Approved: 1-24-96
Date

MINUTES OF THE HOUSE COMMITTEE ON AGRICULTURE.

The meeting was called to order by Chairperson Joann Flower at 9:00 a.m. on January 9, 1996, in Room 423-S of the Capitol.

All members were present except: Representative Crabb - Excused
Representative Humerickhouse - Excused

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

Conferees appearing before the committee:
Marc A. Johnson, Dean of Agriculture, Kansas State University
Richard R. Hahn, Head, Department of Grain Science and Industry, KSU
Jack G. Riley, Head, Department of Animal Sciences and Industry, KSU
Daniel J. Bernardo, Head, Department of Agricultural Economics, KSU

Others attending: See attached list

Marc A. Johnson, Dean of Agriculture, Kansas State University, addressed the committee stating that the KSU College of Agriculture was focusing on value-added agricultural products as a way of enhancing economic development in the State of Kansas. Three years ago when the Regents system went through their goal and aspirations process whereby each university indicated the areas in which it wanted to excel, KSU developed five basic themes, one of which was to do activities at KSU that would enhance economic development in Kansas and enhance the environmental quality of Kansas. The College of Agriculture, including the Agricultural Experiment Station and Kansas Cooperative Extension Service, has turned to the following themes in order to follow the guidelines of the University:

1. To enhance crop and livestock production and production efficiency to keep Kansas agriculture competitive in an increasingly competitive worldwide agricultural market;

2. To enhance value-added uses of Kansas agricultural commodities to enhance economic development by keeping jobs in Kansas and by enhancing the income from commodity agriculture in Kansas;

3. To do research and extension activities in food safety to enhance health and safety of the Kansas living environment; and

4. To study the environmental impact of agriculture and devise ways to perform agriculture in environmentally sound ways, first of which is the safety of the water supply in Kansas.

Dr. Johnson stated that their efforts in the area of creating, adding, and protecting values for our Kansas agricultural commodities, not only returns income to the producer, but creates jobs in Kansas with further processing. (Attachment 1)

Richard R. Hahn, Head, Department of Grain Science and Industry, stated that the objective of KSU value-added research was to develop a competitive advantage for Kansas commodities. It might involve developing a more profitable raw material with quality as the most important characteristic; technology development for new or more profitable products; or could include information to help Kansans be safer, smarter, more effective, or more competitive economically. Two major projects in the KSU Grain Science Department last year were grain quality measurement and milling research. Kansas is the leading producer of grain sorghum, which is used primarily as an animal feed. Development of other uses could add to its value to the state. Kansas is also the leading producer of wheat starch, but it has suffered from limited markets because cornstarch is cheaper. KSU has been doing research on various uses. Recently there was a major breakthrough in industrial use, when a packing filler was developed. Additional starch-based thermoplastics

are under development. Dr. Hahn brought samples of products produced from grain, including a rat food used in space, fat-free chips and glues used in plywood and box board construction. (Attachment 1, Pages 4 and 5)

Jack G. Riley, Head, Department of Animal Sciences and Industry, stated that animal scientists continue to devote priority to research that adds value, creates new products or uses, and improves the safety and enhances the potential profitability of meat and livestock products. The impact of research in this area goes beyond benefits to producers, suppliers, processors, and consumers, as a safe, nutritious supply of food is essential for a healthy, thriving population. Animal health and welfare, conservation of natural resources, and infusion of human capital into rural communities are vitally important to the future of animal agriculture. Highly skilled, well-educated young people represent the future for growth in value-added products and enhanced production of raw commodities. Animal Sciences and Industry is the largest undergraduate program at K-State. (Attachment 1, Pages 6 and 7)

Daniel J. Bernardo, Head, Department of Agricultural Economics, stated that his department works closely with the other departments in the College of Agriculture. The economic impact of value-added activities is manifest in a variety of ways in the Kansas economy. Examples include the adoption of new production practices, development of new products and/or markets, reductions in risks associated with current production and processing activities, improvements in food safety, and new market structures. Economic assessment of these activities requires determination of their impact on commodity prices, processor costs and revenues, prices paid by consumers, as well as income and employment effects on local economies. Value-added activities occurring in one sector of the food and fiber complex have beneficial effects in other areas. ( Attachment 1, Pages 7 and 8)

The meeting adjourned at 10:00 a.m. The next meeting is scheduled for January 10, 1996.

# HOUSE AGRICULTURE COMMITTEE GUEST LIST

DATE: 1-9-96

| NAME | REPRESENTING |
|---|---|
| Mary Johnson | K State |
| Steven Graham | KSU Ag |
| Dick Hahn | KSU |
| Dan "Bernard" | KSU |
| Jack Riley | KSU |
| Jane Peterson | Kansas State University |
| Jim Alley | Seaboard |
| Brenda Mitchell | Gov. Graves |
| Mike Jensen | Ks Pork Producers |
| Tom Luber | Ks Coop Council |
| BILL R. FULLER | Kansas Farm Bureau |
| Leslie J. Kaufman | Kansas Farm Bureau |
| LeeJene Schneider | Ks Livestock Assoc |
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# ADDING VALUE TO KANSAS AGRICULTURAL PRODUCTS

## SELECTED EXAMPLES–PRODUCTS, PROCESSES, AND POTENTIAL

AN INFORMAL REPORT TO THE KANSAS LEGISLATURE

*by the*

**Kansas Agricultural Experiment Station**

*and the* **Kansas Cooperative Extension Service**

**January 1996**

KANSAS STATE UNIVERSITY

House Agriculture
Attachment 1
1-9-96

# TABLE OF CONTENTS

# EXECUTIVE SUMMARY

This report addresses efforts to add value to Kansas agricultural products by scientists in the College of Agriculture, Kansas Agricultural Experiment Station, and Kansas Cooperative Extension Service.

## Crops

The primary method for adding value to field crops is through plant breeding activities.

**Wheat:** Karl 92, a KSU release, became the top performing variety in Texas, Oklahoma, Kansas, and Missouri. Jagger is an improved 1994 release. Since 1989, KAES has released over 30 germplasms and numerous varieties. Scientists in the Wheat Genetics Resource Center are generating a high density chromosomal map of the wheat genome to speed variety development.

**Other Field Crops:** KAES scientists are breeding grain sorghums with improved digestibility, better yield, tolerance to fusarium stalk rot, and improved resistance to chinch bugs. They are also developing biodegradable foamed plastic sheets that contain 45 percent cornstarch. In addition the release of disease resistant soybean varieties accounts for one-half of the increase in soybean yields in Kansas—0.44 bu./ac./yr. since 1970. K-State researchers also work with alternate crops like sunflowers, pearl millet, rapeseed, and triticale.

**Horticulture:** Cold hardy cell lines of grape hybrids have been identified which are 8–10°F more cold tolerant than the original plants. Research shows that cucumbers can be treated during emergence with high (35°C) or low (7.5°C) temperatures or dilute ethanol to increase tolerance to chilling at 2.5°C. The focus is now to develop hardy, cold tolerant grape and cucumber plants.

Cut flower research focuses on improved salability through improved post-harvest handling, freeze drying, controlled atmosphere storage, and preserving and tinting selected annual species.

## Livestock

Animal and meat scientists are working to add value to meat and livestock products while enhancing profitability and food safety.

**Adding Value to Kansas Feeds:** Researchers determined that wheat gluten can be used as a protein source for calf milk replacers. In addition, extrusion increased the availability of essential amino acids from 63 percent in roasted soybeans to 84 percent for extruded soybeans. For finishing pigs, extrusion enhanced the nutritional value of corn, sorghum, wheat, and barley. A fine grind (600 rather than 1000 microns) improved feed performance 10 to 15 percent and reduced fecal excretion of nitrogen and dry matter 25 to 30 percent.

**Feed, Carcass, and Product Safety:** Scientists discovered that the use of bacterial components removes toxic products (aflatoxin) from water, that trimming gross contamination sites followed by an organic acid wash reduces trim losses by 5 to 10 lbs. per carcass, and that steam pasteurization reduces bacterial counts on carcasses by over 99.9 percent. Meat scientists are also working to enhance the shelf life of pre-cooked beef and to maintain the flavor and aroma of turkey.

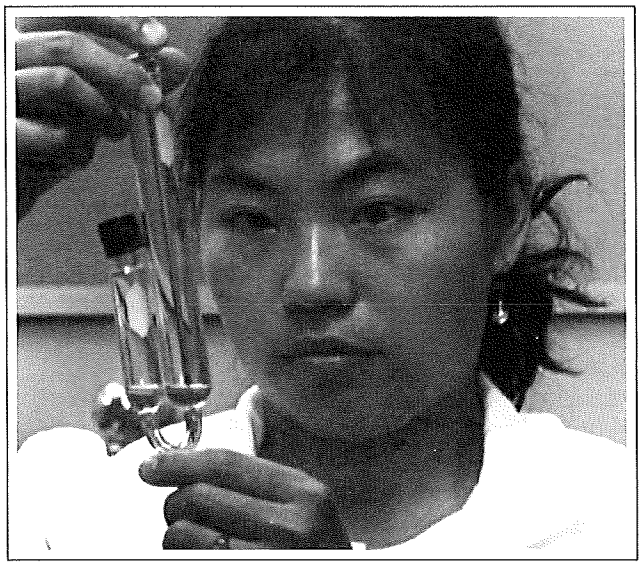
**Cheese Quality and Milk Flavor:** The use of near infrared reflectance spectroscopy (NIRS) provides for rapidly determining moisture, protein, fat, and lactose in cheese curds. This should improve cheese quality and yield. To prevent undesirable flavors, good quality milk is essential if ultra high temperatures are used for pasteurization.

## Food Safety

Food safety concerns are critical to the Kansas economy.

**Food Safety and Quality:** Food systems specialists organized programs to 1) inform food handlers about food safety issues, 2) assist selected processors to become certified to process low acid and acidified foods, and 3) help utilize Hazard Analysis Critical Control Point Programs.

**Detecting Bacteria:** K-State has patented a U-Tube system to rapidly detect, isolate, and enumerate *Listeria* and other bacteria in meat. Research also shows that hydrogen peroxide reacts with microbial enzymes and can be used to indicate surface cleanliness.



## Food and Feed Grain Utilization

KSU utilizes a pilot flour mill, feed mill, bakery, extrusion laboratory, a thermal and wet-milling laboratory in work to add value to Kansas products.

**Market Enhancement Projects:** On-farm feed manufacturers are helped to comply with Food and Drug Administration (FDA) regulations through a specially organized Extension program which has attracted national attention. Those in feed manufacturing and feed mill management workshops enhance their marketing proficiency by acquiring skills in feed processing, quality assurance, business, and by understanding government regulations.

**Milling:** A short-flow flour mill developed by K-State scientists can be fully erected and operable in 5–10 days. An experimental mill adapted to high speed data acquisition related to energy requirements to roll speed, roll gap, and feed rate will help in automation and energy saving efforts for the flour industry.

**Value-Added Developments:** Grain scientists demonstrated the value of Kansas hard red and hard white wheats in 1) the frozen dough industry, 2) producing specialty multigrain and reduced calorie breads, and 3) making bread with high temperature, short time extruders coupled with high velocity forced-convection ovens. They also showed that whole flour and bran from hard red winter wheat lowers cholesterol as much as does oat bran.

## Disease and Insect Pests

Increasingly, plant pathologists and entomologists are using biological control methods to protect Kansas crops.

**Biological Control:** A dry bran formulation, applied with a sticker material, is used to reduce the amount of tan spot fungus in straw. Tan spot organisms are also inhibited by beneficial fungi and by a bacterial strain, Pf-5, that prevents the growth of tan spot organisms.

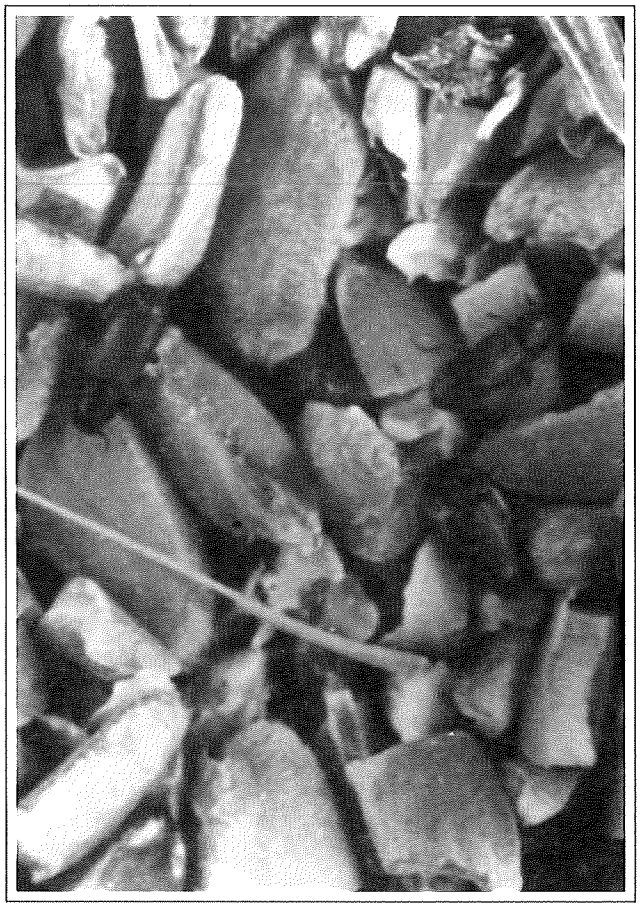
**Integrated Pest Management:** Extension specialists have organized integrated pest management (IPM) grain management demonstrations using aeration controllers and improved sanitation procedures to manage stored grain. This strategy gave better protection than did the use of chemicals. EPA hopes to achieve a 75 percent adoption rate of IPM principles by the year 2000.

**Plant Viruses:** Changes in the coat protein of a virus caused dramatic changes in the symptoms expressed by infected plants. In turnip crinkle virus, an induced mutation reduced the capacity of the virus to move from cell to cell and infect plants. In another advance, crop scientists transferred the genes to impart resistance to wheat streak mosaic virus to wheat from rye and wheat grass. Resistant lines were also derived from Agropyron sources.

## Assessing Economic Impact or Value-Added Potential

Extension specialists have developed programs to help small businesses assess the feasibility of proposed products. Projects include:

Locker plant managers were helped to gather data and evaluate the impact of proposed investments. County authorities were aided in analyzing remodeling and consolidation costs for educational facilities prior to the vote on a county-wide bond issue. The Rural Electric Administration was assisted with feasibility studies on contract farrowing and finishing, swine breeder, and sow herd facilities. The impact of a proposed short-flow flour mill in a rural county was estimated to be one million bushels of grain and $900,000 annually. A 4,000 head and a 2,000 head dairy were started in southwest Kansas subsequent to the completion of dairy enterprise studies. One company obtained data on production and break even prices and subsequently negotiated a needed price increase.



# OVERVIEW

*Marc A. Johnson, Dean of Agriculture*

## Introduction

The teaching, research, and extension efforts of faculty in the College of Agriculture, Kansas Agricultural Experiment Station, and Kansas Cooperative Extension Service add value to Kansas agricultural products, enhance the economy, and help make Kansas a better place to live. I'm pleased to share this report which gives a snapshot of selected advances in the important value-added arena.

I will provide an overview of the value-added impact of selected projects. My colleagues will address value-added advances in meat and meat products, food and feed grains, and the utility of assessing the economic impact of proposed private sector projects and products.

## Kansas Crops

K-State plant breeders should be commended for their efforts to add value to Kansas crops. For example, Karl 92, a K-State release, became the top performing wheat variety in Kansas, Texas, Oklahoma, and Missouri. Jagger, a wheat variety with improved yield and quality, was released in 1994. Since 1989, the experiment station has released 40 wheat, sorghum, and alfalfa germplasms and numerous wheat, soybean, and barley varieties. White wheat is beginning to make inroads in developing an identity preserved market. To add value, the American White Wheat Producers Association markets the products from Kansas white wheats (flour for bread, tortillas, pita bread, etc.) rather than just marketing white wheat grain.

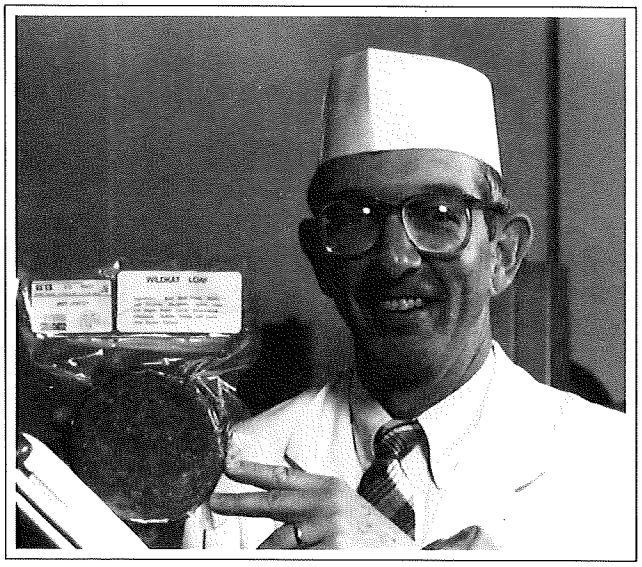
New variety releases usually yield better (perhaps 1 to 2 bu./ac.) and will likely have better insect and disease resistance, higher protein or oil content, and, for wheat, improved milling and baking quality. New cultivars are often grown on millions of acres, not only in Kansas but also in surrounding states, so the annual economic benefit is enormous.

