

Identifying Priorities for Iowa's Future

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Background on the Experiment Station

What is the Experiment Station?

The Iowa Agriculture and Home Economics Experiment Station is the title of the research program that has addressed immediate and long-term needs of Iowans for more than 115 years. Established at Iowa State in 1888, the Experiment Station fulfilled a Congressional charge for land-grant universities to develop organizations to advance science for the citizens of their states. The dean of the College of Agriculture serves as director of the Experiment Station.

Where is the Experiment Station?

Because of its name, the Experiment Station sometimes is mistakenly viewed as Iowa State's agricultural research farms and labs. Those are important places for its work, but as this review hopes to show, the Experiment Station is a vital research program involving hundreds of people—faculty and staff, hundreds of partners and connections to extension reaching Iowans in every county. The research is conducted on campus, on ISU's research farms and with cooperating producers, businesses and communities.

Why the Experiment Station?

The Experiment Station's advances in biological, physical and social sciences have contributed greatly to Iowa. Experiment Station research and ISU Extension not only help Iowa remain a world leader in food production, they address societal issues intimately linked to agriculture, including economic development, life-science frontiers, the environment, public policy, and families and communities. Innovation resulting from Experiment Station research is one reason why Iowa State University is among the nation's leading universities in transferring research and technology into commercial uses. In FY02, Experiment Station research made up half of ISU's patent disclosures and more than half of its active commercial agreements.

The Experiment Station and Extension are central to fulfilling Iowa State's land-grant mission of education, research and outreach.

Goal for the Review

Iowa State University's College of Agriculture is seeking Iowans' input to ensure that resources in the Iowa Agriculture and Home Economics Experiment Station are aligned to meet the present and future needs of Iowa, as well as to adequately address current realities in state funding for research and education.

The Vision

The College of Agriculture aspires to be the foundation for the education and technology that will be the future of Iowa agricultural and food systems. We will achieve this vision by educating our future leaders; by maintaining our strengths in production and value-added agriculture; and by investing in new areas to ensure Iowa remains a world leader in agriculture and life sciences. Recently the College has made investments in areas that include animal and plant genomics, biorenewable products and processes, corn and soybean production programs, risk assessment of genetically modified products, and food safety and security.

We will achieve the vision through partnerships with people and groups who believe in a better Iowa. The College will be a vital force for opportunity and positive change. That's our vision.

How You Can Help

In this report, we've assembled information for a snapshot of our recent research. As you review the information, consider whether we are asking the right questions to meet Iowans' needs and whether resources are adequately aligned to respond to needs. What do you believe should be the high priorities for agricultural research in the future? Your insights are valuable as the College of Agriculture makes plans to reach its vision by determining future directions of the Experiment Station and connected extension and outreach programs.

Scope of the Review

This review of research funded through the Experiment Station covers the Federal Fiscal Year from October 1, 2001, to September 30, 2002 (FY02). This period represents the most complete financial information available. Information on research and extension programs primarily represent results reported from this period. The review is divided into the following categories, which follow federal classifications for agricultural research:

- Plants & Their Systems
- Animals & Their Systems
- Natural Resources & Environment/
Engineering & Support Systems

- Family & Community Systems
- Economics, Markets & Policy
- Food & Non-Food Products: Development, Processing, Quality & Delivery
- Human Nutrition, Food Safety & Human Health and Well-being
- Research Support, Administration & Communication

Scope of the Research

In FY02, the Experiment Station had 226 active research projects, representing the efforts of scientists in nearly 35 departments, centers and programs across the Iowa State campus. The Experiment Station supported nearly 300 faculty (147 full-time equivalents, FTEs) and 420 staff members (145 FTEs). Although their work primarily focuses on areas in the College of Agriculture, the Experiment Station also supports efforts in Engineering, Family and Consumer Sciences, Liberal Arts and Sciences and Veterinary Medicine.

Funding Sources

The Experiment Station receives funds from three primary sources: state appropriations, federal formula funds (allocated to states based on their number of farmers and rural residents) and grants and contracts. In FY02, Experiment Station expenditures totaled \$85.4 million. In the figures below, we've included a category of product sales, which are expenditures from sales of agricultural products or services resulting from research programs (i.e., grain, livestock, seminar fees, publications). We've also included the current FY04 state appropriations for the Experiment Station. Current FY04 figures are unavailable for the other categories.

	FY02		FY04
State Appropriations	\$36.1 million	42%	\$31.3 million
Federal Formula Funds	\$4.1 million	5%	
Grants & Contracts	\$38.6 million	45%	
Product Sales	\$6.6 million	8%	
Total:	\$85.4 million	100%	

The State Funding Picture

Over the past several years, state budget difficulties have meant serious cuts to research in the College of Agriculture. With budget cuts and unfunded salary increases, the Experiment Station's base budget has declined 24.6 percent since 2001. The picture is similar for state funding of Extension within the College. In response, the College has reduced staff, left faculty positions unfilled and consolidated research facilities. For the current year, 2003-04, state funding for the Experiment Station is \$31.3 million (this figure includes the mid-year budget cuts

announced in October). In FY02, the year this review is based upon, the state appropriated \$36.1 million to the Experiment Station.

Why State Funds Are Critical

Results of this review will be an important part of upcoming discussions involving state budgets for the College of Agriculture. State funding for the Experiment Station and Extension pays for the people — faculty and staff — and the places — infrastructure such as labs and farms — that keep Iowa State among the nation’s leaders in agricultural research, education and extension. Experiment Station scientists leverage state dollars to compete in bringing in grants and contracts for work that addresses Iowa’s needs. And they compete very successfully. In FY02, they brought in \$38.6 million in grants and contracts. State funding supplies the resources crucial for retaining the best and brightest scientists and for maintaining high-quality programs. It supports graduate students who will contribute to Iowa’s future economy in agriculture and life sciences. It helps provide the science-based information that contributes to Iowa’s economic development and quality of life. State funds are crucial to continue Extension’s efforts to deliver unbiased research information to Iowans. Approximately \$10 million supports ISU Extension to Agriculture and Natural Resources, which includes faculty and staff in the College of Agriculture and other areas on campus and field specialists around the state.

Research and Extension Trends

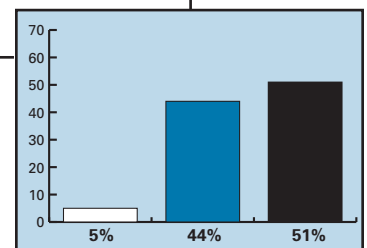
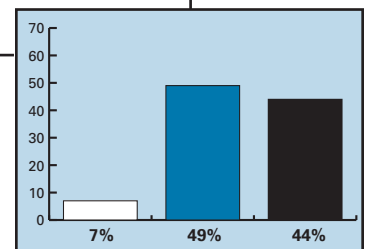
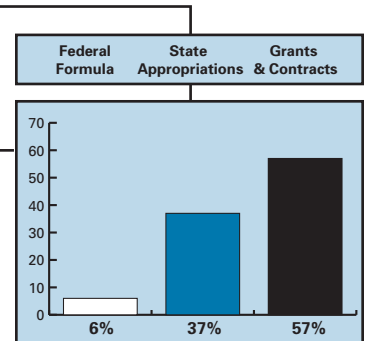
Generally, the broad categories of Experiment Station research have not changed dramatically over 20 years (see table below). In FY02, 57 percent of expenditures was directly linked to research in production agriculture. Twenty years ago, in FY83, production agriculture research accounted for 59 percent of Experiment Station expenditures. The remaining funds have supported research primarily in natural resources, water quality, forestry, food and human nutrition, value-added agriculture, horticulture, nonproduction economic issues, human health, and family and communities. Today, 72 percent of ISU Extension to Agriculture and Natural Resources’s activities on campus is devoted to production agriculture and 56 percent of field specialists’ efforts is tied to production agriculture. Production agriculture research has included work in plant production and protection, animal production and protection, soils and agricultural economics and marketing.

Finances

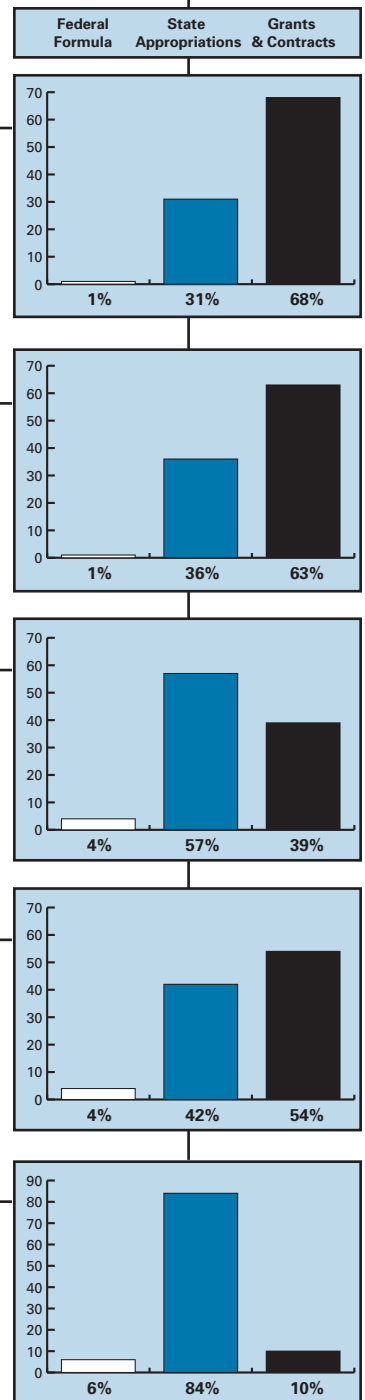
In the table, financial information from FY02 and from FY83 shows expenditures by research category. Also shown for FY02 is a breakdown of sources of funding — state, federal and grants and contracts.

