C-FAR

Illinois Council on Food and Agricultural Research

2005

Annual Report

A Partnership for Illinois Food and Agriculture

OFFICE OF THE GOVERNOR

Rod Blagojevich

Dear Friends,

I want to first extend my sincere gratitude for your hard work and dedication in guiding research that supports Illinois agriculture. Your efforts to expand agricultural markets, develop new technologies and alternative practices and maximize the potential of Illinois agriculture to meet global demand continues to build Illinois' status as an agricultural leader worldwide.

Over the last few decades, advancements in agriculture through research have provided us with healthier food choices, top quality products and a safer, more secure food supply. It has also allowed our farmers to produce some of the best products in the world more efficiently than past generations.

Through your leadership, our number one industry will continue to advance and strengthen the Illinois economy. Thank you again for your efforts.

Sincerely,

Rod Blagojevich

Rod Blagojevich
Governor

C-FAR: A Statewide Partnership For Illinois

The Illinois Council on Food and Agricultural Research (C-FAR) is a statewide partnership organized to support relevant, high-quality research and related outreach programs for Illinois' food, agricultural, and related systems. C-FAR was founded in December 1993 as a nonprofit association to work closely with the State of Illinois and Illinois' research community to ensure a viable food and agricultural research program and to provide stakeholder input into setting research priorities.

Prior to the establishment of C-FAR, state funding for food and agriculture research was stagnant or nonexistent at the public universities, and there was no meaningful way for food and agricultural stakeholders to provide input into public research direction. In addition, there was no comprehensive coordination of Illinois research activities. Through an unprecedented partnership of the private sector and State of Illinois officials, the Food and Agriculture Research Act (the C-FAR appropriation's enabling legislation) became law, effective July 1, 1995.

Highlights of the Food and Agriculture Research Act:

- The purpose of the act is to put a solid foundation of stable and long-term State support for food and agricultural research programs in Illinois, while fostering public confidence in this research through public participation.
- The act specifically names C-FAR as the entity that, in conjunction with Illinois' four public universities with food and agricultural research programs, shall develop and prioritize an appropriate research agenda for the State system.
- The act states that funds shall be utilized to support a broad program of food and agricultural research and to build and maintain research capacity.
- An intent of the act is that Illinois should be among the top 10 agricultural states in State funding for its agricultural experiment station, and that other agricultural institutions in the state should be funded proportionately.

The C-FAR partnership among state officials, food and agricultural stakeholders, and the research community continues to ensure the state's investment returns maximum benefit for Illinois and its citizens.

OUR MISSION

The mission of the Illinois Council on Food and Agricultural Research (C-FAR) is to advance profitable, consumer-sensitive, environmentally sound food, agricultural, and related systems by securing funding for relevant research and outreach and fostering public participation in program guidance.

C-FAR Appropriation: A Critical Investment for Illinois and Its Economy

The following highlights the importance of the C-FAR appropriation and stakeholder-driven food and agricultural research for Illinois.

Illinois' #1 Industry: Food and agricultural production and related businesses comprise Illinois' leading industry. Marketing of Illinois' agricultural commodities generates more than $8.3 billion annually. About 1.5 million Illinois workers are in the food and agricultural system (21% of workforce) (Illinois Department of Agriculture).

State Funding Essential: National research funding is becoming even more limited, and what is available is often designated for research not of significance to Illinois. State funding is critical in providing practical research for the needs of Illinois' food and agricultural sectors.

C-FAR: A True Partnership: Food and agricultural leaders, government officials, legislators, researchers, and other dedicated individuals throughout Illinois are working together in an unprecedented manner to provide direction for targeted, high-quality research to support Illinois' number one industry. This partnership, and the dialogue it allows, ensures maximum impact and accountability for state research investments via C-FAR.

High-Impact Outcomes: C-FAR research has had an immense impact on the quality of life of Illinois citizens and the economy of the state since the first C-FAR appropriation in FY96. Positive impacts are documented across all areas of production agriculture, market development, food safety and nutrition, natural resource protection, and more.

Being Competitive: State investments in strategic food and agricultural research allow Illinois to capitalize on its abundant natural resources and remain competitive in U.S. and world markets.

Green Industry: Illinois' green industry is the fastest growing sector of Illinois agriculture. The combined economic value of product sales, service sector receipts, and employee payrolls for this industry is about $4 billion (University of Illinois survey).

Millions Leveraged: C-FAR research investments are leveraged to attract additional dollars into Illinois' economy. Often, the C-FAR appropriation serves as the seed money to begin a particular research initiative, which can lead to substantial federal, corporate, and other funding. While it is not necessary for every research initiative funded to attract leveraged funding, a significant number of initiatives do obtain additional funds to bring the research to its full fruition. This has resulted in millions of additional dollars being directed to Illinois' economy.

C-FAR research funding is provided by the State of Illinois. C-FAR gratefully acknowledges the State of Illinois—Rod R. Blagojevich, Governor—for these financial investments, which are enabling advancements in Illinois' food and agricultural industries and contributing to the economic vitality of our state.

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Message from C-FAR

Greetings,

It is difficult to imagine Illinois without the food and agricultural sectors not being its bedrock industry. Agriculture is, indeed, our state's number one industry. Marketing of agricultural commodities alone generates more than $8.3 billion annually for our state's economy. Twenty-one percent of our state's workforce is tied to this industry. The list of such attributes is lengthy and staggering.

From our vast food-processing companies in Chicago, Decatur, and elsewhere, to our productive farms that stretch across every Illinois county, our state is prominently positioned for continued food and agricultural distinction at the national and international levels.

As the food and agricultural industry becomes more complex, the reliance on sound research—research that benefits the public good—will become even greater.

C-FAR, as a partner with the State of Illinois, is extremely proud to provide a vital function as our state works to enhance its prominent food and agricultural role. Our pledge is to do so through a vibrant, publicly funded food and agricultural research program. The nexus for an industry such as ours is rooted in research. History is undeniably clear in reminding us that practically every development in the food and agricultural sectors is attributable to research.

As the food and agricultural industry becomes more complex, the reliance on sound research—research that benefits the public good—will become even greater. From commodity production, to transportation, to processing, to marketing, research will be the anchor for advancement. Coupling such research with our state's abundant natural resources and our highly-skilled and educated workforce will position Illinois for continued preeminence in U.S. and world markets. The unprecedented C-FAR coalition, along with the partnerships that it represents, is posed to demonstrably contribute to this prominence and, as a result, to our state's future economy.

We look forward to continuing to embrace, and to meaningfully engage, each of our partners—the State of Illinois, our stakeholder-based members, and our universities and related research entities—as we continue to contribute to the vibrancy of our state's number one industry.

Sincerely,

Alan Puzey
Chairman of the Board

Kraig A. Wagenecht
Executive Administrator

2005 Highlights

Annual Meeting

C-FAR met for its annual meeting on February 15 at the Northfield Inn, Suites & Conference Center in Springfield. The C-FAR membership reelected four individuals to serve on the seven-person board of directors: Fred Bradshaw, David Downs, Nels Kasey, and Karen Little. They joined Larry Fischer, Alan Puzey, and Steve Scates. The five C-FAR working groups met to elect chairs and vice chairs to serve in 2005.

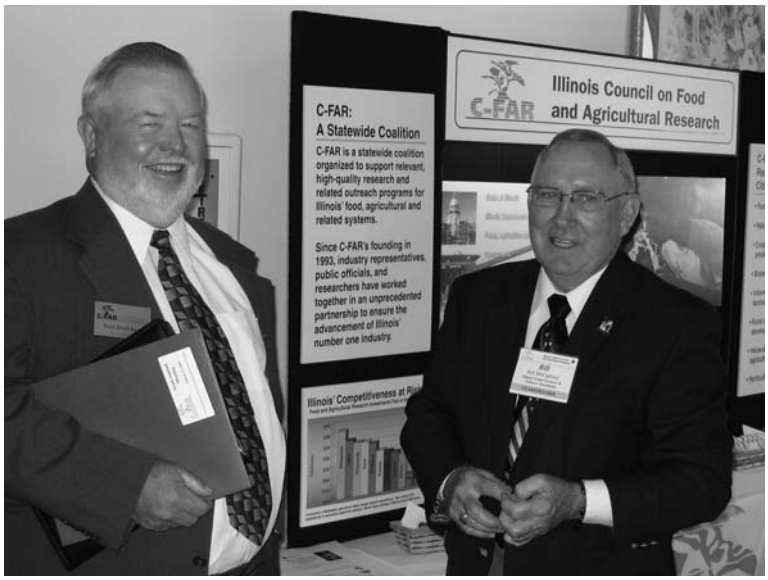
Meeting attendees heard presentations given by C-FAR-funded researchers on the effects of soy isoflavones on human health, on potential new alternative crops for Illinois producers, and on the development of advanced biocomposites using agricultural byproducts. In addition, principal investigators of C-FAR's three strategic research initiatives (SRIs) provided updates on their research programs. The SRIs addressed the economic and social challenges facing Illinois' livestock industry, the use of biomass energy crops for power and heat generation in Illinois, and water quality in Illinois, including the development and implementation of total maximum daily loads.

C-FAR members (left to right) Carol Meyer, Jerry Cassida, and Charlie Grotevant engage in a discussion at the 2005 Annual Meeting.

Semi-Annual Meeting

C-FAR held its 2005 Semi-Annual Meeting at the Northfield Inn, Suites & Conference Center, in Springfield, on August 23. About 130 members representing a broad range of sectors within Illinois' food and agricultural community attended the meeting. Highlights of the meeting included reports from board officers and committee chairs, presentations by guest researchers, and meetings of C-FAR's five working groups. The working groups met to identify priority research to support Illinois' food, agricultural, and related systems.

