some forms of cancer, stroke, diabetes, and atherosclerosis, and poor-quality diets increase the risk of developing these conditions.

Poverty in Kansas

The 1997 Kansas Kids Count Data Book, a project of Kansas Action for Children, provides an annual report card on the welfare of Kansas children. The report shows a trend toward a population of Kansas children who have greater economic and social needs than ever before. According to the 1990 U.S. Census, 11.5 percent of all Kansans live below the poverty line, and one in every seven Kansas children lives in poverty. Children in single-parent families are more than four times as likely to experience poverty as are children in two-parent families. Between 1980 and 1990, the number of single-mother households increased by 25 percent to a total of 81,433 households. The incidence of poverty among

female householder families with children under 18 years of age is at an all-time high of 40 percent. In female householder families with children under 5 years of age, the poverty rate is 55 percent.

Hunger in Kansas

It is hard to believe that hunger exists in the nation's breadbasket, but a recent study revealed that there is hunger among Kansas citizens.

Following are some findings of the Kansas Childhood Hunger Identification Project, which identifies the extent and severity of hunger in Kansas children under 12 years of age:

- There are 21,000 hungry children in Kansas.
- There are 48,000 Kansas children at risk of being hungry.
- In 1994, 2,403 babies were born with low birth weights.
- 18 percent (120,358) of Kansas children received economic assistance in 1995.
- Children under 12 in 64 percent of low-income households are hungry or at risk of being hungry.

Children are hungry and dietary quality in low-income families is poor because family expenses are too high and income is too low. Some family incomes are too low to feed children adequately. The minimum wage, now worth only 74 percent of its original value, is not enough to feed a family—even with full-time wage earners. USDA research indicates that a thrifty family diet for four persons costs $348 per month. A minimum wage worker earns only $760 per month before taxes and withholdings. This income must cover the cost of housing, health care, and childcare, leaving little left to buy food. In addition, many poor families lack the knowledge, skills, or time to use the limited amount of money they have to select and prepare the healthiest foods. National studies show that low-income households consume 10 percent fewer dairy products, 21 percent fewer fresh fruits, 13 percent fewer fresh vegetables, and 12 percent more sugars and sweets than the population as a whole.

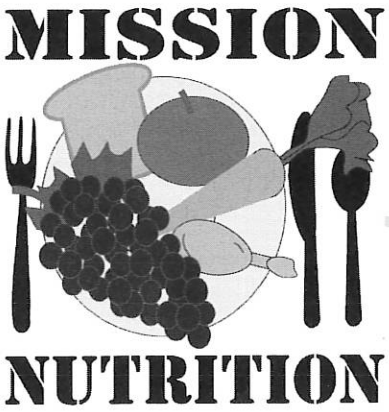
K-State provides information on nutrition to pregnant women.

Maternal and Child Health

Diet plays an especially important role in the health of pregnant mothers and their children. An adequate diet is essential in preventing low birth weight (LBW), which is the greatest single factor in infant health. In Kansas, the overall LBW rate is over 6 percent. The rate increases to over 10 percent in high-risk populations. Risk factors for LBW include teen pregnancy, inadequate prenatal care, substance abuse, and poor dietary quality. The need for extension programming in these areas is reflected in the following statistics:

- The birth rate for single teens in Kansas is now 9.6 percent, an 11 percent increase from the previous five years.

- Adequate prenatal care has been shown to yield over $3.38 savings for every dollar invested.
- Fourteen percent of all mothers do not receive adequate prenatal care.



Programs that Make a Difference

WIC Kitchen: Cooking for Better Health—This is a collaborative program of K-State Research and Extension and WIC and administered through the Kansas Department of Health and Environment. WIC Kitchen is designed to actively involve the learner. It uses informal group teaching methods to demonstrate basic food preparation skills and meal planning, nutrition, shopping, food safety, and parenting.

Program evaluations from over 400 Kansas participants indicate that those who most need the information are participating. The study showed:

- Compared to nonparticipants, WIC Kitchen participants more often tried new foods, allowed children to help with food preparation, read food labels, and compared prices before buying food.
- The more classes attended, the better the behavior was with regard to trying different foods, allowing children to help with food preparation, thawing food properly, comparing prices before buying food, and shopping with a list.
- At the beginning of the program, women who decided to participate were less likely to think about healthy foods when deciding what to feed their family, less likely to shop with a list, and less likely to serve foods safely than were women who chose not to participate.