FY 1983 AND FY 2002 EXPENDITURES BY RESEARCH CATEGORY

Research Problem Area	1983		2002	
	Expenditures	% of Total	Expenditures	% of Total
Plants & Their Systems	\$6,112,368	24.2%	\$24,036,831	28.1%
Animals & Their Systems	\$6,820,760	27.0%	\$19,409,666	22.7%
Natural Resources & Environment/ Engineering & Support Systems	\$4,416,510	17.5%	\$12,733,835	14.9%

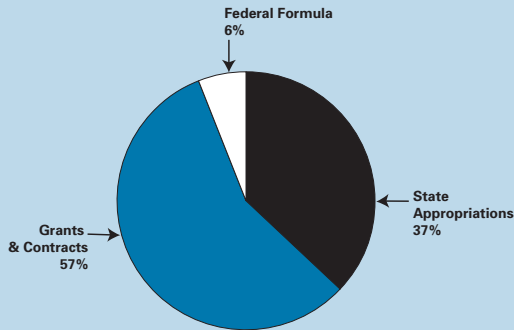


Research Problem Area	1983		2002	
	Expenditures	% of Total	Expenditures	% of Total
Family & Community Systems	\$1,238,773	4.9%	\$9,714,195	11.4%
Economics, Markets, & Policy	\$2,220,086	8.8%	\$7,764,268	9.1%
Food & Non-Food Products	\$2,405,691	9.5%	\$6,853,499	8.0%
Human Nutrition, Food Safety, & Human Health and Well-being	\$957,349	3.8%	\$4,573,200	5.3%
Research Support, Administration, & Communication	\$1,096,067	4.3%	\$403,296	0.5%
TOTAL	\$25,267,604	100%	\$85,488,790	100%



Source: USDA CSREES Current Research Information System (CRIS), FY 2002 and FY 1983 Research Reports for IAHEES. 2002 figures do not exactly match the figures in each category of the review due to reassignment of some projects to different categories to more clearly reflect research goals.

\$24,010,000 in FY02 expenditures



THE QUESTIONS

Experiment Station researchers work in areas that are both practical and fundamental, short-term and far-reaching. What key questions are researchers addressing for Iowans?

- How can crop yields be improved through application of novel agronomic practices, plant breeding and genetics advances, and new fundamental knowledge on plant biology?
 - Field Crops **\$5,492,000**
 - Forage Crops **\$5,077,000**
 - Horticultural Crops **\$1,505,000**
- How can crop losses from damages by bacteria, fungi, insects, weeds and other pests be reduced?
 - Field Crops **\$3,808,000**
 - Forage Crops **\$884,000**
 - Horticultural Crops **\$1,402,000**
- How can the utilization of crops be increased?
 - Field Crops **\$1,643,000**
 - Forage Crops **\$1,363,000**
 - Horticultural Crops **\$478,000**
- How can the sustainability of crop production systems be improved to reduce environmental consequences?
 - Field Crops **\$662,000**
 - Forage Crops **\$569,000**
 - Horticultural Crops **\$1,127,000**

SELECTED IMPACTS

Research results often improve understanding, help solve practical problems and build to greater discoveries. How has Experiment Station research impacted Iowans?

Field Crops

- Soybean genes were discovered that control the interaction between the plant and soybean cyst nematodes. This knowledge will be critical in creating a means to combat this serious pathogen of soybean. Researchers also learned the nematodes continue to increase in fields after harvest. This means soil samples should be collected prior to planting in the spring to accurately determine the magnitude of infestation.
- Progress has been made in testing and optimizing models that predict crop growth in Iowa corresponding to different agronomic, environmental and management conditions. Break-even costs associated with moving from single rate to variable rate management have been determined, allowing Iowa farmers to make more informed decisions about management practices.
- Five soybean genes were cloned, each shown to confer Phytophthora resistance in transgenic soybean plants. The existence of 33 additional genes of this type was shown. The knowledge will help develop new soybean germplasm with broad-spectrum resistance to Phytophthora.
- Manipulating nitrogen applications can maintain corn yields while reducing weed competition.
- Phytodyne, Inc., an ISU-created biotechnology company, has set up research collaborations with several private companies. They will use Phytodyne's technologies to develop more precise, efficient methods to generate transgenic crops. The company is located in the ISU Research Park. Nine of the Phytodyne's 11 employees are research scientists.
- Three genes linked to quantity and quality traits of starch have been cloned from maize. This genetic engineering produced transgenic plants with new types of starches. Two patents have been granted and one is pending related to starch biosynthesis genes. One of the patents has been exclusively licensed to a multinational agricultural biotechnology company.
- A risk assessment evaluated the toxicity of Bt corn pollen on monarch butterfly larvae. It was determined that Bt corn grown under field conditions is not detrimental to many non-target insects, including the monarch.

- Corn lines were screened to evaluate starch content. The new corn lines will be incorporated into commercial hybrids by traditional breeding strategies and will make significant contributions to U.S. crop diversification.
- A model predicts the occurrence and severity of gray leaf spot infection of corn.
- Crop nutrient recommendations are the result of long-term fertility studies conducted at five strategic locations in Iowa: Nashua, Kanawha, Sutherland, Crawfordsville and Lewis.
- Improvements in yield, stalk strength, root development, maturity, pest tolerance and drought resistance have resulted from plant breeding research conducted annually at nine ISU research farms at Castana, Lewis, Chariton, Crawfordsville, Fruitland, Nashua, Kanawha, Sutherland and Ames.
- Basic studies on the growth and development of corn and soybeans have provided a better understanding on the effects of planting date, row spacing, emergence, seeding rates, populations and crop injury on crop performance. This information is critical for yield projects and replant decisions linked to crop damage from weather or insects.
- Extension recommendations and integrated pest management strategies are based on data from studies of cultural and chemical control methods. The work is generated from ISU's network of research farms.
- A cover crop of yellow mustard planted prior to soybean planting, along with reduced herbicide rates, resulted in equal or higher yields and fewer weeds than conventional weed management systems.

Forage Crops

- Models have identified the critical points in weed life cycles that are vulnerable to manipulation by changing management tactics. Researchers found red clover legume mulch improved weed management in a number of management systems.
- Genotypes of alfalfa, white clover, kura clover and orchardgrass have been identified that may increase yield and persistence in Iowa, making them more economical to produce.
- Connections have been identified between genetic, environmental and management practices and the usefulness of forage crops as animal feed. Producers can use this information to identify conditions that optimize production and forage quality.
- The isolation of new genes may improve winter hardiness in alfalfa. The work advances understanding of a plant trait that makes alfalfa a suitable crop for Iowa's climate.
- Researchers showed it's possible to use anaerobic digestion of corn stover, sweet sorghum and sugar beets to produce ethanol.
- Switchgrass cultivars with superior adaptation for biofuel production in Iowa have been identified.

- Forage and grazing research and demonstrations with sheep and beef cattle generated information on intensive rotational grazing, forages for drought situations and fencing innovations. Much of the work is conducted at the McNay Research and Demonstration Farm near Chariton.

Horticultural Crops

- Strategies control diseases and insects in cucurbit crops without the use of pesticides. The result: lower pesticide use on cucumbers and melons and economic savings for Iowa producers.
- Turfgrass germplasm was evaluated to improve tolerance to stresses. Perennial ryegrass was by far the most traffic-tolerant species in the seedling stage and should be considered for sports turf use to improve the safety of athletes.
- Using rotations of small grains and legumes, horticultural crops can be grown profitably without synthetic fertilizers or pesticides. Also, insect pests can be maintained below economic thresholds by using naturally occurring predatory insects, resulting in a 10 percent reduction in production costs.
- When fertilized with approved organic soil amendments, yields of horticultural crops can be similar to those achieved under conventional fertilizers. Research identified crop rotations for which organic yields met or exceeded conventional corn-soybean rotation yields.
- A sooty blotch/fly speck warning system for apples was developed and validated. The weather-based system was found to be effective and saves fungicide applications, money and time for Midwest fruit growers.
- Studies of commercial horticultural practices and variety trials for melons, tomatoes, squash, sweet corn, apples, grapes and green peppers provided information to support Iowa's fruit and vegetable operations.
- Corn gluten was successfully used as a natural herbicide for weed control in strawberries.

SELECTED EXTENSION/OUTREACH

Science-based information is a hallmark of the Experiment Station and Iowa State's land-grant mission. What key extension or outreach activities are making the information available to Iowans and others?

- Greg Tylka established a large-scale soybean cyst nematode plot near DeWitt to demonstrate the benefits of planting SCN-resistant soybean varieties. The result: SCN-resistant varieties had yields greater than nonresistant varieties.
- The Field Extension Education Laboratory provided training to over 1,400 ag chemical dealers who attended crop diagnostic workshops, shortcourses or Ag Dealer Updates. Also, the statewide Integrated Crop Management Conference was attended by 866 ag chemical dealers, crop consultants and producers.