Meeting attendees heard presentations on C-FAR–funded research focused on managing emerging soybean pathogens in Illinois, soy in the diet of infants and children, and efforts underway to assist Illinois livestock producers in gaining access to new markets.



Board member Fred Bradshaw (left) and C-FAR member Bill McCartney at the 2005 Semi-Annual Meeting.

C-FAR Day at the University of Illinois at Urbana-Champaign

C-FAR held its fifth annual C-FAR Day on November 16 at the University of Illinois at Urbana-Champaign. C-FAR Day provides a unique opportunity for C-FAR members to visit with scientists and hear firsthand about their research activities. During this special event, attendees toured research facilities and learned about a broad range of C-FAR–funded research initiatives taking place at the university. UIUC faculty and research staff provided updates on ongoing research and recent achievements in areas including addressing challenges facing Illinois' livestock industry, development of biomass energy crops, food safety initiatives, advancing crop processing technologies, and developing the scientific basis for nutrient standards to protect Illinois water quality.

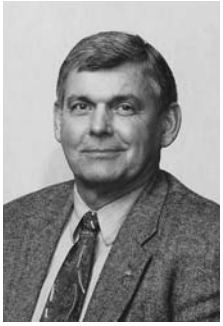
C-FAR Day 2005 attendees hear about C-FAR–funded biomass energy crop research taking place at the University of Illinois at Urbana-Champaign.

Who's Who

2005 Board of Directors and Staff

Board of Directors

Alan Puzey
CHAIRMAN OF THE BOARD, FAIRMOUNT



David Downs
VICE CHAIRMAN OF THE BOARD, ALLERTON

Fred Bradshaw
SECRETARY-TREASURER, GRIGGSVILLE

Larry Fischer
MEMBERSHIP CHAIR, QUINCY

Nels Kasey
RESEARCH CHAIR, PARIS

Karen Little
RESEARCH VICE CHAIR, PLEASANT PLAINS

Stephen Scates
DIRECTOR, SHAWNEETOWN

Staff

Kraig A. Wagenecht
EXECUTIVE ADMINISTRATOR

LeAnn M. Ormsby
COMMUNICATIONS DIRECTOR

Rhonda Hunter
ADMINISTRATIVE ASSISTANT

Gloria Buhrmester
SECRETARY

Arena Jackson
SECRETARY

2005 Working Group Leadership

Expanding Agricultural Markets

Jim Charlesworth
CHAIR, BLOOMINGTON

Heather Hampton+Knodle
VICE CHAIR, FILLMORE

Rural Economic Development

Kae Hankes
CHAIR, GALESBURG

Linda Wikoff
VICE CHAIR, ONEIDA

Agricultural Production Systems

Molly Ann Godar
CHAIR, ROCHESTER

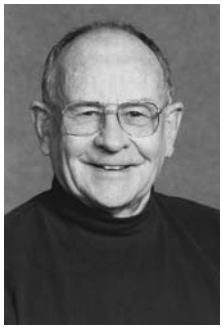
Anne Builta Crider
VICE CHAIR, ARROWSMITH

Human Nutrition and Food Safety

Jeanne Harland
CHAIR, LAFAYETTE

Jim Fraley
VICE CHAIR, COOKSVILLE

Natural Resources



Byford Wood
CHAIR, BREESE

Brian Frieden
VICE CHAIR, PETERSBURG

2005 Members

Organizational Members

Association of Illinois Soil and Water Conservation Districts

Audubon Council of Illinois

Central Illinois Golf Course Superintendent's Association

Champaign County Farm Bureau

Dairy Management Inc.

DuPage County Farm Bureau

GROWMARK

Horseradish Growers of Illinois

Illinois Agri-Women

Illinois Association of Drainage Districts

Illinois Association of Meat Processors

Illinois Beef Association, Checkoff Division

Illinois Beef Association, Dues Division

Illinois Corn Growers Association

Illinois Corn Marketing Board

Illinois Dietetic Association

Illinois Farm Bureau

Illinois Farm Business Farm Management Association

Illinois Farm Credit Services

Illinois Farmers Union

Illinois Fertilizer and Chemical Association

Illinois Forage and Grassland Council

Illinois Grape Growers and Vintners Association

Illinois Lamb & Wool Producers

Illinois Landscape Contractors Association

Illinois Milk Producers' Association

Illinois Nurserymen's Association

Illinois Pork Producers Association

Illinois Pork Producers Association, Checkoff Division

Illinois Restaurant Association

Illinois Seed Trade Association

Illinois Society of Professional Farm Managers & Rural Appraisers

Illinois Soil Testing Association

Illinois Soybean Association

Illinois Specialty Growers Association

Illinois State Grange

Illinois State Horticultural Society

ISU Agriculture Alumni Association

Illinois State Veterinary Medical Association

Illinois Stewardship Alliance

Illinois Sustainable Agriculture Society

Illinois Turfgrass Foundation

Illinois Wheat Association

Institute of Food Technologists, Chicago Section

Kane County Farm Bureau

Kankakee County Farm Bureau

Knox County Farm Bureau

Land of Lincoln Soybean Association

Madison County Farm Bureau

Mason County Farm Bureau

Mercer County Farm Bureau

Midwest Association of Golf Course Superintendents

Midwest Dairy Association

Orr Agricultural Research Center

Sod Growers Association of Mid-America

Southern Illinois University College of Agricultural Sciences Alumni Society

The Chicago Farmers

UIUC College of Agricultural, Consumer and Environmental Sciences Alumni Association

UIUC College of Veterinary Medicine Alumni Association

Warren-Henderson Farm Bureau

Affiliate Members

Central Illinois Agricultural Research Farms

Environmentally Correct Concepts, Inc.

Greene Farm Management Services, Inc.

Illinois Crop Improvement Association

Illinois Department of Natural Resources

Illinois Finance Authority

Illinois Forestry Development Council

Illinois State Geological Survey

ISU Department of Agriculture

Illinois State Water Survey

Lake Vermilion Water Quality Coalition

National Center for Food Safety and Technology

NIU, College of Health and Human Sciences

Sangamon County Soil and Water Conservation District

Shawnee Community College

SIUC Center of Excellence for Soybean Research, Teaching, and Outreach

SIUC College of Agricultural Sciences

SIUC Department of Agribusiness Economics

SIUC Department of Animal Science, Food and Nutrition

SIUC Department of Forestry

SIUC Department of Plant, Soil and Agricultural Systems

The Nature Conservancy in Illinois

UIUC College of Agricultural, Consumer and Environmental Sciences

UIUC College of Veterinary Medicine

UIUC Department of Agricultural and Biological Engineering

UIUC Department of Agricultural and Consumer Economics

UIUC Department of Animal Sciences

UIUC Department of Crop Sciences

UIUC Department of Food Science and Human Nutrition

UIUC Department of Human and Community Development

UIUC Department of Natural Resources and Environmental Sciences

UIUC Department of Pathobiology

UIUC Department of Veterinary Biosciences

UIUC Department of Veterinary Clinical Medicine

WIU Department of Agriculture

WIU Department of Dietetics, Fashion Merchandising, and Hospitality

Individual Members

In addition to the Organizational and Affiliate members and all of their representatives, there were 133 Individual members who also supported food, agricultural, and related research in Illinois via C-FAR in 2005.

COMMITTEES

Research Committee

The purpose and charge of this committee is to

- inquire into and prepare reports on current and planned research in Illinois on food and agriculture
- seek recommendations on research needs from (a) research professionals currently conducting such research at Illinois universities or elsewhere, (b) interested persons and groups, and (c) the public
- identify research beneficiaries
- prepare recommendations regarding research needs, processes, and impacts, and pursue their implementation as authorized
- foster public confidence in ongoing food and agricultural research by engaging public participation in planning and evaluating the process and impact of research activities

Committee Members:

Nels Kasey, chair; Karen Little, vice chair; Susan Adams; Bill Becker; Constance Locher Bussard; Jim Charlesworth; Pat Dumoulin; Brian Frieden; Paul Gebhart; Molly Ann Godar; Kae Hankes; Jeanne Harland; Carl Hopphan; Richard Hull; John Huston; John Quandt; Wendell Shauman; Richard Showalter; William Whiteside; Linda Wikoff; and Byford Wood. *Ex-officio*: William Bailey; George Fahey, Jr.; Patrick O'Rourke; Steven Pueppke; John Russin.

Legislative Committee

The charge of this committee is to

- monitor all legislative activity, state and federal, that may have an impact on C-FAR or its mission and objectives
- develop recommendations for Council or Board approval
- implement and execute plans

Committee Members:

Jack Erisman, chair; Fred Bradshaw; Constance Locher Bussard; David Downs; David Erickson; Wally Furrow; Carl Hopphan; Carol Keiser; Craig Keller; Karen Little; Alan Puzey; Stephen Scates; and William Whiteside. *Ex-officio*: Herman Bodewes.

Nominating Committee

The purpose and charge for this committee includes soliciting and receiving nominations for the board of directors from organizational members and presenting a slate of candidates to be considered by the C-FAR membership at the annual meeting.

Committee Members:

Terry Wolf, chair; Allan Aves; Bill Campion; Richard Denhart; Charlie Grotevant; William McCartney; Carl Neubauer; and Bob Swires.

Rules and Procedures Committee

This committee, in consultation with the other committees, monitors C-FAR processes and develops proposals for improvements as needed.