Because of its overwhelming success, this program has been revised for a broader audience. The new program is entitled Mission Nutrition and is now available for use with a variety of groups throughout Kansas.

One K-State extension program is reducing the incidence of low birth weight in newborns.

The Have a Healthy Baby program—This program is designed to improve birth outcomes and the health of pregnant women by targeting the risk factors for low birth weight (LBW). The program focuses on the importance of:

- Early prenatal care.
- Healthy eating for optimum weight gain and fetal development.
- Healthy lifestyle choices.

The program has been implemented in Kansas by K-State Research and Extension with positive results. The incidence of low birth weight among program recipients has been reduced, and Medicaid and health care costs have been decreased. Data collected from 175 participants showed that 94 percent of babies born

were at normal weight. Only 10 babies (5.7 percent) were LBW. None were less than 3.3 pounds. Without this program, the same number of women would be expected to deliver 12 or 13 LBW babies. Prevention of three LBW infants resulted in substantial savings in Medicaid, delivery, and nursery care costs ranging from $22,000 to $360,000.

Safe Food for Children
A series of lessons for parents & child care providers

Safe Food for Young Children—This lesson series written by Kansas Research and Extension faculty provides family child-care providers and parents with information on food safety in a fun, lighthearted manner. Topics covered are hand washing, safe food shopping, safe food preparation and service, safe food storage, and kitchen cleanliness. Each lesson includes a leader's guide, a brochure for parents, and extras such as stickers, shopping lists, magnets, food storage charts, and certificates of participation. Each lesson is accompanied by a short animated video starring Mike the Microbe who brings food safety concepts to life.

A national satellite conference and simultaneous broadcast over Kansas PBS-TV introduced the materials to more than 3,000 people in 47 states. A survey of agencies using the materials was conducted in 1996. About 95 percent of respondents indicated that the lesson objectives were met well or very well. The overall effectiveness of the materials was rated as good to excellent by 98 percent of respondents.

The Safe Foods for Children program currently is being translated into Spanish. This will meet a growing need for bilingual materials, especially for limited-resource families.

Kids' Meal TIMES

Kids' Meal Times—This set of 12 newsletters for parents and caregivers of preschool age children that provides information on:

- Basic nutrition and feeding tips.
- Activities to do with the child.
- Books to read with the child.
- Simple recipes for adults and children to make together.

Each four-page issue is written in an easy-to-read format and designed especially for those with limited reading ability. It has undergone extensive review by child nutrition specialists around the country and was approved as a North Central Region Extension Publication. Wisconsin, Massachusetts, Delaware, Florida, Missouri, and Georgia are some of the states that have purchased the materials. A Spanish translation is in progress.

Nutrition Education Partners

K-State Research and Extension is the perfect partner for the nutrition education program because it already has an office in every county and can adapt educational programs to meet local needs. Forty-three Kansas counties in the Family Nutrition Program (FNP) reported making 67,000 contacts in 1997. FNP's purpose is

Teaching people to eat healthier helps to increase their energy and productivity.

to improve the quality of the diets for food stamp recipients and those eligible for food stamps. Nutrition education supplements welfare reform. Better nutrition also contributes to wellness, which reduces medical expenses. The program is a cooperative effort with the USDA and the Kansas Department of Social and Rehabilitative Services (SRS). The following are examples of accomplishments:

- In Shawnee County, an FNP assistant utilized an educational display to teach hundreds of food stamp clients food safety, menu planning, nutrition basics, and tips for stretching their food dollars—all while clients waited in busy lobbies for other services.
- Three smaller rural counties—Pratt, Barber, and Kingman—collaboratively applied for and received an FNP grant to establish nutrition training for SRS recipients. A full-time assistant was hired to provide nutrition education. Resources purchased with the grant included materials for education displays and for youth nutrition education.
- Focusing on teen mothers, the FNP reduced the number of LBW babies in Crawford County.
- In Finney County, the nutrition education program piggybacked with Even Start, a family literacy program.
- Joining Johnson County as local partners were Olathe Family Investment Center; WIC; Head Start; and Parkview Manor Senior Housing. The FNP programs were planned to supplement existing efforts of local agencies.

