

MINUTES OF THE HOUSE COMMITTEE ON AGRICULTURE.

The meeting was called to order by Chairperson Joann Flower at 9:00 a.m. on January 21, 1997, in Room 423-S of the Capitol.

All members were present except: Representative Phelps - excused  
Representative Henry - excused

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

Conferees appearing before the committee:

Marc Johnson, Dean, Agricultural Experiment Station and Cooperative Extension Service, Kansas State University  
Sally Nellor, Dairy Farmer, Gardner, Kansas  
Marlyn Spare, Water PACK, St. John, Kansas  
Allie Devine, Secretary, Kansas Department of Agriculture

Others attending: See attached list

Marc Johnson, Dean, Agricultural Experiment Station and Cooperative Extension Service, Kansas State University, reported on environmental quality research endeavors at Kansas State University. (Attachment 1) He explained that Kansas State University Agricultural Experiment Station and Cooperative Extension Service are research and education partners with agriculture and agri-business to develop and test methods to produce and process products of agriculture in environmentally responsible ways. Dean Johnson reported that this year K-State Research and Extension established the Kansas Center for Agricultural Resources and the Environment (KCARE) to put additional focus in the area of environmental science and education. The center covers the activities of seventy scientists and educators all focused on some aspect of natural resource conservation and environmental protection. He said that during the past year and a half, K-State Research and Extension has worked closely with the Governor's Water Quality Initiative team to provide technical information and education strategies to attack nonpoint source pollution in northeast Kansas. Dean Johnson introduced other conferees to discuss how K-State Research and Extension has helped them with environmental issues.

Sally Nellor, who with her husband, Dick, operates a 3000-acre grain farm and 250-head (currently milking 120 head) dairy operation south of Gardner in Johnson County, discussed how Kansas State University Agricultural Experiment Station and Cooperative Extension Service helped them plan a waste management system for their dairy operation. Their waste management system has been in place for about a year and a half now and has been used as a demonstration project. She indicated that there will be no actual financial payback with the system which cost approximately \$100,000, the payback is to the environment.

Marlyn Spare, a central Kansas farmer from St. John in Stafford County, reported on the Water Protection Association of Central Kansas (Water PACK), an organization of about 500 agricultural producers and businesses formed in 1990 to promote, foster, and encourage the beneficial, economical, and sustainable use of quality water. He explained that Water PACK is a pro-active voice for irrigated agriculture and takes an active role in water issues and works with other groups and government agencies to develop water policy. He discussed the South Central Kansas Irrigation Scheduling and Water Management Demonstration Project, a five-year cooperative effort between Kansas State University Agricultural Experiment Station and Cooperative Extension Service and Water PACK. (Attachment 2)

Allie Devine, Secretary, Kansas Department of Agriculture, discussed the cooperative efforts of Kansas State University Agricultural Experiment Station and Cooperative Extension Service and the Kansas Department of Agriculture. She said that while K-State Research and Extension's role is research and education, the Kansas Department of Agriculture's role is regulatory. She discussed their joint efforts with the Governor's Water

CONTINUATION SHEET

MINUTES OF THE HOUSE COMMITTEE ON AGRICULTURE, Room 423-S Statehouse, at 9:00 a.m. on January 21, 1997.

Quality Initiative. Secretary Devine reported that there are impending regulatory aspects coming from EPA that will have a significant impact on agriculture in Kansas. She explained that the Kansas Department of Agriculture is the cooperative arm of EPA in the area of pesticides. EPA has the responsibility for setting water quality standards and has called upon all the states to prepare a ground water management plan. She said that K-State Research and Extension has been asked to develop best management practices and is currently gathering Kansas specific data to show how best management practices are applied, that they are economically feasible for the producer, and that they are effective in protecting the environment.

Representative Correll moved to approve the minutes of January 14 and January 15 as presented. Seconded by Representative Freeborn, the motion passed.

The meeting adjourned at 10:00 a.m. The next meeting is scheduled for January 22, 1997.

# HOUSE AGRICULTURE COMMITTEE GUEST LIST

DATE: June 21, 1997

NAME	REPRESENTING
Marc Johnson	KSV
Steven Graham	KSV
Jamie Clover Adams	Governor's Office
Edward Rome	League of Women Voters/KS
Ivan Wilgatt	Ks Farmers Union
Zach A. Jackson	Intern Rep. Steve Lloyd
Dale Lambly	Ks. Dept of Ag.
Tim Stroda	KS Pork Producers Council
George Teagarden	Ks Animal Health Dept
Doug Wardham	Ks. Fert & Chem Assn
Charles Benjamin	KNRC/KS Sierra Club
Kerri Elbert	KS Dairy Association
Rich McKee	KLA
SUE PETERSON	K-STATE
John M. Jackson	Water Protection Assoc of Central Kansas
MARLYN SPURGE	KSU & WATER Protection Association of Central Kansas
JOHN FEDERICO	PETE MCGILL + ASSOC
Tom Bruno	Allen + Assoc.



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January 1997

**Extension  
Systems and  
Agricultural  
Research  
Programs**

*Cooperative  
Extension  
Service*

*Agricultural  
Experiment  
Station*

*International  
Programs*

**College of  
Agriculture**

*Academic  
Programs*

Dear Friends,

Agriculture has played and continues to play a vital role in Kansas' environmental quality. Agricultural producers have invested heavily in terraces, grass-covered waterways, chemical handling facilities, waste lagoons, and many other facilities to control soil sediment and chemical and waste runoff. The Kansas State University Agricultural Experiment Station and Cooperative Extension Service have been research and education partners with agriculture and agribusiness to develop and test methods to produce and process products of agriculture in environmentally responsible ways.

During the past year and a half, K-State Research and Extension has worked closely with the Governor's Water Quality Initiative team to provide technical information and educational strategies to attack nonpoint source pollution in northeast Kansas. K-State Research and Extension also has developed the Kansas Center for Agricultural Resources and the Environment (KCARE) to bring greater focus to environmental science and education.

I'm pleased to share this report of selected projects at Kansas State University that address important environmental quality issues.

Should there be questions or suggestions, I'd be pleased respond.

Sincerely,

Marc A. Johnson  
Dean and Director

*House Agriculture Committee  
January 21, 1997  
Attachment 1*



# **PROMOTING CONSERVATION AND PROTECTING THE ENVIRONMENT**

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**S E L E C T E D   E X A M P L E S**

**AN INFORMAL REPORT TO THE KANSAS LEGISLATURE**

*by the*

**KANSAS STATE UNIVERSITY  
Agricultural Experiment Station  
*and* Cooperative Extension Service**

**January 1997**

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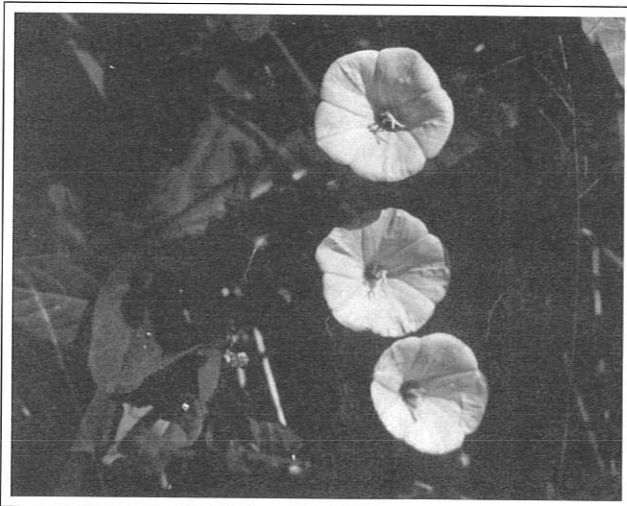
# PROMOTING CONSERVATION AND PROTECTING THE ENVIRONMENT

S E L E C T E D E X A M P L E S

## CONTROLLING INSECTS

### The Biological Control of Field Bindweed

Field bindweed is a perennial weed that is capable of reducing crop yields by 20 percent to 80 percent. It is the most difficult perennial weed in Kansas to control and is a significant weed problem throughout the Great Plains. Field bindweed has a vining nature and is capable of reproducing from seed or from its extensive root system. It commonly occurs in roadside areas, pastures, and cropped fields where it is especially troublesome. Part of the reason why it is difficult to control is because its seeds remain dormant in the soil for up to 50 years. Secondly, the extensive root system fully infests the soil profile. Traditional control practices, including tillage and herbicides, are costly and must be repeated yearly. For these reasons, the development of new management strategies are essential and must be cost effective, self-sustaining, and provide long-term control. Biological control may offer an acceptable alternative or supplement to traditional management strategies for this weed—an approach that is sustainable, environmentally and agronomically compatible, and of benefit to farmers and others concerned with weed management.



For the past two years, KSU researchers in agronomy and entomology have been studying a moth and a gall mite from Europe that are specific feeders on field bindweed. The long-term goal is to establish these organisms as self-perpetuating components of the agroecosystem, expecting that their impact on field bindweed will reduce the weed's competitive ability. The primary focus of current research has been on the bindweed moth. Thus far, findings indicate

that the moth is capable of successfully overwintering in Kansas and that it feeds equally well on a number of field bindweed biotypes. Greenhouse studies are in progress to assess the impact of the caterpillars of this moth on bindweed growth and productivity. Studies on the gall mite have focused only on assessing its overwintering potential.

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### Identifying Sorghum Hybrids Resistant to Chinch Bugs

Progress is being made in identifying commercial sorghum hybrids that are less susceptible to chinch bug infestation. Chinch bugs are a common problem during dry years, especially for sorghum growers in the eastern areas of Kansas. To protect against infestation, growers currently use soil-applied insecticides. By identifying sorghums that are less susceptible to chinch bug attack, growers may be able to reduce the amount of insecticide treatment that is currently used. In addition, the use of seed treatment insecticides—only the seed but not the soil is treated—offers an additional means to decrease the amount of environmental contamination.

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### **Developing Greenbug Resistant Sorghum**

K-State has been involved in a long-term effort to identify and develop germplasm that is resistant to sorghum greenbug. Since the early 1970s, a number of inbreeds has been identified and released to commercial breeders. Currently, almost half of the commercial hybrids grown in Kansas contain biotype E resistance developed by KSU and other regional universities. The search for new and better sources of greenbug resistance continues. By utilizing greenbug resistant hybrids, growers have been able to reduce the amount of foliar insecticides applied (reduction of about 100,000 acres per year in Kansas) and thereby reduce the amount of environmental contamination.

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### **Important New Test Developed**

A K-State entomologist has developed a single, inexpensive, and quick test that can be used to detect whether greenbugs are resistant to the organophosphate insecticides used to control greenbugs on wheat and sorghum. The technique involves placing greenbugs in a plastic dish treated with an insecticide at a concentration that discriminates between resistant and susceptible greenbugs. After two hours, resistant greenbugs are alive while susceptible greenbugs are dead. This method will allow growers, aerial applicators, consultants, and researchers to monitor greenbug populations and their resistance to insecticides.