Horticulturists have isolated cell lines in grapes that are 8°–10° more cold tolerant than the original plant. This will help in developing adaptable varieties for use in Kansas. To increase the salability, experiment station scientists are experimenting with freeze drying, controlled atmosphere storage, and improved postharvest handling techniques for cut flowers.

## Livestock

K-State animal scientists are enhancing the value of meat, livestock products, and critical feed components. To enhance the value of grains, they demonstrated that 1) wheat gluten can supply needed protein in milk replacers for calves, 2) extruding soybeans increased available amino acids by 21 percent, 3) extrusion also enhanced the nutritive value of corn, sorghum, wheat, barley, and 4) finely ground feed improved growth performance 10 to 15 percent and reduced the fecal excretion of nitrogen and dry matter by 25 to 30 percent. Each of these discoveries adds substantial value to an already important agricultural product.

Food safety is a concern both for producers, processors, and the consuming public. KSU cooperated with industry to develop an energy efficient steam pasteurization process which reduces bacterial counts on carcasses by over 99.9 percent. The process has been approved by USDA–FSIS for in-plant tests. Meat scientists are also testing procedures to 1) enhance the shelf life of boxed subprimals, ground beef, and precooked meat; 2) develop rapid and efficient methods for determining the end points in cheese



making by using near infrared reflectance spectroscopy methods to analyze for moisture, protein, fat, and lactose in cheese curds; and 3) protect milk flavor in ultra-high temperature pasteurization. A KSU bacteriologist patented a newly developed procedure to speed the identification of *Listeria* and other bacteria in meat. Each procedure helps insure a safe, wholesome, and nutritious product.

## Food and Feed Grain Utilization

Last year, we reported that K-State scientists had developed a short-flow flour mill that can be set up and fully operable in 5 to 10 days. K-State scientists have also designed a variable rate, two-row experimental mill for acquiring high speed, computerized data to speed automation and achieve new energy efficiencies in flour mills.

In other value added developments, grain scientists have demonstrated the utility of using hard red and hard white wheats in the frozen dough industry (utilized in 25,000 in-store bakeries), in specialty and ethnic breads, and in pasta and oriental noodle products. These uses represent important new markets for Kansas wheats. A K-State biochemist is testing the use of wheat and cornstarch in manufacturing biodegrable plastics for wrapping or cushioning food and nonfood products.

## Value-Added Potential

Value-added specialists and extension economists help individuals and small businesses with programs that assist in analyzing the economic impact and value-added potential of numerous products and enterprises. This work is often cooperative with the Kansas Value-Added Center and may involve chemical, microbiological, or sensory analysis or in-house consultation, business plans, or shelf life evaluation.

Extension specialists also help with programs to assess the value- added or economic potential of locker plants; flour mills in rural areas; farrow and finish operations; consolidation of county educational programs; small businesses; dairies in southwest Kansas; turkey feeding, breeding, and processing facilities, feedlots and other value-added products or enterprises.

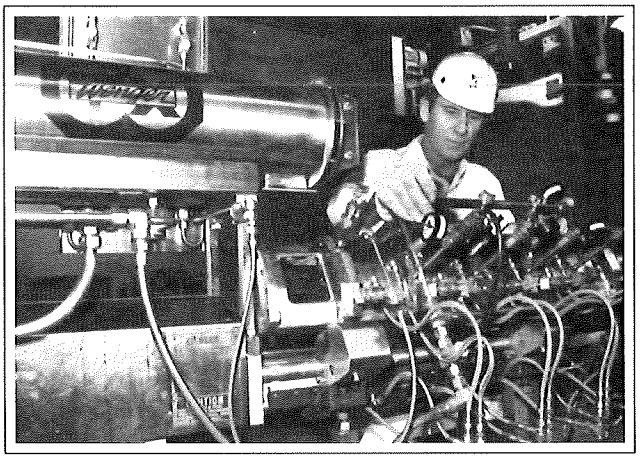
## Summary

I'm genuinely pleased to share this report of activities by K-State researchers and extension specialists that add significant value to Kansas products, processes, and small businesses.

Should there be questions or suggestions, I would be pleased to respond.

# ADDING VALUE TO FOOD AND FEED GRAINS

*Richard R. Hahn, Head, Department of Grain Science and Industry*



The theme of KSU value-added research is to develop a competitive advantage for Kansas commodities. It may involve developing a more profitable raw material with quality as the most important characteristic. It may concern technology developed for new or more profitable products. Or it could include information to help Kansans to be safer, smarter, more effective, or more competitive economically. The following examples are cited as examples of the impact of our research on the Kansas economy.

## Wheat Flour Milling

Wheat flour milling is very important to the state of Kansas, and we are a major player in the U.S. wheat flour milling industry. Kansas has ranked first in the United States in number of flour mills and in wheat flour production for the last 100 years, and 10.2 percent of the U.S. milling capacity is located in Kansas. Currently, the industry is undergoing an unprecedented expansion due to the increasing consumption of wheat products by U.S. consumers. Consumption has increased to 144 lbs. per person, up 21 percent in the last 10 years. This is largely due to the Food Pyramid dietary guidelines that recommend a major increase in the consumption of grain-based products for a healthy diet. Are you eating your 6 servings of grain-based products every day as recommended?

Kansas is sharing in this expanding milling capacity with four major expansions currently underway or recently completed. Mills are located either where the grain is grown or in population centers. We are fortunate that mills have chosen to remain in Kansas. It would take only 10 percent of the Kansas mills and only 2 percent of the Kansas wheat crop to supply the needs of the Kansas population. Our mills not only have a state focus but also a national and an international focus. The impact of the wheat flour milling

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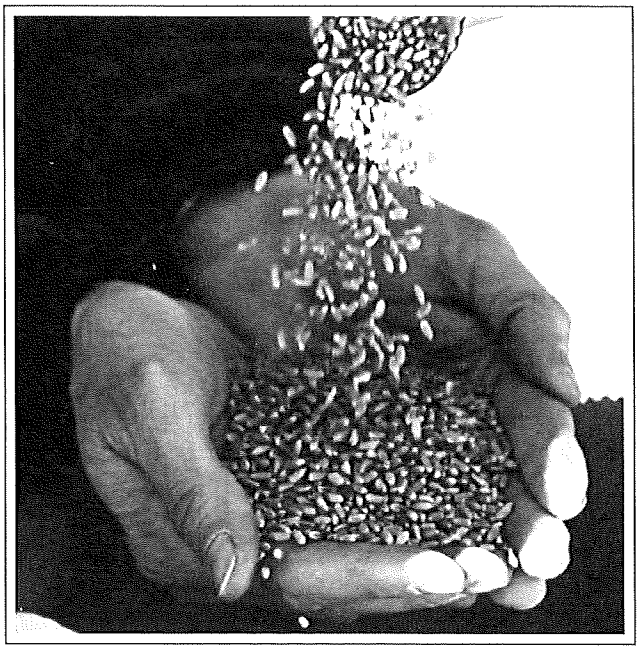
industry on the state's economy is tremendous. A conservative estimate is that milling value adds more than $1 billion per year to the state's economy.

Research at the K-State Grain Science Department serves the needs of the Kansas and U.S. milling industry. Two specific projects that have made important contributions in the last year are grain quality measurement and milling research. Quality is an ongoing effort, and Kansas is the leading state in wheat quality research. The Grain Science Department works closely with the Department of Agronomy and others in making sure Kansas varieties have the necessary milling and baking qualities.

We also have been working on the development of the single kernel wheat characterization system. An instrument was developed by the U.S. Grain Marketing Laboratory in Manhattan and has just been adopted by the FGIS for quality measurement of domestic and overseas marketing of wheat. By 1996, every bushel of Kansas wheat will be evaluated for quality by this test.

Our role in this development has been to work closely with industry to relate the measurements obtained to important processing characteristics. The instrument used takes 300 wheat kernels from a sample, and in three minutes provides information on hardness, moisture, kernel size, and kernel weight. From this we can estimate milling yield, which quickly provides part of the information millers need to assess the value of the wheat. The remaining factor to be measured is baking quality.

A second research area is the impact of large vs. small wheat kernels on milling yield. The industry has believed for years that large kernels mill better than small, but such a belief has never been studied and quantified. In the last year, using the KSU continuous pilot flour mill under carefully controlled conditions, we demonstrated a 1 percent to 2 percent increase in milling yield from larger kernels. This is important to the profitability of the industry and will be used in our wheat breeding program to provide a competitive advantage for Kansas wheat.



## Sorghum Wet Milling

Kansas is the leading producer of grain sorghum. Its primary use is as animal feed, with only about 2 percent of the crop going to ethanol production and other industrial uses. Development of other uses could add to its value to the state. Sorghum is not an easy crop to process. A breeding program is under way in the Department of Agronomy to improve the feeding value of sorghum. We have begun evaluating the impact of these improved hybrids on the processing potential for sorghum. We have found that a lowwater, low-energy, modified wet-milling process produces a starch suitable for many industrial uses that should be competitive with cornstarch. Adhesives and ethanol are first targets.

## Industrial Uses of Wheat Starch

Kansas is the leading producer of wheat starch. Wheat starch has suffered from limited markets because cornstarch is generally cheaper. Expansion of the wheat wet milling industry requires major new uses for the starch, and we have been doing research on various uses. Recently, there was a major breakthrough in industrial use because of the licensing of a KSU patent to Environmental Technologies, USA, for producing biodegradable packing filler from wheat starch. This firm is a major producer of environmentally friendly, plastic-type materials. They have found that KSU technology improves their competitiveness with the polystyrene-based materials in use today. Immediate potential is 50 to 100 mm lbs. annually in a 1 billion pound market. Additional starch-based thermoplastics are under development.

# ADDING VALUE TO MEAT AND LIVESTOCK PRODUCTS

*Jack G. Riley, Head, Department of Animal Sciences and Industry*

Animal scientists continue to devote priority to research that adds value, creates new products or uses, and improves the safety and enhances the potential profitability of meat and livestock products. The impact of research in this area has far-reaching benefits to producers, suppliers, processors, and consumers, and those benefits go beyond simple economics. A safe, nutritious supply of food is essential for a healthy, thriving population. Protection of animals' health and welfare, conservation of natural resources, maintaining quality of the water and environment, and infusion of human capital into rural communities are vitally important to the future of animal agriculture, especially in Kansas.

## Education

Highly skilled, well-educated young people represent the future for growth in value-added products and enhanced production of raw commodities. Animal Sciences and Industry is the largest undergraduate program at K-State, and students majoring in Animal Sciences or Food Science are an excellent human capital resource.

## Livestock Production

Research to improve the level and efficiency of livestock production is vital to the profitability and sustainability of animal agriculture in Kansas and the United States. For example, Kansas has 4 percent of U.S. beef cows, 6 percent of total cattle, 14 percent of feedlot cattle, and 20 percent of cattle slaughtered. Even though swine, dairy, sheep, and poultry numbers in Kansas are less impressive, they still represent over $525 million of annual farm income. An increased level of production from each animal unit represents the most cost-effective, value- added potential for most farmers and ranchers. Land-grant research in the last 20 years has helped increase beef/cow by 33 percent, pork/sow by 63 percent, milk/cow by 50 percent, and poultry/hen by 86 percent.

## Range Utilization

Adding value by effective utilization of natural resources has provided Kansas ranchers significant advantages over other parts of the United States. Kansas ranks first in per acre productivity of rangeland in the 17 western states. The use of cattle to convert this basic natural resource into salable beef is a basic component of value-added Kansas agriculture.

## Livestock Management

Encouraging the optimum use of genetics, reproductive physiology, molecular biology, preventive herd health, and economically sound animal production systems offers the greatest potential for added value starting at the farm or ranch.

## Enhancing Composition and Nutritional Quality

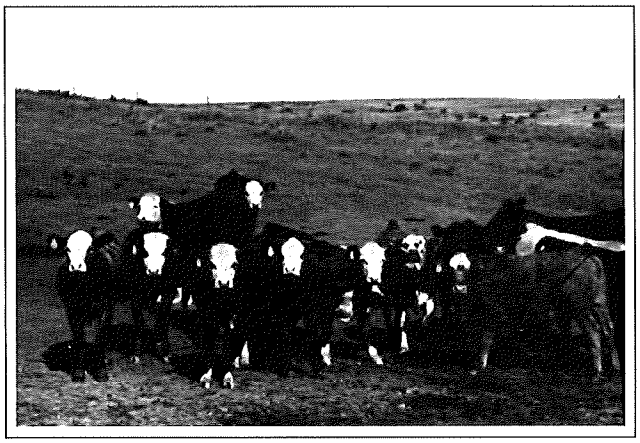
Developing better production and processing technologies to improve product quality and decrease fat quantity is an important research objective. Biotechnology, coupled with selective breeding systems, can be used to enhance muscle growth and protein synthesis while reducing fat deposition without impacting product palatability.

## Food Safety

Consumers expect the animal products they purchase to be safe as well as wholesome and nutritious. Safety of livestock products starts by implementing quality assurance programs for live animals and identifying critical intervention points in the production, processing, retail, and consumer chain where hazards may be prevented. Scientifically based intervention strategies are being developed for the various Hazard Analysis Critical Control Points in the food chain. Major research emphasis is placed on detection of pathogens and reduction of pathogens.

## Value Improvement

Emphasis is being placed upon developing new, and perhaps novel, uses of meat and animal products. Special attention is being given to developing consumer-ready



products and convenience items. New markets need to be identified and developed, including greater international outlets. Increased utilization and efforts to improve the value of low-value, raw materials such as fat, heart, blood, skin, and whey offer significant value-added potential.

### Consistency

Consumers have demonstrated a willingness to pay for quality, provided that consistency and reliability are assured. Beef, in particular, has been criticized for lack of consistency. Answers to those issues involving consistency can best be determined by interdisciplinary research efforts.

Adding value to meat and livestock products is clearly covered in the mission and goals statement of the 1995 Strategic Plan of the Kansas Agricultural Experiment Station.

# ECONOMIC IMPACT OF VALUE-ADDED ACTIVITIES

*Daniel J. Bernardo, Head, Department of Agricultural Economics*

The economic impact of value-added activities is manifest in a variety of ways in the Kansas economy. Examples include increases in economic activity resulting from the adoption of new production practices; the development of new products and/or markets; reductions in risk associated with current production and processing activities; improvements in food safety; and the emergence of new market structures—these all represent additional value to producers, processors, and consumers. Proper economic assessment of these activities requires determination of their impact on commodity prices, processor costs and revenues, prices paid by consumers, as well as income and employment effects on local economies. Through applied research and Extension programs, faculty in the Department of Agricultural Economics continue to pursue both disciplinary and interdisciplinary efforts related to value-added activities.

Although value-added activities occurring in one sector of the food and fiber complex have beneficial effects in other sectors, what follows are some recent economic assessments of value-added activities as they relate to producers, processors, and consumers. While this discussion is not an exhaustive treatment of recent economic analyses of value-added activities, it does provide some idea of the breadth of our involvement in this area.

## Value Added to Agricultural Production Activities

A recent effort focusing on value-added activity at the producer level evaluated those attributes of wheat that are most highly valued by the market. Understanding the value that the market places on those attributes will help guide breeding programs toward producing varieties that contain the most desired characteristics. The research will also help producers make informed decisions regarding varietal selections.

The benefits and costs of producing and marketing identity-preserved grain products continues to be evaluated. Much of this work is being performed in conjunction with the American White Wheat Producers Association. The goal of this research is to identify new markets for specialty wheat crops and determine if producers can add value to their production through cooperative marketing of high-quality, identity-preserved grains.

The potential benefits of producer-financed advertising and promotion programs also are being investigated. Cattle producers require such information if they are to make optimal use of checkoff receipts. The effects on cattle producers of developing new, low-fat ground beef products have been examined. As additional value-added beef products are produced, the ultimate effects on beef producers need to continue to be examined.

The economic feasibility and additional value created by sitespecific farming techniques are currently being investigated. Site-specific farming refers to the use of global positioning satellites to manage fertilizer and pesticide applications on small plots within larger fields. This interdisciplinary research will provide important information regarding the economic feasibility of such ventures.

## Value Added to Food and Fiber Processing Activities

Technological changes in food processing resulting from consumers' increasing demand for convenience and variety have affected the relative demands for raw food inputs. Understanding these changes and how they affect production agriculture provides additional insight into value-added possibilities for agricultural producers and food processors.