Committee Members

Dennis Thompson, chair; Rick Dean; Pam Hansen; Maralee Johnson; Neal Merchen; Bert Princen; and Ron Warfield.

RESEARCH PARTNERS

University of Illinois at Urbana-Champaign

Robert A. Easter, Dean

COLLEGE OF AGRICULTURAL, CONSUMER AND ENVIRONMENTAL SCIENCES

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Steven G. Pueppke, Associate Dean for Research

COLLEGE OF AGRICULTURAL, CONSUMER AND ENVIRONMENTAL SCIENCES

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

George C. Fahey, Jr., Assistant Dean, Research Leadership–C-FAR

COLLEGE OF AGRICULTURAL, CONSUMER AND ENVIRONMENTAL SCIENCES

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Southern Illinois University Carbondale

Gary L. Minish, Dean

COLLEGE OF AGRICULTURAL SCIENCES

SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

John S. Russin, Associate Dean for Research and Personnel Administration

COLLEGE OF AGRICULTURAL SCIENCES

SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

Illinois State University

Patrick D. O'Rourke, Chair

DEPARTMENT OF AGRICULTURE

ILLINOIS STATE UNIVERSITY

Western Illinois University

William C. Bailey, Chair

DEPARTMENT OF AGRICULTURE

WESTERN ILLINOIS UNIVERSITY

Research Programs

In 1995, the Food and Agriculture Research Act, the enabling legislation that provides the framework for C-FAR funding and research activity, became a state statute. In FY05, a $3.5 million C-FAR appropriation was approved. The FY06 C-FAR appropriation was also set at $3.5 million.*

Funds are allocated to three C-FAR research programs:

Strategic Research Initiatives

The Strategic Research Initiatives (SRIs) are team-based research efforts that provide a targeted, multidisciplinary, and multi-institutional approach for addressing major issues and concerns of Illinois' food and agricultural industry and consumers.

University Internal Programs

In accordance with the Food and Agriculture Research Act, the majority of research funds are allocated on a percentage basis to Illinois' four universities with food and agricultural research programs: the University of Illinois at Urbana-Champaign (Illinois Agricultural Experiment Station) (82%), Southern Illinois University Carbondale (11%), Illinois State University (4%), and Western Illinois University (3%). Each university solicits requests for proposals (RFPs) as part of an internal competitive grants program to select innovative, high-quality research that addresses the needs of the Illinois food, agriculture, and related communities and consumers as defined by the C-FAR membership.

In 1999, the University of Illinois initiated its C-FAR Sentinel Program as part of the university's internal research program. The Sentinel Program's purpose is to take advantage of opportunities for performing creative, problem-solving research.

External Competitive Grants Program

C-FAR's External Competitive Grants Program is designed to encourage and support research efforts from state agencies and organizations outside the four universities. The program solicits RFPs from nonprofit research entities throughout the state. By legislation a minimum of 15% of the C-FAR appropriation is allocated to support these research projects.

Working group participants review and select proposals submitted to this program for funding. Proposal review follows a two-step process. The first step is a request for, and review of, preproposals. C-FAR working group participants evaluate preproposals based on relevance to C-FAR research focus areas, potential outcomes and benefits to stakeholders, and dissemination plans. The second step involves inviting principal investigators of top-ranking preproposals to submit full proposals. Full proposals undergo scientific review and evaluation.

* The FY05 appropriation was assessed a $473,184 reserve. The FY06 appropriation was assessed a 2% reserve.

Strategic Research Initiative Program

In 1998 the C-FAR membership established the Strategic Research Initiative (SRI) Program to implement a targeted, multidisciplinary, and multi-institutional team approach to addressing major concerns and opportunities for Illinois' food, agriculture, and related industries and consumers. Currently, there are three initiatives which began in FY04. The following are highlights of FY05 progress reports submitted by the principal investigators of these initiatives.

BIOMASS ENERGY CROPS FOR POWER AND HEAT GENERATION IN ILLINOIS: DIVERSIFYING CROPPING, IMPROVING ENERGY SECURITY, AND BENEFITING THE ENVIRONMENT

Dr. Stephen Long, professor of crop sciences and plant biology at the University of Illinois at Urbana-Champaign, provides leadership for a multidisciplinary team of researchers working to provide Illinois with the foundation and technology leadership for the large-scale cultivation of biomass crops. In this five-year SRI, researchers are focusing on the use of Miscanthus (*Miscanthus x giganteus*), a perennial rhizomatous grass, as a potential renewable energy source for Illinois and as a profitable alternative crop for Illinois producers.

Principal Investigators

Stephen P. Long, Crop Sciences and Plant Biology

Yuanhui Zhang, Agricultural and Biological Engineering

Madhu Khanna, Agricultural and Consumer Economics

German A. Bollero, Jack M. Widholm, Emily A. Heaton, Crop Sciences

Anne Heinze Silvis, Human and Community Development

Mark B. David, Jack A. Juvik, Gregory F. McIsaac, Thomas B. Voigt, Michelle M. Wander, Natural Resources and Environmental Sciences

University of Illinois at Urbana-Champaign

Field Trials

Small (0.25 acre) field trials were established to assess the productivity of Miscanthus and switchgrass over a variety of growing conditions. Urbana and Dixon Springs sites yielded 24 dry tons per acre in 2004. Yields were 10 tons more than projected, but this may have resulted from exceptional growing conditions. Despite the drought, these plots look similarly productive in 2005 with as yet no evidence of drought symptoms in contrast to the adjacent corn and soybean crops. Large plots (0.46 acre each) of Miscanthus, Miscanthus with hairy vetch as a cover crop, switchgrass, and a corn/soybean rotation have also been established.

Miscanthus Breeding and Improvement

Research is being performed to provide genetic diversity and the basis for breeding higher-yielding and better-adapted Miscanthus. To create new germplasm, researchers are working to hybridize accessions of *M. sinensis* with stocks of *M. sacchariflorus* acquired from five different nurseries. Researchers are also generating and testing somoclonal variants of Miscanthus.

Development of Genetic Engineering Techniques

Techniques are being developed to introduce desired traits, such as disease and pest resistance, in Miscanthus. Researchers can now routinely initiate new cultures from immature Miscanthus influorescences. These cultures can be maintained for months and still be capable of regenerating plants.

Soil Carbon and Gas Emissions

Soil samples were collected from the Urbana site and analyzed for carbon and nitrogen content to provide the important baseline needed to evaluate the long-term impact of biofuels. N_2O emission from soils under Miscanthus, switchgrass, and corn is being measured to calculate and compare global warming potential (GWP).

Water Resource Implications

Soil samples from Miscanthus, switchgrass, and soybean plots were analyzed for exactable nitrate and ammonium to estimate leachable nitrogen (N) pools. Miscanthus and switchgrass had lower inorganic N pools compared to soybean. This was expected, and it demonstrated that bioenergy crops immediately reduce soil inorganic N pools. PVC tubes for monitoring soil moisture were installed in the switchgrass, corn, and Miscanthus plots. Resin lysimeters for measuring ammonium and nitrate leaching were installed in the corn and switchgrass plots. Researchers will estimate water use and water flux by the various crops and inorganic N leaching from beneath the root zone.

Propagation and Eradications of *Miscanthus X Giganteus*

Researchers are investigating Miscanthus planting management. Optimal rhizome size and planting depth are being examined. Long-term survival is promising if plants survive the first winter. Miscanthus plants are also being evaluated for response to herbicide applications.

Harvesting and Preprocessing Technologies

Harvesting technologies for Miscanthus and switchgrass are being tested. A New Holland 2450 self-propelled haybine and a New Holland 575 small square baler were tested. Switchgrass baled satisfactorily, but Miscanthus bales were consistently loose. A John Deere 337 small baler also baled switchgrass satisfactorily, but not Miscanthus. Miscanthus was successfully baled into large bales with a New Holland BB940. John Deere and CNH have expressed interest in testing equipment.

Thermochemical Conversion of Biomass to Fuel

Mechanical parts of the batch reactor system, such as the high pressure vessel, mixer, and valves, have been modified for carrying out high-temperature and pressure experiments for the conversion of Miscanthus. The temperature-control system is being developed to give an accurate and precise control on temperature.

Economic Analysis

An economic model is being developed to determine the optimal pattern of land use for Illinois that maximizes returns to landowners while meeting certain goals for energy generation using renewable sources of energy. The model will be used to examine the demand for bioenergy crops generated under various policy scenarios, commodity and fossil fuel prices, and subsidy programs.

Social Acceptability of Energy Crops

Miscanthus x giganteus (the plant form used in the SRI) is a sterile hybrid. It has been grown in Denmark for over 40 years with no incidence of invasiveness into surrounding fields. Fertile forms of Miscanthus are available at commercial nurseries; therefore researchers are working to educate growers on the importance of planting the sterile form of the plant. A survey of northwest Illinois producers indicated that they have concerns about containing Miscanthus, and they characterize it as a possibly invasive exotic species. Focus groups are planned to follow up the survey. Surveys and focus groups are also planned for southern and central Illinois.

ILLINOIS LIVESTOCK INTEGRATED FOCUS TEAM (IL LIFT)

Dr. Michael Hutjens, professor of animal sciences at the University of Illinois at Urbana-Champaign, leads a multidisciplinary, multi-institutional research team to address the economic and social challenges facing Illinois' livestock industry. The four-year SRI focuses on livestock facility siting in Illinois; using Illinois byproduct feeds in livestock feeding programs; pasture-based forage systems to sustain Illinois livestock producers; and animal identification for enhanced food quality and monitoring of livestock health.