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### **Seeking Ways to Control Pests without Chemicals**

Long-term research is being done on nonchemical control of insect pests. One focus has been on mechanisms for disrupting the protective coverings of the exoskeleton and skin of the insect. Another has been on the membranous lining that insects secrete to protect the alimentary canal from ingested food particles. Insects must form a new exoskeleton at each stage of growth and molt the old one in order to grow and develop to adults. Interference with the formation of this outer protective covering during the molting cycle can terminate development of crop pests and also prevent reproduction in the adult stages. Likewise, disruption of the continuously formed protective envelope that surrounds ingested food causes cessation of feeding by crop pests and eventually death. KSU research has led to discoveries of the chemical processes that insects use to form the rigid exoskeleton. Selective pest control through disruption of exoskeletal formation at critical stages is the goal. A second approach is to disrupt the peritrophic membrane envelope lining of the alimentary canal of insects. Electron microscope studies have revealed that wheat germ agglutinin interferes with the formation of peritrophic membrane and allows food particles to damage the delicate cells lining the larval midgut. Further studies have indicated that wheat germ agglutinin selectively binds to certain proteins and chitin in the peritrophic membrane and disrupts its formation. The goal of this research is to exploit the use of plant lectins or their derivatives for selective control of insect pests. Transgenic crop plants producing these larvicidal proteins in their tissues would reduce the use of toxic chemical treatments and environmental damage.

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### **Finding an Alternative to a Banned Granular Pesticide**

Insecticide tests by K-State researchers on sorghum showed that Gaucho, a seed treatment insecticide, is effective in controlling chinch bugs and greenbugs on sorghum. The treatment could be used to replace the banned granular pesticide Furadan, which had been used to control chinch bugs.

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### Reducing Pesticide Residues in Stored Wheat

For years, Cooperative Extension Service personnel have stressed a chemical-based management system for preserving the quality of farm-stored wheat. However, research performed by Kansas Ag Experiment Station scientists has documented that it is highly effective to use aeration as the basis of an integrated pest management (IPM) strategy for controlling insects in farm-stored wheat. Public concern about the presence of pesticide residues in the food supply and a commitment by the U.S. government for 75 percent adoption of IPM by the year 2000 heightens the need for Kansas farmers to adopt this technology.

K-State Extension personnel and cooperating farmers demonstrated how the use of aeration controllers facilitated grain cooling and reduced insect pests in farm-stored wheat at 16 locations across Kansas. The IPM strategy was approximately 40 percent less expensive compared to traditional storage pest management practices. Personnel from commercial grain elevators, Kansas Farm Service Agency, Kansas Wheat Commission, and the American White Wheat Producers Association were involved in the project and are assisting producers in their decision to adopt this technology.

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### Genetic Engineering of Cereal Grains for Enhanced Resistance

Chitinases are induced in plants as defense mechanisms in response to pathogen infection. Using genetic engineering, scientists can develop crop plants that can produce chitinases and other defense proteins prior to infection. Such efforts are attempts to enhance the plants' resistance to fungal infection and attack by insects. At K-State, transgenic rice, tobacco, wheat, and sorghum plants have been developed that express a plant or insect chitinase gene

constitutively. Testing against fungi or insects has demonstrated that, in some cases, the transgenic plants are able to withstand fungal infection or insect attack much better than control plants. This strategy of enhancing host defense is far more preferable than the use of insecticides or fungicides—both from an economic and an environmental point of view.

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### Naturally Controlling Squash Bugs

The squash bug is a major pest nationwide of squash and pumpkins. Pesticides are the only controls currently available, and they only marginally control this major pest. In addition, they may be harmful to the environment. A K-State entomologist is studying a parasitic wasp called Gyron that is a natural enemy of the squash bug. It attacks the eggs of the squash bug and could be an excellent biocontrol.

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### A New Way to Get Rid of Fleas

U.S. consumers spend about \$1.1 billion each year in attempts to control fleas on their dogs and cats. A new trap for collecting fleas in homes has been developed by KSU entomologists and patented by Kansas State University. This trap is more effective than other existing traps in removing newly emerged fleas that have developed in homes (or other premises) infested with fleas. Its operation is based on the behavior of newly emerged fleas seeking a host. Fleas poised to jump on a passing host orient toward a light source or a window, and when this light source is interrupted by a host passing in front of the light the flea jumps toward the suddenly created shadow. The main feature of the trap is a green light with an on/off cycle. The short cycle simulates the shadow of a passing potential host. Fleas jump when the light goes off and are then trapped on an adhesive board placed in front of the light source. The patent for this trap has been licensed to S.C. Johnson and Son, Inc. The commercial version will provide pest control companies with a better tool to determine the extent of flea infestation in homes. Its use can lead to reduced use of insecticides in homes.

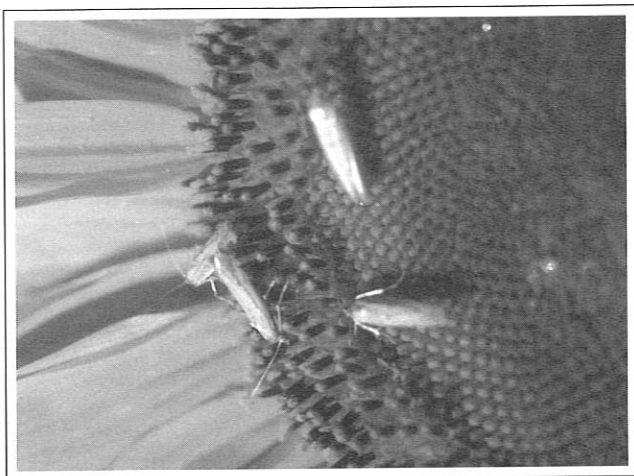
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## Decreasing Chemical Control of Sunflower Head Moth

Research by Kansas Ag Experiment Station entomologists has shown that pheromone traps can be used to monitor populations of sunflower head moth. The traps are in expensive and help growers know when chemical control of the sunflower head moth is needed. The result is that growers can protect sunflower yield potential when needed and yet not waste their money on unnecessary chemical control. A Kansas farmer who has 200 acres of sunflowers can save up to \$15 an acre or a total of \$3,000 if he or she doesn't need to treat.

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## Extension Entomology Diagnostic Lab

The Extension Entomology Diagnostic Laboratory provides county extension personnel and the general public with quick, accurate identification of insects found in homes, yards, on people and animals, and in agriculture. In addition to identification, the laboratory provides information on biology of the insect, its status as a pest or nonpest, and control measures. Most insect questions are not of economic importance and are handled without use of insecticides. Alternative control tactics are often suggested for insects that are considered harmful, decreasing chemical use as much as possible. The laboratory diagnoses about 600 samples annually submitted by county agents, companies, and the general public. In addition, a number of insect questions are handled over the telephone and by direct contact with individuals who come to the laboratory. Over 40 percent of the samples submitted come from horticultural settings, followed by households (40 percent), agriculture (15 percent), and animal/medical (2 percent). Response to a submittal occurs within three days after receiving it. Educational information on insects is provided by

the Diagnostic Laboratory through Cooperative Extension Service publications and reports.

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## Eliminating Termites with Fewer Chemicals

New technology is emerging in the marketplace for the control of termites. Termite-baiting technology has been the subject of research by private industries such as DowElanco, FMC, and American Cyanamid in recent years. The first commercialization of this technology in Kansas was in 1995 on a very limited basis by DowElanco. Extension representatives are evaluating this technology as it evolves in the marketplace.

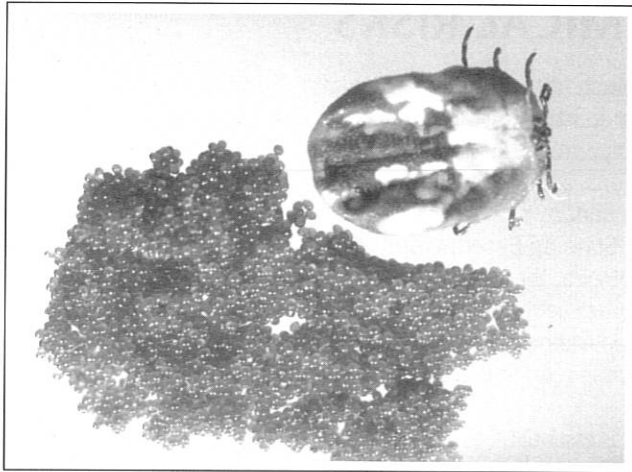
Other termite baiting systems are under development by other companies and will enter the marketplace soon. As they emerge, they will be similarly evaluated. Through this process, Extension can continue its role of providing unbiased information by comparing competing technology, products, and services, regardless of who developed them.

Termite-baiting technology utilizing an insect growth regulator 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.

Specially designed bait stations in DowElanco's Sentricon system are installed at a maximum of 20 feet apart in the soil around the house. The stations are monitored by a pest control technician on a regularly scheduled basis. When termites are found in the bait stations, the monitoring device is replaced by a tube containing an insect growth regulating (IGR) chemical that is spread by the feeding termites throughout the colony. When termites are no longer found in the tubes for a period of two months, the colony is considered to be eliminated. The total number of IGR-containing tubes used will vary with colony size and other factors but normally ranges from 1 to 10. Each tube contains 0.0012 ounce of IGR. Furthermore, the IGR is not applied to the soil, which virtually eliminates any chance for soil, water, or structural contamination.

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### **Informing the Public About Potentially Dangerous Insects**

Prior to 1989, when Extension agents were inundated by questions about ticks and Lyme disease, there was no Kansas Extension program in medical entomology. A bootstrap program was launched through which thousands of clients received information on ticks and tick-borne disease. As a spin-off from this program, a research collection of 1,150 lots of ticks has been established and continues to grow. Thus, K-State has a research base, representing Kansas species, from which to draw further knowledge. Utilizing public educational meetings, news releases, printed material, and the entire Extension organization, this program has become a primary source of information for Kansas doctors, pest control operators, county and school nurses, regional installations of the U.S. Army, the Kansas Department of Health and Environment, and the general public.

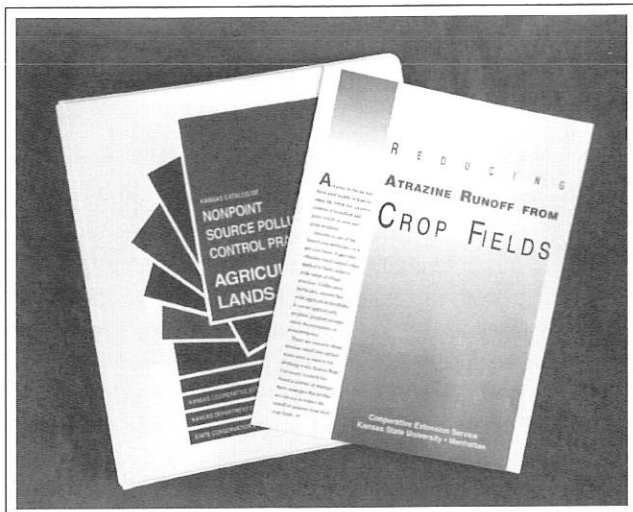
A user-friendly identification key to Kansas ticks was written and made available to county agents and personnel of other agencies and businesses. This has facilitated more rapid and accessible identification of ticks—an essential step in determining individual risk of disease. Public consciousness has been raised, and the nature of questions received reveals a generally greater level of public knowledge.