HEALTH

Programs for Older Kansans

The number of Kansans aged 65 or older is growing. Older Kansans need to maintain health and independence; meet nutritional needs; and reduce injuries in the home, on the farm, or in the workplace. K-State Research and Extension is assisting them in these areas and helping them to have more satisfying and productive lives. One example of assistance is the KSU **Personal Actions to Health (PATH)** program. PATH provides statewide support to communities that establish health programs in nutrition and physical activity for older Kansans. Over 65 communities have developed PATH projects that have involved nearly 2,000 Kansans in the past three years. Activities include walking and other exercise programs, label-reading tours of grocery stores, water aerobics, line dancing, and cooking seminars. Program evaluations indicate that participants are eating better, learning about nutrition and physical fitness, and are more physically active. A grant of $500,000 was received to enable the program. Communities that participated in the first PATH program

received resource and educational materials, technical assistance, and up to $1,000 to underwrite the costs of PATH projects. They developed programs that have included community gardens, walking clubs, exercise classes at senior centers, reduced-cost mammograms, and brain attack/stroke clinics. Each program also included information on food and nutrition to encourage healthier meals and snacks. The grant money will underwrite more than 100 health programs across the state.

Other programs that help older Kansans include Healthy Eating for Life Program (HELP) for Mature Adults; Creating Accessible Homes; Agricultural Safety and Health Promotion for Older Kansans; Our Mothers, Our Daughters, Our Sisters, Ourselves (focusing on early detection of breast cancer); and Coming Home: Basic Information for the Home Caregiver.

Office of Community Health

This office develops practical educational programs on a wide range of health and safety issues. Examples include promoting well-being and physical and mental health for people of all ages; preventing illness, addictions, injuries, and disabilities; and helping local health services in such areas as access, financing, and quality care.

IN SUMMARY

These are just some examples of the efforts that K-State Research and Extension is involved in to help solve problems and improve the lives of all Kansans. They are evidence that this integral part of Kansas State University continues to be relevant and vital and true to its mission: **"Dedicated to a safe, sustainable, competitive food and fiber system and to strong, healthy communities, families, and youth through integrated research, analysis, and education."** The funds provided to carry on such work are returned manyfold to the state and its citizens through the benefits of research, development, and education, which give all Kansans **"Knowledge for Life."**

WANT TO KNOW MORE?

K-Staters who can provide more information on topics in this report.

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BIOLOGY AND CONTROL OF SERICEA LESPEDEZA

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I. History

- Introduction to U.S. and Kansas
- Uses past and present
- Invasive problem in Kansas

II. Past Research

- 1988-90 herbicide screening
  - > 0.5 lbs/acre triclopyr (Remedy, Garlon 4, Crossbow) and 0.5 oz/acre metsulfuron (Ally, Escort) provided greater than 80% density reduction 1 year after treatment
  - > no difference between treatments applied during vegetative or bud-early bloom stages
- 1995-98 integrated control
  - > a single burn in late spring or mowing once in mid-summer provided some defoliation year of treatment (31-55%) but increased stem density 1 year after treatment
  - > burn + mow + 0.25 lb/acre triclopyr provided greater than 90% defoliation year of treatment and density reduction similar to recommended herbicides 1 year after treatment
  - > herbicides generally increased grass composition and production while decreasing sericea lespedeza and other forbs
  - > mowing in mid-summer reduced the root/crown total nonstructural carbohydrate concentration for 3-8 weeks compared to unmowed plants
  - > leaf/stem residues decreased the germination, radicle lengths, and coleoptile lengths of big bluestem, indiangrass, and Kentucky bluegrass; little bluestem was unaffected

III. Progress in 1998-99

- Basic research
  - > herbicide translocation and seed bank studies yet to be done (primary constraint has been late arrival of graduate student)
- Applied research
  - > aerial application at 3 and 5 gal/acre put out at 1 site
  - > tebuthiuron and fluroxypyr applied at number of locations and sites during 1998
  - > studies initiated at 2 locations to compare annual mowing vs herbicides and mowing + herbicides
  - > use of sericea by goats being monitored