Value-added product development provides excellent opportunities to stimulate economic development in Kansas communities. Over 20 economic impact analyses of specific value-added food and fiber processing activities have been conducted. These projects have involved the application of a variety of economic tools and concepts, as well as estimation of employment and income effects on rural communities. These studies have involved a variety of products and activities, including the production and processing of vegetables and specialty meats, restaurant development,

expansion of hog production, alternative uses of wheat straw, and various dairy production facilities.

The impact of food-safety regulations on meat processors is currently being considered. The costs of such regulations include both direct compliance costs and indirect productivity losses. The economic effectiveness of recent regulations is being considered. In related work, sources and causes of variability in microorganism contamination in meat processing are being identified. The approach is to quantify costs and benefits of various antimicrobial control measures. Finally, producer (and consumer) adoption and acceptance of Hazard Analysis Critical Control Point (HACCP) programs within the meat-processing industry is being considered by research and Extension faculty.

## Value Added to Consumer Activities

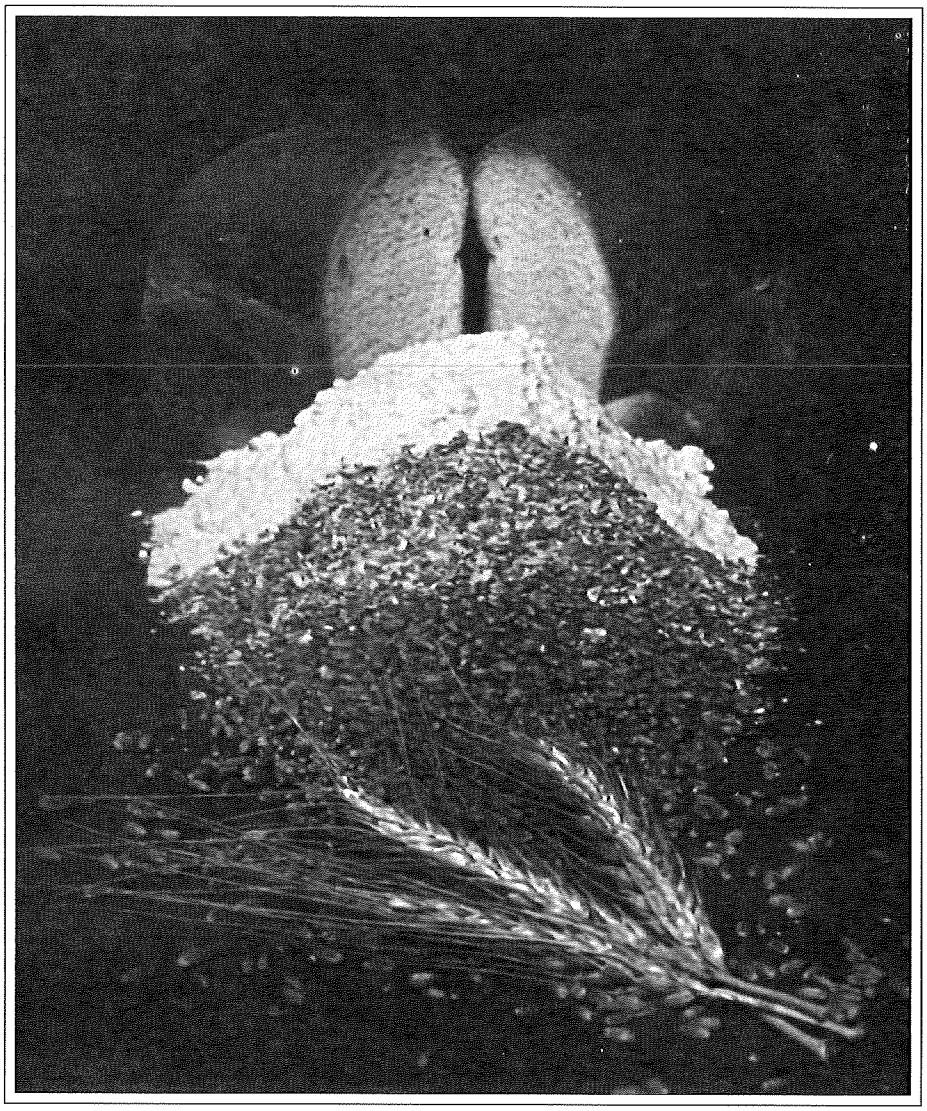
All of the previously mentioned activities have, at least, indirect benefits to consumers. In addition, the Department of Agricultural Economics has been involved in many research activities that have direct benefits to consumers.

An ongoing study addresses the use of irradiation to control salmonella. The purpose of this research is to determine consumer acceptability of irradiated meat products.

Consumer surveys and case studies are being used to evaluate the market potential for new value-added grain products both domestically and internationally. Domestically, many of the markets for these products will likely involve ethnic food products. Internationally, the key will be to provide a very high-quality product into a variety of niche markets.

## Summary

Value-added activities produce direct and indirect economic impact throughout the economy. An important component of KSU's research and Extension programs focuses on quantifying these impacts to assist private and public decision-makers in identifying those activities that yield the highest return on investment. These efforts will continue as new products and processes are developed.



# ADDING VALUE TO KANSAS AGRICULTURAL PRODUCTS

## AGRICULTURE IN KANSAS

Agriculture in Kansas is big business and includes 66,000 farms on more than 47 million acres (33 million acres of field crops and 14 million acres of range). The value of production is over $7 billion annually. Although best known for the production of wheat (Kansas produces 15 percent of the nation's wheat), the leading crops also include corn, grain sorghum, soybeans, and alfalfa. Improved hybrids and better varieties that enhance the yield per acre are among the many value-added products produced in Kansas.


Because the leading crops occupy such large acreage in Kansas and other states, these advances are multiplied many times each year. The state's impressive range and crop industry provides the foundation for the Kansas livestock industry—an industry that is first in the nation in cattle slaughtered, second in all cattle and calves on farms, and third in red meat production.

## FIELD CROPS

Nationally, Kansas consistently ranks first in wheat and sorghum production for grain and silage. Because of favorable soil and climate, Kansas ranks second in the nation in cropland; fourth in sunflower production; sixth in exports of farm products and in cash receipts from farm marketings; eighth in all hay produced; ninth in corn grain production; tenth in soybeans produced; eleventh in alfalfa hay produced, oat production, and in dry edible bean production; and twelfth in corn silage production. The challenge is to add value to each raw product that Kansas produces so abundantly.

**Adding Value to Agronomic Crops:** A primary method for adding value to most agronomic crops is through crop breeding activities. The Kansas Agricultural Experiment Station has breeding efforts in wheat, sorghum, soybeans, alfalfa, barley, and canola. In addition, value may be added to producer net income through more efficient management practices that reduce input costs such as fertilizer, herbicides, labor, etc. This report focuses primarily on value added to crops through improved varieties and germplasms. Examples of improved management techniques that enhance profitability also are cited.

**Crop Variety and Germplasm Releases:** The Kansas Agricultural Experiment Station has supported crop breeding activities in Kansas since 1863. Much of that work has been in cooperation with the U.S. Department of Agriculture. For selected crops and for the past 20 years, this support has been augmented by the Kansas Wheat, Grain Sorghum, Corn, and Soybean commissions, and the Kansas Crop Improvement Association. The goal is to develop cultivars and germplasm that provide improvements in yield, insect and disease resistance, and, for wheat, milling and baking quality.

### WHEAT

Wheat is planted on 11.9 million acres in Kansas and had a farm value of $1.5 billion in 1994. Because Kansas leads the nation in wheat flour produced and in active milling capacity, the end-use properties of wheat are of particular concern to plant breeders, farmers and ranchers, and the milling and baking industry. Each new variety or hybrid released by the Kansas Agricultural Experiment Station must exhibit a definite advancement in crop yield, insect or disease resistance, or other agronomic or end-use qualities.

**Improving Kansas Wheats:** Plant breeding is the only way to economically incorporate higher protein, better milling quality, and better baking characteristics into Kansas winter wheats. Fortunately, it costs wheat growers no more to produce high quality wheats. Yet it is advantageous



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to meet the requirements of customers who demand quality and to compete with a quality product in the marketplace. Successful new wheat varieties have a huge economic impact on the Kansas economy. We estimate that for every dollar invested in wheat breeding research, the return to the Kansas economy is over $40.

**Karl Wheat:** Karl, released by the Agricultural Experiment Station in 1988, is currently the leading wheat variety planted in Kansas and Oklahoma and is planted on more than 6 million acres. It is estimated that this variety alone provides $25 million to the state's economy each year because of its outstanding milling and baking characteristics, high yields, and premium payments for high protein.

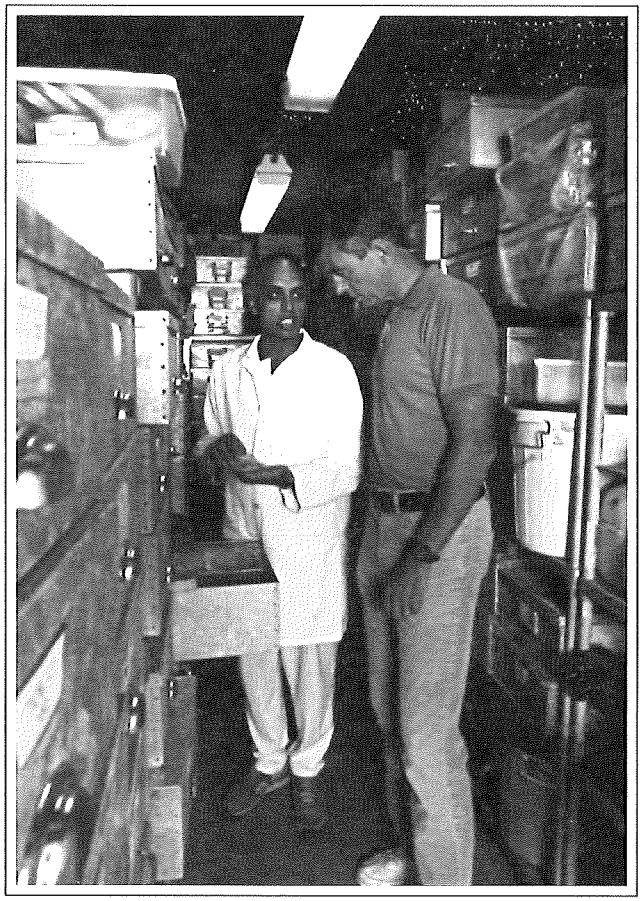
**Karl 92 Wheat:** Karl 92, the top performing variety in Texas, Oklahoma, Kansas, and Missouri, is a reselection of the variety Karl. Karl 92 has improved disease resistance, excellent milling, baking, and flour quality, and a (4 bu./ ac.) yield advantage over Karl. It has good tolerance to leaf rust, stem rust, powdery mildew, tan spot, *Septoria tritici*, *Septoria nodorum*, bacterial leaf blight, soilborne mosaic virus, and spindle streak mosaic virus. Wheats like Karl, Karl 92, Ike, and Jagger clearly demonstrate that it is possible to develop wheats that have excellent milling and baking quality and performance.

**Jagger and Other Wheats:** In 1994, Jagger hard red winter wheat was released to Kansas certified seed growers. It represents improvements in baking quality and grain yield compared to Karl 92. This improved performance is at no sacrifice to milling and baking quality, which are excellent for both varieties.

The experimental line, KS92PO263-137 was approved for increase and release at the 1995 Fall Cereal Conference and was named 2137. This line has a 5 bushel yield advantage over Karl 92 and 2163 and an excellent combination of disease and insect resistance. 2137 is adapted to all growing areas of Kansas, unlike Karl and Karl 92, which are best adapted to central and eastern Kansas.

**Developing Hard White Winter Wheats for Kansas:** Arlin, a recent KSU release, is grown on 10,000 acres in Kansas. Because of improvements in yield, test weight, protein concentration, kernel color (whiteness), straw strength, milling and baking quality it is allowing the American White Wheat Producers Association to expand their production capacity.

Two new hard white wheat selections are being tested. In 1994, their performance was better than Arlin in central and eastern Kansas and slightly lower in western Kansas. Both selections have better disease resistance than Arlin and competing white wheats. The germplasm release, KS84HW196, also helped advance the white wheat breeding program.



**Wheat Genetics Resource Center:** Established in 1984, The Wheat Genetics Resource Center (WGRC) collects, maintains, evaluates, and documents the genetic resources of wheat. The WGRC helps to broaden the crop genetic base and develop genetic and cytogenetic stocks for rapid and efficient gene transfer for breeding superior wheat cultivars. Resistance genes are incorporated into wheat lines and released as germplasm. The WGRC also develops new cytogenetic stocks and chromosome and DNA-based assays for plant genome analysis and germplasm development.

The WGRC catalogs more than 2,200 strains of wheat collected from around the world and identifies gene translocations that confer resistance to diseases and pests of wheat. Currently, 39 such transfers have been identified providing resistance to leaf and stem rust, powdery mildew fungi, wheat streak mosaic virus, greenbug, and Hessian fly.

One accession was evaluated for resistance to tan spot and *Septoria* fungi. This wild species of wheat is extremely resistant and over 80 percent of the accessions tested were resistant to the fungi.

**Wheat Germplasm Releases:** For wheat germplasm, the traits of genetic interest included genes that enhanced resistance to Hessian fly, leaf rust, soilborne mosaic virus, powdery mildew, Russian wheat aphid, *Septoria* leaf blotch, or that improved response to heat and drought or Durham

wheat characteristics. New cultivars and germplasm released by the experiment station are rapidly accepted by farmers or utilized effectively by scientists to transfer needed characteristics to new varieties and hybrids. Germplasm releases are listed below:

| | | |
|---|---|---|
| KS85WGRC1 | KS86WGRC2 | KS89WGRC3 |
| KS89WGRC4 | KS89WGRC6 | KS89WGRC7 |
| KS89WGRC8 | KS89WGRC9 | KS90WGRC10 |
| KS91WGRC11 | KS91WGRC12 | KS91WGRC13 |
| KS91WGRC14 | KS92WGRC15 | KS92WGRC17 |
| KS92WGRC18 | KS92WGRC19 | KS92WGRC20 |
| KS92WGRC21 | KS92WGRC22 | KS92WGRC23 |
| KS92WGRC24 | KS92WGRC25 | KS92WGRC26 |
| KS92WGRC27 | KS92WGRC28 | KS94WGRC29 |
| KS94WGRC30 | KS94WGRC31 | KS94WGRC32 |
| KS95WGRC33 | | |

**Mapping the Wheat Genome:** KSU scientists are mapping the wheat genome to hasten the development of wheat and disease resistant cultivars. The map contains 280 DNA loci, eight protein markers, a leaf rust resistance gene, and links specific genes to identified plant traits.

**Genetic Scissors:** Each visible or phenotypic trait of the plant i.e. height, seed color, yield, and disease resistance, is controlled by a gene. Researchers have developed a genetic scissors system to help locate phenotypic traits. Thus, wheat plants missing small pieces of chromosomes can be obtained and the "deletion" chromosome can be identified. If a 'deletion chromosome plant' is deficient in a certain phenotypic trait, then that gene must lie on the missing chromosome segment. This helps in decoding the genetic blueprint of the entire wheat plant.

**Hessian Fly:** Detailed genetic maps are being developed of chromosomal regions that carry a gene for resistance to Hessian fly, a destructive pest of wheat. After the genes are molecularly isolated, they can be genetically engineered into wheat. DNA sequences have been isolated from rye that allow the selection of DNA markers for specific areas of the genome using wheat lines that carry small pieces of rye chromosomes. This is a powerful way to generate high density chromosomal maps.

**County Wheat Programs:** Numerous county agents establish demonstration plots, and organize educational events to keep producers abreast of new varieties and their yield potential. One specialist held wheat production schools in five counties, reached 270 producers, and helped farmers with production practices related to tillage, variety selection, soil and water erosion control, soil fertility, insect and disease control, weed control, and harvesting and storage.

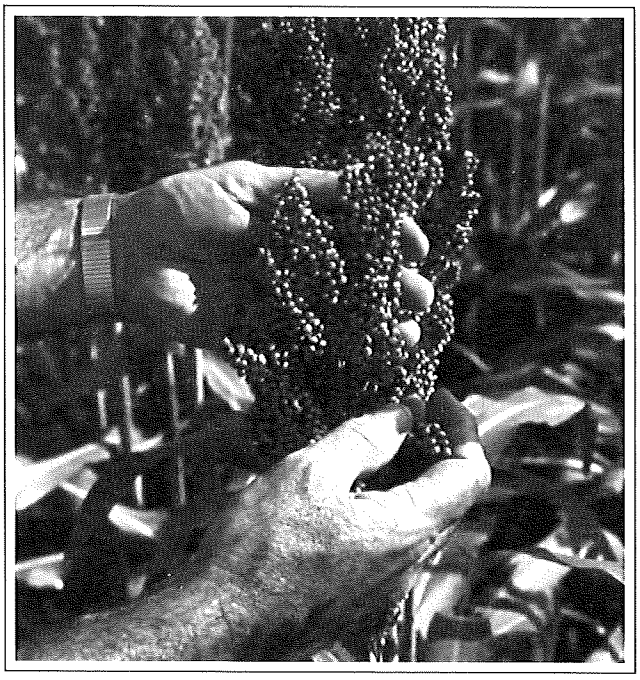
**Adding Yield Potential:** The county agent in Lincoln County encouraged producers to add 3 to 5 bu./ac. to their potential yield value by planting top yielding varieties. He demonstrated that this could add 250,000 to 500,000 extra bushels of wheat on the 120,000 acres of wheat in the county; 50,000 to 125,000 additional bushels on the 25,000 acres of grain sorghum; and 60,000 extra pounds of sunflowers in the county. The plots will be continued because of their educational potential.