Ten years ago people thought Kansas was free of Lyme disease, but now 20 to 40 cases per year are diagnosed and treated for this potentially debilitating disease. During the same time period, the incidence of two sometimes deadly tick-borne diseases, Rocky Mountain spotted fever and tularemia, has declined from 35 to 40 cases per year in Kansas to only 5 to 10. This reduction may be at least partially the result of Kansas State University's multifaceted educational program.

Through serving other types of requests from these clientele, a broader program in medical entomology has evolved. Now the program addresses all biting and stinging arthropods, disease vectors, and dermatological and respiratory manifestations of allergy to insects.

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## REDUCING CHEMICAL RISKS



### Kansas Catalog of Nonpoint Source Pollution Control Practices

K-State Extension provided the leadership, in cooperation with the Kansas Department of Health and Environment and the State Conservation Commission, in compiling a catalog on the principles of nonpoint source pollution. It also lists 31 pollution control practices for agriculture. Each practice is evaluated for its effectiveness in reducing pollutants and for its cost to install and maintain. The catalog is intended to be used by county extension agents, county nonpoint source pollution coordinators, conservation districts, natural resource conservation service personnel, and other professionals. The information in the catalog will be used to help farmers and ranchers develop better environmental and economic management strategies.

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### New Publication Focuses on Reducing Atrazine Runoff

A colorful new KSU Agriculture publication will help producers reduce atrazine levels in Kansas surface water supplies. The eight-page publication, titled "Reducing Atrazine Runoff from Crop Fields," lists 10 specific best management practices (BMPs) that farmers and chemical applicators can use to reduce the potential for atrazine runoff from crop fields. There are one or more practices to fit every tillage practice or field situation. These practices involve little extra expense and result in better weed control than the traditional use of atrazine that is surface applied at planting time.

Much of the information on atrazine BMPs was generated by K-State research funded by the Kansas Agricultural Experiment Station, the Kansas Corn and Sorghum commissions, and agribusinesses. Field research on atrazine runoff is underway at several northeastern Kansas sites, including K-State Ag Experiment Station fields at Powhattan and Ottawa, the Foster Farm near Rossville, and elsewhere. Other field research focuses on atrazine formulations and application timings to maintain weed control objectives while reducing field runoff potential.

It is essential that these research results are communicated to farmers and chemical applicators. Adoption of these practices should reduce atrazine runoff. This will help maintain good water quality and could help keep the product commercially available. Atrazine remains an immensely effective and economical herbicide for broadleaf weed control and grass suppression in Kansas corn and sorghum fields. It is applied to over 75 percent of Kansas corn and sorghum acreage. As new herbicides are developed for these crops, most are used in combination with atrazine.

Some of the atrazine applied to fields is inevitably lost in surface water runoff. But by using the BMPs explained in this new K-State publication, runoff losses can be reduced.

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### Reducing Chemical Use in Farming Through Biotechnology

Rice and tobacco plants have been genetically engineered at K-State to express a plant or insect chitinase gene. The expression of this gene alone or in combination with other defense proteins confers upon the host plant greater resistance to fungal and insect pests, which could result in reduced use of chemicals used in growing these plants. Similar work is now being done in the genetically more complicated wheat and sorghum.

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## Reducing the Use of Nitrogen Fertilizer

Many of the soils in Kansas have relatively high levels of soil organic matter, which can be a valuable source of nitrogen for plants. Accurate determination of these organic sources of nitrogen can reduce nitrogen fertilizer needed for crop growth. Reducing the amount of nitrogen fertilizer lowers production costs and also reduces nitrogen contamination of surface water and groundwater. Nitrogen released from the soil represents 20 percent of applied fertilizer. Nitrogen released from manure, soybeans, and soil is being studied in several experiments. For example, it is estimated that in one year approximately 20 pounds of nitrogen per acre were available to corn and grain sorghum following soybean under dryland conditions. Previous research estimated a contribution of 30 pounds of nitrogen per acre under irrigated conditions. Another finding was that manure applications can maintain the nitrogen supply capability of the soil, thus reducing the need for nitrogen fertilizer. Tillage and crop rotation also can affect the timing of nitrogen released. The economic benefit to Kansas farmers is difficult to determine, but if nitrogen fertilizer use could be reduced by approximately 22 pounds per acre on 2 million acres of the state's corn and grain sorghum acreage, then economic savings of \$8.9 million would be realized (assuming nitrogen cost at 20 cents a pound). Additional savings could be realized through reduced contamination of groundwater resources.

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## Making Cakes without a Dangerous Chemical

Flours used to make the most common cakes in the United States are bleached with chlorine gas. This bleaching not only whitens the flour and the cakes made from the flour but also alters the cake-baking properties of the flour.

Flours that have been treated with chlorine can be used with formulas containing much higher levels of sugar. This is considered a more desirable cake in the United States. The use of chlorine gas, a highly poisonous and corrosive chemical, is considered to be an environmental and safety hazard. The use of chlorine also has been questioned from a food safety perspective; however, to date, no actual problems have been documented. Research in the K-State Grain Science and Industry Department has shown that, by heating the flour and slightly modifying the cake formula, cakes of equal or better quality can be made compared to those made from flours treated with chlorine.

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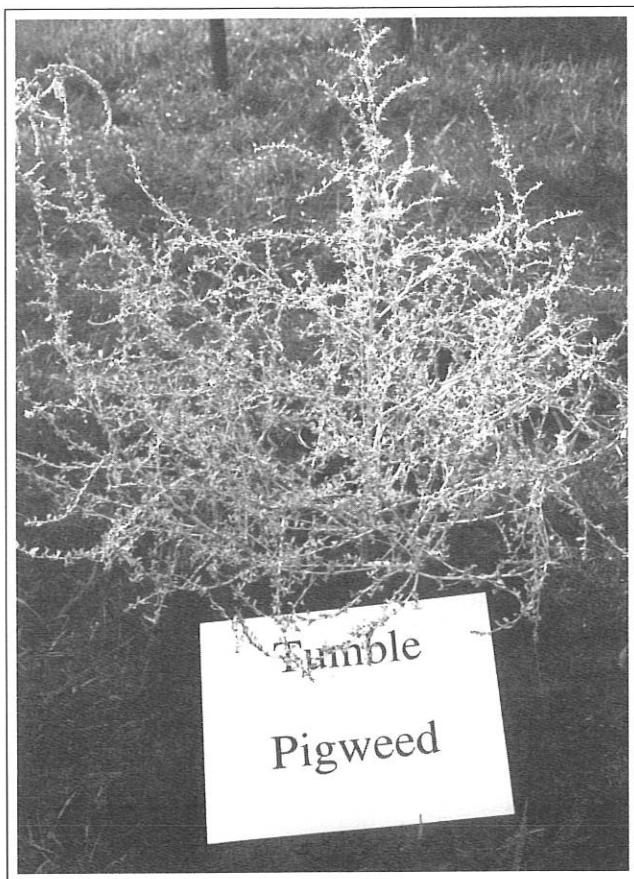


## Kansas Farmers at Greater Risk of Cancer

A Kansas Ag Experiment Station researcher found that Kansas farmers experienced an inflated risk of cancer morbidity from 1980 to 1990. Farmers were found to be at an increased risk of morbidity for non-Hodgkins lymphoma; Hodgkin's disease; multiple myeloma; leukemia; and cancers of the lip, bone and connective tissue, prostate, brain, and skin. The cost of excessive cancer morbidity to the Kansas economy is currently unknown.

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# WEED CONTROL



## A Machine That Can Identify Weeds

It can be difficult for equipment operators to locate weeds and control a sprayer at the same time when applying herbicides. A researcher at K-State is investigating a machine that can identify weeds common to Kansas wheat fields. The vision device would be able to distinguish between weeds, crops, and soils. This new equipment would allow selective application of herbicides, help farmers save on expenses, and protect the environment.

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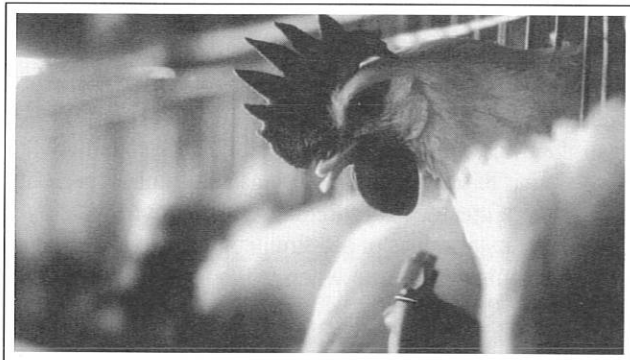
## Biological Control of Annual Grass Weeds

Because of the widespread adoption of conservation tillage systems and a shift to semidwarf wheats, there has been a dramatic increase and spread of winter annual grass weeds that compete with wheat. At the same time, an increased awareness exists of environmental and health risks from intensive use of herbicides and increased soil erosion from tillage methods used for weed control. Scientists at K-State are evaluating native bacteria from soils and roots of plants to see if they can effectively control weeds in winter wheat. In one study, the researchers found that several isolates of bacteria reduced downy brome and Japanese brome by more than 50 percent.

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# LIVESTOCK



## Chicken By-Products

An estimated 282 million to 284 million laying hens were at some stage of egg production in 1994. Under normal practices the retired hens (or spent fowl) are processed for meat, and the remaining carcasses are rendered into value-added by-products. However, processing costs of laying fowl have increased while yield and quality have decreased due to continued selection for reduced body weight of the hens to produce a more efficient layer. The lack of demand for spent fowl has depressed prices and increased the need for finding alternative methods of disposal or rendering into value-added products. Methods to dispose of spent fowl and farm mortalities include burying, incineration, composting, or rendering, raising concerns about water and air quality, costs, and intensive management requirements. A new method for continuous flow roasting and drying of high-moisture products has been developed at K-State. Whole, ground, spent hens can be processed and dried to 6 percent moisture at low cost. An inexpensive method for rendering whole fowl into a digestible meal would increase the utilization of spent fowl. Rendering spent fowl and mortalities into a value-added by-product for the feed industry would be a preferred alternative to composting, burial, or incineration. The effectiveness of this method for producing a pathogen-free protein meal for use as a feed component is being investigated.