House Agriculture Committee
January 27, 1999
Attachment 3

- Extension
  - > Forage Fact Sheet on "Sericea Lespedeza" published fall, 1998
  - > Plan to publish color brochure on identification and control of sericea lespedeza spring, 1999
  - > Field Days, Workshops, Meetings, ect.
    - Sericea lespedeza - biology and control, Sept. 9, 1998, Bressner Pasture Field Day, Yates Center, KS (Jeff Davidson and Gary Kilgore)
    - Sericea lespedeza tour, Sept. 24, 1998, Hamilton, KS (area ranchers, KSU, Greenwood Co. Cattlemen's Assoc., Kansas Livestock Assoc.)
    - Using goats to control sericea lespedeza, Sept. 30, 1998, Reading, KS (Emporia St. Univ., KSU, Kansas Dept. Wildlife & Parks, Langston Univ., Dan Rogers)
    - Sericea lespedeza control, October 7, 1998, Coyville, KS, Kansas Section Society for Range Management (Walt Fick and Jeff Davidson)
    - Understanding sericea lespedeza management, Oct. 28, 1998, Manhattan, KS, K-State Research & Extension annual conference (Walt Fick, Jeff Davidson, and Gary Kilgore)
    - Sericea lespedeza, Nov. 23, 1998, Wichita, KS, Grasslands Committee, Kansas Association Conservation Districts (Walt Fick)

IV. Plans for 1999-2000

- Seed bank study
- Repeat and monitor integrated control studies
- Herbicide absorption/translocation study
- Monitor livestock grazing studies

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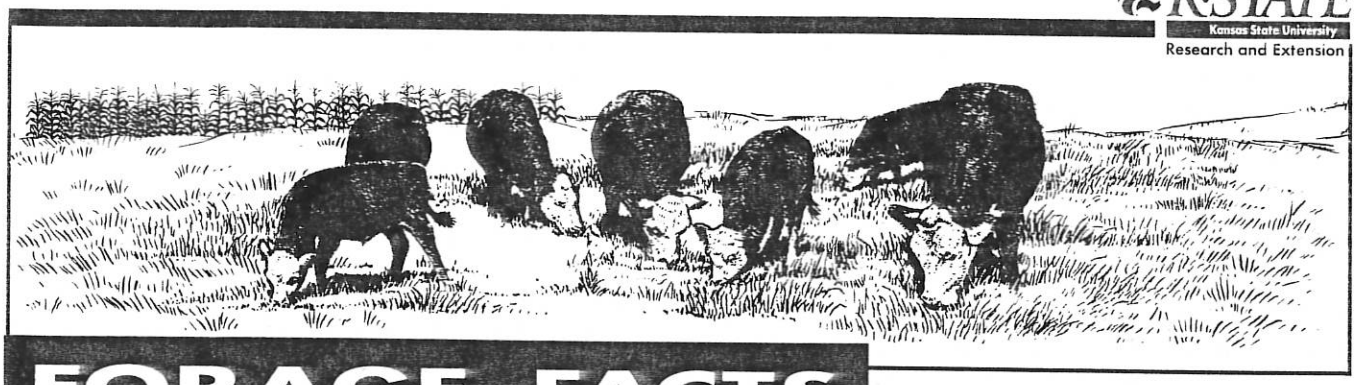

FORAGE FACTS

Publication Series

SERICEA LESPEDEZA

HISTORY

Sericea lespedeza (*Lespedeza cuneata*) is an introduced perennial legume that was first recognized as a potential weed problem in southeast Kansas in the early 1980s. Since that time, sericea has spread profusely throughout southeast Kansas and beyond. Southeast Kansas counties began declaring it a "county option" noxious weed in the late 1980s; and by July 1, 2000, it will be a statewide noxious weed in Kansas. This is the first time that a federally listed crop has been declared noxious.

Sericea lespedeza was introduced into the United States by the USDA in 1900 for erosion control. In the 1930s it was planted on strip-mined areas in southeast Kansas, and in the 1940s and '50s was planted around state and federal reservoirs for wildlife habitat. It is recognized for its tolerance of drought, acidity and shallow soils of low fertility. It will tolerate soils ranging from very acidic to slightly alkaline, but prefers a Ph of 6.0 to 6.5. It does best on clay and loamy soils that are deep, fertile and well drained, but will also grow on poor sites. Sericea uses water less efficiently than many other warm-season plants and does best when annual precipitation is 30 inches or more.