## GRAIN SORGHUM

Grain sorghum is planted on 3,200,000 acres in Kansas and has a farm value of $482,160,000. It is an important drought-resistant crop and is used for feed grain and silage by livestock. K-State research is directed at enhancing the yield, nutritive, and processing potential of this important feed grain. It is grown primarily as a non-irrigated crop (89 percent) although a small acreage is grown under irrigation (8 percent) and some is utilized for silage (3 percent).

**Grain Sorghum Germplasms:** Grain sorghum germplasms with resistance to chinchbugs, greenbugs, sorghum diseases, and stress tolerance have been released by the Agricultural Experiment Station. Researchers have developed field screening procedures based on rearing chinch bugs first on barley and then on corn. This helped identify four new sources of resistance to chinch bugs. Researchers have also identified two germplasms from Russia that are resistant to biotype I greenbugs. In the near future these critical discoveries will be used to enhance the pest resistance of commercial hybrids used in Kansas and other states. Grain sorghum germplasm releases from 1985–1994 include:

| | | |
|---|---|---|
| KS Bulk 30 | KS Bulk 31 | KS 84 |
| KS 85 | KS 86 | KS 87 |
| KS 88 | KS 89 | KS 90 |
| KS 91 | KS 92 | KS 93 |
| KS 94 | KS 95 | KS 96 |



**Breeding Sorghum for Improved Digestibility:** Most grain sorghum is marketed as feed grain for cattle, swine, or poultry. Researchers are working to genetically improve the digestibility and feed efficiency of sorghum relative to corn. They are using screening techniques and selecting populations for grain yield, maturity, and agronomic acceptability in the field and for protein digestibility in the laboratory. Test results from the breeding program and from feeding trials indicate that this conjunctive approach will result in high yielding grain sorghum hybrids with improved digestibility.

**Breeding Sorghum for Improved Dryland Production:** In Kansas, nine acres of dryland sorghum are produced for every irrigated acre of production. Dryland production requires fewer inputs and is more sustainable given our restricted supply of water, yet those crops may yield less and would benefit from more intensive research. Scientists are using 'stress' and 'non-stress' techniques to develop stress-tolerant, inbred lines. Trials show that the stress-selected population had higher-yielding, broader adapted lines than the non-stress population. A number of lines resulted in hybrids that yielded more than the best commercial hybrids.

**Breeding Sorghum for Tolerance to *Fusarium* Stalk Rot:** Stalk rots cause lodging, induce small seed, and reduce grain yield. Plant breeders are developing stalk rot tolerant parental lines using an inoculation technique. Parent lines come from screening programs for drought, feed quality, and chinch bug resistance. Because of inoculation, the incidence of lodging was severe but six new lines, 2 male parent and 4 female parent lines, were advanced for release. The female parent lines will be sterilized and released as A–B pairs. All hybrids have improved yield, stress tolerance, and stalk strength.

**Screening for Chinch Bug Resistance:** Chinch bugs often infest grain sorghum fields in northeast Kansas. Entomologists have developed procedures to identify sorghum lines with resistance to chinch bugs so they can be advanced in the breeding program. High populations of chinch bugs were developed by planting thin stands of barley in early March. June planting of sorghum lines and hybrids were then evaluated for chinch bug damage. Experiments utilizing 16 chinch bug resistant lines demonstrated that some highly resistant lines possess a high level of antibiosis. The number of eggs laid by females confined to resistant lines of sorghum was about one tenth of those laid by females confined to a line containing susceptible sorghum.

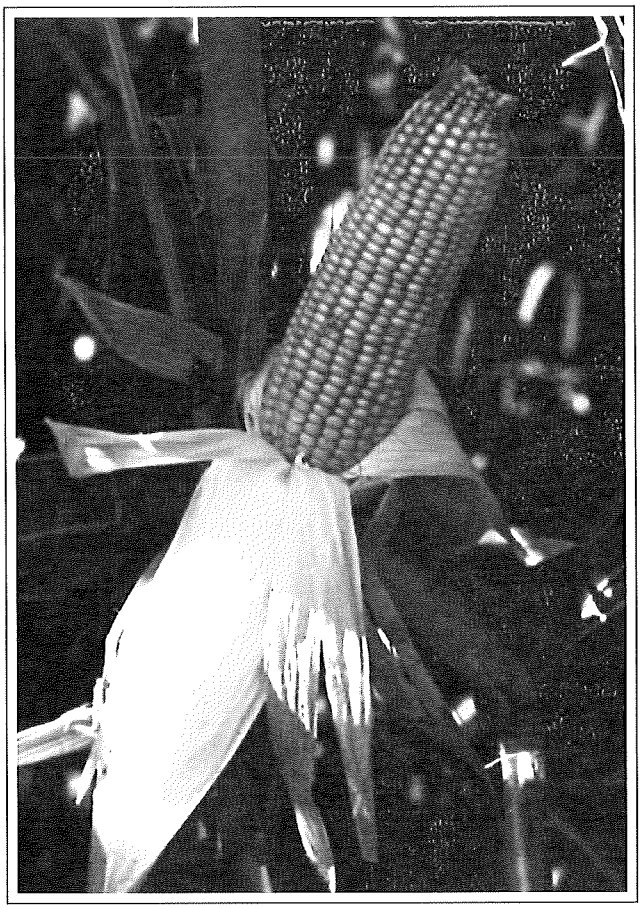
**Nutritional Value of Grain Sorghum:** Subsequent to K-State investigations on grain sorghum, the National Research Council (NRC) increased their assessment of its nutritional value from 82 percent to 90 to 100 percent that of corn, depending on the processing method. This adds about $0.20 to the price per bushel and $40 million to the state's economy each year.

**Processing Grain Sorghum—Swine and Poultry:** For grain sorghum, digestibility improves but processing costs increase as particle size is reduced. For finishing pigs, the best particle size for both hard and soft sorghums was near 600 μm when milling costs were balanced against improved efficiency. For laying hens, the ideal particle size for feed approximated 800 μm for egg production. In other experiments, a 10 percent to 15 percent increase in litter weight gain resulted when lactating sows were fed extruded rather than ground grain sorghum. Steam flaking resulted in better feed intake than extrusion, but extrusion still resulted in the greatest nutrient digestibility and greatest reduction of fecally excreted nutrients.

**Processing Grain Sorghum—Nursery Pigs and Broiler Chicks:** KSU investigators found that reducing the particle size of grain sorghum to 400μ made its nutritional value equal to corn in nursery pig and broiler chick diets. They also found that diets for baby pigs containing wheat gluten had a 5 percent greater digestibility than diets with soybean meal.

## CORN

Corn is grown on almost 2,280,000 acres in Kansas and returned $757,387,000 to the Kansas economy in 1994. In feedlots, corn is often the grain of choice and the nutrient and digestibility standard by which other feedstocks are compared. Because of its value, Kansans grow more irrigated corn (1,400,000 acres) than dryland corn



(730,000 acres). Corn silage is produced on an additional 130,000 acres. K-State research addresses a variety of corn production and utilization needs.

**Urease Inhibitor, NBPT:** Results from two years of research indicate that NBPT has good potential for improving the performance of surface-applied urea in conservation tillage production systems. Corn and grain sorghum yield were increased 14 bu./ac. and 5 bu./ac., respectively by using urea with NBPT compared to urea alone. Use of the urease inhibitor improved performance of urea regardless of previous crop residue. NBPT will be available for the 1995 crop season.

**Thermoplastics Technology Using Corn:** Foamed flexible plastic sheets are used to cushion delicate instruments during shipment. Grain scientists want to produce flexible foamed sheets containing high levels of cornstarch because petroleum-based polymers cost approximately 5 times more than cornstarch. A laboratory-scale extruder was used to test several formulations to produce foamed products. One formulation contained 45 percent starch and gave low density foams with a uniform cell structure and good elastic properties. The product is thought to be biodegradable.

**Rust Resistance in Maize:** Scientists have made good progress to clone a rust resistant gene in maize. They identified DNA sequences near the rust resistant genes on maize chromosomes and are using various strategies to walk down the chromosome from DNA markers to the resistant gene. A technique called RAPD mapping works efficiently for maize and is being used to generate DNA markers near two disease resistant genes.

**Rust Resistant Loci in Corn:** K-State scientists have studied rust resistant loci in corn. The gene worked with most, Rp1, is genetically the best characterized gene of any complex disease resistant locus. Plant pathologists have combined several kinds of resistance into one chromosomal spot, so they can be manipulated as a single gene by plant breeders.

**Proteinase Inhibitors:** Genes for proteinase inhibitors from corn and rice, with potential for enhancing resistance in crop plants, have been genetically engineered into tobacco. This is a useful model system because it can be rapidly regenerated from tissue culture. Scientists also want to increase the amount of these inhibitors in alfalfa, tomato, and soybeans to provide new sources of pest resistance and other useful genetic traits. Hopefully, the inhibitors will interfere with feeding by the alfalfa weevil and other pests.

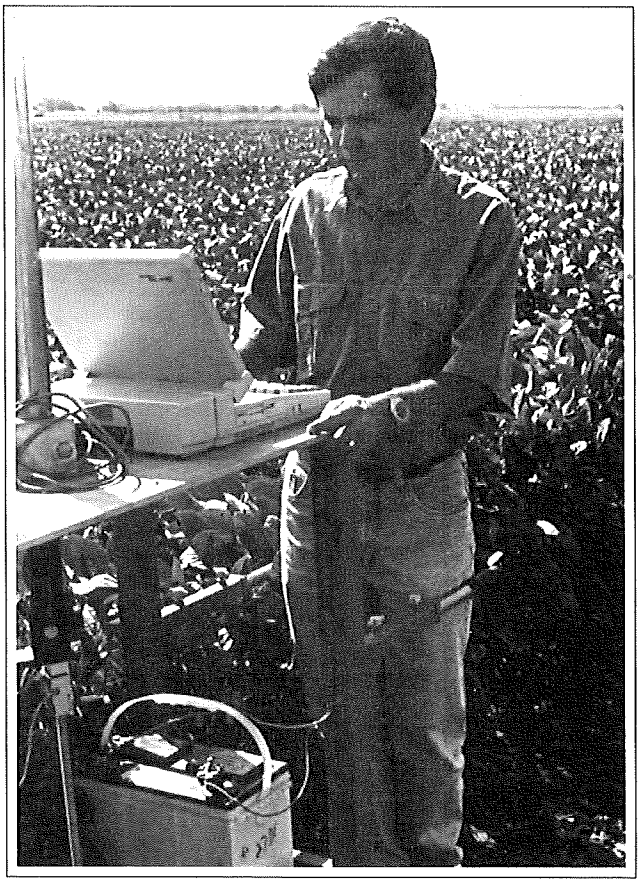
## SOYBEANS

Soybeans are legumes that fix nitrogen from the air for use by the growing plant. This significantly enhances environmental quality by reducing the need to apply nitrogen fertilizer. The crop yields a high protein, high energy grain which is grown on 2,150,000 acres and has a farm gate value of $400,680,000. Soybeans are marketed as a high protein meal for livestock and as an edible oil. Soybean oil is also utilized for a variety of industrial applications.

**Breeding Soybeans for Increased Productivity:** Development of new, disease resistant varieties and integration of those varieties into cropping systems accounts for approximately one-half of the improvement in soybean yields in Kansas. Over the past 25 years, yield averages have increased from 15–19 bu./ac. to 34–39 bu./ac. or 0.44 bu./ac./yr. since 1970. It is estimated that about one half of this increase resulted from improved genetics.

**Soybean Variety Release Policy:** K-State has pioneered a new soybean release procedure. The Kansas Soybean Variety Release Board coordinates the release of soybean varieties developed by Kansas State University and cooperating institutions. All varieties are protected under Title V (Certification Option) of the Plant Variety Protection Act. Eligible certified soybean growers who choose to participate can form a marketing association for each released variety. Each association elects its own leadership and has considerable flexibility in producing and merchandising the soybean variety for which it is responsible.

**Commercial Soybean Varieties for Kansas:** The Kansas Agricultural Experiment Station has approved the release of



3 new soybean varieties. KS4895 is a late Group 4 line, Probst from Indiana is a late Group 3 line, and Stressland from Ohio is an early Group 4 line. All three releases exhibit a significant yield advantage over other public varieties with similar maturity. In Kansas, genetic improvement of yield increases farm income by about $1.2 to $2.4 million per year.

**Soybean Cyst Nematodes (SCN):** Infestations by SCN now includes 16 Kansas counties and 2 percent of the state's soybean acreage. In infested acres, losses average about 15 percent but can exceed 35 percent in some fields. To find SCN resistant germplasm, 4,000 lines were screened and 100 Group 3-5 entries were evaluated for resistance to SCN in breeding trials. To date, one resistant variety, KS5292, has been released. This variety is grown on 25 to 30 thousand acres in southeast Kansas. However, scientists are continuing their work to develop resistant varieties and strategies to minimize losses. If the yield loss in infected fields is only one percent, the use of resistant varieties and improved management will enhance farm income in Kansas by $1 million annually.

**Soybean Planting Rates:** Researchers showed that soybean stands could be lowered 30 percent without lowering yields. The potential savings in seed costs approximate $4.5 million. In addition, the use of a crop rotation reduced nematode counts by 47 percent (a $44/acre advantage). If a resistant variety was used in the rotation, the economic advantage rose to $78/acre.

**Biotechnical Improvement of Soybeans:** Genetic engineering technology is being used to enhance soybean resistance to cyst nematodes and for improving the quality of soybean seed and oil. A few soybean plants have been regenerated from immature cotyledons. Tests with a particle gun indicate that gene-coated particles can be introduced into soybean cell suspensions provided the genes of interest are available. Because regeneration techniques have been developed and because targeted genes have been isolated, scientists hope to obtain a genetically engineered soybean this coming year.

## ALFALFA

Alfalfa is a premium forage for the livestock industry because of its superior palatability, digestibility, and nutritive (high protein) value. Like soybeans, alfalfa is a legume and fixes nitrogen from the air and significantly reduces the need for fertilizer nitrogen by the growing crop. Because of its deep and prolific root system, it also is valued as a soil conserving, erosion reducing crop. In Kansas, alfalfa hay is grown on 800,000 acres and has a farm value of $230,880,000.

**Protein Degradation—Alfalfa:** The degradation of proteins in alfalfa from 1) accessions representing the nine basic germplasm sources from which all cultivated alfalfa is thought to be derived and 2) two exotic germplasms used as the source for glandular hairs, was determined. Proteins in the exotic germplasms degraded at a faster rate than proteins from the basic sources of alfalfa germplasms. Significant differences in protein degradation among the basic germplasm sources also were found. Based on these results, the selection and breeding of alfalfa lines with less rapidly degradable proteins is being initiated.

**Alfalfa Breeding Lines:** During a 26-year period, K-State plant breeders cooperated with a regional research project (NC-83) to produce seed, evaluate breeding lines, and release 45 breeding lines or alfalfa cultivars worth millions of dollars in increased revenue to Kansas farmers.

**Germplasm Releases:** For alfalfa, the focus is on identifying germplasm and incorporating genes that transfer resistance to insects and diseases or improve nutritive quality. Between 1985 and 1994, the alfalfa germplasms releases by the experiment station included:

| | | |
|---|---|---|
| KS187 | KS108GH5 | KS189 |
| KS94GH6 | KS204 | KS207 |
| KS81-7VE2 | KS206 | KS208 |
| KS71AN2BA2M2P4PA2SA2 | | KS153BA3P4 |
| KS219 | KS220 | KS221 |
| KS222 | KS223 | KS224 |

## OTHER KANSAS CROPS AND SYSTEMS

KSU researchers are working to adapt and enhance the production of rapeseed, pearl millet, triticale, and sunflowers to provide alternative crops for Kansas farmers. Researchers are keenly aware that new or alternate crops must be adapted to Kansas soils, climate, and growing conditions and must be resistant to a local array of insects and diseases. They must also compete in open or specialty markets and find their niche among Kansas crops and production strategies.

**Weskan Barley:** Weskan is a 6-row, winter feed barley released by KSU in 1990 for northwest Kansas. Because of enhanced yield and improved characteristics it is growing in popularity. In yield trials, Weskan averaged 10 percent higher in yield and 2 percent higher in test weight than comparable varieties. If adopted by 60 percent of the producers in northwest Kansas, its economic impact, due to superior yield and winter hardiness, could reach $270,000 annually.