Principal Investigators

Michael F. Hutjens, Animal Sciences
Larry L. Berger, Geoffrey E. Dahl, Animal Sciences
Ted L. Funk, Agricultural and Biological Engineering
Peter D. Goldsmith, Agricultural and Consumer Economics
University of Illinois at Urbana-Champaign

Justin W. Sexten, University of Illinois Extension

Livestock Facility Siting in Illinois

As Illinois livestock facilities modernize and expand, they address a variety of issues including requirements for manure handling, consumer acceptance, community reaction, and economic impact on their facilities. A survey of swine producers revealed information on how they approach compliance with environmental regulations. Educational opportunities were discovered in three areas: manure system measurements and recordkeeping, neighbor relations and awareness of odor nuisance potential, and storm water pollution prevention. The IL LIFT website (http://ilift.traill.uiuc.edu) includes information on 2006 environmental regulations, facility permitting, comparisons between IEPA, IDOA, and NRCS regulations, and worksheets for nutrient management planning.

Using Illinois By-Product Feed in Livestock Feeding

An interactive website has been developed to inform Illinois livestock producers about the use of dried and wet distiller's grains in livestock diets. Information on distiller's grains and their utilization in swine, dairy, and beef cattle diets has been added. Distiller's grain production information from ethanol plants in or within a 100 mile radius of Illinois is also available now. To access the site, go to http://ilift.traill.uiuc.edu/distillers/.

Using Illinois Forages Based on Pasture-Based System

Livestock producers have renewed interest in low-input, forage-based feeding systems that utilize high-quality, intensively managed pasture systems with residual forages as alternative winter feeds. For summer 2004, Becherer Sheep Farm ewe grazing day costs ranged from $0.06 to $0.99. Higher grazing costs were observed when excess forages are mechanically harvested. Daily cow grazing day costs ranged from $0.40 to $0.82 for perennial pastures at the Dudley Smith Farm. Higher grazing costs were associated with warm season paddocks and a limited grazing season. Cow day grazing costs for Schuette Farms ranged from $0.26 to $0.88. Higher grazing costs were associated with harvesting excess forages and reduced grazing opportunities. The 2004-2005 winter grazing costs were $0.81 per grazing day for cattle at the Dudley Smith Farm; this cost was increased due to wet weather and reduced grazing opportunities.

Animal Identification for Enhanced Food Quality and Monitoring Livestock Health

Animal identification is a national concern for producers, processors, and consumers to improve animal health, traceability of livestock products, and meat and milk quality, and to manage livestock using individual animal data. Researchers tested commercially available identification chips that provide temperature-sensing information. They found that fever response in implants placed in peripheral subcutaneous locations such as the ear consistently show a depression rather than an increase in body temperature. Presentations on the Illinois Premises Registration System were given to inform livestock producers about this initial step in the U.S. Animal ID Plan.

WATER QUALITY WITH A FOCUS ON TOTAL MAXIMUM DAILY LOADS

This three-year initiative continues efforts of the former water quality SRI with a new focus on total maximum daily loads (TMDLs). Dr. George Czapar, a University of Illinois Extension educator, leads a team of investigators from across the state to help develop the scientific basis for nutrient standards in the surface waters of Illinois and to assist in the appropriate development and implementation of standards for TMDLs. The research team works closely with the Illinois Environmental Protection Agency, the Illinois Department of Agriculture, and the Metropolitan Water Reclamation District of Greater Chicago.

Principal Investigators

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William L. Perry, Biological Sciences
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Roderick I. Mackie, Animal Sciences
Mark B. David, Lowell E. Gentry, Robert G. Darmody, Gregory F. McIsaac, Natural Resources and Environmental Sciences
University of Illinois at Urbana-Champaign

Spatial and Temporal Relationships among Biotic Integrity of Illinois Streams, Dissolved Oxygen, and Nutrients

Statewide water sampling will determine the relationship among nutrients, dissolved oxygen, and chlorophyll-a for streams, and their relationships to biotic integrity. Preliminary findings suggest that phosphorus (P) concentrations in rivers and streams are in excess of concentrations needed to cause eutrophic conditions; however, there is not a strong relationship between P concentrations and chlorophyll-a due to available light and/or to the presence of a suitable substrate for algal growth. Based on the samples processed to date, macroinvertebrate metrics such as diversity and richness are more closely related to habitat quality than to P concentrations.

Effects of Phosphorus Mediated through Algal Biomass in Illinois Streams

Sampling sites were established in Little Kickapoo Creek prior to completion of the Bloomington sewage treatment plant. Predischarge nutrient data showed low phosphorus levels. Algal growth is phosphorus limited at unshaded sites. The amount of shade cast by streamside trees is a significant variable explaining periphyton biomass variability. Sampling of periphyton, mussels, stoneroller minnows, and water-column nutrients was initiated at sites downstream to exploit the decreasing gradient in phosphorus. Sampling was completed at 14 sites statewide. Periphyton data show that high spatial and temporal variability are not statistically related to phosphorus concentration. Historical data link the increasing concentrations of ammonia and total phosphorous with the decline of fish and mussels.

Seasonal Dynamics of Nutrients, Algae, and Dissolved Oxygen in Agriculturally Dominated Headwater Streams: the Link between Land Use and Water Quality

Researchers have documented several patterns important to understanding the relationships among nitrogen and phosphorus, algal biomass, and dissolved oxygen in headwater streams of central Illinois. Large amounts of phosphorous are brought into the system during flood events when phosphorous is either resuspended from stream sediments or washed in from surrounding fields. During much of the year, total phosphorous levels are low, relative to nitrate levels. Even though there are low levels of dissolved reactive phosphorous in the water column, the algae are seldom phosphorus limited.

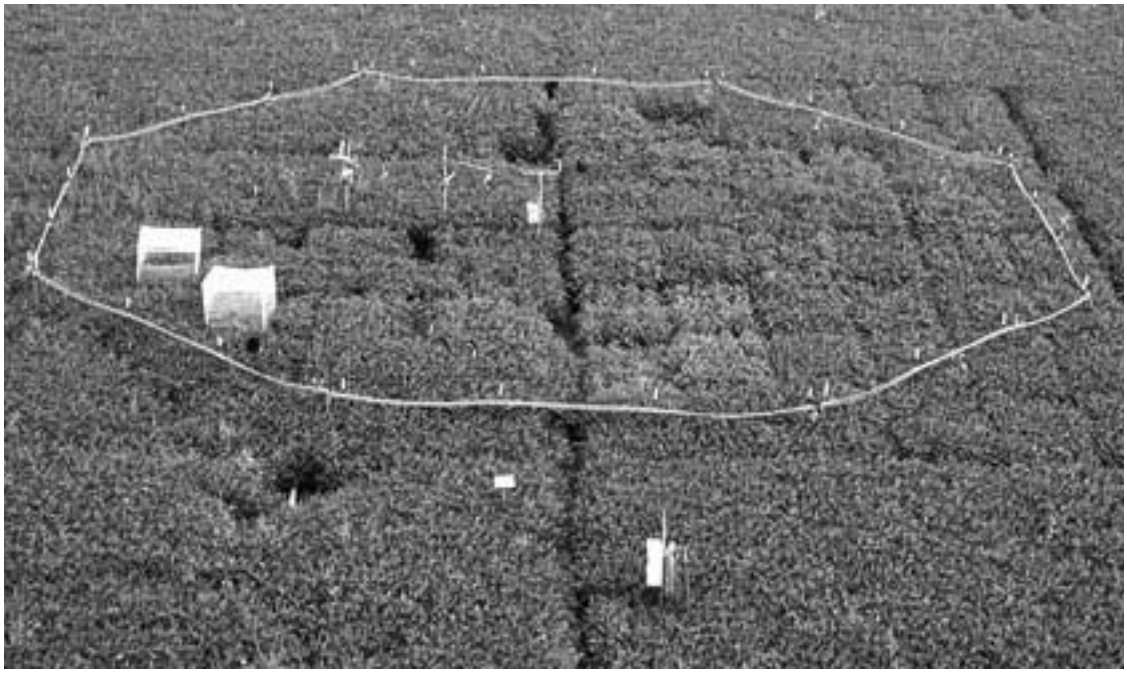
The Impact of Sediments on the Potential Bioavailability of Phosphorus in Illinois Streams

Sediment samples are being analyzed for their ability to adsorb added inorganic phosphorus and to determine phosphorus forms present. Equilibrium phosphorus concentration values of sediments were shown to vary directly with mean overlying water column dissolved reactive phosphorus (DRP) concentrations. DRP concentrations were generally lower in summer 2005 than in summer 2004. Bioavailable phosphorus (BP) concentrations were generally equal to DRP concentrations during summer 2004, but they were typically 2–5 times higher than summer 2005 DRP concentrations. BP concentrations are also 2–5 times higher during storm events.

Sentinel Program

Introduced in 1999, the C-FAR Sentinel Program at the University of Illinois at Urbana-Champaign was initiated to take advantage of windows of opportunity to conduct research that address C-FAR priorities. Sentinel projects are multi-investigator and multi-departmental, with most crossing college boundaries and bringing together investigators from a variety of disciplines. In FY05, this program comprised five creative, problem-solving research initiatives.