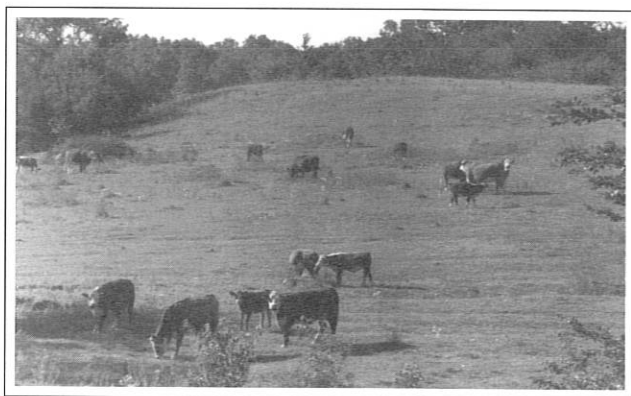
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## Improved Livestock Waste Handling Systems

The Herington Reservoir was polluted with livestock waste runoff several years ago, but now the quality of water is greatly improved because of the cooperative work of several livestock producers in the area, Kansas State University researchers and Extension specialists, and many other government support agencies. The Herington Reservoir serves as the source of drinking water for the communities

of Herington and Hope. Extension specialists worked directly with 11 livestock feeding operations in the watershed, helping the producers design new, effective animal waste facilities to meet Kansas Department of Health and Environment (KDHE) approval. The Extension team set up demonstration projects and held field days for area producers. The team also developed long-range plans for each operation, taking costs and profits into account. The changes made in the livestock operations were expensive and took several years to complete. But the results have been positive. Levels of nearly all pollutants in the reservoir from livestock wastes are now below the safe drinking target level set by KDHE. Because of the design and location improvements made in the feeding operations, producers were able to greatly expand their cattle numbers while still reducing livestock waste pollution.

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## Water Quality Publication Focuses on Grazing Lands

Livestock grazing has the potential to produce waste materials that can pollute water, but pollution from grazing lands can be controlled by proper management. Pollution control and water quality is the subject of a publication, "Managing Kansas Grazing Lands for Water Quality," by the Kansas Cooperative Extension Service and the Kansas Department of Health and Environment. The 16-page publication outlines the most important management principles that can be used to address potential pollution. It then focuses on some specific practices producers can use to improve their grazing lands.

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## CROPPING PRACTICES



### Grain Sorghum Production without Atrazine

Research is being done at KSU Agricultural Research Center—Hays to find alternatives for atrazine. Dryland plots in west-central Kansas treated with a tank mix of halosulfuron plus bromoxynil, about five weeks after sorghum emergence, produced yields equivalent to plots treated before sorghum emergence with metalachlor plus atrazine. Plots where weeds were not controlled produced 1,600 pounds of grain per acre. Halosulfuron plus bromoxynil-treated plots yielded 2,000 pounds of grain per acre even during the driest June-to-September period on record. Under current economic conditions, expected additional net income from timely weed control would be \$9 per acre.

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### Importance of Crop Rotations

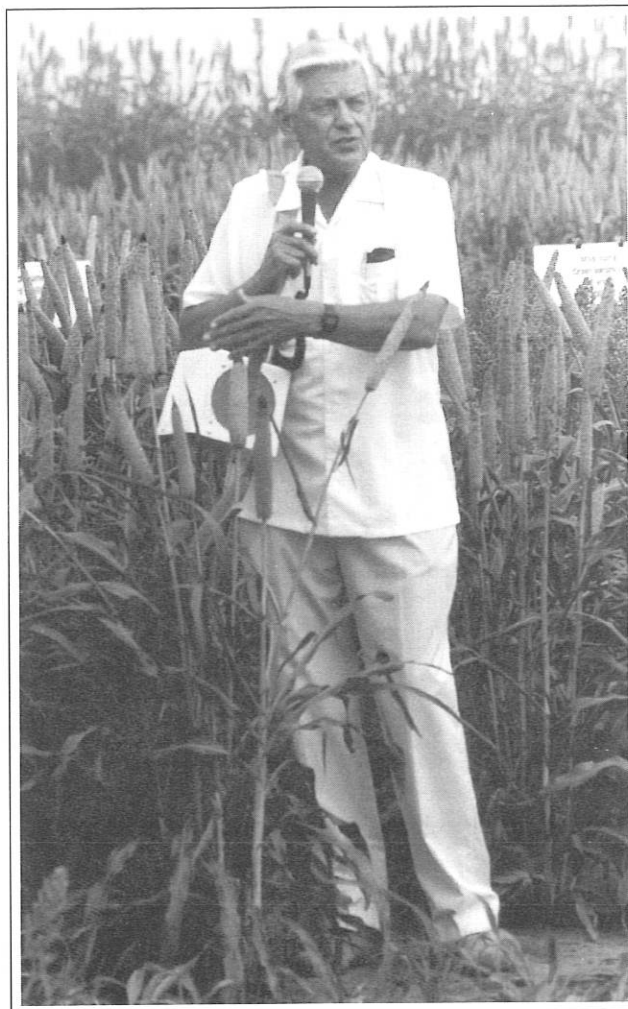
Even in adverse seasons, wheat grown in a wheat-sorghum-fallow cropping system produced nearly 34 bushels per acre or 72 percent more than continuous wheat at the KSU Ag Research Center—Hays. If 1995 continuous wheat acres within a 75 mile radius of Hays had been grown under the wheat-sorghum-fallow, a yield increase of almost 10 bushels per acre would have been expected. Estimated additional economic impact is \$32 million, which is derived by projecting this yield increase at \$4 per bushel across 800,000 acres. This clearly demonstrates the importance of choosing an optimum cropping rotation in the drier regions of Kansas.

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### An Alternate Crop for Low-Rainfall Areas in Kansas

The development of pearl millet as an alternative grain crop continues to show promise for production in low-rainfall areas of Kansas. Superior experimental hybrids produce yields similar to sorghum on silt loams and from 10 percent to 50 percent greater than sorghum when grown on sandy soils. Nutritional values of pearl millet grain are comparable to corn for human food and when fed to several classes of livestock and poultry.

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## Adapting Sunflower to Kansas

You wouldn't think that the Kansas flower would need any help, but it does when being grown as a cash crop.

Research at the KSU Northwest Research-Extension Center in Colby is showing that oilseed and confectionery yields, seed quality, and crop residue for controlling wind erosion can be improved substantially by proper selection of planting date, row spacing, and plant population.

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## SOIL CONSERVATION



### Research on Soil Quality

Soil samples from several KSU experiment fields, centers, and farmers' fields are being collected and analyzed for organic matter, water-holding capacity, infiltration rate, and water-stable aggregates (contributors to soil structure or tilth) to determine which farming practices contribute most to soil quality improvement in Kansas. Farming practices that improve soil quality include cover crops; using manures

and composts; crop rotations that include hay-type legumes (alfalfa and clovers); reduced tillage; and planting perennial grasses. If soil quality degrades, soil erodes more quickly, holds less water, and can compact and restrict root growth, which makes plants more susceptible to other stress factors.

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### Helping Return CRP Land to Crop Production

A KSU research and Extension project involves determining the best management practices for returning Conservation Reserve Program land to crop production while also maintaining good soil conservation practices. The Conservation Reserve Program has been a very successful program at reducing soil erosion from wind and water. It has benefited the environment, reduced production of surplus commodities, benefited wildlife, and provided income for producers. Kansans have enrolled 2.9 million acres into the Conservation Reserve Program. However, in previous set aside programs like "Soil Bank," 75 percent to 80 percent of the acres were returned to crop production with the close of the program. If history repeats itself, it is very likely that greater than 75 percent of the Conservation Reserve Program land will be returned to crop production. K-State is cooperating with private industry and other government agencies on the project.

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### Remediation of Contaminated Soils Using Vegetation

Several departments at K-State have combined their expertise to explore the use of vegetation to clean up soils that are contaminated with heavy metals or petroleum products. Researchers from Agronomy, Civil Engineering, Biochemistry, Geology, and Chemical Engineering are investigating the impacts of establishing vegetation on sites that have concentrations of contaminants that are a threat to the environment.

#### Removing Heavy Metals

The mining and smelting areas of southeast Kansas were subjected to a century of exposure to waste materials with very high contents of lead, zinc, and cadmium. Huge piles of mine tailings and decades of emissions from smelters have left a large portion of Cherokee County with heavily polluted soils, groundwater, and surface water. Significant progress has been made in stabilizing the contamination by planting vegetation in the mine tailings. The U.S. Bureau of Mines and KSU cooperatively developed a revegetation technique of seeding directly into the mine tailings in the presence of a small percentage of composted material. With just a few exceptions, the reclamation has been highly successful. Mixtures of native and introduced prairie species are well established, and several sites are beginning to resemble the original landscape. The vegetation established on the soils will prevent further contamination of soils, air, and surface water. The plants will greatly reduce blowing dust as well as curtail surface erosion. This alone will improve the environment and living conditions for people in and around these areas. The monetary savings directly resulting from this research is considerable. The normal technique of covering mine tailings with up to five feet of topsoil would have cost millions of dollars for the area that has been revegetated.

Another alternative that is being explored is the use of phosphorous to reduce heavy metal bioavailability. Soils are amended with large amounts of phosphorous, and the chemical forms of metals are altered. Work at KSU has focused on assessing the changes in heavy metal chemistry brought about by various phosphorous sources and rates and what influence those changes might have. Other scientists have demonstrated that children who consumed lead contaminated soil treated with phosphorous adsorbed less lead than if they consumed soil that had not been treated with phosphorous. Adapting this remediation alternative would eliminate the need for excavating lead contaminated soil from residential yards.



#### Cleaning Petroleum Contaminated Soils

Petroleum contamination is one of the most prevalent forms of pollution in the United States. Groundwater, surface water, and soils have been contaminated in every state through leaking underground storage tanks, large spills, pipeline breaks, and industrial processing. Although there are many technologies available for the cleanup of these sites, most alternatives are very expensive. Bioremediation of organic contaminants (the use of microorganisms to degrade pollutants) was developed many years ago as an inexpensive and more natural approach. For some contaminant compounds in soil, this is a viable method. However, some contaminants are tightly held by the soil and resist attack by microorganisms; even after years of bioremediation, some soils still are not acceptably clean.

A large, interdisciplinary research group at K-State has been studying the feasibility of phytoremediation, a special variation of bioremediation that includes the use of vegetation. The roots of plants actively explore the soil and promote very high levels of microbial activity. As a result, the small volume of soil immediately surrounding the roots has excellent potential for degrading contaminants.

The potential monetary benefits from this technology are enormous. Traditional engineering solutions to petroleum contamination can cost up to \$2 million per acre. Phytoremediation is about one-half the cost of the least expensive

form of bioremediation (about \$15,000 per acre compared to \$30,000 per acre or more).