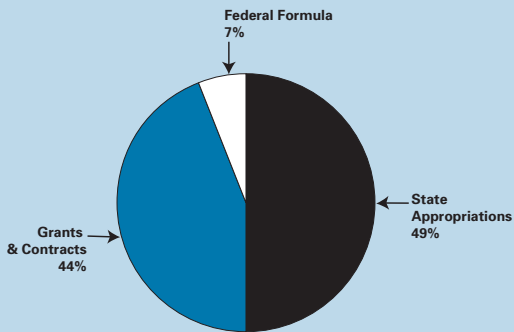
- More than 800 cooperators who participated in research on integrated tillage and manure management strategies reduced their use of commercial nitrogen fertilizer by 50 pounds per acre. Mahdi Al-Kaisi, Mark Hanna and Mark Licht coordinated the Integrated Farm and Livestock Demonstration Program.
- More than 500 people viewed home demonstration gardens at eight ISU Research Farm field days. Seventy-seven percent said they'd try one or more plants or practices demonstrated in the gardens.
- Extension field crop specialists, like Brian Lang in northeast Iowa and Joel DeJong in northwest Iowa, rely on e-mail newsletters to provide timely crop management information. Lang's "Crop Notes" is e-mailed to over 400 producers each year. As a result of DeJong's "Crop Update," producers scouted 17,000 acres for western bean cutworms and made appropriate treatment decisions.
- More than 19,000 producers attended a private pesticide application training program. Ninety-six percent rated the program good or excellent.
- More than 2,000 agribusiness personnel and farmers subscribe to the Integrated Crop Management newsletter. Eighty-six percent of readers said the newsletter contained information not available elsewhere and 78 percent had changed a pest management or crop production practice as a result of reading the newsletter.
- In northwest Iowa, Paul Kassel worked with 22 ag chemical and fertilizer dealers to help them assess crop problems in the field. The dealers said the economic value of this education was \$459,500, including lowered nitrogen recommendations; increased soil testing and soil fertility; and improved herbicide selections.
- Kris Kohl coordinated three manure field days attended by 110 producers in northwest Iowa. Seventy-seven percent of participants stated that all of their manure was injected and incorporated into soil; 85 percent had tested manure in the last 5 years and 62 percent had tested their manure last fall and applied the manure according to the results.
- Dairyland Research provides land for soybean research plots near Gilbert.
- The Iowa Soybean Association is providing precision-farming data from about 100 fields for ISU research funded by the Iowa Soybean Promotion Board.
- Pioneer/DuPont has supplied proprietary technology to assist research on the development of new inbred corn lines.
- For a combine clean-out project, John Deere donated the use of a new combine and Van-Wall Implement provided a used combine along with corn and soybean heads.
- Case/DMI has provided an anhydrous ammonia applicator for field research.
- Prinsco Tile, Timewell Tile, Hawkeye Tile, Advance Drainage Systems, Springfield Tile and Diller Tile each provided a truckload of tile for a project adjacent to ISU's Southeast Iowa Research Farm. More than 50 acres was tiled.
- Pioneer has provided land and labor for field operations for research on developing a pre-plant risk assessment system to predict the prevalence and geographic distribution of Stewart's disease of corn.
- Horticultural plants, seeds and soil mix supplies have been donated by companies including Yoder Brothers, Fischer USA, Ball Seed Co., Plantpeddler, Burpee Seed and Hummert International.
- More than 45 companies and associations have provided turf-related equipment, irrigation equipment, seeds, chemicals and support, including Aiken Peat, Andersons Lawn Tech, BASF, Becker Underwood, Dow Agrosiences, Gardens Alive, Golf Course Superintendents Association of America, Iowa Golf Course Superintendents Association, Iowa Professional Lawn Care Association, Iowa Sports Turf Managers Association, Iowa Turfgrass Institute, Jacklin Seed, LESCO Inc., Rainbird Irrigation Co., The Scotts Co., Sun Turf Equipment Co., TeeJet Spray Products, Terra Chemical Corp., The Toro Co., United States Golf Association, Valent Chemical and Williams Lawn Seed Co.

PARTNERS

Many individuals and groups support Experiment Station research and education in ways that go beyond dollars. Here are a few examples.

- A Sutherland farmer provided composted swine manure for an experiment at ISU's Northwest Research Farm.
- Pioneer Hi-Bred International and Syngenta Seeds provided access to seed production fields for research on modeling kernel set.
- Seed companies, including Sansgaard (Story City, IA), Syngenta (Jefferson, IA), Dairyland (Clinton, WI), Merschmann (West Point, IA), Otilie (Marshalltown, IA) and Pioneer Hi-Bred (Johnston, IA) have provided soybean seed varieties for a seed testing standardization project.
- In soybean cyst nematode research, New Horizon FS Inc. has organized strip trial demonstrations; the Iowa Soybean Association has organized educational meetings; and iphaTech Inc., has provided Rhizobium inoculum.
- On-farm demonstration trials are conducted annually with about 15 Iowa commercial fruit and vegetable growers.
- Frontier Herbs has donated Echinacea pueraria (purple coneflower) and Hypericum pueraria (St. John's wort) for initial work by ISU's Botanical Center.
- Seven local research farm associations have provided land to researchers to work on regional agricultural topics dating back to the 1930s. Work has centered on crops, soils, water quality and livestock.

\$19,016,000 in FY02 expenditures



THE QUESTIONS

Experiment Station researchers work in areas that are both practical and fundamental, short-term and far-reaching. What key questions are researchers addressing for Iowans?

Swine \$5,404,000

- How can enhanced genetic selection tools, genetic markers and gene mapping improve meat quality and safety and reduce costs for swine producers? **\$3,223,000**
- How can improved nutrition management improve swine efficiency and increase producer profitability? **\$1,752,000**
- How can swine producers improve housing for their animals in ways that are economical as well as environmentally sustainable? **\$159,000**
- How can odors and gas emissions from swine operations be reduced? **\$270,000**

Beef \$4,841,000

- How can enhanced genetic selection tools and nutrition management improve meat quality and safety and reduce costs for beef producers? **\$2,377,000**
- How can beef producers achieve greater production efficiency, resource utilization and cost reduction? **\$289,000**
- What beef production management practices protect or improve the quality of Iowa's natural resources? **\$2,175,000**

Dairy \$2,687,000

How can enhanced genetic selection tools, genetic markers, and gene mapping improve milk quality and safety and reduce costs for dairy producers? **\$1,410,000**

How can improved nutrition and production management improve dairy efficiency and increase producer profitability? **\$437,000**

What factors determine milk product value and improve milk product quality? **\$187,000**

What can dairy producers do related to production facilities to help protect water and air quality? **\$653,000**

Poultry \$2,751,000

- How is poultry production enhanced by decreasing the incidence of disease? **\$236,000**
- How is poultry production increased through genetic selection and evaluation? **\$2,135,000**
- What can poultry producers do to help protect water and air quality? **\$380,000**

Basic Research \$3,333,000

- How can enhanced genetic selection tools, genetic markers and gene mapping improve meat quality and safety and production efficiency for animal agriculture? **\$714,000**
- How can a better understanding of molecular structure and cell pathways improve meat quality and safety and production efficiency for animal agriculture? **\$2,619,000**

SELECTED IMPACTS

Research results often improve understanding, help solve practical problems and build to greater discoveries. How has Experiment Station research impacted Iowans?

Swine

- Specific genes can be used in selection lines for improving the genetics of swine. The genes directly affect litter size, growth, backfat and meat quality. The research involves mapping the genome of swine and using gene markers to develop tests that allow swine breeders to identify animals that carry genes that correspond to traits. A major swine breeding company is using six of the identified genes.
- An intramuscular vaccine and the feeding of conjugated linoleic acids (CLA) can help prevent dysentery, a costly swine disease.
- Research comparing conventional confinement facilities to deep-bedded hoop buildings identified production and economic trade-offs essential to producer decisions regarding investment and operating costs and returns.
- Management — of ventilation, nutrition and manure application timing and methods — is key to reducing odor emissions. Studies are comparing different swine systems to gain more information on odor emissions.

- Different processing methods for corn contaminated with mycotoxins improve utilization, allowing producers to efficiently utilize grain in years when contamination is a problem.

Beef

- Research has developed EPDs (expected progeny differences) for beef body composition using ultrasound on live animals. The result: reduced cost and speedier genetic selection.
- Using ultrasound EPDs for selection has resulted in development of two lines of Angus cattle — a retail product line and a quality line. Currently 37 of the nation's top 200 cows for percentage of intramuscular fat in the Angus breed are in the Iowa State herd.
- Identification of genes that affect skeletal muscle development and lean tissue deposition will allow producers to better select genetics for specific production efficiency and end product traits. The result: increased profitability and consumer satisfaction.
- Feed costs for pasture-based beef systems can be reduced significantly by using corn stalks and stockpiled pastures to extend the grazing season.
- A low-cost nasal swab was an effective diagnostic tool for *Mycoplasma bovis*, a costly respiratory disease in feedlot cattle. Coupled with genomic fingerprinting, the analysis provides a rapid determination of infection in a feedlot.
- Phase feeding of feedlot cattle and reducing protein as the cattle get heavier reduce both costs and nitrogen excretion.
- Cows grazing cornstalks during the winter did not affect soil compaction nor subsequent soybean yields.
- Studies of stable flies point to critical control points linked to time and temperature that indicate when control measures are most effective.