Most recent large-scale introductions of the plant occurred with establishing native grass on Conservation Reserve Program (CRP) acres, a provision of the 1985 Farm Bill. Numerous CRP fields throughout the eastern part of Kansas have been found infested with sericea lespedeza. The native grass seed used in these plantings was contaminated with sericea lespedeza seed—not recognized as a noxious or invasive weed at that time.

FORAGE QUALITY

Sericea lespedeza as a legume is recognized for its high levels of crude protein, but this is offset by high concentrations of chemical compounds called tannins. Tannins bind with proteins, leaving them unavailable for digestion. They also reduce the palatability and digestibility of forages. The level of tannins in sericea appears to increase with maturity of the plant, high air temperatures and low rainfall. The tannins also reduce insect feeding.

WILDLIFE CONSERVATION

Sericea lespedeza has been considered valuable for wildlife benefits, both as food and cover. However, this is not supported by research or practical experience. Deer will not utilize sericea unless it is kept short by mowing or grazing. Quail will consume the seeds in fall and early winter, but the seeds do not contain enough energy to sustain quail through adverse weather conditions. Sericea probably holds its greatest wildlife benefit as a source for cover, but when dormant, cover will be lacking because other plants are excluded by the sericea.

COMPETITIVE CHARACTERISTICS

Sericea lespedeza, once established, will reduce or eliminate competing vegetation. However, it is relatively slow to establish, having a rather weak and vulnerable seedling stage. On the other hand, it is opportunistic, and will establish itself in full sun or partial shade. While it tolerates shading quite well, it doesn't seem to establish in dense shade where direct sunlight does not reach during any part of the day.

Sericea perhaps establishes best where competing vegetation is very short, and light is allowed to reach the germinating seedlings. Many legumes need good exposure to sunlight during the seedling stage, which is the situation of a burned pasture. Fire is also

assumed to scarify sericea seed, enhancing germination. However, the fire may result in more sunlight hitting the seed and seedlings, resulting in better germination. Seedlings will also germinate and survive where ground cover and other plant competition is quite dense but at a much lower population. It has established in fence rows, brushy and grassy areas, where fire and grazing have been excluded for years.

Once established, sericea restricts the amount of light reaching other plants because it is tall with multiple branches and dense foliage. It requires more water to produce foliage than other warm season plants, creating a "drought" for competing vegetation. It also produces allelopathic chemicals that inhibit seed germination and growth of other plants. Some of these chemicals are produced by the roots, while others come from plant residue, chiefly leaves.

Although sericea is a legume, it furnishes very little nitrogen to surrounding plants, and that amount is negated by the effects of the allelopathic toxins it produces. Rather than providing nitrogen for other plants, it actually makes it necessary to add nitrogen to maintain production of introduced forages. The shoots of grass exposed to the toxins of sericea residue have lower nitrogen content, consequently, overcoming the loss of production caused by the toxins requires nitrogen fertilization.

CONTROL

As with any weed problem, early detection and treatment is paramount to gaining control of this weed. Investing the time to control scattered plants and isolated patches must be done. Remedy and Escort are the two chemicals of choice at the present time for controlling sericea lespedeza. Once it becomes established over a wide area, an integrated approach to control will be necessary. Conventional management practices such as prescribed grazing and fire have been less than effective in preventing the spread of sericea in rangelands.

Chemical control includes Escort or Ally at .5 ounces per acre applied after bud stage until early October. Remedy is also effective at 1.5 pint per acre applied to actively growing plants in the vegetative stage (June) or in flower (late July to August). If applying from the ground, use a minimum of 20 gallons spray per acre. If sericea plants are not growing or flowering because of heat or drought conditions, herbicide effectiveness is greatly reduced. When Escort or Ally is applied in mid-September or later, seedling control has been observed the following spring because of herbicide carryover in the soil. Earlier applications do not result in this condition.