**Sunflower Production:** Growing sunflowers gives farmers additional cropping flexibility. Sunflower meal is a good protein source for cattle but is currently undervalued relative to soybean meal. Researchers just finished a study with stocker cattle where sunflower meal was compared to soybean meal as the protein source in corn silage based diets. In the 50-day study, there was no difference in animal performance. With sunflowers priced at 12.5 cents, and soybean meal priced at 16.7 cents per pound of crude protein, feeding sunflower meal results in substantial savings.

**Sunflowers:** The 1994 sunflower crop was valued at $35 million and totaled 331 million pounds. Researchers have developed plant populations with improved tolerance to head moth and Rhizopus head rot. Oil content and seed size were improved by planting at the optimum time. Yields are improved and erosion hazards are reduced by growing plants in 15-inch rows.

**Sunflower Production Demonstrations:** Extension specialists held public meetings, planted variety trials, and established soil fertility, tillage, and crop residue plots to assist farmers enhance sunflower production in northwest Kansas. Programs reached 1,200 producers and were planned cooperatively with personnel from USDA, industry, county agents, and the High Plains Sunflower Association. Industry reports suggest the sunflower acreage in the area more than doubled.

**Pearl Millet:** Pearl millet, nutritionally similar to sorghum for beef and equal to corn for poultry, promises to be more drought tolerant on sandy soils than grain sorghum. Recent releases include a dwarf grain and a bird resistant population. Millet could be grown on 500,000 acres in Kansas within a decade.

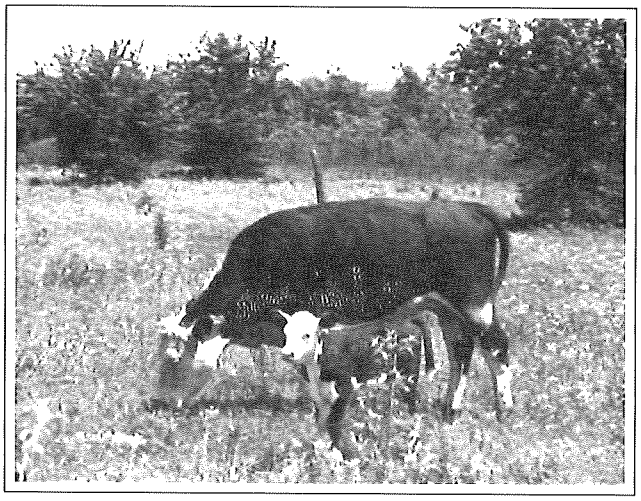
**Rapeseed (Canola):** Researchers examined the adaptability, agronomic requirements, yield, seed quality, and winter hardiness attributes of promising rapeseed (canola) lines. Research is focused on overcoming the crop's susceptibility to winterkill in Kansas.

**Triticale:** Adapted winter triticale produce $17 per acre more hay than winter wheat and $31 per acre more hay than winter rye based on $50 per ton for hay.

# LIVESTOCK

Livestock and livestock products account for nearly 66 percent of the cash receipts by farmers and ranchers in the state. Kansas, with 6,300,000 cattle and calves on farms, ranks first in the nation in cattle slaughtered, second in cattle numbers, and third in red meat production (5,251,816,000 lbs.).

Cash receipts from farm marketing of livestock and livestock products totaled nearly $4.8 billion in 1994. Many farmers and ranchers feed livestock in order to add value to the pasture, forage, grain, and crops they produce. It is estimated that nearly one-third of the state's crop production and essentially all range and pasture production are used in support of the state's animal agriculture industry.



## TEACHING INNOVATIONS

Well prepared students are a great resource. We especially need the understanding, skill, and potential they develop to prepare for future needs, solve real and perceived problems, and enhance the environment and quality of life.

**Nontraditional Coursework:** Non-traditional teaching efforts through Continuing Education allow off-campus students to obtain degrees and educational upgrades in their jobs. Recently faculty in Animal Sciences cooperated to update a second generation of courses. In total, over 3,000 off-campus students have added value to their educational skills over the past 10 years. Most students took more than one course.

**Teaching via Internet:** Students are enrolling in Food/Meat Science courses offered via the Internet. This involves discussion groups comprised of students and faculty from across the United States. In addition to standard course work, students gain valuable perspectives from individuals in different disciplines and with different professional backgrounds. Internet courses provide individuals who are restricted from returning to campus by family and job ties an opportunity to take specialized coursework at the university. The participating nontraditional students come from Kansas and across America.

A Michigan student said, "This class is the start of my effort to round out my knowledge of the food industry by gaining more indepth technical knowledge. It has already greatly assisted me. . . ." A student from Oklahoma wrote, "There's a lot I don't know about e-mail but I learn more each day. . . . The good thing is that the more you learn the more you want to know!"

## VALUE-ADDED RESEARCH FOR MEAT AND LIVESTOCK

Animal and meat scientists work to identify production techniques and technological advances that will add value to Kansas products, enhance its marketability, and add to its consumer appeal. They are acutely aware that proposed solutions must be cost-effective and profitable as well as affordable and desirable. They have effected advances in milk and meat quality, processing procedures, and food safety. The emphasis is on producing and improving quality products that are safe, nutritious, and wholesome.

**Value-Added Developments:** Meat scientists are assisting in adding value to meat and meat products by restructuring portions of the carcass previously used for ground beef into higher-value steak-like and roast-like products. Innovative ways to package and process red meat (gas packs) and extend shelf life for the modern consumer are also being studied.

Food scientists have also produced a meat-based snack food composed of 75 percent wheat flour and 25 percent mechanically deboned meat using a cooking-extrusion process. They are working to develop a low-fat (7 to 10 percent) meat product with texture and taste comparable to that with higher fat (25 to 35 percent) level.

Shank meat is high in connective tissue (sinew) and often is used as a source of low-cost manufacturing meat. To enhance the value of shank meat, researchers are investigating desinewing and ways to utilize shank meat and reincorporate sinew in value-added products.

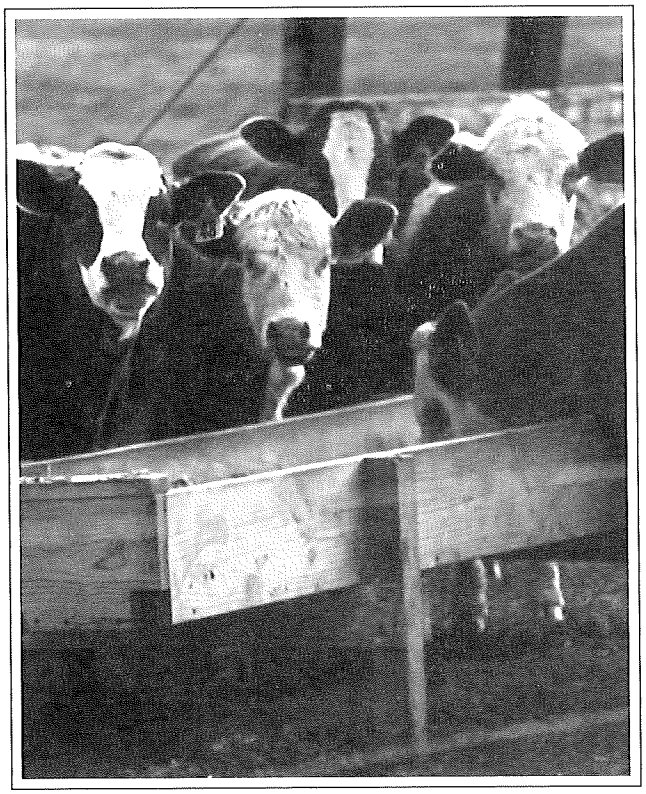
**Animal Evaluation and Quality Control:** Researchers at the Agricultural Research Center—Hays have developed an ultrasound, artificial intelligence, expert systems interface that can enhance quality control in the cattle production process. This system will evaluate cattle and predict future carcass development. This enables producers to know the potential of each animal and design a growing, full feed, and time in the feed lot sequence that optimizes product quality.

This improves efficiency, lowers cost, and markets each animal when it most nearly meets consumer demands for leanness and quality.

**Enhancing Livestock Production—Wheat Gluten:** Animal scientists have shown that properly prepared wheat gluten can be used as a protein source for milk replacer for calves. Used in this way the product would replace skim milk powder which costs $94 to $125 per 100 pounds or whey protein concentrate which costs $55 to $75 per 100 pounds.

**Cross Breeding and Profitability:** Researchers have shown that cattle crossbreeding systems that result in crosses of 50 percent 'Continental' and 50 percent Angus or Angus X other 'British' breeding stock results in optimum carcass composition and meat quality. This crossbreeding system significantly reduces the proportion of carcasses currently discounted for non-conformity for being too light or too heavy, excessively fat, low in quality or grade, and with undesirable tenderness. Discounts for nonconformity can be as much as $280 per carcass.

**Feeding Home-Grown Soybeans:** KSU experiments show that the availability of indispensable amino acids in growing pigs is increased from an average of 63 percent for roasted soybeans to 84 percent for extruded soybeans. Research also suggests that the nutritional value of soybeans is greater when an extrusion enhancer (sodium sulfite) is used. These processing techniques will encourage soybean producers to consider marketing their product through livestock to capture the full value of their crops.



**Processing Soybeans for Calves:** Methods for 1) processing whole soybeans in starter rations for young calves and 2) determining the amount and type of protein needed (rumen degraded, undegraded, soluble or non-soluble) were tested experimentally. Soybeans roasted at 295°C were superior to soybeans roasted at lower or higher temperatures. Laboratory tests for undegradable intake protein, indigestible intake protein, and residual lipase were used to evaluate the processing method and to maximize the use of soybeans as a source of fat and protein.

**Feeding Cattle:** KSU scientists took the lead in establishing the value of wheat in cattle rations. Now, when prices drop, 80 percent of Kansas feedlots include wheat in cattle rations. This adds about $0.10 per bushel to the price of wheat and $40 million to the Kansas economy each year.

**Maximizing the Utilization of Cereal Grain Feeds:** Extrusion processing of corn, sorghum, wheat, and barley improved the nutritional value of cereal grains for finishing pigs. The greatest increase in nutrient digestibility was for pigs fed barley-based diets. This technology can improve the nutritional value of feed, provided the cost of processing and equipment continues to decrease.

Particle size reduction and pelleting are processing methods that improve rate and efficiency of gain in finishing pigs. Considering milling costs, growth performance, nutrient digestibility, and stomach morphology, a particle size of 500 to 600 microns is recommended for both meal and pelleted diets.

**Improving the Nutritional Value of Cereals:** Research demonstrates the value of processing techniques that improve the nutritional value of cereal grains and reduce the amount of fecal excretions. The milk yield in sows and growth performance in finishing and nursery pigs and broiler chicks was improved 10 percent to 15 percent when

grain was ground to 600 microns compared to the more typical 1,000 microns. Excretions of nitrogen and dry matter for finishing pigswere reduced by 25 to 30 percent with the reduction in particle size.

**Wheat Gluten for Young Pigs and Calves:** Modified wheat glutens were evaluated as protein sources for weanling pigs and preruminant calves. Spray-dried vital wheat gluten and lactose can be used to replace dried skim milk in diets for weanling pigs. This improves growth performance by 10 to 20 percent during the nursery phase. Up to 50 percent of the spray-dried porcine plasma protein in diets for weanling pigs also can be replaced using spray-dried vital wheat gluten. This results in equal or greater growth performance and a $50 to $60 per ton cost saving for prestarter diets. Similar responses were noted in preruminant dairy calves when up to 50 percent of the dried skim milk in a milk replacer was supplanted with an enzyme-treated or finely ground wheat gluten to enhance solubility.

**Detoxifying Mycotoxins:** Researchers are investigating biological methods for detoxifying mycotoxin-contaminated cereal grains and other food products. Aflatoxins and fumonisins are toxic and carcinogenic compounds that can contaminate grains, particularly corn. The associated costs include devalued crops, nutritional inefficiency, health care, contaminated products, regulatory surveillance, and detoxification. Researchers have identified cellular components of a bacterium capable of removing high concentrations of aflatoxins from suspensions. These components are being characterized so the bacterium or its cellular components can be used to decontaminate grains and other food products.

**Trimming and Washing Beef Carcasses:** Animal scientists have shown that the "zero tolerance" trimming level required by USDA Meat Inspectors is not necessarily required to insure microbiological safety. Trimming of gross contamination followed by carcass washing with organic acids found in food and steam can reduce trim losses by 5–10 lbs. per carcass. Kansas processes 6 to 7 million beef carcasses each year. Additionally, the speed of the processing could be increased up to 20 percent if the "zero tolerance" requirement was modified as K-State research suggests. The potential savings in product and time are substantial.

**Steam Pasteurizing Carcasses:** A steam pasteurization process developed by meat and microbial scientists at K-State, with support by Cargill, Inc., materially reduces the likelihood that bacteria, including *E. coli* 0157:H7, will survive on beef carcasses. Patents are pending, but the process and equipment has been approved by USDA–FSIS for in-plant testing and evaluation. Because of the pervasive coverage by live steam, bacterial counts are reduced by 99.9 percent or more on every exposed surface. No additives are required and less energy is used than with an approved hot water cleaning process.

**Shelf Life of Ground Beef:** Meat scientists have demonstrated that removal of surface muscles before complete chilling and carcass decontamination with chlorine or lactic acid have potential in creating a safer beef supply and one with less discarded product. Improved shelf life and safety is critical to the Kansas beef processing industry that centrally processes course-ground beef for shipment. Approximately 40–50 percent of the beef tonnage is marketed in ground form.

**Shelf Life of Meat Products:** Scientists are researching methods to extend shelf life of boxed subprimals. Treatment of beef carcasses with lactic acid and chlorine decreases microbial contamination but does not, necessarily increase shelf life. Procedures that are approved for use with the carcass will be applied to subprimals just before packaging to determine if safety and shelf life are enhanced. A 3–5 day increase in shelf life for beef could increase carcass value by $100.

**Enhancing Shelf Life of Precooked Beef:** Shelf life and consumer acceptance is of great economic importance to the meat industry. Precooked beef provides products consistent in quality, composition, size, and price but the development of "off" flavors is a serious problem. Meat scientists are investigating the use of natural antioxidants, wheat and soybean products, to enhance shelf life. Sugars are added to the wheat and soybean hydrolyzate and reacted to form brown colored pigments that may delay the development of off-flavors.

**Flavor and Aroma—Turkey:** Consumer acceptability of food often depends on flavor and aroma. Vacuum-packed turkey has a more meaty and less stale/warmed over flavor and aroma. The addition of phosphate and phosphate-



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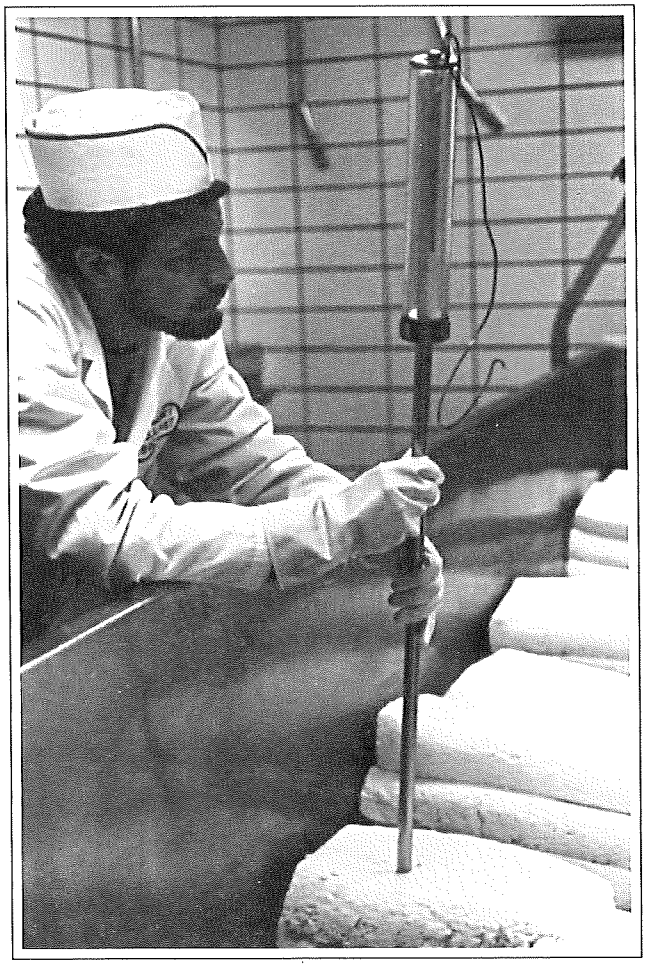
ascorbate salts were effective in reducing stale flavor in cooked meat that was not vacuum packed. However, addition of those salts provided little additional benefit in reducing stale flavor in vacuum-packaged, cooked turkey.

**Controlling Liver Abscesses:** With 850,000 cattle affected in Kansas (20 to 25 percent of grain fed cattle), liver abscesses are a serious concern. The loss is estimated to be $20 to $66 per head. KSU research has focused on developing a vaccine to prevent the occurrence of liver abscesses. Animal scientists are working to neutralize the production of a toxin by *Fusobacterium necrophorum*, the causative agent, that enables the bacterium to ward off the defense mechanism of the liver. Neutralizing the toxin will prevent the establishment of the bacterium in the liver.