Dairy

- Research is identifying genetic differences in cows that produce milk with known human health benefits, which will make the milk more valuable to consumers or processors. For example, studies show feeding more soy oil to selected cows can lower saturated milkfat.
- A protocol has been developed to improve mastitis detection and control measures in dry cows and post-calving cows. Result: reduced dependence on antibiotics.
- As many as half of U.S. dairy cows have mild to severe fatty liver problems in early lactation, costing millions of dollars in treatment and production losses. Research found that improved nutritional management will reduce fatty liver complications.
- Researchers developed management tools to identify noncycling dairy cows and the selective use of estrus synchronization products. Their use will increase cow fertility, improving calving and lactation intervals leading to increased milk production and cow longevity.

- Research is developing genetic selection tools to identify sires that will lead to reduced dystocia and perinatal mortality, thus improving survival, reproduction and premature culling in high-yielding dairy cows.
- Researchers are identifying factors that define and impact air quality, helping establish science-based standards for animal agriculture. Research also is evaluating the cost and effectiveness of biofilters to reduce particulates and odor from facilities.

Poultry

- Research shows altering poultry feeding programs reduces manure nutrient levels and can lead to improved water and air quality.
- Researchers have identified genes that enhance pre-harvest food safety efforts against *Salmonella*.
- Researchers are making advances in pathogenesis, surveillance, diagnosis and control of avian respiratory diseases.
- Researchers have determined that composting may be an effective, safe and environmentally feasible way to dispose of carcasses in the event of a catastrophic disease like avian influenza or Newcastle disease.
- Using unique genetic crosses of chickens allows the estimation of the number of genes controlling important economic traits of growth and carcass composition. The results will help direct future molecular genetic studies into areas that improve performance.
- The development of biophysical models for poultry production systems will help establish ammonia emission inventory data and investigate emission mitigation measures for U.S. poultry production systems. The models also will help develop alternative cooling systems to help the industry better cope with adverse summer weather, and will improve environmental conditions and animal well-being during the transport of day-old breeder chicks.

Basic Research

- Procedures have been developed to reduce gene-mapping errors. This makes it possible to conduct more powerful experiments to detect genes that have significant effects on economically important animal traits.
- Research is developing models to implement gene mapping into animal production management decisions. As more is learned about genetic mapping, these kinds of practical methods are needed to link DNA information to the functions they control.
- Discovery of new genes that regulate interactions between neurons in developing animal nervous systems will lead to new insights into congenital neural defects.
- Better understanding of molecular structure will help researchers study cell growth, immune response, chemotherapy, dietary supplements and drug-resistant bacteria.

- Better understanding of cell development and behavior will allow researchers to better predict muscle growth, nutritional and eating quality of meats; properly time transgenic operations in genetically modified embryos; and study cell and tissue development more cost effectively.

SELECTED EXTENSION/OUTREACH

What key extension or outreach activities are making science-based information available to Iowans and others?

Swine

- Nineteen faculty and staff are associated with ISU's Iowa Pork Industry Center. They cover animal science, economics, agricultural and biosystems engineering and veterinary medicine. John Mabry is director of the center. There are 28 extension field specialists who work with the Center to serve swine producers.
- Reproductive traits in swine are extremely important economically, but selection for the traits at the farm level hasn't been feasible. Iowa State has been a leader in developing science-based technology (Best Linear Unbiased Prediction, or BLUP) to accurately estimate the genetic merit of animals for traits like reproduction. ISU Extension and the Iowa Pork Industry Center have developed a user-friendly interface that allows pork producers to use BLUP technology in conjunction with commonly used reproductive data management software.
- The Iowa Pork Industry Center offers numerous educational programs and products for producers. Topics include advanced animal health; environmental education; Pork Quality Assurance education; swine handling and transport education; value of swine nutrients for crop production; advanced swine breeding herd management; finisher facilities; ventilation systems; Iowa Manure Digester Conference; statewide Swine Welfare Assurance training; and ICN programs on market prices and manure issues.
- Real-time ultrasound is the most reliable method of estimating backfat and loin muscle area in live pigs. ISU research has resulted in a dramatic increase in implementation of this technology. A series of education and certification conferences have been held.
- Publications and products helping producers include the annual ISU Swine Research Report, "Minimizing the Use of Antibiotics" and "Group Tracker" software.
- Larry McMullen worked with Kirkwood Community College to demonstrate the use of dietary phytase to reduce phosphorus in swine manure. A 22 percent reduction was achieved, pig performance was not affected and diet costs remained the same.

Beef

- Seventeen faculty and staff members on campus are associated with ISU's Iowa Beef Center. They cover areas in animal science, agronomy, economics, agricultural and biosystems engineering and veterinary

medicine. John Lawrence is director of the Iowa Beef Center. Sixteen extension field specialists linked to the center serve beef producers.

- Forage-planning software, developed by Daryl Strohbehm and Dan Morrill and incorporating research by Jim Russell, can help extend the grazing season to reduce stored feed costs for beef herds. The result: a monthly forage balance producers can use to evaluate alternative grazing systems. Extension field specialists trained producers in using the software at Cyclone Beef Days Forage Management Workshops.
- A feedlot short course developed by Darrell Busby and Dan Loy meets monthly, following a pen of cattle through the feeding period from beginning to end. The five-day curriculum incorporates hands-on learning with presentations by leading researchers on feedlot management, animal health, marketing and nutrition.
- The TriCounty Steer Carcass Futurity fed more than 10,000 cattle for 600 producers from nine states, using Iowa feedlots. With the help of Darrell Busby and extension personnel, individual performance and carcass data was collected to help producers make better management decisions.
- ISU's Iowa Beef Center worked with more than 30 feedlots to develop environmental management systems for their operations. Producers developed an environmental policy statement, conducted an assessment to determine priorities and implemented an action plan to operate their business in accordance with environmental regulations and their own stewardship principles.
- ISU's Iowa Beef Center offers many programs and products that target producers, including Grid Market Analyzer software, Feedlot Monitoring Program, Forage Planner Software, SPA Analysis and Summary, Estrus Synchronization software, Cyclone Beef Days and workshops, the grid-marketing Market Cow Feeding Demonstration and sire and tenderness progeny testing.
- Publications and products designed to help producers include the annual ISU Beef Research Report, "Solutions for Small Feedlots," "Marketing What's Under the Hide," and "Marketing Corn Through Cattle."
- More than 9,600 head of cattle from Iowa and seven other states were fed in southwestern Iowa as a part of the Tri-County Steer Carcass Futurity Cooperative, resulting in an extra \$3 million spent in Iowa for feed, trucking and associated costs.
- Adoption of a beef cattle sire profit comparison project that measures differences in progeny market value can improve feedlot producer profit by \$58 per head.
- Hundreds of beef producers and agribusiness personnel attend the annual Cornbelt Cow/Calf Conference in Ottumwa. Producers used information from the conference to implement management changes that increased returns by 8 to 13 percent and production efficiency by 11 percent, and decreased labor input by 16 to 19 percent.
- Beth Doran, Allen Trenkle and Dan Loy investigated the value of ethanol co-products in beef cattle production. Samples from three northwest Iowa ethanol plants will be analyzed to determine any variability in nutritional content.

Dairy

- Ten faculty members on campus have expertise in dairy science and are available to assist producers. Eight extension field specialists assist dairy producers.
- Publications to assist producers include annual DHI averages by breed; the ISU Extension View Dairy newsletter; the annual ISU Dairy Research Report; Teat Condition Portfolio CD-Rom; Milk Quality Issues and Programs For Transition Cows and Heifers; and Evaluation of Bovine Teat Condition in Commercial Dairy Herds.
- Several programs and products that target dairy producers include regional Dairy Days; Milker Training Schools; Dairy Feeder Schools; Dairy Herdsperson Schools; Dairy Challenge Competition; Beginning Dairy Farmer course and curriculum; Manure Application Field Day; Iowa Manure Digester Conference; and on-farm dairy management teams.
- Dairy farmers with milk quality problems increased annual income per cow by approximately \$190 when they adopted Extension's milk quality suggestions.
- Dale Thoreson provided one-on-one educational assistance to 120 livestock operations. As a result, producers implemented changes that included a new feedlot monitoring program, different milking procedures and remodeling facilities. Producers said the economic impact of these efforts ranged from \$1,074 for a 92-cow dairy herd to \$15,210 for a 1,300-head feedlot.

Poultry

- Six ISU faculty members (Darrel Trampel, Sue Lamont, Hongwei Xin, Don Reynolds, Dong Ahn, Kristjan Bregendahl) have expertise in poultry production and provide support to producers. Farm visits and diagnostic assistance are a part of extension and outreach efforts.
- Extension activities that target poultry producers include the annual Iowa Poultry Symposium, area meetings for poultry producers, Pullorum schools and the video, "Exotic Newcastle Disease and the California Outbreak."
- Darrell Trampel provided diagnostic assistance to Iowa poultry producers through 376 cases. A rapid diagnosis allows early actions that greatly reduce disease and losses in affected flocks.