SoyFACE: RESEARCH AND DISCOVERY PROGRAM TO ABATE THE THREATS AND HARNESS THE POTENTIAL OF ATMOSPHERE CHANGE TO BENEFIT ILLINOIS AGRICULTURE



Principal Investigators

Stephen P. Long, Crop Sciences and Plant Biology

Donald R. Ort, Crop Sciences and USDA-Agricultural Research Service

Evan H. DeLucia, Plant Biology

With contributions from investigators representing the UIUC departments of Animal Sciences, Atmospheric Sciences, Crop Sciences, Entomology, Food Sciences and Human Nutrition, Natural Resources and Environmental Sciences, and Plant Biology, as well as the Illinois State Water Survey, USDA-Agricultural Research Service, and other research institutions throughout the U.S. and Europe.

The 2005 experiment on the 80-acre site utilized four 70 ft diameter plots (FACE rings) elevating carbon dioxide (CO_2), four elevating ozone, and four elevating both gases in combination to predicted levels for 2040–2050. These treatments were administered in soybean together with four further control rings. The facility successfully maintained these elevations to a high degree of precision from crop emergence to harvest. In addition to soybean, three lines of snap bean and several lines of Arabidopsis were also included. Sub-plots of 20 different soybean germplasm lines from the USDA collection were included in each plot. A genomics and metabolomics analysis was conducted via Department of Energy support. These analyses identified a number of previously unknown responses, and they are allowing the team to identify the mechanisms by which soybean is responding to atmospheric change. The results will provide a basis for manipulation to improve tolerance to these ongoing changes. Genomic analysis of the soil microflora in 2005 also showed that five years of elevated CO_2 had significantly altered the bacterial species in the soil, showing that changes go beyond the crop itself.

A 50% increase in CO_2 increased yield by almost 18%, and the increase in ozone decreased yield by 20%; this is in agreement with the findings of the past two years. The results also showed that rising CO_2 will, to some extent, protect against the damaging effects of rising ozone. Although the increase in yield caused by elevated CO_2 may appear large, it is in fact considerably less than expected from theory or seen when soybean is treated in glasshouses. Soybean yields would be increased even more if researchers can discover how to translate the yields seen in protected environments to the field. Two approaches are being taken: (1) comparing germplasm where lines showing a larger response in the field have been identified, and (2) identifying gene expression associated with a larger yield response.

Unlike CO_2, ozone concentrations vary greatly from year to year. The average daytime level for central Illinois (past 10 years) is about 60 parts of ozone per billion parts of air (ppb) during the growing season; that compares to about 30 ppb of 40 years ago. However, 2003 and 2004 saw unusually low levels of ozone of about 50 ppb. This meant that our 20% elevation raised levels in these years to the typical current level. In effect, the experiment in these two years could be said to have investigated the effect of lowering ozone from the current average rather than raising it. Ozone treatment in these two years lowered yield by 20%. This provides the first open-field confirmation that the increase in ozone that has occurred over the past 40 years results in large yield penalty for soybean growers. In 2002 and 2005, background ozone levels were close to the average of 60 ppb, and the treatment increase by 20% again lowered yield by about 20%. These yield losses were seen in all germplasm grown, which included current production cultivars and breeding lines. These results confirm that developing lines resistant to ozone is not only needed to protect yield for the future, but also for the present. While all soybean germplasm appears affected, some lines are clearly more affected than others, and a priority will now be to use the system to identify more tolerant germplasm and to understand the genetic and molecular basis of tolerance.

Two important results emerged from investigations of changes in pest damage under elevated CO_2. First, Japanese beetle damage was shown to be doubled in soybean grown under the elevated CO_2 conditions expected within the next 35–45 years. While this may seem a long time away, since CO_2 is rising year by year, it would suggest a ca. 3–4% increase in damage due to rising CO_2 each year. Beetles on plants growing in elevated CO_2 consumed more leaf area and produced many more young. It was also shown that Western Corn Root Borers laid double the number of eggs under soybean grown at elevated CO_2 than in current conditions. Elevated ozone did not affect either insect. Assessments of both the effects of atmospheric change on disease resistance and disease incidence on soybean are being made.

SoyFACE has been featured in multiple print news articles and television news spots. In May 2005, research findings were presented at a congressional briefing in Washington, D.C. and at a Royal Society Pre-G8 briefing in London, both concerning atmospheric change and future agricultural systems.

DEVELOPING AN AGRICULTURAL REMOTE SENSING PROGRAM AT THE UNIVERSITY OF ILLINOIS

Principal Investigator

Lei Tian, Agricultural and Biological Engineering

The mission of Illinois Laboratory for Agricultural Remote Sensing (ILARS) is to conduct applied research and work with industry and government agencies to develop "real world" precision and site-specific tools for agriculture and natural resources management. Research conducted by the laboratory ranges from "on-farm" production uses to large-scale agribusiness uses, such as regional yield estimations. The laboratory is staffed with experts in the fields of crop science, agriculture engineering, extension, agriculture economics, geographic information systems, and remote sensing. Researchers continue to focus on individual projects sponsored by federal and private agencies to develop a requisite database for a major crop remote sensing–based precision farming system, autonomous aerial data collection platform, and ground truth data collection robotic system.

Hyperspectral remote sensing imagery was collected over a soybean field in central Illinois before canopy closure. Estimates of percent vegetation cover were generated through the processing of RGB (red, green, blue) digital images collected on the ground with an automated crop-mapping system. A stand-alone high-resolution remote sensing system was developed and tested. With this system, the remote sensing image data is collected every hour in an experimental field. An unmanned Aerial Vehicle (UAV) remote sensing system has been developed as well to be used in this growing season. The helicopter used in the UAV experiment can carry about a 12 lb payload (sensors and instrument) in the field operation. High spatial and temporal resolution data are collected in the field. The experiments are designed to eliminate the errors caused by natural lighting conditions and the limitation in remote sensing data-collection process. Preliminary data have shown very promising results in increasing the sensing system accuracy. Weed plots have been prepared for the high-resolution system.

ILARS has actively participated in both local and international events to demonstrate the unique agricultural remote sensing program at Illinois. With newly developed equipment, researchers provided unique remote sensing data-collection and data-processing services to producers and other scientists. Researchers are working closely with similar research labs at other universities and also with government agencies such as NASA and USDA.

ILLINOIS CENTER FOR SOY FOODS

Principal Investigators

Barbara P. Klein, Keith R. Cadwallader, Food Science and Human Nutrition

Overall, soy food sales in the U.S. stabilized at the $4 billion mark in 2004, showing the slowest annual growing rate (2.1%) in the past 20 years. In order for the market to continue growing, innovation will be needed for the American and global markets. Soymilk sales continue to increase slowly, but meat alternatives, energy bars, tofu, and meal replacements sales dropped slightly. These decreases are attributable, in part, to reports that question the health benefits of soy. To counteract these reports, a combination of research and education is necessary. The stated goal of the Illinois Center for Soy Foods (ICSF) is to promote consumption of soy foods, which would benefit growers, processors, and consumers in Illinois. The ICSF continues to implement research, training, and outreach projects to stimulate further growth.

Continuing concerns about obesity in the U.S. and globally raises the question of whether soy foods can play an important role in weight loss. The ICSF participated with the Soy Foods Managed Research Area (MRA) in presenting a unique forum on the role of soy in reduction of obesity and chronic diseases associated with excess weight. Over 150 people, comprising representatives from the food industry, academia, and health professions, attended the forum, held on May 25–26, 2005. New initiatives in basic and applied research were discussed.

Programs in school districts throughout the U.S. emphasize the need for lower calorie and fat choices in school lunch programs, coupled with increased exercise. Educational opportunities exist for showing how soy can be incorporated into school lunches. Results from the pilot project "ISoy: A Better School Lunch" indicated that addition of soy products, either by substitution or enhancement of meat-based entrees, lowered fat, cholesterol, and calories in typical lunch offerings. Soy-based entrees were as acceptable as more familiar meat products. Learning modules for elementary school students, teachers, and food service personnel are under development. Possible spin-offs from the school foodservice project are to the institutional market, including prisons and hospitals.

Five cookbooks in the *Soy in the American Kitchen* series are now complete and available through the ICSF website. The two latest are *Soy for the Last Minute Chef* and *Around the World with Soy*. A foodservice cookbook is under development. Information and recipe booklets dealing with meat and soy combinations, soy for vegetarians, and home processing of soy are being prepared. A Soy Foods Starter Kit was developed to familiarize consumers with a variety of soy products commercially.

The ICSF continues to have an annual Soy Foods Tasting event to show how soy foods can play a role in daily diets. Invitees for the soy tasting include health and nutrition professionals, foodservice operators, and the food industry. *Soy Source*, a retail "store" in Bevier Hall, continues to feature new soy foods during the school year.

Short courses related to soy flavor, product development, and nutritional benefits of soy are part of the continuing effort to reach both U.S. and foreign markets. Working with WISHH, ICSF has conducted workshops for private voluntary organizations and government agencies from the United States and other countries. ICSF personnel spoke at schools, community organizations, and national and international food science and dietetics meetings about the health benefits of soy and the ease of using it, as well as research studies. Outreach programs were held in the field for international audiences in Botswana, Cote d' Ivoire, Haiti, Honduras, Kenya, Mozambique, Senegal, Tajikistan, Thailand, Uganda, and Vietnam on how to add soy to local diets. Outreach programs for Afghanistan and India are under development. The Center has also provided research and technical services to several companies on problems related to extrusion and dairy analogues.

During 2005, the ICSF received external financial support of more than $1 million from the federal government and the soybean industry. Researchers have also continued their success in obtaining industry funds from food ingredient companies, as well as from MAFMA and NRI-USDA programs. Collaboration with ADM continues in the areas of food product development and education about soy foods. The center's website at www.soyfoodsillinois.uiuc.edu remains a resource for consumers on soy foods and nutrition.