**Cheese Quality:** Traditionally, cheese makers rely on subjective judgement to determine the completion of each step in the cheesemaking process. Research demonstrates that near infrared reflectance spectroscopy (NIRS) can provide a routine, rapid, and efficient method for simultaneous analysis for moisture, protein, fat, and lactose in cheese curds. Using NIRS, cheese makers can control cheese quality more uniformly, predict compositional requirements on finished cheese, and, perhaps, increase cheese yields by optimizing the manufacturing process.



**Flavor of Ultra-High Temperature Milk:** Ultra-high temperature processing of milk involves heating milk at 140° to 150° for 2–10 seconds to reduce the bacterial and enzyme content. The process effectively controls microorganisms but is not totally effective in destroying enzymes in milk. Studies at K-State show that a small amount of lipase, perhaps from a bacterial source, survived treatment, and could cause undesirable flavors. Thus, raw milk used in ultra-high temperature must be low in bacterial count.

## EDUCATIONAL OUTREACH

Extension specialists in animal sciences address citizen need for assistance with their production, protection, marketing and value-added needs for programs related to livestock (beef, swine, dairy, sheep, and horses) and livestock products (meat and milk).

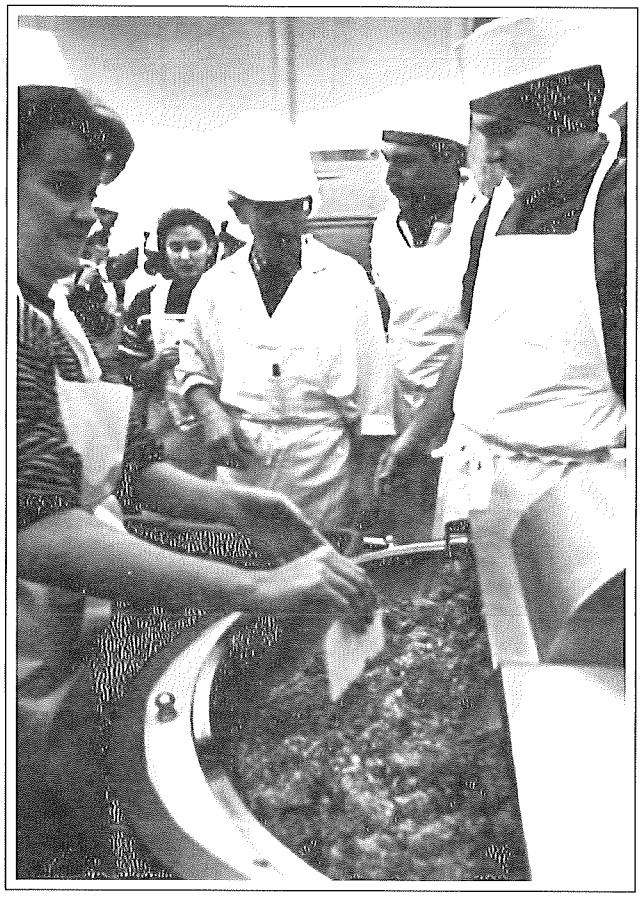
**Educational Programs in Meats:** Extension specialists utilize seminars and workshops to advise processors and potential entrepreneurs about 1) starting a business and commercializing meat products, 2) new techniques and information about the meat business, 3) Hazard Analysis Critical Control Point Programs, and 4) food safety. Specialists distribute a newsletter to assist meat processors with facts about advances in meat processing techniques, regulations, and food safety. A column to inform consumers about meat and meat products is distributed to Kansas newspapers.

**Livestock Quality Assurance Programs:** Quality assurance programs, which play a key role in assuring that information and technical assistance reach beef, swine, and dairy producers, have been initiated in Kansas. Over 1,528 beef producers, 700 pork producers, and 475 dairy producers completed quality assurance programs conducted by Extension specialists. The National Beef Quality Audit identified and quantified quality concerns, that if addressed, could theoretically add $280 in value to each beef carcass. Even if only a portion of that amount could be realized for cattle slaughtered in Kansas (6–7 million head/year) the savings would be significant.

**Youth Programs for the Livestock Industry:** Meat evaluation, cut identification, and reason-giving are important skills for youth to develop for life-long use and for possible careers in the meat and livestock industries. Because of the loss of facilities elsewhere and respect for KSU's modern meat laboratory and extension and research faculty, the National 4-H and FFA Meat Contests (200 youth from 37 states and 55 teams) were held at KSU in 1994. Costs, other than facilities and staff, were underwritten by the American Royal, National Livestock & Meat Board, National 4-H Council, FFA, and others. KSU will continue to host these contests as long as the participating parties mutually agree.

# FOOD SAFETY

Food safety is an issue of concern to agriculture, industry, and the consuming public. Food safety programs at K-State are designed to address questions that are critical to the Kansas economy. Concerns include food safety in foodservice, rapid detection of microbiological and chemical contaminants, quality assurance on the farm and in the home, and the development of new products. KSU is the home of the Kansas Value-Added Center, a Food Safety Consortium, and a cadre of value-added specialists that address food safety and related problems associated with the development and marketing of food and food related, value-added products.



**Extension Programs in Food Safety and Quality:** Food systems specialists organize programs to inform food handlers in restaurants, retail stores, and other food service facilities about food safety issues. Specialists emphasize the need for laboratory analysis for water activity, pH, microbial quality, and head space to assess product shelf-life. Selected food processors were assisted in becoming certified to process low acid and acidified foods in an FDA approved Better Process Control School. More than 150 products were analyzed for issues related to food safety and shelf life.

**Food Safety and Quality:** Extension specialists are addressing food safety and quality issues for small businesses and new entrepreneurs by expanding the Hazard Analysis Critical Control Points program. Educational meetings and written materials focus on food plant sanitation, consumer perceptions of food safety, and risk assessment for individual processors, commodity groups, and professional organizations.

**Detecting *Listeria* Bacteria:** The difficulty and time required to detect low numbers of *Listeria* bacteria in contaminated food is well established. To enhance reliability and minimize detection time, K-State food scientists developed a U-Tube system using an enzyme for the rapid detection, isolation, and enumeration of this and other bacterium in meat. This patented system decreases detection time from 5 days to 24 hours.

**Foodborne Illness:** Because illnesses from microorganisms in food cause 9,000 deaths and cost from $5 billion to $17 billion in medical care and lost productivity each year, Extension agents are conducting food safety and sanitation programs for school, university, and foodservice personnel.

**Cleaning Cutting Surfaces:** Microorganisms on cutting surfaces and tables can contaminate food if those surfaces are not properly cleansed. Research shows that hydrogen peroxide reacts with microbial enzymes and is an indicator of surface cleanliness. This simplified procedure can be used readily by food processors to help insure product safety.

# VALUE-ADDED ENGINEERING

**Wet-Milling Laboratory:** A new KSU wet-milling laboratory is now operational at KSU. The laboratory, funded by the Kansas ValueAdded Center, is housed in the Biological and Agricultural Engineering Department but is also used by the Chemical Engineering and Grain Science and Industry departments. The laboratory enhances the capability to develop value-added food and nonfood products from wheat and grain sorghum and should increase the marketability of those grains. A project to produce an ensiled cattle feed using readily accessible grain sorghum starch is underway.

**Thermal Processing Laboratory:** This laboratory, used by engineering and food scientists, enhances the development of value-added products. KSU specialists work with personnel from small companies on their promising new products. The benefits for new or developing entrepreneurs include:

1. Producing new or experimental products in quantities needed or commercial production and testing.
2. Determining the kind of equipment needed for commercial production.

3. Learning needed food safety concepts for commercial production.

A recently completed project included the freeze drying of ornamental products. Freeze drying can produce valuable, shelfstable, dried ornamental flowers and provide new markets for ornamental products or fresh cut flowers that would otherwise be wasted.

**Subsurface Drip Irrigation:** Research at the Northwest Research- Extension Center shows that subsurface drip irrigation can save 4 inches of irrigation during corn production. In one sense, this savings could increase the useful life of the aquifer by 25 percent and give producers a much longer transition time to a less water intensive economy. In another sense, the 4 inches of water saved could produce an additional 30 bushels of corn per acre. This value approximates $24 million annually ($2.00/bu. for onehalf of the production on 800,000 acres of corn in western Kansas).

# HORTICULTURE AND FORESTRY

A Horticultural Industry Survey by Kansas Agricultural Statistics (KAS) set gross sales from nurseries, greenhouses, florists, Christmas tree growers, and grape growers at $123.3 million in 1992. Florists accounted for the largest portion of the gross income, $50 million; followed by greenhouses, $36.5 million; and nurseries, $22 million. As a group, the industries survey provided employment for nearly 10,000 people and contributed nearly $56 million in wages and benefits to the Kansas economy. The contributions of the turf, fruit, and vegetable industries was surveyed by KAS in 1994 and the results are being compiled.

A 1994 Gallup Survey, sponsored by the Professional Lawn Care Association and the Association of Landscape Contractors, reveals that most households value an attractive, healthy lawn and landscape because it enriches the neighborhood, provides a place of beauty and relaxation, and enhances property values.

## HORTICULTURE

**Education for Value-Added Horticultural Industries:** Horticultural specialists provide educational programs, technical assistance, and they write for the Focus Newsletter. They assist entrepreneurs and small businesses with interdisciplinary, value-added educational efforts on food processing—profitability, safety, and quality; cut flowers—postharvest, storage, and marketing; dried/preserved flowers; and farmers' markets. They also evaluate information about the production, handling, and feasibility of field grown, cut flowers.

Extension specialists help producers with tomato, melon, pumpkin, vegetable, stone fruit, and greenhouse production and marketing problems. Educational programs include field days, grower visitations, public meetings, and research-based educational materials. The focus is on producing, protecting, and marketing a wholesome, safe, and appealing product. Growers are advised about essential harvest, postharvest, storage, and packaging criteria.

**Winter Survival Mechanisms and Cold Tolerant Small Fruits:** Small fruits are prone to winter injury in many regions of the United States including Kansas. KSU scientists are working to characterize the cold-responsive gene in blackberries and strawberries and to develop cold hardy plants. The studies have included various environmental cues and plant hormones that facilitate the expression of cold-responsive genes in these crops. Efforts are underway to introduce cold-responsive genes from other crops like oats and wheat into blackberries and strawberries.

**Frost Protection Methods:** These studies focus on identifying methods to reduce winter injury and improve the overwintering characteristics of perennial crops.

Horticulturists want to identify natural osmolytes that afford cold protection in dormant plants. Frost protection measures using osmolytes like proline, glycine betaine and glutamine are being tested on whole plants for their frost protection efficacy in blackberries, strawberries, and spinach.

**Vegetables—Low Temperature Stress:** K-State research on environmental stress of vegetable production systems is focused on low temperature, non-freezing stresses on early stages of germination and seeding establishment. This is a critical time since many crops sensitive to low temperatures are planted in early spring when frost is an important hazard. KSU research centers on the physiological mechanism of low temperature injury during germination and seedling development. Chemical and temperature treatments that induce tolerance to low temperature stress injury are being tested.

**Cold Hardiness—Blackberry, Grapes, and Cucumbers:** Lack of winter dormancy is one of the primary causes of winter damage in blackberries. Horticulturists have shown that the application of growth retardants can prolong dormancy in early spring and avoid winter damage in blackberries. The growth retardants also increase heat tolerance and protect against heat injury.

Cold hardy cell lines of grape hybrids have been selected which are 8°–10°F more cold tolerant than the original plants. The cold tolerance trait is stable and horticulturists are developing methods to regenerate whole plants from the selected cell lines. They also want to identify the cold tolerant genes so grape cultivars can be developed that can survive harsh winters.

**Tolerance to Chilling:** When cucumbers are treated during emergence with high (35°C) or low (7.5°C) temperatures, or dilute ethanol, the tolerance to chilling at 2.5°C is increased. If this characteristic can be transferred to genetic control and hardier plants, growers could plant earlier and extend the market period.

**Environmental Horticulture:** Functional, attractive, and creative landscapes not only increase property values but also conserve energy and heating costs. Extension specialists educate homeowners through the media and provide training for design and other professionals on functional landscapes for residences, businesses, public buildings, schools, and outdoor classrooms. The program impacts tourism by helping landowners profit from community parks, natural areas, and regional landscapes like the land of post-rock, the Post Office Oak at Council Grove, and the Louis Vieux elm northwest of Wamego.

**Floral Crop Production:** The floral crop industry is undergoing dynamic change. Research focuses on the flowering process in herbaceous perennials and specialty cut flowers. Herbaceous perennials provide a dual-use for the consumer. If these species could be flowered year-round as potted plants, consumers could then plant them in the landscape instead of disposing them in landfills. To date, an understanding of the flowering mechanism of *Heuchera* and *America* cultivars has been achieved. Specialty cut flower research focuses on species that are grown for fresh flowers or the processing industry.

**Postharvest Handling of Flowers:** Mixed bouquets of fresh flowers sell at a higher price than a bouquet of just one flower type. Cut flowers can be air- or freeze-dried or preserved with glycerine. Once processed, they are used for interior floral design and crafts or sold through farmers' markets, wholesale firms, or direct sales. The Society of American Florists reports that 25 percent of floral material sold during the 1994 Christmas season was dried or preserved. Specialty cut flower research focuses on the postharvest handling of peonies: greenhouse scheduling for flower production, freeze-drying of assorted cultivars, and controlled atmospheric storage of harvested flowers. Work is also directed toward the preservation and tinting of annual statice.

**Postharvest Technology and Physiology Education:** A new course, postharvest technology and physiology of horticultural crops, was first offered in 1994. The course deals with adding value to harvested crop materials. This includes recognizing when a product is at its marketable peak, harvest procedures, and postharvest handling, packaging, and storage to maintain quality and shelf-life.

**Diversifying Farm Production:** Farm families are diversifying by on-farm marketing of fall decorative vegetables (decorative corn, corn stalks, hay bales, gourds, field-grown fresh flowers, and other items). Some offer a pick your own option with a wagon ride to the pumpkin patch. Others offer field trips to school children, discussions on pumpkins and how they grow, and a select your own pumpkin with a per/child charge. Other farmers include a coloring sheet, cookie or snack, and a petting zoo. Some handle as many as 30,000 to 40,000 participants in a single month.



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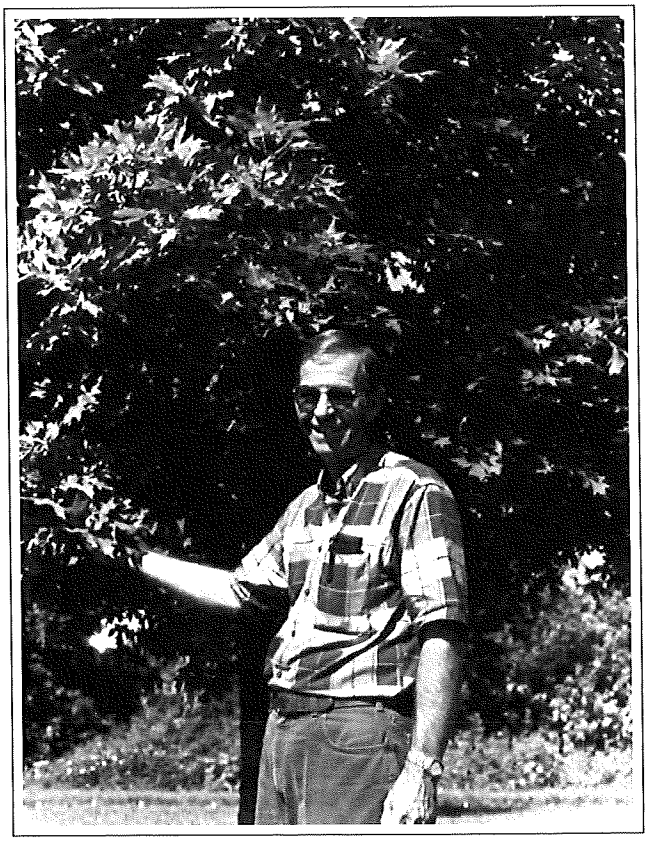
KSU research trials on pumpkins include variety trials; producing 'baby' varieties; weed, insect, and squash bug control; and nonchemical, alternative means of controlling disease problems. Procedures to set up, advertise, and operate pumpkin marketing systems have been demonstrated at field days.

## FOREST RESOURCES

**Forest Resources:** In Kansas, the acreage and dollar and esthetics value of its forested lands are significant and are estimated to be: 1) commercial forest—1.2 million acres with a value of $100 million; 2) windbreak trees, 190,000 acres with a value of $25 million; 3) urban forests, 1.2 million acres with a value of $200 million; and 4) riparian vegetation, 25,000 lineal miles with a value of $200 million. In many instances, forested areas also provide grazing and sheltered areas for cattle and protection against stream and soil erosion.