Some suppression of sericea has been observed after mowing or burning followed by intensive early stocking with stocker cattle. Livestock will consume the seeds and deposit them elsewhere in manure, so it is advisable to not graze sericea-infested range in fall and winter when the plants have produced seeds. Intensive early stocking provides this option. Goats will provide some control as they do eat sericea much more readily than cattle. However, any grazing control program must be closely monitored and continued once begun. Grazing will increase the number of tillers of each individual plant. This means that if grazing is ceased, then a larger, more robust, multi-tillered plant is left than if it had never been grazed, and will result in increased seed production. Current research with goats indicated that they will eat sericea and reduce seed production, but have not reduced plant population.

Mowing will reduce the vigor of sericea plants if it is cut closely multiple times each year. Plants should be mowed each time they reach a height of 12 to 18 inches. The most damaging time to cut sericea is late in the growing season when the plants are trying to build root reserves. However, mowing will not kill sericea, and may damage desirable grasses.

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Kansas State University Agricultural Experiment Station and Cooperative Extension Service

Biology and Control of Sericea Lespedeza in Kansas

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Justification

Sericea lespedeza [*Lespedeza cuneata* (Dumont) G. Don] is an introduced, herbaceous, perennial legume. The species is commonly used in the southeastern U.S. for erosion control, wildlife habitat, hay, and grazing. It was first introduced into Kansas during the 1930's. It occurs primarily in the eastern one-third of the state but has been reported in southcentral and southwestern Kansas. Sericea lespedeza is increasing on rangelands in eastern Kansas and is also present along roadsides and in Conservation Reserve Program plantings. The Kansas State Board of Agriculture estimates that nearly 250,000 acres of land are infested with sericea lespedeza in Kansas causing a reduced grazing value of $1.3 million.

Previous Work

The State Legislature of Kansas declared sericea lespedeza as a county-option noxious weed in 1988. Since that time considerable research has been conducted to determine possible control measures. Fick (1990) screened a number of herbicides for control of sericea lespedeza and found that treatments containing greater than 0.5 lbs/acre triclopyr or 0.5 oz/acre metsulfuron provided greater than 80% control. Sericea lespedeza was equally controlled whether treated during the vegetative stage in June or during flowering in August. Picloram, dicamba, clopyralid, chlorsulfuron, and 2,4-D were less effective (< 50% control). In Oklahoma, Altom et al. (1992) found that triclopyr and fluroxypr controlled sericea lespedeza treated during the vegetative stage. Control with picloram and metsulfuron was variable. Dudley and Fick (1996) investigated the use of burning, mowing, and herbicides used alone and in combination for the control of sericea lespedeza. A single late-spring burn or one defoliation with mowing had minimal impact on sericea lespedeza. Mowing in early June followed by triclopyr application 7 weeks later provided 72% density reduction. Reducing the interval of herbicide application to 4 weeks after mowing showed even greater promise (95% defoliation at the end of the first growing season). These researchers are also studying the effects of sericea lespedeza control on forage production and species composition.

Coarse stems and high tannin content in the leaves contribute to the low quality of sericea lespedeza (Donnelly, 1954) and make it unpalatable compared to the native species with which it competes on rangeland. Sheep and goats will apparently consume sericea lespedeza more readily than will cattle.

Observations and reports from landowners have indicated that a herbicide treatment may need to be repeated after 2-3 years to maintain acceptable control of sericea lespedeza. Most of the reinfestation appears to come from seed but some of the initially treated plants survive. More research is needed to understand the biology of sericea lespedeza in order to develop sound management strategies to enhance the control of this species.

Research Objectives

a. Basic Research

- investigate factors influencing the translocation of a ^{14}C-labeled herbicide to the bud zone
- determine the size of the sericea lespedeza seedbank in the soil, level of seed dormancy, and germination percentage

b. Applied Research

- determine the appropriate spray volume to use to achieve optimum control
- determine the efficacy of longer residual herbicides such as tebuthiuron for control of sericea lespedeza
- compare repeated annual mowing with recommended herbicides and mowing + herbicides for sericea lespedeza control
- investigate ways of increasing grazing use of sericea lespedeza, e.g. enhancing palatability, grazing systems, kind and class of animal

c. Extension

- publication of a color brochure detailing identification and control of sericea lespedeza
- demonstration plots showing proper timing and application of herbicides for sericea lespedeza control
- conduct field days and workshops to view and discuss management options regarding sericea lespedeza

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Sericea Lespedeza