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### **Conservation Reserve Program Economic Research**

Conservation Reserve Program research has been conducted from 1994 to 1996 on nine field sites in eight counties in Kansas. Research objectives are to determine the productivity of hay production and grazing on Conservation Reserve Program land and to determine the economic feasibility of haying and grazing Conserve Reserve Program land. Five of the sites involve hay production and four involve grazing (either stocker or cow-calf). An economic analysis of hay production and grazing performance on each site showed the cost of producing hay on a per-pound basis of crude protein was lower than the cost of alfalfa on two of five hay sites. Spring burning was cost effective on all of the grazing sites. The economic analysis of grazing suggests that stocker grazing is a potentially feasible option on one-third of the Conservation Reserve Program land in western Kansas. A conceptual framework has been developed so that Conservation Reserve Program contract holders can compare net returns per acre for several alternatives.

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### **Woodland's Contribute to Conservation**

Kansas has more than 1.4 million acres of natural woodland, mostly under private ownership. These woodlands help control soil erosion and filter the sediment that washes into streams and rivers. They help lower home heating bills and improve livestock performance. They are important wildlife habitat. And they are utilized in wood products made and sold in Kansas. A KSU and state-federal program is helping to further expand Kansas' conservation plantings. The program sells more than 1 million low-cost tree and shrub seedlings yearly through county Extension and conservation district offices. The available species stand up well under the state's diverse growing conditions.

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## **Economic Evaluation of Topsoil Loss in Spring Wheat Production**

Relationships among topsoil removal treatments and additions of nitrogen and phosphorus fertilizer on dryland spring wheat yields in a Northern Plains wheat-fallow rotation were used to determine the on-site effects of topsoil loss and fertilizer applications on net returns and to estimate the value of soil. Yields were estimated from a production function, and corresponding net returns were examined for spring wheat under alternative soil loss levels and fertilization rates. The most efficient levels of fertilizer applications for farm managers at various levels of soil loss also were examined. The first centimeter of loss reduced yield from 1,719 kg/ha to 1,709 kg/ha, whereas the last centimeter of loss reduced yield from 1,362 kg/ha to 1,331 kg/ha. Each additional centimeter of loss increased the yield loss. The KSU economic analysis indicates that the optimum amount of nitrogen and phosphorus that should be applied increases with each increment of soil loss. Fertilizer reduces yield loss to some extent, but net returns continue to decline as soil loss increases. This result confirms that nitrogen and phosphorus fertilizers are imperfect economic substitutes for soil.

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## **Soil-Specific Production Strategies and Agricultural Contamination Levels**

The intense application of chemicals to the land surface has created concern about nonpoint-source contamination of surface water and groundwater resources. Potential economic profitability and environmental impacts of five cropping systems, including one conventional and four alternative systems were examined for northeast Kansas. Erosion/Productivity Impact Calculator (EPIC) was used to estimate potential crop yields and nitrate loadings from five cropping systems. To calculate annual net returns from each system, price and cost information from enterprise budgets was combined with the crop yields simulated by EPIC.

The Conventional System is representative of commercial farms in northeast Kansas. The Conventional System includes four major crops: wheat, grain sorghum, soybean, and corn on 640 acres. These crops are components in the five crop rotations common in northeast Kansas. Alternative System 1 has 213 acres each planted to wheat, sorghum, and soybeans. The total land in production in Alternative System 2 is divided equally between sorghum and wheat—320 acres each. In Alternative System 3, alfalfa accounts for 372 acres, with the rest used for wheat and soybeans. Alfalfa was harvested three times in the second year and once in the third year. Alternative system 4 consists of corn, soybeans, and alfalfa with a 7-year rotation. Harvesting alfalfa occurs three times in years 2 and 3. The Conventional System uses the most fertilizer of all the systems. Alternative systems 1, 2, and 3 use several chemicals; however, the amounts applied are smaller than those in the Conventional System.

System 3 has the highest net return but also the highest nitrate leachate. System 2 has the lowest level of nitrate leachate but has the lowest net return. The Conventional System has the third highest net return, second highest nitrate runoff, and second highest nitrate leachate. There is no unique system that maximizes contaminant loadings. System 2 has the lowest combined nitrate leachate and runoff but also has the lowest net return. System 3 has the highest net return and has the highest combined contaminate loading. However, System 3 has the lowest contaminated loading per dollar of net return. System 2 has the highest.

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# WASTE MANAGEMENT



## Utilizing Municipal Solid Waste Compost

Solid waste disposal is one of the most pressing environmental issues facing Kansas communities. With diminishing capacity of existing landfills and the reluctance of the general populace to create new landfills, other alternatives to straight landfilling of municipal solid waste (MSW) need to be explored. Incineration may reduce waste volume but raises as many environmental concerns as landfilling. However, composting of MSW may be more environmentally acceptable and should substantially reduce waste volume. Landfill longevity could be extended further by finding alternatives to landfilling the composted MSW. Application to agricultural land is one of the largest potential uses for MSW compost.

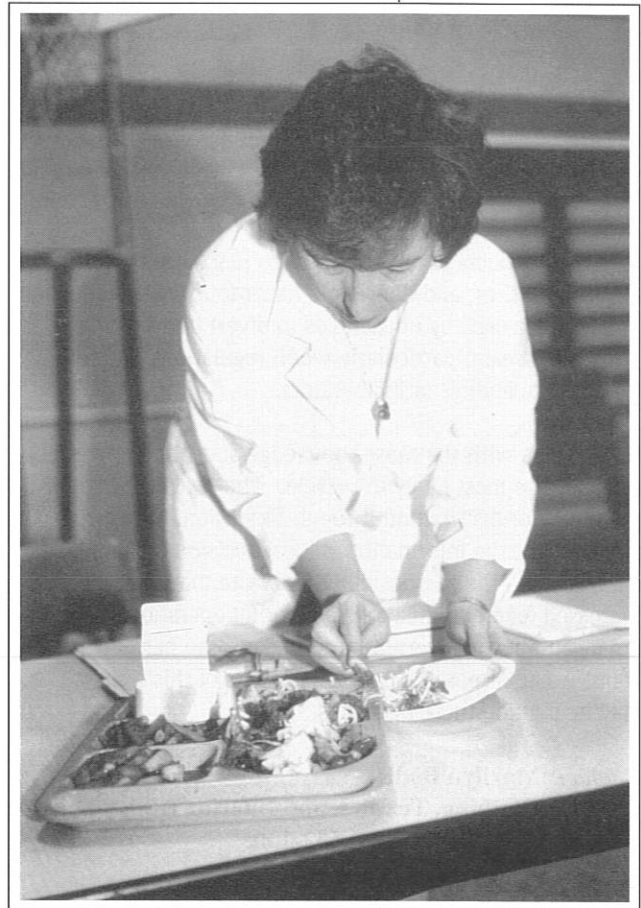
A study was done to determine the effect of application rate of composted municipal solid waste—with or without cow manure and with or without commercial fertilizer—on growth, composition, and yield of grain sorghum. Increases in yields of grain sorghum due to MSW compost applications were small and inconsistent. Few differences in plant uptake of nitrogen, phosphorous, and potassium due to compost were found, especially at later growth stages. Both cattle manure and fertilizer additions increased yield and nutrient uptake. Therefore, the availability of macronutrients from MSW compost may be less than from cattle manure and fertilizer. Trace metal accumulation from MSW compost in plant tissue and soil was minimal and did not appear to pose a problem.

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## Environmental Issues Impacting Foodservice Operations

A waste stream analysis completed in a residential care facility found that an average of nearly 1 pound and almost 1 ½ gallons of total waste was discarded per meal served. Packaging waste accounted for 87.7 percent of total volume of waste. Cardboard, plastic, and paperboard were the materials that could be recycled. Food waste accounted for 69.9 percent of total weight of waste discarded, which was mainly done by a garbage disposal requiring significant amounts of water and energy. If alternatives to disposal of food waste were identified, foodservice operations could save several thousand dollars annually. An infrastructure within the state that supported recycling would not only save money but would divert waste from landfills.

An "Environmental Issues Impacting Foodservice Operations" manual was developed and evaluated by content specialists and representatives of noncommercial foodservice operations, including schools, colleges and universities, and health-care facilities in Kansas, Nebraska, Iowa, and Missouri. The manual is available for a minimum fee from the KSU Department of Hotel, Restaurant, Institution Management, and Dietetics. It is designed to assist foodservice directors and managers in enhancing their knowledge of



diverse environmental issues, including the Clean Air Act, refrigerants, water and energy conservation, hazard communication standards, and solid waste management. General resources are identified that all operations could utilize. Specific resources for the states of Kansas, Nebraska, Iowa, and Missouri are included in the manual. The manual is a valuable resource for noncommercial foodservice operators desiring to establish environmental programs.

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### **A Comparison of Household Waste Management Practices**

A random sample of residents in five states was surveyed by mail about their household waste management practices. Nearly 1,000 responses were received from households in Kansas (125), Iowa (182), Minnesota (312), Missouri (227), and Nebraska (120). The reported practices for disposing of household waste were compared with the programs and regulatory policies for disposing of waste in each state. The implications from this research are that governmental units desiring to reduce the amount of household waste going to landfills can learn from successful programs and policies that include:

- Curbside pick up of recyclables is a strong motivator for recycling because it reduces the effort needed by households to divert items from the waste stream.
- Beverage container deposit programs motivate consumers to recycle to recover deposits made at the time of purchase.
- Well-publicized public programs (e.g., compost sites, used oil sites, and household hazardous waste collection sites) are used by households to divert items from the waste stream, particularly when regulations prohibit disposal in landfills or incinerators.

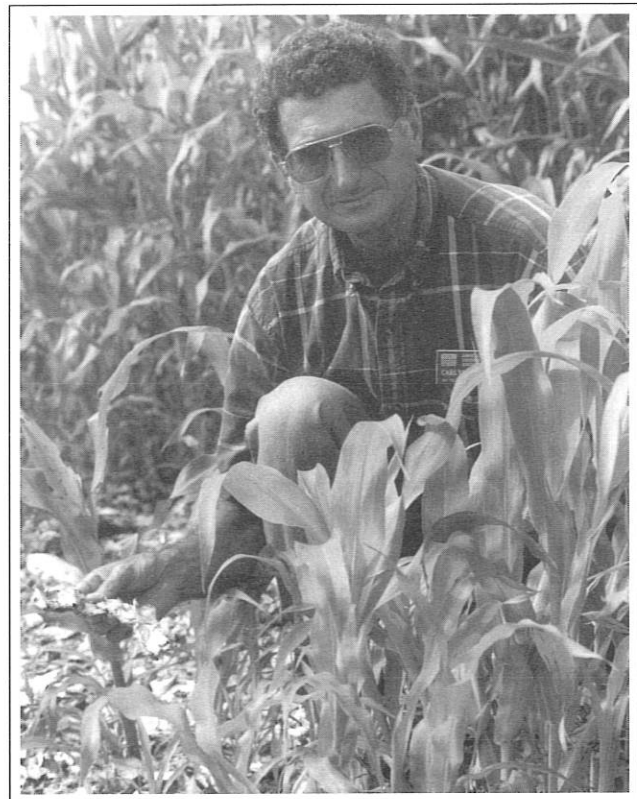
Households with the most knowledge about the programs available are most likely to recycle. The results are being produced for distribution through Extension. The target audience for the information is local decision-makers charged with the responsibility for waste management. Increased federal regulations on landfill operations are causing local units of government to make some hard decisions about waste disposal issues. The results of this research may help guide those decisions.