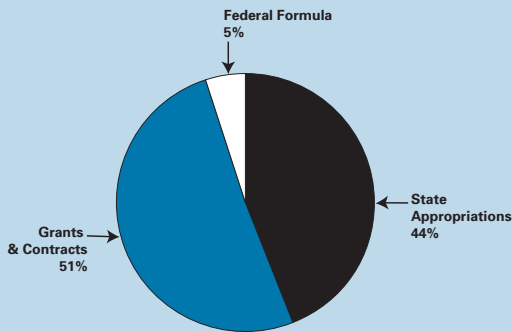
PARTNERS

Many individuals and groups support Experiment Station research and education in ways that go beyond dollars. Here are a few samples.

- Surebeam has provided use of irradiation facilities.

- In-kind support has been provided by many companies and associations, including the National Swine Improvement Federation, Seghers-Newsham, Babcock Swine, ABS Global, American Angus Association, West Agro Inc., Alcide Corp., IBA Inc., Westphalia Surge, Boumatic Inc., Gallo Dairy Farm, Land O'Lakes, Milk Specialties, Merricks Inc., and American Protein Corp.
- Iowa Pork Producers Association sponsored development of a four-state ventilation workshop series.
- Two beef farms, a dairy farm and three swine farms have allowed ISU manure management and water quality scientists to collect data and bring visitors to the sites for several years.
- Practical Farmers of Iowa and Iowa Farm Bureau farmer cooperators provided field plots and in-kind labor and equipment for a six-farm study of swine hoop manure composting and compost utilization.
- Several Iowa egg companies have provided the use of their commercial laying hen houses for research and extension projects.
- Poultry breeding companies provide contributions of genetic stock, biological samples and measurement of phenotypic traits.
- Syngen provided DNA samples of pigs in infectious disease trials.
- Northeast Iowa Community-Based Dairy Foundation provides access to facilities for research and extension.
- Trans Ova Genetics has provided access to facilities and equipment for research and transfer of embryos from endangered species.
- Henry Doorly Zoo has provided access to facilities and equipment for research, donations of embryos and donations of labor.
- More than 90 producers participated in the grid marketing demonstration by sharing their carcass data.
- Several farmers regularly host educational field days for grazing systems and environmental structures.
- TriCounty Steer Carcass Futurity and its consigners provide cattle and detailed animal data for research use.
- The Iowa Quality Beef database is shared with Iowa State to develop carcass benchmarks.
- The Iowa Cattlemen's Association purchased water quality monitoring equipment for use by ISU researchers.
- Seven local research farm associations have provided land to researchers to work on regional agricultural topics dating back to the 1930s. Work has centered on crops, soils, water quality and livestock.

\$12,991,000 in FY02 expenditures



THE QUESTIONS

Experiment Station researchers work in areas that are both practical and fundamental, short-term and far-reaching. What key questions are researchers addressing for Iowans?

Water Quality and Air Quality \$7,845,000

- How can recommendations for fertilizer and herbicide applications be improved? **\$1,256,000**
- How can measurements of agriculture's impacts on water quality be improved? **\$2,662,000**
- Can a real-time, rapid test for soil nitrogen availability be developed for different soil and climate conditions? **\$112,000**
- What technology and management practices can be developed to reduce odors, gases and other airborne emissions from concentrated livestock production facilities? **\$664,000**
- What are the basic chemical and biological processes controlling the function of pesticides, organic chemicals, trace metals, surfactants and microorganisms? **\$1,629,000**
- How can environmental impacts be reduced in horticultural crop production? **\$1,146,000**
- How can the value of watershed level planning and community-based educational efforts be communicated more effectively? **\$89,000**
- What technologies, including biosolids applications, are available for producers to add value to agricultural and waste products? **\$287,000**

New Economic Opportunities \$515,000

- Are environmentally friendly soy-based adhesives as good or better than traditional products, and can processes be improved for creating bonded-wood products? **\$191,000**

- How can rapidly growing tree species be genetically improved for faster growth as well as disease and insect resistance, and can they be grown intensively in an environmentally friendly manner? **\$324,000**

Biodiversity and Climate Change \$4,631,000

- Can perennial plants and wetlands remove nonpoint source pollutants from surface waters while providing habitat for diverse organisms? **\$967,000**
- Can biodiversity in urban and suburban areas be maintained or enhanced through community tree care and planting programs? **\$96,000**
- How can pheromones, genetic analyses and other scientific methods be employed against destructive insect pests such as gypsy moth and bark beetles? **\$741,000**
- How can an examination of natural processes be used to better understand the distribution, abundance and richness of wildlife and plant species? **\$669,000**
- Can landscape-scale computer models be developed for a more integrated and systematic approach to restoration ecology and wildlife management? **\$96,000**
- Can computer models reliably predict potential climate changes in the Midwest as well as assess the impact of shelterbelts on crop yields? **\$2,062,000**

SELECTED IMPACTS & EXTENSION

Research results often improve understanding, help solve practical problems and build to greater discoveries. Here are selected examples of Experiment Station research results and Extension and outreach activities that have impacted Iowans.

- Riparian buffers are more than 95 percent effective in removing nitrogen, phosphorus and sediment from drainage waters, while at the same time improving soil quality, diversity of soil microbes and wildlife habitat. ISU's Bear Creek Watershed Project was one of 12 projects nationwide selected as a "National Restoration Demonstration Watershed" under the federal Clean Water Action Plan. The work by ISU researchers has provided much of the science now guiding the National Resource Conservation Service's National Buffer Initiative. Tom Isenhardt and Dick Schultz have shared buffer strip research results with landowners and natural resource professionals.
- Results of research on subsurface banding of nutrients, precision agriculture technologies and environmental impacts of phosphorus fertilization have changed fertilizer recommendations and led to the first Iowa Phosphorus Risk Index.

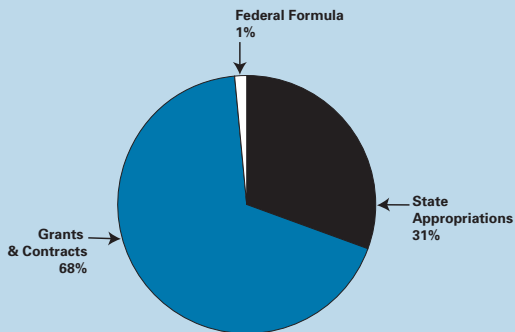
- Water movement in soil is key to the availability and loss of nutrients and agricultural chemicals. Two techniques have been found to accurately measure water movement in soils. Data collected with these methods will allow better models of water and chemical movement to be developed and tested.
- New adhesives made from soy protein have been developed and are being commercialized. Wood and other plant fiber, such as cornstalks, have been used to create components for office furniture.
- Woody crops are a largely unexplored income opportunity. Research has produced fast-growing cottonwoods and hybrid poplars with improved disease and insect resistance, making it possible to intensively grow trees without excessive pesticide use.
- In a local watershed project, a citizens' council was formed to make decisions on reducing the negative impact of nutrient application and agricultural practices on water quality. On the basis of research data collected in the study, the council decided to reduce the watershed's nutrient losses by half of the current levels. Producers in the watershed have been implementing technologies to meet the goal.
- Agricultural & biosystems engineering faculty Jim Baker, Stu Melvin, Steve Mickelson, Ramesh Kanwar and Jeff Lorimor work with faculty in other departments and field specialists to conduct extension water-quality workshops and field days, plus make presentations at local, national and international conferences. Faculty in other departments, including John Downing, Bill Crumpton and Joe Morris, have led other outreach efforts in water quality.
- The Heartland Integrated Water Quality Coordination Initiative and the Tribal College Community Natural Resources Education Program are two examples of efforts to extend water quality management and planning information on a regional basis and improve understanding for the need for watershed-based planning and pollution reduction approaches. The Heartland Initiative is led by Jerry Miller and John Lawrence. The Tribal College Program is coordinated by Harold Crawford.
- Dwaine Bundy, Steve Hoff, Jeff Lorimor, Hongwei Xin, Wendy Powers and Joe Colletti are among the faculty actively engaged with livestock producers to communicate research findings on air quality issues associated with confined animal production.
- Elywnn Taylor deals with questions on global climate and pending climate changes in his extension-sponsored weekly radio call-in program and makes numerous presentations around the state.
- Paul Wray and Carl Mize present workshops on shelterbelt and windbreak construction. Wray coordinated Forestry Field Days in 10 locations. After the field days, 97 percent of participants reported they had a better understanding of their woodlands; 49 percent placed a woodland in the Forest Reserve; 67 percent developed a woodland management plan; and 75 percent implemented management changes.
- Soy-based adhesives and how they can be used by local industry for testing and evaluation have been part of the efforts of Doug Stokke and Monlin Kuo.
- The NatureMAP program is led by Jason O'Brien and Jim Pease. Pease also leads Extension's Master Conservationist program.

PARTNERS

Many individuals and groups support Experiment Station research and education in ways that go beyond dollars. Here are a few examples.