CREATING NICHE MARKET OPPORTUNITIES IN ANIMAL FEEDING FOR SMALL FARMERS WITH SOYBEANS

Principal Investigators

George C. Fahey, Jr., Neal R. Merchen, Animal Sciences

The central goal of this project is to identify soybean processing techniques that will add value to soybean meal as a feedstuff for poultry and swine. By identifying soybean processing conditions that could increase soybean meal amino acid digestibility and/or minimize soybean meal phytate phosphorus content, more nutrient-efficient diet formulations for pigs and poultry and less phosphorus supplementation would be required in feed formulations, resulting in less phosphorus excretion by the animal and positively impacting the environment. By developing soybean meal with benefits specific to swine and/or poultry feeding, it is anticipated that increased opportunities will arise for processing plants to furnish "species specific" soybean meal.

Soybean meal samples from soybeans processed with varying residence times through alteration of the bed depths during the desolventizing/toasting process were analyzed to determine whether amino acid digestibility by pigs and roosters was affected. Little difference in total essential amino acid digestibilities occurred among bed depths, but higher digestibilities of tryptophan and histidine were noted for bed depths of 7 or 8 inches when fed to roosters.

Samples for examining phytate phosphorus variation were manufactured by varying extractor residence time from 45 to 60 and 90 minutes times, and they were analyzed for composition and quality. The soybean meal phytate

phosphorus concentrations decreased slightly as residence time increased from 45 to 90 min., but they were still higher than those of soybean meal prepared from low phytate soybeans. Both increased heat processing and genetic selection for low-phytate content resulted in increased bioavailability of phosphorus in SBM for chicks, increasing bioavailability from 38.8 to 65.6% when extraction time increased from 45 to 90 min. This was still less than for soybean meal prepared from low phytate soybeans (85.8%).

When fed to cecetomized roosters, lysine digestibilities were highest when the extraction time was 45 min. (87.6% vs. 83.0%), with no consistent effect being observed for other amino acids. Additionally, soybean meal samples from 55 U.S. processing plants were collected and analyzed for amino acids, fat, and oligosaccharides. Soybean meal prepared in northern maturity zones had lower amino acid, verbascose, and raffinose concentrations than soybean meal prepared in central or southern maturity zones.

Amino acid digestibility and true metabolizable energy (TME) in poultry were determined for seven solvent-extracted soybean meals that contained no contaminants, 1 or 3% gums, 0.05% or 1.5% soapstock, 2% weeds and trash, or 6% for all contaminants. These values were then compared to a roasted soybean sample. The presence of contaminants had no effect on amino acid levels and digestibility. The addition of gums and soapstock generally increased TME. The amino acid digestibility of roasted soybeans was lower than that of the solvent-extracted soybean meals; however, the TME of the roasted soybeans was higher than for solvent-extracted soybean meals.

In addition to digestibility research, scientists have attempted to quantify variation in U.S. commercial soybean processing plants. Soybean meal samples were collected from 55 U.S. soybean processing plants located in seven of the geographic soybean maturity zones at three time points. Acid hydrolyzed fat concentrations were higher for soybean meals prepared in the southern zones (V, VI, and VII) compared with the northern zones (I and II). Raffinose and verbascose concentrations were lowest ($P < 0.05$) for soybean meals prepared in northern maturity zones, whereas stachyose concentrations were highest for soybean meals prepared in central maturity zones (III and IV). Total essential, total nonessential, and total amino acid concentrations were lowest for soybean meals prepared in northern zones. Additional work is ongoing to determine variation in soybean meals produced from commercial extruder/expeller plants.

Frazier Barnes & Associates provides linkages with soybean producer groups that are interested in possible advantages of producing specialized soybean meal products for feeding to animals in small scale processing plants. Because research results indicate potential advantages for swine or poultry fed with meal produced using modified processing conditions, participating producer groups will be better prepared to capture the value of working within a niche market. These groups will be interested mainly in the biodiesel component, with the soybean meal being of secondary interest.

A website was developed containing information ranging from general soybean processing information to specific databases of soy nutrition information that will be of interest to the animal feeding industry. A series of charts were developed showing the results on an as-fed basis and on a dry matter basis. Chart comparisons include general composition information, total amino acids, percentage standardized digestibility of amino acids, standardized digestible amino acids, percentage apparent digestibility of amino acids, and apparent digestibility of amino acids, carbohydrates, and minerals. The charts are available at http://www.traill.uiuc.edu//sand/.

ILLINOIS GENETIC MARKER CENTER

Principal Investigators

Brian W. Diers, Torbert R. Rocheford, Frederic L. Kolb, Crop Sciences

Randall L. Nelson, USDA-ARS, Crop Sciences

John A. Juvik, Natural Resources and Environmental Sciences

Lucienne T. Burrus, Manager

The Illinois Genetic Marker Center is being used by researchers in several departments on the University of Illinois campus. This center provides a valuable resource from which researchers can collect genetic data on biological samples. Genetic data can be collected inexpensively in the center, thus allowing more research to be completed on campus. In addition, the center provides a valuable teaching tool as the researchers (mostly graduate students and postdoctoral research associates) learn to use automated genotyping equipment and to analyze data they obtain from the equipment.

The equipment in the center is being updated through the addition of a Luminex 100 SNP detector. This will allow researchers to genotype DNA samples for SNPs (single nucleotide polymorphisms), the next generation of DNA markers. The machine was purchased through funding from the USDA and will be housed in the center and made available to researchers across campus.

Projects for which the laboratory was used in 2004–2005 include

- Soybean diversity testing and mapping of genes for agronomically important traits (Diers)
- Genetic fingerprinting of bluegill sunfish (Epifanio)
- Mapping genes conferring resistance to *Sclerotinia* stem rot in soybean (Hartman)
- Studying the status and distribution of shrubby spurge (*Euphorbiaceae*) in North America and Mexico (Levin)
- Investigating genes that increase protein concentration in soybean (Nelson)
- Genetic determination of nest origin in largemouth bass (Phillip)
- Studying genes controlling agronomic traits in Maize (Rocheford)
- Colony structure and competitive ability in Argentine ants (Swarez)
- Gene flow among weedy *Amaranthus* pigweed species (Tranel)
- Mapping genes identified in a genome-wide gene expression study in soybean (Vuong)

Lucienne Burrus is currently a half-time manager of the laboratory. She provides training to users, helps troubleshoot equipment problems, and maintains the equipment.

Internal and External Research Projects

Projects supported through the university-internal programs and the External Competitive Grants Program are funded for one, two, or three years. No-cost extensions can be granted if unforeseen circumstances arise. Support is provided on a fiscal-year basis (July 1 through June 30). The following section includes summaries of final reports for internal and external research projects that were completed in 2005.

Please visit the C-FAR website at ***http://web.aces.uiuc.edu/c-far/cfarreporting/public.cfm*** *for more information about these projects.*

CROPS

Quantifying the Fertilizer N Needs of Corn Based Upon a New Organic N Soil Test

A new mineralizable organic nitrogen (N) soil test has been developed at the University of Illinois that reportedly can identify fields that are responsive compared to those non-responsive to fertilizer N when planted to corn. This soil test, referred to as the Illinois Soil Nitrogen Test (ISNT), primarily determines amino sugar–N in the soil. If the test proves to be successful, it could save producers a significant amount of non-needed N fertilizer. The purpose of this research was to identify soil sampling conditions that may be important for soil test accuracy and usefulness, and to determine the amount of fertilizer N needed to augment varying soil test levels so that the optimum amount of soil N plus fertilizer N is available for corn and less remains in the soil where it may degrade water quality. The research methods employed included the application of incremental rates of fertilizer N in regions of low, medium, and high ISNT values in grower fields, followed by the determination of corn response to fertilizer N in each soil test environment. Ideally, little or no fertilizer N should be needed for soils with high ISNT levels, but greater amounts of N would need to be applied to soils with low ISNT values.

The Illinois Soil Nitrogen Test (ISNT) appeared to have reasonably good success in identifying fields unlikely to give a corn yield response to fertilizer nitrogen. Following three years of study, this research showed that with ISNT values in excess of 235 ppm-N, little yield benefit was derived from fertilizer N applications, especially in fields that had a recent history of manure application. The greatest limitation of the test appeared to be its inability to accurately predict amounts of fertilizer N to apply when ISNT values were less than 235 ppm-N. Factors or variables other than the amount of N detected by the ISNT appeared to be more important in determining corn response to fertilizer N. Another finding of this research was that ISNT levels do vary significantly when the same sites are sampled on a month-by-month basis. Larger fluctuations were observed in soils with a history of manure application compared to soils with a history of no manure application. Further critical studies on the causes for ISNT temporal changes, as well as on the precautions that may be necessary in sample handling, are needed.

A C-FAR External Competitive Grants project

Edward C. Varsa, Plant, Soil and Agricultural Systems

Southern Illinois University Carbondale

Stephen A. Ebelhar, Crop Sciences, Dixon Springs Agricultural Center

University of Illinois at Urbana-Champaign

Increasing Butanol Yield by Fermenting Degermed Corn to Benefit Illinois Farmers

The objectives of this project were (1) identification of nutrients/factors that reduce butanol yield, increase acid production, and affect the culture adversely, (2) fermentation of degermed corn supplemented with identified nutrients to increase butanol yield and reduce acid production and thereby make the culture more productive, (3) scale-up of the process in a 1–2 L batch bioreactor for improved butanol-yield from degermed corn, and (4) examination of high-yield continuous butanol fermentation to improve economics of this process. The purpose was to increase butanol yield to 0.30.