**Tree Improvement for Central Great Plains Region:** Genetically improved planting stock is used in selected Great Plains forestry trials. Ponderosa pine, an important species, is used for agroforestry windbreak plantings. Results showed that genetic material from north central Nebraska and South Dakota were best for superior height growth and survival under the challenging environmental conditions in Kansas. Data from this large scale regional test is believed to have saved countless hours and more than $1 million in renovating windbreaks and replanting insect damaged trees.



**Woody Biomass Plantations:** Wood energy use in the USA has increased dramatically since the mid-1970s. Annual home sales for fuelwood in Kansas are estimated to be over $20 million. Potential users of "energy-wood" techniques include municipal, institutional, and/or industrial facilities, as well as farm families. Because of KSU research, foresters can now recommend the correct tree species for farmstead woodlot planting and offer technical assistance for large operations with a big savings in funds. As a result, it is estimated that products adding over $2 million a year to the economy are being utilized.

**Agroforestry Plantings:** Agroforestry, the intentional integration of agricultural and forestry-related land-use systems, provides multiple benefits that collectively contribute to agro-ecosystem sustainability. Alley cropping, riparian, and windbreak plantings add over $5 million annually to the economy; the great Flood of 1993 attested to the significant amount of land lost and devalued.

**Windbreaks and Recreational Hunting:** Economic analysis of the use of windbreaks by hunters in Kansas found that hunters spend $30.5 million annually hunting in Kansas windbreaks. Moreover, the net economic value above expenditures was $21.3 million annually. These numbers may be conservative in estimating the value of windbreaks for hunting because they did not include value to young, unlicensed hunters nor the value to out-of-state hunters. Research was also conducted that provided information to landowners about managing windbreaks to enhance wildlife populations and associated benefits.

## STATE AND EXTENSION FORESTRY

Kansas State and Extension Forestry provides technical and educational assistance to the forest industry; delivers tree care, maintenance and planting programs to communities; assists landowners in their development of management plans; and cooperates with the federal government and others in conservation tree planting and rural fire protection.

**Conservation Tree Planting:** This year marks the 39th year of the Cooperative Extension's Conservation Tree Planting Program. This multi-agency effort (Cooperative

Extension, Natural Resource Conservation Service, and Wildlife and Parks) fosters the planting of over 850,000 tree and shrub seedlings annually. Landowners are advised about site preparation, species selection, and planting design and care. The estimated annual value for windbreaks ($1,209,991), Christmas trees ($712,500), wildlife habitat ($242,550), woodlot products ($3,252), and crop protection ($36,923) totals over $2.2 million.

**Community Forestry:** Over 200 Kansas communities are involved in forestry programs representing nearly 60 percent of the state's population. The public trees managed by these communities represents 218,300 acres with a $194 million value. These programs provide an estimated annual value of $400,000 to commercial arborists in the state. KSU foresters administer the Tree City USA program, advise the Kansas Urban Forestry Council, and provide training to the aboricultural industry.

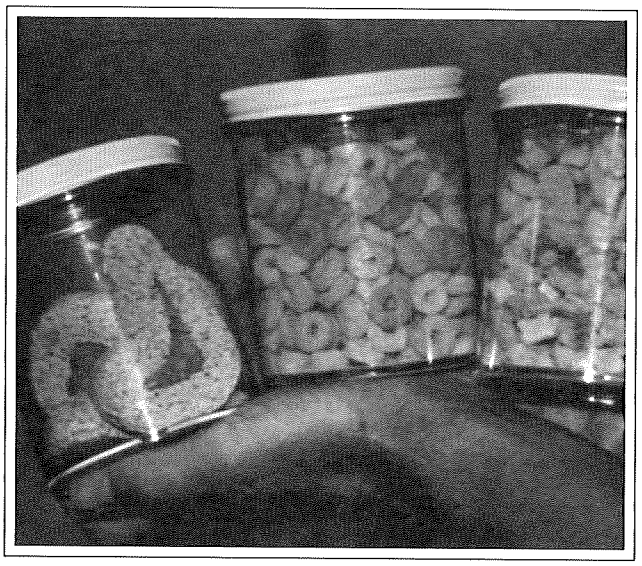
**Rural Fire Program:** Through a cooperative agreement with the USDA Forest Service, K-State foresters acquire excess equipment from military bases in the state for the sole purpose of rural fire fighting. The acquired vehicles are loaned to rural fire departments. Each rural fire department equips, paints, maintains, and insures the vehicles. Currently, 718 pieces of excess equipment (586 vehicles) are in service in 95 Kansas counties. The equipment represents over $11.9 million in replacement value to Kansas fire departments.

**Forest Industry:** Forestry specialists provide technical assistance to the forest industry. A recent industry survey identified 36 primary wood-using mills with an annual production of over 14 million board feet. The processing of logs from these mills and the subsequent sale of products and secondary manufacturing processes provides $50 to $75 million in annual economic benefits to the state.

**Forest Management:** Kansas has approximately 1.4 million acres of natural woodland of which 96 percent is privately owned. Because of increasing demand for wood products from private land due to reduced harvesting from federal land, landowners are finding it is economically and environmentally important for them to obtain management assistance for their woodlands. With professional assistance, especially for timber harvest, landowners regularly realize a 15 to 20 percent higher return on their timber. The annual income to woodland owners approximates $5.0 to $7.5 million.

# FOOD AND FEED GRAIN UTILIZATION

To assist in its research and teaching programs with food and feed grains, K-State facilities include a pilot flour mill, feed mill, bakery, extrusion laboratory, and grain storage and handling facilities. They are equipped to receive, clean, and classify a variety of raw materials as well as to grind, pellet, flake, or extrude related products. Laboratories equipped for chemical research and special laboratories are maintained for studies of the physical properties of flour, dough, and food systems. The facilities provide an excellent teaching and research environment for university, industry, and government cooperators.



## MARKET ENHANCEMENT PROJECTS

**On-Farm Feed Manufacturing:** This project, funded by the USDA and Extension Service Food Safety Program, was organized in response to concerns about compliance of on-farm feed manufacturers with FDA regulations. The project utilizes an FDA, industry, and producer advisory council to insure that training programs and materials are complementary with other national efforts. Compliance with FDA regulations by producers who process their own feed is critical because FDA has proposed that veterinary prescriptions be required for newly developed medicated feed additives targeted for therapeutic use. The "Quality Assurance for On-Farm Manufacturing" project has attracted national interest by industry, producer, and veterinary associations.

**Feed Manufacturing Short Course and Feed Mill Management Workshops:** The goal of these Extension programs is to equip the feed industry with better trained employees. Participants representing the feed manufacturing industry are instructed concerning feed processing methods, government regulations, quality assurance, and business practice. The industry manufactures feed with a market value worth several billion dollars. The Feed Mill Management Workshops provide training to Kansas formula feed manufacturers.

**Wheat Utilization:** Starches in the wheat kernel are renewable, low-cost biopolymers that are increasingly in



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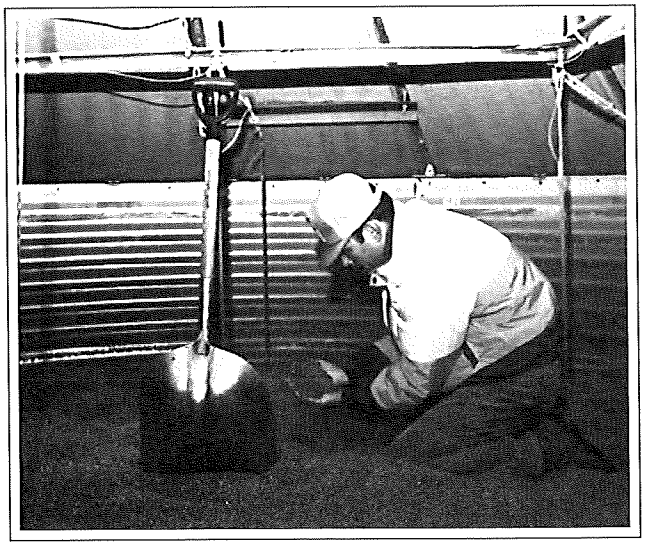
demand for nonfood, nonfeed purposes. In addition, starch molecules can be mixed and compounded with other biodegradable polymers to produce composites that are moldable into useful plastics. Experiments are underway to measure properties of wheat starches during their isolation and purification, and as they affect their use in adhesives, paper products, and plastics.

**Wheat Scab Survey:** A 1993 survey of wheat quality samples allowed KSU Grain Science researchers to identify areas of the state where wheat scab might be present and to quantify the levels of vomitoxin in the grain. Wheat quality teams used this information to assure export customers that vomitoxin was limited to low production areas of Kansas and that the average vomitoxin level for Kansas wheat was at or below 0.1 ppm. This was essential marketing information since conditions in 1993 were similar to those in 1982 when wheat purchases were interrupted because of the vomitoxin scare.

**Wheat Quality Laboratory:** The KSU wheat quality laboratory provides data used in selecting superior wheat releases like Ike and Jagger and each experimental line which is being considered for future release. This provides essential information to KState plant breeders and assures that protein content, mixing time, and milling and baking characteristics of each KSU release will be both competitive and exemplary in domestic and export markets. This kind of quality control is essential in selecting wheats with superior end-use qualities.

**Managing Stored Grain:** Through a grant received by the KSU Grain Science and Industry Department, aeration controllers were installed at 17 farms participating in a KSU Extension stored grain management demonstration project. These devices, supplemented with well planned management strategies and sanitation procedures, did a better job of controlling insects than did chemical protectors. Based on four years of data, fumigation was required in less than 20 percent of the bins.



**Marketing Quality Grains:** For Kansas and the nation to remain competitive, new markets must be found for wheat and other grains. To enhance quality, grain scientists have organized effective programs for industry workers to increase their knowledge of grain quality issues and insure that Kansas grains are in demand because of superior quality. In this program, over 350 grain industry personnel were trained to better identify kernel damage; 1,600 producers and grain industry representatives were instructed in new techniques for classifying wheat hardness; and producers and pest control applicators were schooled in integrated pest management techniques to minimize damage from insects and rodents.

**Grain Quality Issues:** Extension specialists are informing producers, millers, processors, and industry representatives about principles of stored grain management and alternative methods to control insects and enhance industry and food safety. Programs focus on grain grading and kernel damage, classifying wheat hardness, wheat quality issues, integrated pest management, and insect and rodent pests. Collectively, these programs enhance the management skills of 2,350 farm and industry representatives. Program needs were assessed through targeted interaction with farm and industry leaders, state and national committees, and agency and organizational representatives.

## MILLING

**New Flour Mill Concept:** A short-flow flour mill developed at K-State and licensed to Kice Industries, Inc., Wichita, is finding a market in building new mills and in converting existing mills. The mill can be operated by one person and can be fully erected and operable in 5 to 10 days. The potential of the export market also is being explored.

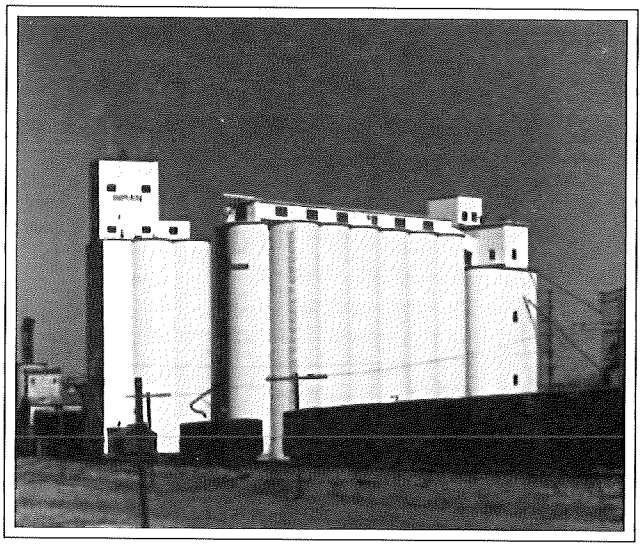
**Milling and Baking Quality:** KSU research and extension faculty are national leaders in responding to questions on the milling and baking quality of wheat throughout the world. They serve on numerous state and national committees and organizations that focus on wheat quality, cereal chemistry, wheat improvement, sanitation, and bakery assistance and engineering. Grain science faculty also organize numerous short courses for national and international leaders to enhance the marketing of U.S. grains. Industry personnel are instructed about the U.S. marketing system and the milling, baking, and end-use properties of U.S. grains.

**Experimental Milling Techniques:** Traditional experimental roller mills have many limitations, especially in the measurement of power and energy. KSU has developed an experimental, variable rate, two-roll mill for high speed computerized data acquisition. The mill is being used to relate energy requirements to grain parameters such as hardness, kernel weight and size, and moisture; and machine parameters such as roll speed, differential speed,

roll gap, and feed rate. The objective is to better understand flour milling, make it more energy efficient, and automate the process.

**Improving Milling Quality:** KSU grain scientists have successfully related the test weight of wheat to milling yield and value to the processor. This information will be used by plant breeders to improve the milling quality of the new wheats they release and to better demonstrate the adaptability and impressive value of Kansas wheats.

**Characterizing Wheat Hardness:** Kansas State is the first facility outside the USDA Federal Grain Inspection Service laboratories to have a Perten Single Kernel Wheat Characterization system. The unit is being used to survey wheats for hardness and provide training to Kansas elevator operators, farmers, and exporters on this new development which will soon become a new grading tool. This could provide a significant competitive advantage to Kansas grain marketers.



**Grain Elevator Safety:** Because of K-State Extension programs in elevator safety, approximately 40 percent of grain industry safety directors in Kansas are now more knowledgeable about industrial hygiene and are better equipped to identify unsafe working conditions. This event is planned by the Grain Safety Working Group, which is directed at industry and agency personnel. The commercial elevator industry in Kansas has a 0.9 billion bushel storage capacity.

## VALUE-ADDED DEVELOPMENTS

**Value-Added Products:** The Value-Added Food Products Extension program disseminates information through
1) meetings, seminars, fact sheets, and newsletters;
2) by answering technical inquiries and conducting physical, chemical, microbiological, and sensory analyses; and
3) by providing on-site assistance in process optimization, in-house consultation, shelf-life evaluation, and the development of new products. This educational program enables food businesses to create new products and comply with federal and state laws and regulations (including nutritional labeling guidelines). The "Focus" newsletter reaches 1,400 individuals and organizations.

**Frozen Dough:** Frozen dough is used in 25,000 in-store bakeries and is an $8 billion industry. KSU scientists have shown that high-protein, hard red winter wheats like Karl and Advantage produce frozen dough of notable quality. This aids in marketing Kansas wheats for the frozen dough industry.

**Bread Quality:** The shelf life of bread is influenced by many factors including emulsifiers and enzymes. K-State researchers are testing the bread making application of a new raw-starch degrading enzyme (RSDE) during normal dough processing. The enzyme reduced the firmness of bread over a one-week shelf life. It also complemented the effect of the emulsifier, but no direct interaction was noted. RSDE also converts some wheat starch to dextrose. In bread made with no sugar, this characteristic enhances loaf volume and color.

**Bread Quality:** KSU researchers have developed a new theory for staling of bread. This provides for more astute and far reaching studies of firming and anti-firming agents and should ultimately result in better bread in the market.

**Specialty Breads:** Experiments show that stronger wheats (Karl and Karl-like) made better multigrain and reduced calorie breads than did mellower wheats (Sierra & Victory). These specialty breads are increasing in popularity but are more demanding of flour quality than regular breads. The work also demonstrated that tests performed on white bread could predict the results for specialty breads.

**Bread Baking using a High Temperature Short Time (HTST) Extruder:** Baking is becoming increasingly expensive and researchers want to develop a process for making bread using a HTST extruder and a high velocity, forced-convection oven technology. By controlling extruder variables, use of emulsifiers, and injecting carbon dioxide it was possible to adjust the degree of puff and grain of the product—a crouton with the shape and flavor of a bagel chip. When sliced and toasted, the products were tasty and had a long shelf life. When left at higher moisture content, they were tough and difficult to chew, apparently because too much starch had been gelatinized by the vigorous heat and mechanical shear.

**Wheat Quality:** KSU studies indicate that the alveograph may be a much better predictor of hard wheat quality than previously shown. The data show that the test procedure must be under precise control. These results are thought to have favorable implications in marketing hard red winter wheats (including Kansas wheats) to Latin America.

**Sticky Dough Problems:** The use of 1B/1R translocations in wheat breeding transmits disease resistance and, often, greater yield in wheat cultivars. However, such wheats may produce sticky dough, a serious problem in high speed bakeries. Researchers are working to develop an objective test for stickiness and to identify the material that causes this troublesome characteristic. Then, plant breeders could identify lines that contain the sticky factor and eliminate them from the breeding program. This would allow greater use of the advantageous qualities of this important translocation.

**Wheat Bran Utilization:** Grain scientists are investigating pelleting as a means of increasing the amount of wheat bran in the diets of nonruminants, like pigs and chickens. By comparing meal to pellets in a chicken diet, they found no advantage at low fiber levels (5 percent). However, at intermediate and high fiber levels (8 and 11 percent) pelleting improved animal daily gain and feed conversion. At the high fiber level, feed efficiency improved 13.6 percent with no loss in performance.