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### **Better Forecasting of Food Production**

Foodservice in the United States is a huge industry, totaling more than \$300 billion annually. Any improvements in the industry can result in substantial savings for businesses and consumers and in better utilization of resources. Ag Experiment Station scientists in the Department of Hotel, Restaurant, Institution Management, and Dietetics have demonstrated that food production can be improved by using Expert Systems, Neural Networks, and Quantitative Models, a computerized forecasting program developed by Ag Experiment Station researchers. Because consumers spend 44 percent of each food dollar away from home, better forecasting of food production, which this program can provide, means better use of raw agricultural products and labor in the hospitality industry, cost savings, more efficient operations, less waste (both food and packaging) into the waste stream, and more satisfied customers.

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### **Extending the Life of Landfills**

Disposal of municipal solid waste is a problem both economically and environmentally. Nearly 60 percent of an average community's solid waste stream currently deposited in landfills is biodegradable. Over 80 percent of these



organic materials are paper products and yard waste (primarily grass). An alternate method of disposing of these biodegradable materials would significantly extend the life of landfills. Research at the KSU Agricultural Research Center-Hays showed that biodegradable materials like newspaper and grass, when applied in the raw form to agricultural soils, were decomposed by soil microorganisms. To ensure rapid decomposition, early application after fall harvest and monthly tillage of the soil were critical. Also, rate of application and blending of high (grass) and low (paper) nitrogen sources were important. Under irrigation and continuous cropping, rates up to 45 tons per acre of grass and newspaper mixture decomposed sufficiently during the period from harvest to planting of a forage sorghum. The performance of the newly planted crop was not affected. On dryland fields, lower rates of solid wastes may be necessary. Also, a crop-fallow rotation would allow more

time to decompose the organic materials. To accomplish the above, city- or county-owned land and equipment could be used to facilitate the program. In addition, private landowners could submit bids to apply the material on their own land providing they do not object to foreign materials contained in the waste. In either case, trench silos would be necessary (to allow material to be wetted down and packed to keep from blowing) to store the shredded newspaper and grass until application could be made after the fall harvest. The economic and environmental implications for land applications versus deposits in Title D landfills are enormous.

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## UTILIZING BIODEGRADABLE MATERIALS



### Increasing Degradability of Plastics by Using Soybeans

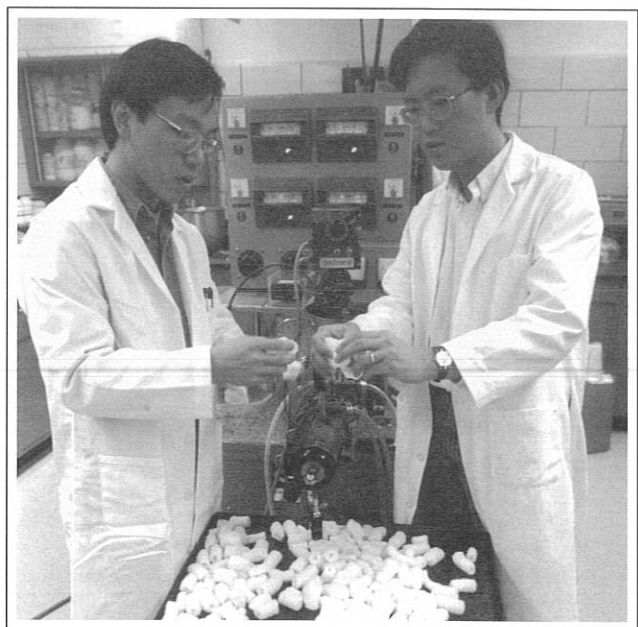
A K-State textile scientist has developed polyethylene films containing 40 percent saturated soybean fatty acid fillers to enhance biodegradability. Polyethylene is used in making a wide variety of consumer products, so this project has considerable commercial potential. For example, plastics used in packaging are produced from polyethylene. In addition to being biodegradable, one new polyethylene film also is resistant to microorganisms.

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### Thermoplastics Technology Using Corn

Industry uses flexible foamed plastic sheets made from petroleum-based polymers to cushion delicate instruments during shipment. Grain scientists at K-State are investigating ways to produce similar packaging material that contains high levels of cornstarch. One formulation developed by the researchers contained 45 percent starch and gave low density foams with a uniform cell structure and good elastic properties. The product is estimated to be 60 percent biodegradable.

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## Harnessing Microbes to Clean Up the Environment

KSU scientists are enlisting microbes—or bacteria and fungi—to break down pollutants created by humans in a process known as bioremediation of toxins. The researchers have been finding that microbes are capable of breaking down pesticide residues and other synthesized toxic chemicals. A few years ago, this was thought to be an impossibility. 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. Currently, the primary clean-up targets for bioremediation are wastewater from pesticide manufacturing plants, accidental spills, and soil polluted by

industrial and military activities. The new twist to bioremediation at K-State as well as at other major universities is to modify the organisms through genetic engineering. The process might include 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 might be to use bacteria that can detoxify a pollutant down to a point and then employing another better suited to carry out the process to completion.

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## WATER MANAGEMENT

### Subsurface Drip Irrigation

Research at the KSU Northwest Research-Extension Center at Colby shows that subsurface drip irrigation is a highly efficient delivery system. One study demonstrated that careful management of Subsurface Drip Irrigation systems could reduce net irrigation needs by nearly 25 percent while maintaining top corn yields of more than 200 bushels per acre. Another study showed that Subsurface Drip Irrigation for corn production reduced water use by 46 percent while reducing yields by only 15 bushels per acre. Also, Subsurface Drip Irrigation helps protect water quality through reduced drainage to the water table.

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### Irrigation Practices that Conserve Water

Research at KSU is evaluating the potential for water conservation through the use of high-frequency, deficit, subsurface drip irrigation for corn production. Conservation of irrigation water is easily attained by practicing deficit irrigation, but yields often are drastically reduced. Subsurface drip irrigation offers the irrigator a “win-win” situation by maintaining high corn yields while still saving water. Irrigation water savings of 46 percent were obtained with only an 8 percent reduction in yield. Researchers hope to further reduce yield reductions through combined management of high frequency deficit subsurface drip irrigation and in-season fertigation. Subsurface drip irrigation also can help to protect water quality through reduced drainage to the water table.

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## Providing Urban Areas with Water Quality Information

A new series of colorful brochures from the Kansas Cooperative Extension Service will help urban residents protect water quality. The brochures address the proper use of fertilizers and lawn and garden chemicals. The fertilizer brochure explains how to evaluate the various fertilizers on the market and how to use them safely so that nitrogen and phosphorous do not enter water sources. The lawn and garden chemical brochure discusses environmental safety as well as safety considerations for people and pets. The brochure also includes information on product selection, application, storage, and disposal. Plans call for the brochures to be stocked in commercial garden centers where county extension agents will be stationed. The brochures will be used in a pilot program in several urban counties.

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## Developing Models to Study Water and Crops

Simulation models are being used to observe and understand the interrelationships among soil water supply, drainage, evapotranspiration (ET), and crop yield. Researchers developed a water balance model and then a micro-computer software package. The model estimates drainage, crop evapotranspiration, and crop yield. Weather records and field research results from Tribune were used to adapt the model to western Kansas. Based on the model, a Windows compatible microcomputer software package was developed for corn, grain sorghum, sunflower, and winter wheat. The software allows users to study the effects of irrigation system efficiency, water application timing and amount, and water conservation under dryland conditions. The software can be used as an educational tool for illustration of water's influence on crop production in western Kansas.

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## Irrigation and Water Management Demonstration Project

K-State Extension and Water PACK (Water Protection Association of Central Kansas) have teamed to develop a five-year cooperative irrigation and water-management demonstration project. The goal of the project is to improve irrigation application and water-use efficiency for sustainable, irrigated crop production in south-central Kansas by increasing irrigation scheduling procedures. This project

involves the use of the most current technology with climatic forecasting and field feedback of soil moisture, applied irrigation, and rainfall. A total of 13 fields irrigated by center pivot are included in this project (one field in each of the 13 Water PACK counties). In 1996, the project included eight fields and will add five more sites in 1997.

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## Limited Irrigation Increases Profits

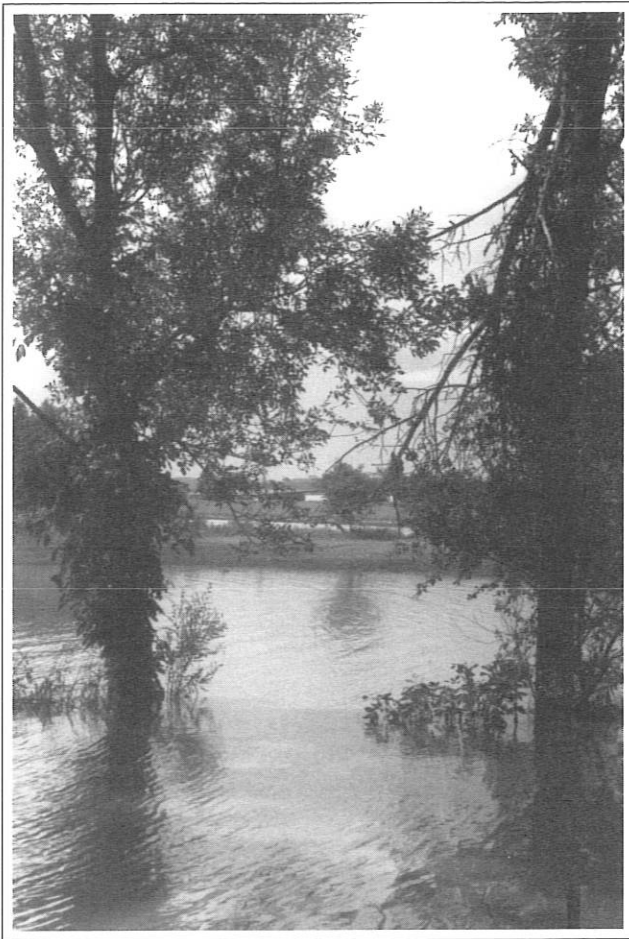
In a three-year study at the KSU Southwest Research-Extension Center near Garden City, corn yields were increased an average of 24 bushels per acre (26 percent) with a single application of 4 inches of irrigation water. At a corn price of \$2.50 per bushel and a cost of irrigation water of \$2.25 per inch, income would increase \$51 per acre over that of an all dryland system.