The degermed corn solution and glucose (as control) were

supplemented with P2 nutrients in order to support growth of *C. beijerinckii* BA101 and ABE (acetone butanol ethanol) production. Batch fermentation of degermed corn was carried out in 150-mL screw-capped bottles containing 125 mL medium, and 24.8 g/L ABE [6.2 g/L acetone, 18.3 g/L butanol, and 0.37 g/L ethanol] was produced in 72 h, resulting in ABE productivity of 0.34 g/L/h, as compared to the glucose control, which yielded 19.1 g/L ABE and an ABE productivity of 0.26 g/L/h. Fermentation of degermed corn resulted in ABE yield of 0.42 and butanol yield of 0.31. The batch fermentation was scaled up to a 2 L bioreactor containing 1.7 L of degermed corn medium. Batch fermentation of degermed corn in the 2 L bioreactor produced 24.2 g/L ABE [6.2 g/L acetone, 17.6 g/L butanol, and 0.4 g/L ethanol], resulting in ABE productivity of 0.33 g/L/h and yields of 0.43 (ABE) and 0.32 (butanol). It should be noted that one of the goals of this project was to increase butanol yield to 0.30. Thus an excess of over 6% over the target yield was achieved. The process has also been scaled up to a 2 L reactor.

A C-FAR External Competitive Grants project

Nasib Qureshi, National Center for Agricultural Utilization Research

U.S. Department of Agriculture (formerly of FSHN at UIUC)

Hans P. Blaschek, Food Science and Human Nutrition

University of Illinois at Urbana-Champaign

Utilizing Compost or Processed Manure as a Soil Amendment for Corn and Soybean Production

This study investigates the use of processed swine manure and composted livestock and urban landscape waste as a soil amendment for row crop production. Regulations regarding field application of liquid swine manure are becoming more stringent. An EPA proposal for total maximum daily loads (TMDL) in surface water could limit the application of swine manure to farm fields. Procedures which decrease manure's nutrient content must be identified and evaluated. This research is designed to compare the use as soil amendments for corn and soybean production of raw unprocessed liquid swine manure, effluent collected from a solid-liquid separator, two rates of mature compost, and traditional inorganic fertilizer.

For soybean, seed yield was similar for all of the treatments. Since soybean can acquire nitrogen from the atmosphere, this result was expected. For corn, grain yield of plants supplied with separated swine effluent or manure was the greatest. The two compost treatments and the inorganic fertilizer treatment tended to produce somewhat lower yields. The lowest-yielding treatment was the zero rate control. Soil data collected thus far suggests that separated effluent can serve as satisfactory nitrogen replacement for inorganic nitrogen fertilizer.

This research project provides many benefits for the environment. Composting provides a way not only of reducing the amount of waste that needs to be disposed of, but also of converting it into a product that is useful for agricultural and urban uses, such as gardening, landscaping, or house plants. The ultimate impact of this research is to improve manure management, which will benefit the livestock producer, and to produce an environmentally friendly, value-added product that can be marketed wholesale or retail for various soil improvement needs.

Kenneth D. Smiciklas, Agriculture

Paul M. Walker, Agriculture

Illinois State University

The Role of Cover Crops in Supplying Nitrogen and Controlling Weeds in Organic Crop Production

The viability of agriculture in Illinois is threatened by low commodity prices. Presently, local corn and soybean prices have decreased to $1.55 and $5.07 per bushel, respectively. Also, the public wants water to be free of pesticides and fertilizers, and food to be pure. To address these problems, Western Illinois University researchers began organic research on a pesticide-free farm. They involved local farmers and members of the agricultural industry in identifying research needs, and in planning, conducting, and supporting this research.

Organic growers often voice two major concerns: (1) the potential of losing the crop as a result of poor weed control, and (2) the limited selection of low-cost, effective fertilizers. Cover crops have been determined to aid weed control, and legume cover crops can provide fixed nitrogen for cereals in the organic crop rotation. There are very few options for organic nitrogen fertilization, especially for growers who do not have livestock manure. Producing cover crops in central Illinois for organic farming is difficult because organic

growers tend to plant later, and subsequently harvest later than conventional growers. Thus, the window of opportunity for preparing the land and planting a cover crop which will grow appreciably before the following planting in spring is very limited, and in many years, non-existent. Consequently, researchers have experimented with many cover crop systems in an attempt to find the most reliable system(s).

The effectiveness of legume cover crops is a long-term focus of this research project. A cover crop is needed in every 3-year rotation to obtain organic crop certification. In these studies, researchers found that successfully established cover crops suppressed weeds, improved the nutrient status of the soil, and greatly improved soil structure. Since peas, sweet clover, alsike clover, and common and hairy vetch are hosts for soybean cyst nematodes, these legumes are unsuitable for rotations with organic soybeans. Also, when hairy vetch was grown before a corn crop, the residue was inhibitory to corn establishment, and hairy vetch did not grow in wet, Sable soils.

Over 10 cover crops have been tested in several systems. A suitable legume cover crop to grow between a soybean and corn crop has not been found. In the most successful studies, winter wheat was fall seeded, and, the following spring, four replications of 5 to 11 different cover crops were frost-seeded into the wheat. Cover crops were scored for percent ground cover, weed control, growth patterns, and weed suppression. Established clover cover crops significantly suppressed weeds in the winter wheat crop. Also, the best performing varieties in our trials were Starfire medium red clover, a generic medium red clover, and Jumbo ladino white clover, which yielded 5,357, 4,506 and 3,944 lbs of dry weight per acre respectively, when harvested on May 23rd.

A rye cover crop, following corn, suppressed weeds during the first five weeks of soybean production. Also, the rye was flail-mowed before tillage. The resulting chopped rye residue made the soil very mellow, so that the cultivation of soybeans with rye residue was much more effective than in comparable fields without rye. Rye is easy to establish with minimal tillage after corn, and it grows profusely.

Gerald T. Vigue, Agriculture

Western Illinois University

Determining the Market Potential of Organic Food Production in Illinois

The purpose of the research was to evaluate the current production and marketing approaches of organic producers in Illinois, determine the market potential for organic products in Illinois, and make the results available to organic farmers and those who would like to transition into the organic food industry.

Research shows that consumer demand for organic products is high nationwide. Organic food sales is the fastest growing sector in the U.S. food industry. Large demand for organic products exists in Chicago, the Quad Cities, and downstate. Illinois has 152 certified organic farmers. A survey of 150 Illinois organic farmers showed they are growing primarily corn and soybeans to meet demand for ingredients for processed organic foods and organic feeds.

Interviews with retailers, restaurants, and cooperatives in Chicago revealed that 95 percent of the organic produce is sold through large supermarkets in Chicago, accounting for over $60 million in revenue, but only 3% is grown locally. Proven marketing strategies of successful organic farmers include understanding the marketplace, educating the public, building a solid reputation, knowing the competition, and being active in the local business community. Existing marketing venues for direct marketing include Community Supported Agriculture (CSA), farmers markets, on-farm sales, and sales to restaurants. Marketing challenges facing organic farmers include finding markets and buyers, dealing with fluctuating demand, and addressing the lack of public awareness. Other issues facing organic farmers have to do with farmland, training, research funds, and the need for a transportation and distribution infrastructure.

Researchers are developing a number of tools to assist current organic farmers and also those interested in transitioning into organic farming. These tools include information on how to become certified, a brochure summarizing our research, and fact sheets.

A C-FAR External Competitive Grants project

Martha S. Bazik-Rittmueller, University of Illinois Extension

John Masiunas, Natural Resources and Environmental Sciences

University of Illinois at Urbana-Champaign.

Quorum Sensing in *Pseudomonas syringae*: New Targets to Control a Plant Pathogen

No final report was submitted for this research initiative.

Stephen K. Farrand, Microbiology

University of Illinois at Urbana-Champaign

Using Worms for Processing Agricultural Biosolids into High Value Enviro-Socially Acceptable Potting Soil Amendments (Year Two)

The purpose of this project was to examine the potential of producing vermicompost from agricultural biosolids for use in the ornamental horticulture industry. The first year looked at processing parameters of the waste materials and the resulting physical characteristics. The second year focused on the uniformity of plant growth grown in the vermicompost produced from manures sampled throughout the year.

The use of vermicompost as a growing media amendment during the production of marigold and tomato plugs resulted in growth differences. When growing media was amended with either 10% or 20% (v/v), there was greater marigold or tomato growth when compared to either the control (0%) or 40% (v/v). However, there were differences in when the original manure was sampled and processed to produce the vermicompost. It had been theorized that vermicompost produced from manure sampled at different times during the calendar year might not be uniform. The results of the plant growth were similar to the first year of this project, where the physical characteristics were varied and nonuniform. The uniformity issue is very important for commercial growers who want very uniform growing media. More research is required to fully elucidate the uniformity issues with vermicompost.

Gary R. Bachman, Agriculture

Illinois State University

Vermicompost and Horticulture Research Lab Support

Horticultural media research currently underway is examining how soilless container media changes when vermicompost is added as a component of the growing media. The purpose of this project was to upgrade lab equipment to improve the analytical and research capabilities of the vermicompost and horticultural growing media research initiative at Illinois State University. The following items were acquired for the vermicompost and horticultural media lab upgrades.

Ohaus Research Balance: Determining how the growth of seedlings is affected by vermicompost media amendment and measuring tissue weight is one parameter of the research. This scale has a sensitivity of 0.001g which is required for determining weights of small seedlings.