**Oriental Noodles:** Cereal chemists have identified several factors that signal whether hard wheats, especially hard white wheat, have good quality for Oriental noodles. Wheat breeders are using several of these tests on new cultivars to identify those with improved noodle making quality. As the huge population in China shifts from an agrarian to an urban population, this should position wheat farmers in Kansas to sell hard wheats with good bread and noodle making properties.

**Wheats in Oriental Noodles:** Kansas ranks first among states in the production of wheat. Three-fourths of the wheat crop is sold in international markets, and one of the largest markets is Southeast Asia where wheat is used principally to produce Oriental noodles. Experiments demonstrate that hard white winter wheats can be used to produce high-quality flours for use in Chinesestyle and instant fried noodles. Hard white winter wheats are best suited for Chinese-style yellow noodles. Cooking quality improves with increasing protein content. The differing protein levels and starch swelling properties of a flour largely determine which white wheat is preferred for a given Oriental noodle.

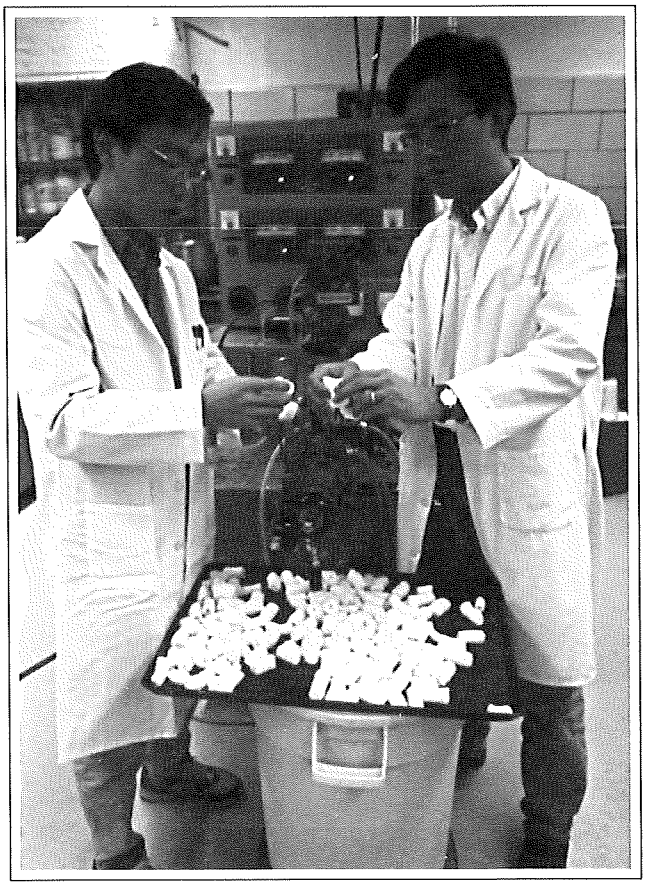
**Pasta and Noodles:** Wheat starch makes up over 85 percent pasta and noodles by weight. Eating quality is affected by the protein content and the cooking process. Although some pasta and noodle products become sticky when overcooked, some flours contain fatty substances that restrict swelling. Researchers are examining soft, hard, and durum wheats to identify the fatty materials in wheat kernels and optimize the selection of wheat for making pasta and noodles.

**Wheat Gluten:** Research papers by grain scientists on adding gluten to frozen dough won two AACC best paper awards in 1993 and 1994. This research shows that improvements in bread quality are achieved when gluten is added to dough made from weaker flours. This allows Kansas wheat to more effectively compete with northern spring wheat flours in the growing market for frozen dough in a multiplicity of in-store bakeries. This discovery will add value to the wheat water solubles.

**Water Soluble By-products—Gluten Production:** Water solubles from wheat, a by-product of commercial gluten washing, are largely wasted, and disposal of them is expensive. The viscous water soluble fraction was tested as a replacement for egg whites in angel food cake mixes. The water solubles could be substituted for 10 percent of the egg whites, but higher amounts produced cakes with reduced volume and poor texture. Addition of water solubles did not adversely affect rat weight gains or feed efficiency; neither did it lower cholesterol levels.

**Starch:** K-State research on wheat starch led to expanded operations at Midwest Grain, Atchison. The company now offers over 15 modified wheat starches with many uses. The company added technical personnel, new products, and new markets.

KSU research also established a formulation and the necessary extrusion conditions to produce a commercially competitive, protective, loose-fill packing material (packaging peanuts) using unmodified cornstarch.



**Extrusion Technology for Nutritious Soy Foods:** Shoppers who study labels are most concerned about fat and dietary fiber. Four honey-flavored, Cheerios-type breakfast foods were prepared by extrusion processing, and a panel of 43 people evaluated their characteristics. One cereal contained added soy cotyledon fiber, a second oat bran, and a third had a combination of soy cotyledon fiber and oat bran. Panelists rated the cereal containing soy cotyledon fiber as high as a commercial Cheerios-type product. The oat bran cereals were thought to be much less sweet than the soy fiber cereal, even though all products contained the same percentage of sweeteners.

**Dietary Fiber and Cholesterol:** Animals fed extruded grains had much lower serum and liver cholesterol and higher high-density cholesterol (good cholesterol) than those fed raw grains. Processing did not damage the nutritional value but increased soluble fiber content and could make such products useful in preventing or treating heart disease.

Whole flour and bran from hard red winter wheat can lower cholesterol as much as oat bran at the same dietary fiber level. The cholesterol-lowering effect of the diet is statistically related to dietary fiber content (especially soluble fiber), amount of fat and neutral sterols excreted daily, phenolic compounds and phytic acid in the diet, and diet viscosity. All of those factors may contribute to the cholesterol-lowering effects of grain diets.

**Cholesterol-Lowering Effects in Wheat:** Hard white wheats are becoming popular in bakery products because of their light color and flour yield. Both hard white and hard red wheat are nutritious with respect to weight gain and feed efficiency in rats. However, red wheat diets lowered cholesterol more than white wheat diets, although both red and white wheat bran diets lowered cholesterol in rats as much as an oatmeal diet. In addition, red wheat bran offered protection against chemically induced cancer in mice, but the bran in white wheat did not.

**Aquatic Diets:** KSU researchers, in a series of projects, have successfully utilized gluten as a stability enhancer in pelleted aquatic diets. As a consequence, large volumes of wheat gluten are now being used in pelleted shrimp diets in the United States and other countries. The long-term objective is to improve the utilization of grain milling and processing of co-products in animal feeds.

KSU scientists in Grain Science are building a reputation for their drive to add value to Kansas products and for their work in improving product quality. A series of discoveries are outlined below.

**Thermoplastics Technology Using Wheat:** A composite plastic that contains 30 percent wheat starch was prepared. The plastic is stable in relative humidities up to 60 percent at room temperature and can be readily molded when warmed above 100°C. In temperate climates, the starch-containing plastic has good mechanical strength and flexibility and is estimated to be 60 percent biodegradable. This constitutes a value-added use of wheat starch because thermoplastics sell above 50¢ per pound compared to 10¢ to 20¢ per pound for wheat starch. Future research will focus on plastic composites with wheat starch that are 100 percent biodegradable.

**Irradiation:** Irradiation has been demonstrated to partially destroy aflatoxins, zearelanone, and deoxynivalenol in soybeans, wheat, and corn—products that effect the marketability, safety, and quality of grain.

**Using Natural Antioxidants:** Naturally occurring antioxidants such as phytic and ferulic acids found in grains can be used to replace synthetic antioxidants (such as BHA) in sugar snap cookies.

# DISEASE AND INSECT PESTS

Selected examples of the biological and genetic control of crop disease and insect pests are cited as developments that assist in protecting cereal grains and value-added products. Instances of educational and integrated pest management programs also are cited.

## PLANT DISEASES

**Biological Control of Soilborne Pathogens:** Plant pathologists have developed a dry bran formulation, applied with a sticker material, that reduces the amount of tan spot fungus in straw. Methods also have been devised to test large numbers of fungi under greenhouse conditions to detect beneficial fungi that inhibit the tan spot pathogen. The objective is to find new and better biological control methods.

Pathologists also have determined that a bacterial strain, Pf-5, produces an antibiotic that prevents the growth of tan spot organisms. They are examining the bacteria's DNA so essential genes can be transferred to bacteria that live on wheat straw and can control the tan spot fungus in conservation-tillage systems.

**Plant Viruses:** Most plant viruses consist of a coat protein and one or more molecules of nucleic acid (DNA or RNA). Using turnip crinkle virus, plant pathologists found that minor changes in the coat protein caused a drastic change in the symptoms expressed by infected plants. (Seemingly, the coat protein for wheat streak mosaic virus behaves similarly). Mutation of a calcium-binding site in turnip crinkle virus reduced its capacity to move from cell to cell. Many

plants are resistant to virus infections not because it cannot replicate but because it cannot move from cell to cell.

**Wheat Streak Mosaic Virus:** Since wheat cultivars did not contain genes that imparted resistance to wheat streak mosaic virus, researchers transferred the required genes from rye and wheatgrass to commercial varieties. Plant pathologists recently developed 4 lines with resistance to Wheat Streak Mosaic Virus (WSMV) (losses to WSMV in Kansas average $36 million annually). Two lines with high levels of resistance also have been derived from Agropyron sources.

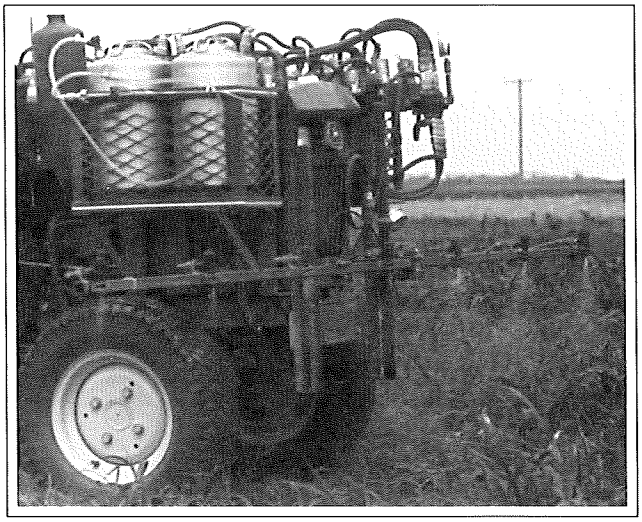
**Testing for Grain Sorghum Pathogens:** Grain sorghum and seed and feed grains are routinely exported to countries with stringent regulations concerning potential pathogens. Determining the presence of disease-causing bacteria, is difficult and time consuming (up to one month). Plant pathologists are developing a monoclonal antibody to enhance specificity and reduce the time needed for diagnosis. This rapid, inexpensive, and relatively simple procedure would help ensure that important export markets are not jeopardized with shipments that contain pathogens.

**Maize Dwarf Mosaic Virus:** Currently all KSU sorghum inbred releases are resistant to Maize Dwarf Mosaic Virus and Sugarcane Mosaic Virus. Losses to those diseases average $6 million annually.

**Eastern Gamagrass:** Eastern Gamagrass, a promising new forage, has been found to be susceptible to Sugarcane Mosaic Virus. This highlights the need to develop resistant lines.

## INSECT PESTS

**Integrated Pest Management—Stored Grain:** Specialists organized an IPM Grain Storage Project using demonstration sites to speed the adoption of IPM techniques. This should reduce pesticide residues and grain quality deterioration and enhance food safety through the use of aeration



controllers and IPM principles. Since this technology is cheaper than controlling stored grain insects with pesticides, farm profitability should increase. Contrary to farmer expectation, the initial infestation of insects in the bin may not come from the field and properly stored grain may not have insect problems until well into spring.

EPA is promoting integrated pest management with the hope of achieving 75 percent adoption by the year 2000. The feasibility of segregating wheat at harvest based on end-use quality should also enhance value-added marketing efforts.

**Wheat Curl Mite:** Resistance to the wheat curl mite was first discovered in common wheat in 1991. The mite is the carrier of the virus which causes wheat streak mosaic disease and causes an estimated annual loss of 15.5 million bushels in Kansas. The newly discovered resistance effectively reduces losses due to wheat streak mosaic virus, but only two varieties have resistance. When the new sources of resistance are transferred to commercial varieties, losses will be significantly reduced.

# ASSESSING ECONOMIC IMPACT OR VALUE-ADDED POTENTIAL

Extension specialists, through a variety of educational programs, help Kansas clientele, organizations, and local entities assess the economic impact of selected business and developmental projects. Potential entrepreneurs can also be assisted in the development of realistic and practical marketing and business plans. Oftentimes such plans involve the interdisciplinary cooperation of extension specialists, the Kansas Value-Added Center, and researchers.

**Economic Development Principles and Strategies:** Extension specialists work closely with the Kansas Value-Added Center (KVAC) and with food and agricultural producers and entrepreneurs to assess the feasibility of proposed value-added products and businesses. The work is coordinated with food systems, meats, food engineering, community enterprise development, postharvest, and marketing, and other KVAC team members. Economic analysis has been completed for 19 KVAC projects and 12 other products or operations. Ten additional analyses have been requested but await additional information from the entrepreneurs.

**Special Olympics:** Extension specialists were asked by the Director of Special Olympics to study the economic impact of their programs in six Kansas communities—Winfield,

Salina, Lawrence, Atchison, Hays, and Wichita. Taken together, the economic impact totaled $5.9 million for a single year. The study gave a clear picture of the value of the program to each community and provided a factual base for negotiating for key program elements in each community.

**Consolidating County Educational Programs:** One county was considering whether to consolidate or remodel their educational facilities. Studies showed that 1) additional classroom space was not needed for declining enrollments, 2) taxes would increase over a 20-year period, and 3) no additional money would be brought into the county. The new school would be financed from existing tax dollars and would cost more than was currently budgeted in the county. School consolidation was rejected in a county-wide vote.

**Locker Plant Operation:** A system of analysis was prepared and presented to the 22nd Annual Midwest Meat Processors Seminar. This included detailed procedures complete with self-analysis tables for use by individual managers. Three locker plant managers were given extra assistance in completing their analysis. In one instance, the city would help with some financing and the manager needed to determine the economic impact of the required investment. Instruction was provided on how to gather data, complete the analysis, and evaluate the investment.

**Flour Mills in Rural Areas:** The new Kice short-flow flour mill can provide the opportunity to locate small mills in rural areas. Economic analysis revealed that the impact of a short-flow flour mill in Greeley County in western Kansas could be substantial. Each year, such a plant would mill 1.6 million bushels of grain, require 6 skilled personnel, and provide an economic impact of $900,000 for the local community.

**Farrow and Finishing Operations:** Contract farrow and finishing hogs by processors like Farmland Industries and DeKalb offer producers a risk-sharing arrangement. The Rural Electric Administration consulted studies by Extension specialists as a basis for providing funding for construction of facilities. A contract farrowing and finishing operation was estimated to require an investment of $2.3 million and provide a $3.8 million impact. A swine breeder program with an investment of $434,000 had an economic impact of $1.5 million. The 500 head sow herd facility required an investment of $964,000 and provided an economic impact approximating $1.8 million.

**Small Business Administration: Procurement of Loans (SBA):** SBA loans are used to create jobs and income in various economic sectors in Kansas. SBA also helps with government procurement from small and disadvantaged businesses. Procurements totaled more than $1 billion in 1990. Extension specialists estimate that SBA loans of $70 million had an economic impact of $133 million. They also estimated that the economic impact of the procurement program approximated $2.2 billion.

**Sweetwater Sprouts:** Working with the Kansas Value-Added Center a company obtained help from Extension specialists in producing sweetwater sprouts. Specialists helped the company obtain actual data and determine a breakeven price. Armed with reliable data, the company negotiated an increase in price from its major buyer. This allowed the company to remain in business. The company is now considering expansion plans.

**Dairies in Southwest Kansas:** Subsequent to the completion of a dairy enterprise study in western Kansas by Extension economists, two major dairies were started. A 4,000 head dairy is being built by local investors in Hamilton County. A 2,000 head dairy is being built in Seward County by dairy producers moving from California. This will increase employment in southwest Kansas by 50 jobs and provide increased income from the sale of the milk.

**Turkey Production:** Turkey production in Kansas is increasing and farmers are investigating the feasibility of large production units. Extension economists studied the feasibility of a 10,000 bird unit, a hatchery, and a slaughter unit in northwest Kansas. An investment approximating $364,595 would be required to produce 65,000 birds per year. Such a facility would have an economic impact of $952,583 for the region.

**Feedlots in Butler County:** Extension specialists helped farmers obtain an economic analysis for a proposed 3,500 capacity feedlot. They had requested loans from the Rural Electrification Administration but needed to provide an economic impact statement. The economic impact of the feedlot was estimated to be $5.5 million. A loan of $1.9 million was required to build the facilities. For each person employed at the feedlot, it was estimated that an additional 2.65 additional jobs would be created in the area.