- Nearly 100 farmers and landowners have provided access to their land for research.
- Iowa Department of Natural Resources has provided equipment, personnel and supplies such as seedlings and fish.
- The U.S. Department of Agriculture's Agriculture Research Service, Natural Resource Conservation Service and Fish and Wildlife Service have provided lab and field facilities, maps and personnel, and site preparation work.
- Municipalities' support has included the City of Ames providing access to the Ada Hayden Lake area.
- Company support has included Pure Fishing providing raw materials for habitat research and Rubbermaid Home Products conducting industrial test molding.
- Groups such as the Iowa Egg Council, the Iowa Poultry Association, The Nature Conservancy and the Iowa Natural Heritage Foundation have provided land or facility access for research.
- The Pekin School District and its vocational agriculture instructor provided 25 acres for a controlled drainage study over the next five to 10 years. Approximately 30,000 feet of tile was provided by Prinsco Tile Inc., as well as surveying and layout. Tile installation was provided at no cost by local contractors.
- Des Moines Metro Waste Agency, Bluestem Solid Waste Agency (Cedar Rapids), and the City of Davenport Composting Facility supplied compost and trucking for erosion research sponsored by the Iowa Department of Natural Resources and the Iowa Department of Transportation.
- Seven local research farm associations have provided land to researchers to work on regional agricultural topics dating back to the 1930s. Work has centered on crops, soils, water quality and livestock.

\$9,441,000 in FY02 expenditures



THE QUESTIONS

Experiment Station researchers work in areas that are both practical and fundamental, short-term and far-reaching. What key questions are researchers addressing for Iowans?

Economic Hardship \$9,203,000

- How can community factors such as social participation, social networks, leadership and population movement and public be measured over time and how do they contribute to community viability, economic vitality and sustainability? **\$325,000**
- How can overall community structure be strengthened? **\$49,000**
- How does rural economic hardship contribute to the need for off-farm employment, increasing employment options and competition for new skills in the local labor market? **\$2,649,000**
- How does the rural economic hardship experienced by many youth affect their life chances and opportunities? **\$883,000**
- How is rural economic hardship reflected in the need for communities to explore new ways of community service delivery in response to population changes and composition? **\$2,207,000**
- How does rural economic hardship nurture collaboration in both the public and private sectors? **\$883,000**
- What is the link between local leadership development and community development strategies? **\$2,207,000**

Local Food Systems \$238,000

What are the opportunities and barriers to developing viable, nutritious local food systems? **\$238,000**

SELECTED IMPACTS & EXTENSION

Research results often improve understanding, help solve practical problems and build to greater discoveries. Here are selected examples of Experiment Station research results and Extension and outreach activities that have impacted Iowans.

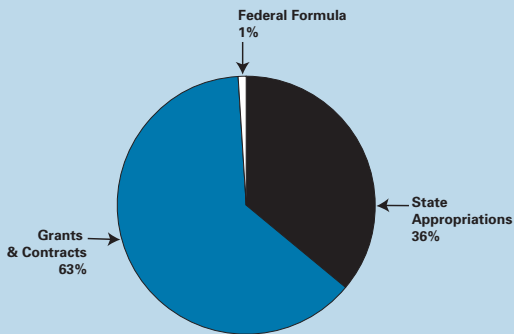
- ISU Extension provided programs, community development and organizational support in 87 of the states 99 counties and in 78 cities. Extension trained 7,600 citizen and community leaders, 2,250 government officials and 325 business entrepreneurs. Also, 455 organizations were assisted and strengthened.
- Survey data from 99 Iowa communities are used to explore how communities respond to economic shocks such as plant closings.
- Research shows that participation in local community development strengthens local communities.
- Research shows structured out-of-school experiences contribute to positive youth development and reduce risky behavior.
- Research confirms that community development and leadership programs based on local participation strengthen communities.
- Social, economic and labor force statistics have helped rural communities make strategic decisions concerning economic development incentives, investments in infrastructure and more effective management of local government resources.
- The development of community housing strategies has helped provide quality housing for a changing labor force.
- Research found that the health of rural populations is linked to consumption patterns and availability of local foods. ISU Families Extension works in rural communities to increase awareness of these issues.
- Studies show community-supported agriculture offers an option for farm families to improve their incomes and assist in local development.
- After three bond issues to improve the courthouse failed, ISU Extension worked with a county board of supervisors on a series of public input and citizen survey activities. As a result, the board put another bond issue before the public in 2003. The \$14.9 million project passed with a 65 percent majority.

PARTNERS

Many individuals and groups support Experiment Station research and education in ways that go beyond dollars. Here are a few examples.

- With the help of ISU Extension, communities are offering leadership academies to find new leaders. Participants have run for city council and school board positions, have been appointed to the planning and zoning commission and participated in a citywide planning initiative.
 - Eight communities and 500 new residents have participated in Community Voices, ISU Extension's leadership program that brings together community leaders and new immigrants, especially those for whom English is a second language.
 - After one year of operation, ISU's Community Vitality Center is expanding upon its initiatives for community-based entrepreneurialism and community foundations. Policy discussions were completed in 10 communities and five demonstration projects are in process.
 - More than 2,500 parents improved their parenting skills by participating in research-based educational workshops offered by ISU Families Extension.
 - More than 200 professionals and volunteers who work with teens increased their understanding of healthy teen development through an ISU Families Extension national satellite series.
- The Community Voices program organizes meetings to enhance the civic understanding and leadership skills of minorities and newly arrived immigrants to Iowa. Businesses have donated about \$10,000 worth of food and beverages, hired Spanish-speaking interpreters and provided other support services for the meetings.
 - The National Endowment for Financial Education provides the High School Financial Planning Program curriculum materials at no cost to Iowa schools to promote financial literacy for youth.
 - The Consumer Federation of America provides publicity materials, a quarterly newsletter and enrollment management services for Iowans in the America Saves program, a national effort with Extension to provide financial literacy education.

\$7,834,000 in FY02 expenditures



THE QUESTIONS

Experiment Station researchers work in areas that are both practical and fundamental, short-term and far-reaching. What key questions are researchers addressing for Iowans?

Commodity, Trade and Research Policy \$1,664,000

- What are the impacts of government policy on commodity prices, production and exports, and on farmers, processors and consumers? **\$481,000**
- How does U.S. and foreign trade policy affect world prices and international trade? **\$954,000**
- How does research policy affect the agricultural sector and economic growth? **\$229,000**

Finance and Risk Management \$264,000

- How do changes in financial markets affect performance of the agricultural sector? **\$264,000**

Environmental Economics \$2,112,000

- What are the effects of agriculture on the environment? **\$1,758,000**
- What are the economic costs and benefits of increasing environmental quality? **\$354,000**

Rural Development \$1,076,000

- What factors lead to rural economic growth or decline? **\$904,000**
- What is the role of value-added agriculture in rural development? **\$172,000**

Evolution of Markets \$2,718,000

- How is U.S. food and fiber demand changing over time? **\$353,000**
- What are alternative ways to enhance food safety? **\$126,000**
- What are the costs and benefits of new or alternative processes or products? **\$996,000**
- What are costs and benefits of alternative firm and market structures in agriculture? **\$668,000**
- How do changes in foreign agricultural production and consumption affect the demand for U.S. exports? **\$575,000**

SELECTED IMPACTS

Research results often improve understanding, help solve practical problems and build to greater discoveries. How has Experiment Station research impacted Iowans?

Commodity, Trade and Research Policy

- Researchers analyzed alternative ways to export fresh meat to Asia. The analysis showed large potential increases to China given a relaxation of Chinese import restrictions. This information provided key evidence to the Senate Finance Committee prior to its vote to approve normal trade relationships with China.
- A model to analyze the impact of genetically modified soybean and soybean products in world trade will enhance negotiators' knowledge of alternative trade liberalization agreements.
- During the debate on the 2002 Farm Bill, researchers analyzed the economic impacts of alternative proposals. This information allowed congressional staff, legislators, commodity organizations and other agricultural groups to better understand the tradeoffs involved.
- Researchers investigated the impact on prices, production and net farm income from changes in U.S. farm and trade policies potentially required under new World Trade Organization agreements.

Finance and Risk Management

- Researchers developed new risk-management insurance products for use by independent Iowa hog producers. The products, which became available in August 2002, have resulted in \$60 million of coverage (\$3.3 million of premiums) covering 830,000 hogs.
- New methods to rate revenue insurance products resulted in a decision to completely overhaul crop insurance rates for coverage on over \$3.5 billion of products.

Environmental Economics

- Researchers studied how Iowans value wetlands, rivers and lakes and the recreational opportunities created by these areas. In Clear Lake, extensive analyses showed the costs and benefits of improving water quality. Results showed the community's willingness to pay for large improvements if the result was significant water quality improvements.
- Researchers increased the effectiveness of plant-growth models to estimate the impact of alternative agricultural practices on production and water quality. The models allow the development of more "what if" scenarios to determine optimal combinations of soil, crops, chemicals, terrain and climate.

Rural Development

- An efficient method was developed to deliver large quantities of economic and demographic data to communities, counties, state officials and Midwestern

researchers. The centralized system increases the availability of data for decision-making at a significantly reduced cost.

- A comprehensive survey showed that community-based banks tended to accept deposits from a relatively large geographic area, but made most loans within 90 miles of their hometowns. The finding emphasizes the importance of local banks for local investments.