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## The Economic Impacts of Water Supply Reductions on the Upper Arkansas River

Changes in agricultural production, water availability, and the implementation of conservation policies in the Arkansas River Basin of Kansas are occurring because of dwindling stream flows, groundwater deficits, and changing agricultural policy. Researchers evaluated economically optimal crop production mixes related to the new agricultural policy environment and the condition of declining water availability for a representative southwest Kansas farm. The results indicate that at lower levels of water the amount of corn is reduced, with no corn produced at or below 12 inches per acre of water availability. Alfalfa is grown in place of corn





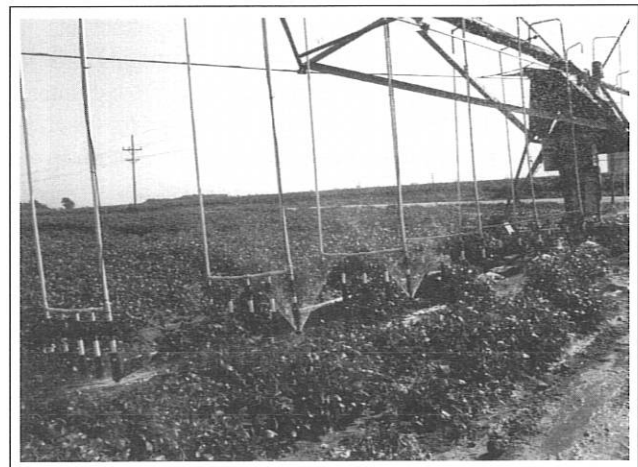
as water availability declines. Irrigated grain sorghum is not produced at any level of water use. Net returns are higher under the Federal Agriculture Improvement and Reform (FAIR) Act or 1996 Farm Bill compared to the policy restrictions of the previous farm bill. However, if a haying restriction, which limits alfalfa production to 15 percent of base acres, is imposed, then net returns decrease, and the crop mix switches away from alfalfa to sunflowers and soybeans. Corn is not produced at 12 inches of water or less. At very low water levels, irrigated land switches to dryland production. The highest net returns under all water availability scenarios are found under the FAIR program with no grazing restriction, given long-term average prices and the 1996 government payments. In each mode, net returns decline as water availability declines, but the decline when water application levels are relatively high is small, generally showing a decrease of less than 1 percent when water availability declines from 24 inches to 20 inches per acre. This suggests that some reductions in water use could possibly be made with relatively small annual losses in net income.

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## **Irrigation Economics Evaluation System**

K-State researchers have found that the microcomputer model, Irrigation Economics Evaluation System (IEES), can be used to estimate costs under a variety of operating conditions and to evaluate irrigation systems for economical water use. IEES is designed to utilize user-supplied data to calculate the operating costs of Medium Pressure Center Pivot, Low Pressure Center Pivot, Low Energy Precision Application Center Pivot, Low Drift Nozzle Center Pivot, Furrow Flood Gated Pipe, Surge Furrow Flood Gated Pipe, and Sub-Surface Drip irrigation systems that use either natural gas, propane (LP) gas, diesel fuel, or electricity. IEES is designed to calculate operating costs for 11 items associated with operating irrigation systems and the total annual operating costs on a per acre, per hour, and per acre-inch basis. The program also calculates the net returns for the crop grown with the irrigation system. In addition to calculating annual operating costs, the mode has six options that can be used to economically evaluate improvements in the pumping plant or the way the irrigation system is used for crop production. These options are evaluation of pump repair or replacement; evaluation of switching power units from one power source to another; estimates of operating cost changes caused by a falling water table and/or a pump efficiency decline; estimates of operating costs for different levels of water application; estimates of operating costs under selected fuel inflation rates; and the economic feasibility of switching distribution systems.

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## Phosphorous Losses in Runoff Water

Despite recent media attention on nitrates and pesticides in groundwater, phosphorous represents a significant threat to surface water quality. Phosphorous accelerates the eutrophication process, producing water that has undesirable odor and taste and greatly reduced recreational potential. Surface waters in Kansas that are impacted by phosphorous receive phosphorous from a variety of sources, including animal production facilities, agricultural lands, wastewater treatment facilities, industrial inputs, and septic systems. KSU scientists have focused on the effect of tillage and fertilization practices on phosphorous losses in runoff water from areas used for grain sorghum production. A field experiment is being conducted at the East Central Experiment Field in Ottawa. Total phosphorous and soluble phosphorous losses have been highest for surface broadcast applications of phosphorous with no-till practices. Phosphorous losses have been lowest for treatments not receiving phosphorous or for phosphorous placed below the soil surface under conventional or no-till practices. Soluble phosphorous, a form which has a high bioavailability, is highest for the surface broadcast applications of phosphorous under no-till or ridge-till systems. Generally, switching from conventional tillage to no-till practices will reduce phosphorous losses as well as reduce soil erosion. Experiments suggest that this change must also be accompanied by practices that place phosphorous fertilizers below the soil surface; otherwise, losses may actually increase compared to losses experienced with conventional tillage.

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## Reducing Atrazine Runoff in the Upper Delaware River Basin

If atrazine cannot be kept below safe drinking water standards by voluntary practices among farmers, the product could be taken off the market or severe limitations could be placed on how atrazine is used. This could have significant economic consequences to Kansas farmers. Atrazine is used on about 3.4 million acres of corn and grain sorghum in Kansas every year. Without atrazine, more expensive herbicides would have to be used in corn and grain sorghum crops. At an average increase of \$5 to \$10 per acre for alternative herbicides, the added costs could total \$17 million to \$34 million annually in additional herbicide costs.

Recent monitoring of water has indicated higher-than-desired atrazine concentrations in Perry Reservoir in the Delaware River Basin. Three sub-basins, located in parts of Atchison, Brown, Jackson, and Nemaha counties, have been found to contribute approximately 80% of the total atrazine runoff occurring in the Delaware River Basin.

Keeping atrazine herbicide out of water supplies ranks high on the Kansas public's "wish list" for agriculture. Kansas Agricultural Experiment Station researchers have discovered best management practices (BMPs) for using atrazine that can help reduce runoff of the herbicide. It is essential that farmers and pesticide dealers adopt these atrazine BMPs. Starting in the fall of 1995, a team of Kansas Cooperative Extension Service (CES) specialists and agents developed an innovative educational program to achieve adoption of the atrazine BMPs. The program targets producers and chemical dealers through one-on-one contacts, surveys, publications, news releases, and demonstrations. An intensive, one-on-one educational approach such as this has rarely been used over such a large area to address an environmental problem.

Also, in response to Governor Graves' Water Quality Initiative for the Kansas-Lower Republican River Basin, a pilot cost-share incentive program was initiated in the Mission Creek Watershed in Brown County in cooperation with the State Conservation Commission. The SCC provides the cost-share incentive monies and administration, and the CES provides the educational support by explaining the program requirements and helping farmers develop qualifying management plans.

The overall goals of the Atrazine Runoff Reduction Program are:

1. To have 15 percent of producers adopt at least one best management practice in 1996 that they did not use in 1995.
2. To reduce atrazine runoff in the targeted area by 10 percent.
3. To maintain average concentrations in Perry Reservoir below the EPA's minimum safety level of three parts per billion.

A survey of farmers in the program area indicated that a majority were going to add at least one BMP for atrazine in 1996 that they had not used in 1995. Therefore, it is expected that atrazine runoff will decline significantly in the future in the Delaware River Basin. This Extension effort will benefit both the public and farmers. The public will have reduced anxiety over the safety of drinking water, and farmers will be able to keep using atrazine to control weeds in corn and grain sorghum without endangering water quality.

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## A Training Program on Wastewater Treatment

For nearly a decade, the Kansas Cooperative Extension Service has been working closely with the Kansas Association of Sanitarians and Kansas Department of Health and Environment to educate and train sanitarians, contractors, and homeowners about on-site wastewater treatment. As part of the program, Extension faculty have edited, printed, and distributed the Environmental Health Handbook. Also, Extension has organized and conducted training with the help of sanitarians and Kansas Department of Health and Environment. As a result, sanitarians are better prepared than ever before to evaluate site conditions and to specify workable and environmentally sound on-site systems, and contractors have a greatly improved understanding of conventional septic systems, individual lagoons, and suitable alternatives for problem sites.

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## Reducing Sewage Discharge and Protecting Groundwater

Cooperative Extension Service specialists are providing leadership for on-site wastewater treatment system design, evaluation, maintenance, and improvement. K-State encourages continued evaluation of alternatives to conventional septic tank soil absorption lateral systems for problem sites and adoption of proven methods where they are technically, practically, and economically feasible. This program is improving the Kansas environment by reducing discharge of sewage to the surface and protection of groundwater. Several publications have been developed to inform people about on-site wastewater, including

- A Blueprint for Rural Communities and Small Town Wastewater Treatment Alternatives.
- Get to Know Your Septic System.
- Septic Tank Maintenance.
- Septic Tank-Soil Absorption System.
- Sewage Sludge Use on Agricultural Land.
- Soil Evaluation for Home Septic Systems.
- Why Do Septic Systems Fail?
- Your Wastewater System Owner/Operator Manual.
- Safe Domestic Wells.

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## New Satellite Technology Can Help Protect Groundwater Quality

To help prevent fertilizer nitrogen from causing groundwater pollution, K-State researchers are bringing the latest satellite technology down to the farm. The goal is to develop an advanced level of nitrogen management that is based on data so precise that it could revolutionize the way farmers apply fertilizers and chemicals.

Currently, nitrogen fertilizer recommendations to farmers are based on average soil nitrogen levels and average yield goals for an entire field. But this approach can cause problems. When the farmer puts 200 pounds of nitrogen onto the entire field based on average needs, some areas end up with too much and some too little. Wherever too much was applied, some of that nitrogen could move down through the soil and eventually into groundwater.

Variable-Rate Nitrogen Management uses the latest in satellite technology to fine-tune nitrogen applications and eliminate overapplication. Global Positioning Systems (GPS) play a key role in Variable-Rate Nitrogen Management, allowing researchers to pinpoint the location of sampling points within a field. This permits the construction of detailed maps that show yield potential and the status of soil nutrients. The researchers use this information to create a fertilizer recommendation map that calls for varying levels of nitrogen across the field. The computer on the fertilizer application equipment then uses the variable-rate recommendation map to adjust fertilizer rates "on the go," with the assistance of computer-driven controllers and GPS guidance.

Research on two large irrigated corn fields in Barton and Stafford counties indicates that the new technology is starting to show benefits. After two years of field work, researchers have found they've been able to match nitrogen applications more closely with crop needs. They've also been able to get more bushels of grain per pound of nitrogen applied. This reduces the chances of polluting groundwater and increases farmers' net income at the same time.

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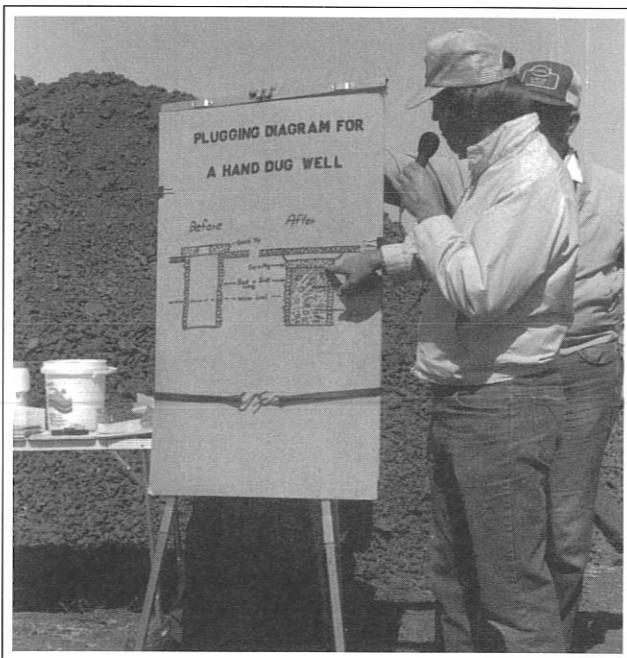


## Plugging Abandoned Wells

Many Kansans, particularly rural residents, depend on private groundwater wells for their domestic water supply. Recent surveys and studies indicate that water from about half of private wells would not meet public water supply standards. Because of the importance of groundwater to rural Kansas residents, the Kansas Cooperative Extension Service in cooperation with Kansas Farm Bureau developed an educational program on plugging abandoned wells.

The program, "Safe Water for Kansas," featured information on water testing, well construction, well site selection, and disposal of abandoned wells. The plugging of the abandoned well, however, was the high-interest feature of the program. Participants learned about the hazards and liabilities associated with abandoned wells and the correct procedure for plugging abandoned wells.

Over 175 well-plugging demonstrations were conducted with almost 100 percent participation by the 105 Kansas counties during the initial two years of the program. Nearly



200 wells were plugged, with approximately 6,000 persons attending. The program focused initially on farms but expanded to include rural residents and small communities. The impact of the demonstration also was magnified with coverage by the local newspapers, radio stations, and, to a lesser extent, by television.

Well-plugging demonstrations are still being conducted but most now are without direct specialist involvement. County Extension agents and other agency personal have continued to schedule events and promote plugging at farms shows, county fairs, agent update training, and other events. State support continues with publications and the production of a video: "Plugging Abandoned Wells." The program's success is probably due to a number of factors, including 1) the increasing concern and awareness of the public regarding the environment; 2) the establishment of local environmental planning groups in Kansas that corresponded with the initiation of the program; 3) the multiple organizational sponsorship of the events; and 4) the hands-on or active nature of the event. In almost every instance, some degree of participation by those in attendance occurred. Every event accomplished a positive action: the proper plugging of at least one abandoned well.

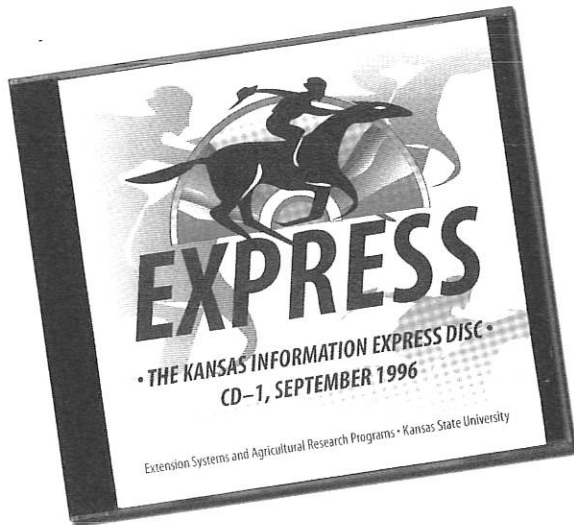
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## Students Tackle Environmental Projects

The capstone course for the Natural Resources and Environmental Science secondary major utilizes environmental case studies as the basis for its semester-long projects completed by students enrolled in the course. Topics for the projects have included the proposed sand dredging from the Kansas River; an alternative wastewater treatment system (wetlands) for Clinton State Park and an accompanying education plan; and the Governor's Water Quality Initiative, with one group emphasizing each area of interest—for example, herbicides or sediment or coliform bacteria. The course is team taught with instructors from such disciplines as agronomy, civil engineering, geography, and communications.

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## GOING ELECTRONIC



### Electronic Publications Save Paper and Help the Environment

The recently developed EXPRESS CD-ROM and Web pages of the Agricultural Experiment Station and the Cooperative Extension Service are benefiting the environment because they provide a wealth of information that is accessible without being printed on paper. Electronic publications allow users to be selective and print only what they need. The Web pages contain approximately 500 documents. The CD-ROM contains 863 documents from Kansas, plus approximately 1,400 from other states. Many of the publications relate to environmental issues. Four of the Web pages contain environmental topics, including 95 publications available as Solid Waste Management Fact Sheets and as the Water Quality Library; the Crops and Soils Library; and the Agricultural Economics Library. These publications benefit the people of Kansas by offering practical, environmentally sound advice on farm, garden, and home topics.

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### 4-H'ers Use the Web Instead of Transportation

The Internet/World Wide Web has been described as one of the most equalizing forces society has experienced. Whether one lives in a village of 200 or a metropolis of 2 million, information accessed through the Web is the same. In the past, those living in urban communities had easier access to educational information than those who lived in rural communities. Comprehensive libraries and universities were more likely to be located in urban centers. Now much of the information found in libraries and at universities is available through the Web. With the growth

of local Internet providers and special phone opportunities for rural families, using the Internet is becoming practical for everyone. If it isn't available now, it will be soon. Such usage helps the environment by reducing travel and all the resources that go into travel.

Using one lesson in the new curriculum, 4-H'ers in Geary County developed a questionnaire and then delivered that questionnaire via the Internet to 4-H'ers in other countries. They collected data that became a part of their local 4-H project work. The 4-H'ers reached beyond the boundaries of their own county, state, and country and incorporated a global interchange with youth in other countries. They were able to do this with no travel expense, with one project leader investing a minimal amount of time, and using a current resource, the Internet, to enrich the global perspective of 4-H'ers, many of whom did not have the means to travel beyond their state, let alone national boundaries. What they accessed via the Internet was the same in this rural Kansas town as it would have been had they used a computer on the Internet in Kansas City, Topeka, or Wichita. This is one example of how the delivery methods in the new 4-H clothing/textiles curriculum have been successfully used to expand the opportunities for all Kansas 4-H'ers.

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**A REPORT TO THE  
KANSAS LEGISLATURE'S  
AGRICULTURE COMMITTEES**

**IN SUPPORT OF  
KANSAS STATE UNIVERSITY  
AGRICULTURAL EXPERIMENT STATION  
AND COOPERATIVE EXTENSION SERVICE**

**BY**

**WATER PROTECTION ASSOCIATION OF CENTRAL KANSAS  
(WATER PACK)**

**JANUARY 1997**

*House Agriculture Committee  
January 21, 1997  
Attachment 2*

## **Water PACK Overview**

Water PACK, formed in 1990, is an organization of about 500 agricultural producers and businesses. The founding principle of Water PACK is activism. The need for a pro-active voice for irrigated agriculture was the catalyst for the formation of the organization.

### **MISSION:**

To promote, foster, and encourage the beneficial, economical and sustainable use of quality water.

### **OBJECTIVES:**

- educate our members and the general public about the management of sustainable irrigated agriculture and the long term benefits to our society
- develop and maintain relationships with government and non-government organizations at all levels to promote the wise use and conservation of our water resource
- develop our membership to enhance our pro-active approach and maintain an effective organization in Kansas and the nation
- develop and implement projects that complement our mission

Water PACK is a pro-active voice for irrigated agriculture and takes an active role in water issues and works with other groups and government agencies to develop water policy. Water PACK is a partner with the Division of Water Resources, Groundwater Management District #5 and US



Fish and Wildlife Service in the Quivira/ Rattlesnake Basin Partnership. The Partnership's goal is to address water resource concerns and develop management strategies for the Rattlesnake basin.

The Quivira Coalition, of which Water PACK is a lead member, consists of other agricultural organizations, municipalities and environmental groups. The Coalition was successful in obtaining federal funds for Quivira National Wildlife Refuge. The funds will be used by US Fish and Wildlife Service to study ways to improve water management on the refuge.

### **Economic Impact**

In South Central Kansas there are more than 758,800 acres of irrigated crops. These crops use \$159,830,000 worth of inputs and create \$280,659,000 worth of income from production. In addition to crops, this area has \$367,815,000 in livestock production. As you can see, this area has a substantial impact on the economy of Kansas.

### **South Central Kansas Irrigation Scheduling and Water Management Demonstration Project**

The Project is a five year cooperative effort between Kansas State University (K-State) Research and Extension and Water PACK. The goal of this project is to increase the understanding,

adoption, and use of improved irrigation management and scheduling procedures by using current technology and climatic forecasting with field feedback of crop growth, soil moisture, applied water, and rainfall. The research is on target for this specific area of Kansas. We are intermediate in rainfall with wetter conditions to the east and dryer conditions to the west. Unique in Kansas, this area has predominately sandy soils with high infiltration rates. With proper management, our water resource is totally renewable.

## **Outreach**

K-State Research and Extension professionals will direct and conduct field demonstrations and applied research of irrigation scheduling and water management practices in cooperation with Water PACK members on demonstration farm sites located in South Central Kansas.

Cooperator/farm demonstration sites, selected in each of the 13 representative Water PACK counties, will be used for the duration of the project. Each site is located near a paved road and is identified with a large sign that lists the project title, the cooperators, the project sponsors and current irrigation scheduling information. Each demonstration site will receive an overall system evaluation and weekly visits for system and field/crop measurements. The fields will be open to peripheral visits throughout the summer with more detailed field tours and project updates scheduled each August. Annual winter seminars of education programs and project updates will also be held throughout the project region.

## Results

By the end of the project, substantial numbers of South Central Kansas farmers and crop consultants will be aware of the benefits of irrigation scheduling and field water management including: water and energy conservation, sustainability of water resources, reduced chemical usage, reduced equipment maintenance and wear, and enhanced crop growth and development. It is also expected that these individuals will know how to access and use the regional weather station network to obtain real-time weather data for irrigation scheduling purposes. This project should also result in a greater public awareness of resource stewardship by area farmers. The cooperative effort between KSU and Water PACK requires technical support from KSU and funding from Water PACK. This funding will cost about \$600,000 during the next five years, most of which will come from the private sector.

## Conclusion

Thank you for your support of K-State Research and Extension. This project is a totally cooperative effort between KSU, Water PACK and other public and private organizations with comprehensive water conservation and economic growth objectives. Water PACK and I, as a producer of crops and livestock, thank you and appreciate Kansas legislative funding of Kansas State University's Agricultural Experiment Station and Cooperative Extension Service programs.

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"When the well's dry, we know the worth of water."

-- Benjamin Franklin