Evolution of Markets

- Researchers investigated the costs of implementing the federal Hazard Analysis and Critical Control Point (HACCP) systems for pork to improve food safety and protect food quality. Annual investments were between 3 and 20 cents per hog, with operating costs of 14 cents per hog. The information is useful to packers and food processors in choosing among alternative methods to meet food safety targets.
- By analyzing soybean protein and oil from around the United States, researchers identified handling procedures that minimized damage to grain and allowed for more efficient segregation. The result: a suggested management protocol for use by private industry. The intent is to develop an efficient way to segregate cereals and oilseeds, allowing for payment of quality premiums. One large cooperative is implementing the system and estimates an increase of \$2 in profits per \$1 of investment.
- Researchers estimated the costs of producing ethanol from corn using alternative processes. They also analyzed the market response of producers to higher ethanol demand. This knowledge will enhance the ability of producers and investors to make better-informed decisions about the construction of new ethanol plants.
- By studying farmer-owned brands in the United States and other countries, researchers demonstrated that tight control over quantity and quality were essential in obtaining sustainable profits. The information has been useful for producer groups trying to design products for niche markets, farmer brands and cooperative marketing ventures.

SELECTED EXTENSION/OUTREACH

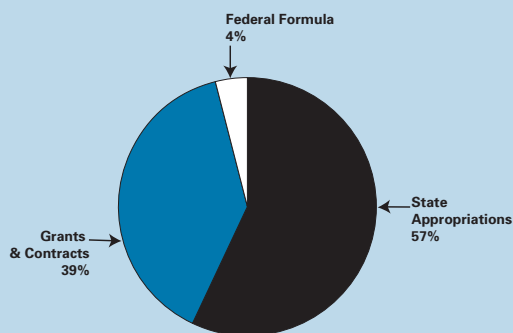
Science-based information is a hallmark of the Experiment Station and Iowa State's land-grant mission. What key extension or outreach activities are making the information available to Iowans and others?

- Because the 2002 Farm Bill significantly changed government support programs for Iowa farmers and landowners, Extension personnel held meetings and developed software to help farmers analyze their personal situations.
- Extension farm management specialists consulted individually with more than 1,100 producers, analyzing their options with the Commodity Programs Payment Analyzer. Participants realized an average benefit of \$5,322 per farm per year.
- ISU Extension developed a series of online courses called Agricultural Management E-School (AMES). The

Advanced Grain Marketing Course has been offered five times to 260 students. Eighty-seven percent of participants said they had completed a marketing plan as a result of taking the course.

- John Beghin and Bruce Babcock testified several times to congressional committees on the impact of federal farm legislation, including alternative agricultural and trade policies.
- The quarterly Iowa Ag Review newsletter takes economic research findings and presents them in easy-to-understand articles.
- The Midwest Agribusiness Trade Research and Information Center regularly publishes research/outreach papers that examine food consumption trends in foreign markets.
- Local and regional decision-makers are using information from the work of Cathy Kling, Joe Herriges, Jinhua Zhao and John Downing that analyzed costs, benefits and willingness-to-pay for water quality improvements at Clear Lake.
- Methods for estimating probability distributions for prices, yields and option values were developed by Bruce Babcock and Dermot Hayes and adapted by Bob Wisner for use in educational extension programs and online courses.
- Bob Jolly, William Edwards, Neil Harl and others hold annual schools to train bankers in current issues in agricultural finance.
- Dan Otto is working with Iowa hospitals on projected demand for services and cost-efficient ways to provide health care.
- The Iowa Farm Outlook newsletter, Pro Ag meetings and regular appearances on WOI radio, coordinated by Bob Wisner and John Lawrence, keep producers apprised of the grain and livestock market outlook.
- William Edwards conducts annual surveys of cash rent and custom machinery rates, which help facilitate negotiations between farmers and landowners.
- The annual land value survey, analysis and conference, led by Michael Duffy, documents changes in Iowa land value and ownership.
- The annual agricultural tax schools, led by Neil Harl, train tax practitioners across the nation to better serve farmers and ranchers.
- Farm financial associates provide one-on-one analysis and advice to farmers considering significant changes in their operations.
- The loan deficiency payment (LDP) analysis Web site developed by the Center for Agricultural and Rural Development provides a user-friendly, yet sophisticated analysis of marketing choices and is used by producers across the country.
- Dermot Hayes regularly provides information on agricultural trade and trade policy to the National Pork Producers Council.
- Giancarlo Moschini and Harvey Lapan have worked with legislators on proposals to modify the structure of Iowa's income tax.

\$6,854,000 in FY02 expenditures



THE QUESTIONS

Experiment Station researchers work in areas that are both practical and fundamental, short-term and far-reaching. What key questions are researchers addressing for Iowans?

- What technologies can enhance or create new opportunities for value-added products?
Food: **\$540,000**
Nonfood: **\$387,000**
- How can agricultural products be processed more efficiently to improve the competitiveness agriculture?
Food: **\$2,054,000**
Nonfood: **\$378,000**
- How can farmers add value, including the development of supply chains to serve new value-added opportunities?
Food: **\$533,000**
Nonfood: **\$365,000**
- How can quality attributes of agricultural products be improved to increase opportunities for new uses, enhance current markets, improve processing efficiency or improve consumer satisfaction?
Food: **\$1,520,000**
Nonfood: **\$341,000**
- How can agricultural products reduce dependence on nonrenewable resources, improve the environment and sustain our quality of life?
Food: **\$277,000**
Nonfood: **\$459,000**

SELECTED IMPACTS & EXTENSION

Research results often improve understanding, help solve practical problems and build to greater discoveries. Here are selected examples of Experiment Station research results and Extension and outreach activities that have impacted Iowans.

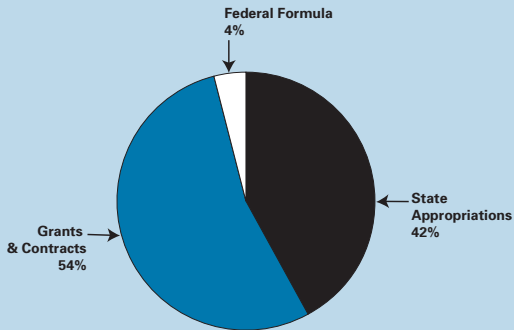
- ISU's Center for Crops Utilization Research has been an incubator for several innovative companies, providing research and other services: Proliant (Ames), ExSeed Genetics (Ames), Kemin Americas (Des Moines), Ajinomoto (Eddyville). ExSeed Genetics grew from three to 30 employees and relocated to the ISU Research Park. Proliant built a new plant in Boone to produce bovine serum albumin using technology it developed at the center. A soybean-based adhesive was developed that eliminates hazardous formaldehyde emissions. Performance advantages of the adhesive in molded wood products have been demonstrated at a commercial scale.
- ISU and the University of Northern Iowa collaborated to demonstrate the value of industrial lubricants and fluids based on plant oils, especially soybean oil. The products were shown to be viable alternatives to petroleum with the advantages of biodegradability, less toxicity and better lubrication.
- A method for making soy protein ingredients was developed, resulting in products with increased levels of healthy phytochemicals and better-performing food properties. The method was awarded a patent and licensed to Pioneer/DuPont, which is using it commercially.
- Scientists found ways to minimize unappealing changes in color, fat oxidation and flavors in irradiated meat. Maintaining meat quality could influence consumer acceptance of irradiated products.
- Research shows pork quality characteristics such as tenderness and moisture retention can be improved through animal genetics. Studies on muscle proteins and protein degradation by enzymes has shown that genetic control of protein degradation in pork may be achieved. The research also showed that postmortem changes could be controlled, improving moisture retention during further processing.
- Meat scientists developed ways to extend the shelf life of chilled red meat. Frozen meat sells at a significant discount in international markets, putting U.S. meat at a disadvantage. The ISU technology now allows the U.S. to export meat in chilled form, and has led to steady increases in exports of beef and pork.

PARTNERS

Many individuals and groups support Experiment Station research and education in ways that go beyond dollars. Here are some examples.

- ISU faculty assisted West Central Cooperative in designing and troubleshooting its first biodiesel production facility. The scientists also provided quality control assistance after the plant was online.
- The Iowa Grain Quality Initiative focuses on making Iowa the preferred location for commercializing specialty or value-added grains; facilitating development and application of technologies to improve the marketing and value of Iowa's grains; educating and assisting producers to capture marketing opportunities; and responding to weather or other forces that affect grain quality. It is coordinated by Charles Hurburgh and managed by Darren Jarboe. and. It also involves Roger Ginder, Larry Johnson, Mary Holz-Clause, Gerald Miller and Mike Owen.
- ISU's Agricultural Marketing Resource Center, led by Don Hofstrand and Mary Holz-Clause, provides independent producers and processors with critical information to build value-added agricultural enterprises. Roger Ginder and Bruce Babcock cooperate.
- Deland Myers has helped transfer newly developed technologies for protein-based adhesives for wood products by putting together a commercialization alliance with three companies.
- Industries and small businesses use ISU facilities to test processes and formulations they plan to develop into goods and services. The Crops Products Pilot Plant of the Center for Crops Utilization Research and the Meat Laboratory provide state-of-the-art equipment. Mark Reuber manages the pilot plant and Randy Petersen manages the meat lab.
- A Leopold Center local food project in Cedar Falls generated more than \$8 of income for local food producers for every dollar invested. In four years, nine institutions and restaurants purchased \$590,000 of locally grown and processed fruits, vegetables and meat.
- The Leopold Center's investment of \$10,000 and leadership in forming the Pork Niche Marketing Group has leveraged an additional \$208,000 from other partners and grants.
- The Leopold Center's "Food Miles" model showed average conventional produce traveled more than 27 times farther than locally grown Iowa produce before reaching consumers.
- MBS Genetics, LLC, Story City, has provided soybean varieties for soybean processing and food studies.
- Several instrument manufacturers have provided near infrared spectroscopy instruments for grain quality research.
- Farmers Coop Elevator has provided access to its financial and grain database for use in designing quality management system protocols.
- Companies that have donated materials and equipment for food research include: Danisco Cultor, Milwaukee, donated probiotic bacteria for evaluation in yogurt products; Kalsec Inc., Kalamazoo, donated flavoring extracts for evaluation in apple cider; AMPC, Ames, donated pilot-plant processing equipment.
- The U.S. Department of Agriculture's Agricultural Research Service donated large quantities of high-cysteine soybeans and many pilot-plant processing equipment.
- The Deere Agricultural Management Solutions group has worked with the agricultural and biosystems engineering department to consult on producer needs with identity-preserved grains and production efficiencies.
- Purdue University and Michigan State University donated wheat and corn samples naturally contaminated with mycotoxins. The University of Missouri donated fumonisin-rich corn culture material to examine fumonisin detoxification in swine.

\$4,940,000 in FY02 expenditures



THE QUESTIONS

Experiment Station researchers work in areas that are both practical and fundamental, short-term and far-reaching. What key questions are researchers addressing for Iowans?

Human Health and Nutrition \$2,583,000

- What can we do to increase the consumption of healthy foods? **\$912,000**
- How can we improve the quality of healthy foods? **\$736,000**
- What dietary changes will improve human health? **\$358,000**
- What cellular and molecular targets may help improve human health? **\$257,000**
- How can the toxic aspects of health-promoting dietary constituents be avoided? **\$58,000**
- What is the link between factors such as diet and clothing to human health, safety and well-being? **\$262,000**

Food Safety \$2,357,000

- What can be done to enhance the safety of foods derived from animals? **\$1,065,000**
- What can be done to enhance the safety of foods derived from plants? **\$1,179,000**
- What methods can be developed to enhance the detection of contaminated food? **\$68,000**
- What critical factors impact consumer acceptance of irradiated foods? **\$45,000**

SELECTED IMPACTS & EXTENSION

Research results often improve understanding, help solve practical problems and build to greater discoveries. Here are selected examples of Experiment Station research results and Extension and outreach activities that have impacted Iowans.

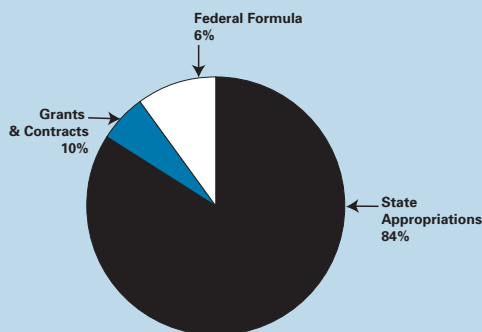
- A meat product was developed in collaboration with ConAgra Foods that lowered cholesterol in young men. Adding plant sterols to their diets reduced plasma cholesterol by inhibiting cholesterol absorption.
- Soybean isoflavones were found to reduce bone mineral loss in peri-menopausal women. The findings could help improve bone health and strength in aging women and prevent or delay osteoporosis. The information has been shared with public and health professionals through ISU Families Extension and the media.
- Collaborators from Iowa State and the USDA evaluated salmonella in live pigs. The study will provide information for a quantitative risk assessment of salmonella in swine.
- Research on alternatives to antibiotics in swine production has produced a probiotic supplement.
- Long-term impacts of diet and child-rearing have been studied for evidence of osteoporosis among middle-aged women, plus heart disease and obesity among young men.
- Researchers have developed corn oils with improved flavor and stability.
- Iowa State has been a leader in evaluating food irradiation, conducting research and offering outreach to food processors and consumers. Research shows irradiation is an effective tool in eliminating foodborne pathogens. Processes have been developed to reduce the impact of irradiation on meat quality.
- A commonly approved food additive has been shown to combat bacteria in ready-to-eat meats. The research has benefited consumers by reducing risk and meat processors by providing a cost-effective means to improve processing.
- Modified diets for turkeys have enhanced the safety and quality of meat. Scientists also evaluated rapid methods for detection of bacteria in turkey.

PARTNERS

Many individuals and groups support Experiment Station research and education in ways that go beyond dollars. Here are some examples.

- Nutrition education has high payoffs — improved food choices and reduced long-term health costs. ISU's Iowa Expanded Food and Nutrition Education Program showed a cost-benefit of \$10.75 for every \$1 invested in nutrition education.
- More than 210 school food-service employees attended Extension-sponsored short courses. Employee food safety training and certification programs have improved food safety practices and the quality of food served to students in public schools.
- Families Extension annually provides nutrition outreach to more than 50,000 consumers and families.
- Families Extension health and wellness field specialists annually distribute information on food quality and safety to more than 13,500 youths and adults. Ninety-eight percent reported adopting one or more recommended food-handling practices.
- Extension provides food safety training to foodservice employees, and has produced and distributed many research-based educational products. In the ServSafe program, 478 people participated and 90 percent were certified.
- Practical techniques for safe handling of apples were developed and communicated to Iowa apple cider manufacturers and orchard owners.
- Sam Beattie leads food safety extension efforts in the food science and human nutrition department.
- Joseph Cordray coordinates annual extension meat science short courses that cover food safety issues such as control of bacteria in ready-to-eat meat products and training on the federal Hazard Analysis and Critical Control Points (HACCP) program.
- The ISU Extension Food Safety Web Site had 395,786 visitors and more than 7 million hits in 2002.
- Dong Ahn and Joe Cordray worked with Wapello County Extension to develop a food safety training program for plant employees of Mount Pleasant Foods. They've trained approximately 300 employees.
- Contributors to soy isoflavone research include GlaxoSmithKline, Consumer Healthcare L.P., Archer Daniels Midland Co. and the James R. Randall Research Center.
- An apple cider safety project received help from local producers and Bio-Rad provided lab equipment for rapid detection of *Listeria monocytogenes*.
- Schouten USA (now Acatris) provided soygerm, ADM provided Novasoy and the National Enzyme Co. provided enzyme preparations for a soy human feeding study.
- Microcide Inc. provided supplies to support a post-harvest quality and safety study of fresh and fresh-cut vegetables and fruits.

\$403,000 in FY02 expenditures



THE QUESTIONS

Experiment Station researchers work in areas that are both practical and fundamental, short-term and far-reaching. What key questions are researchers addressing for Iowans?

- How can telecommunications contribute to rural development? **\$74,000**
- How can innovative experimental design and statistical methods improve analysis and interpretation of agricultural research data? **\$157,000**
- Can the development of new economic analyses better capture the costs and benefits of agricultural research and new technologies? **\$172,000**

SELECTED IMPACTS & EXTENSION

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- Education programs and staff training have been developed and delivered to assist entrepreneurship and business management in southwest Iowa.
- Telecommunications were applied in programs that helped Iowans write business plans as part of entrepreneurial training. Community colleges and other organizations collaborated.
- Consumer training was developed and put in use by extension specialists and businesses to help rural consumers use the Internet in decision-making.
- New statistical models provide a better understanding of environmental factors that limit the growth of organisms or populations. The models have proven useful in analyzing data on water quality, wildlife and air pollution.

- A statistical tool was developed as a guide for fertilizer application rates, to be used with or without information from soil tests. Researchers believe similar approaches can be used to assess the efficiency of using other production inputs.
- Newly refined statistical methods may provide a clearer picture of data emerging from animal genome research, enhancing the power to detect and evaluate genes of economic importance to the livestock industry.
- A set of laboratory "auction" experiments was designed to evaluate consumers' acceptance of genetically modified foods. Research results have provided new insights into public willingness to pay for these foods, the importance of verifiable information in making decisions, opinions on labeling policies and recommendations on tolerance levels for food containing genetic modifications.
- Economic analyses have advanced understanding of the importance of publicly funded agricultural research to society.
- Training programs, exhibits and educational programs have been delivered on consumer behaviors and practices.
- Results on consumer acceptance of genetically modified foods have been used in USDA deliberations on food policy, and discussed at international agricultural biotechnology meetings and national agricultural economics meetings.
- Results on benefits of publicly funded agricultural research have been made available to federal officials for national agricultural science policy discussions, and to directors of state agricultural experiment stations for use in setting research policy.

PARTNERS

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- Contributors to the student-managed Ag 450 Farm have included Heartland Co-op, Pioneer Hi-Bred International and Garst Seed Co. (seed), Nevada Seed & Feed (feed), Ryerson Implement (farm equipment), and Harvest Partners (classroom equipment). In addition, Pearl Edna Rathman provided support for a computer laboratory.
- Instructional materials for students have been provided by the Iowa Farm Bureau Federation, Iowa FFA Foundation, Iowa Agricultural Awareness Coalition, Iowa Department of Education, Iowa Department of Agriculture and Land Stewardship, Iowa Governor's Council on Agricultural Education, Iowa Department of Natural Resources, the Iowa Association of Agricultural Educators; and others.