Fisher Isotemp 500 1.6 ft^3 Lab Oven: Determination of media physical properties is important to horticultural research. This lab oven would allow the processing of an additional 40 samples/week and increase the total sample processing to 60/week. This increased capacity would allow for the potential of more container media research.

Accumet Research pH/Conductivity Meter: An important concern to the ornamental greenhouse and nursery industry in Illinois is the status and condition of container growing media. Changes in container media pH and/or electrical conductivity have an enormous impact on optimum plant growth potential. This meter will produce more reliable data and enhance the capacity to conduct pertinent horticultural research.

The addition of this equipment will enhance the ability to conduct research on container media that will be important to the ornamental greenhouse and nursery industry.

Gary R. Bachman, Agriculture

Illinois State University

Native Herbaceous Perennials as Alternative Crops for Illinois Nurseries

Herbaceous perennials increase property values as they beautify the landscape with a succession of bloom and color. Of several thousand species and cultivars of herbaceous ornamental perennials used, fewer than 5% are native to eastern North America. The availability of additional native plants would benefit users of nursery plants in Illinois by helping to solve 43% of their gardening problems (watering, insects, weather stress/damage, disease, pesticides). Native perennials would help alleviate these problems because they are adapted to Illinois climate, soil, and pests. In this project, researchers sought to determine production techniques including germination and/or vegetative propagation, plant establishment, and floral development for six native plant species as alternative herbaceous perennial flowers with market potential in Illinois.

Six native species were identified with horticultural potential based upon ease of production and performance in gardens, including *Blephilia ciliata* (wood mint), *Dalea purpurea* (purple prairie clover), *Monarda bradburiana* (Bradbury beebalm), *Monarda fistulosa L.* (wild bergamot or horsemint), *Monarda punctata* (spotted beebalm), and *Silene regia* (royal catchfly). *Stylisma pickeringii* (Patterson bindweed) was not satisfactory due to production difficulties. Relative to production techniques, all species with horticultural potential were propagated easily from seed. Seed germination was enhanced by scarification for *D. purpurea* and by stratification for *B. ciliata*, *M. bradburiana*, and *S. regia*. *B. ciliata* and *Monarda* species were propagated easily from cuttings. In greenhouse production, *D. purpurea* and *S. regia* were sensitive to overwatering. *M. bradburiana* was susceptible to powdery mildew. Except for *M. fistulosa*, all species bloomed in greenhouses. Specifics of production protocols are outlined at www.eiu.edu/~n_plants.

In Illinois gardens, species overwintered and bloomed from May to August. Powdery mildew on *M. bradburiana* and slow establishment of *D. purpurea* were problems in gardens.

These native crops will enhance an expanding market niche for regionally adapted plant materials, allowing new producers to enter the high-value nursery industry and current producers to expand their product line. Native plants fill a new niche because they are in demand by Illinois homeowners. These plants will save maintenance costs because of their reduced requirements for water, fertilizer, and pesticides relative to nonnative species. Use of these native plants also is environmentally sound, as it reduces the release of fertilizer and pesticides into natural ecosystems, and also reduces the potential for escape of invasive nonnative plants.

A C-FAR External Competitive Grants project

Janice M. Coons, Biological Sciences
Eastern Illinois University

A Novel Management Strategy for PRRS Virus in Swine: Reducing Vaccine Failure

The purpose of this project was to help determine factors that account for the failure of vaccination against porcine reproductive and respiratory syndrome virus (PRRSV) to protect against clinical disease in the field. PRRSV is the most economically disrupting virus of domestic swine in Illinois and the United States. The study was conducted on Illinois swine farms with chronic PRRSV infection, which were experiencing economic losses due to the virus. The goal of the project was to measure the immunity of swine infected with PRRSV over time, in order to detect what immunological responses corresponded to increased protection from clinical disease. At the same time, researchers sought to measure genetic changes in the virus in an effort to determine whether the virus was mutating on farms to evade host immunity. Information gained will be communicated to scientists and veterinary practitioners to improve vaccine development and delivery programs against this damaging virus.

The primary outcome of this study was the discovery that PRRSV mutates rapidly under field conditions (in a matter of weeks), so that "immune escape mutants" may be very common. In addition, it was found that cell-mediated immunity to PRRSV (as measured in the study) was only a weak predictor of clinical protection against the virus, and that the degree varied from farm to farm. Finally, the study discovered that "acclimatization" to PRRSV—the intentional exposure of naive animals to wild-type, farm-specific virus, which is a common control measure on farms—can actually lead to economic losses (2.2 live pigs per litter on the farm where this was investigated).

Tony L. Goldberg, Federico A. Zuckermann, Lawrence D. Firkins, Pathobiology

University of Illinois at Urbana-Champaign

An Integrated Approach to Reduce Pathogen and Nutrients in Runoff from Animal Production Systems

Dairy and cattle farms are potential sources of microbial contamination of the water supply. The principal worrisome bacteria are *Cryptosporidium parvum* (*C. parvum*) and *Escherichia coli* (*E. coli*) for the hazard they may impose on human health when acquired directly via the fecal-oral route or indirectly as a waterborne infection. In 1993, 400,000 Milwaukee residents were stricken with cryptosporidiosis, a disease caused by *C. parvum*. In 2001, 26 people were infected at a water park in East Peoria, Illinois. In both cases, contaminated water was the likely source of infection. A long-term goal is to control microbial contamination of water resources and provide a safe and sustainable environment for the animal production facilities. The overall objectives of this study are to understand microbial fate and transport processes, to characterize critical environmental factors affecting microbial transport and control in runoff and near-surface runoff, and to disseminate information that will prevent transport of microbial pathogens in the water supply. The central hypothesis of this study is that properly designed vegetative filter strips (VFS) can reduce the risk of microbial contamination and nutrients in runoff from animal production facilities.

Research results indicate VFS are very effective in reducing the overall transport of *C. parvum* in overland and near-surface flow. For all slopes, vegetation acts as an effective barrier, allowing for oocyst entrapment within the vegetation, for adsorption to the plant material, and for infiltration of the oocysts through the soil profile. Even at very high slope and rainfall intensities, VFS proved to reduce oocyst transport in surface runoff. *C. parvum* was detected in near-surface flow for both bare-ground

and vegetative conditions. While the vegetation root system may provide a preferential transport mechanism for oocysts to the near-surface zone, the total percent recovery of oocysts from surface runoff and near-surface flow for the vegetation was significantly less than the total recovery of oocysts for the bare-ground conditions. Because certain environmental conditions cannot be controlled, the slope is the major criterion in designing VFS to achieve maximum percent reduction in oocyst transport.

Among various soil textural classes, clay has the most effect on the adsorption of *C. parvum* oocysts. The silt particles had a minimal effect on oocyst adsorption, and these had minimal adhesive properties in the photomicrographs. There were no signs of adhesion between the sand particles and the oocysts. Therefore, site selection for a vegetative filter strip is very important; soils having higher clay content will aid in the reduction of *C. parvum* oocysts during overland flow. Experimental results showed that a filter strip reduces flow volume, sediment, and PO_4 concentrations in runoff; however, reductions in NO_3–N concentrations are not conclusive yet.

Prasanta K. Kalita, Ted L. Funk, Agricultural and Biological Engineering

Mark S. Kuhlenschmidt, Ronald D. Smith, Pathobiology

University of Illinois at Urbana-Champaign

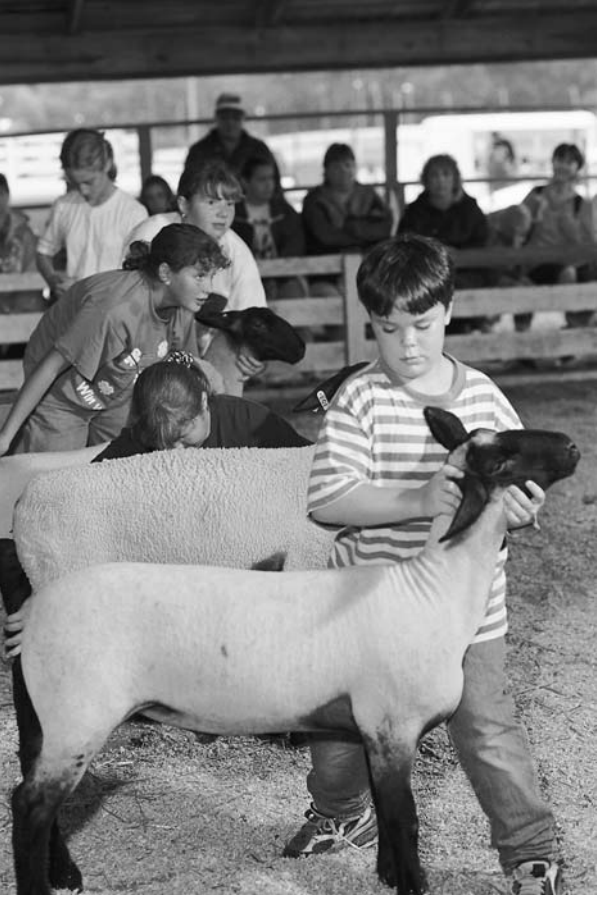
Efficacy of Vacuum Bag Ensiling of Wet Distillers Grain for Beef Cows

High-moisture wet distiller's grain (DG) is an excellent feedstuff for inclusion into cattle diets. Because this feedstuff typically ranges in dry matter content between 40% and 60%, the length of storage time until feeding without spoilage is limited to 3–4 days in summer and to one week in winter. Consequently, cattle producers with smaller herd sizes and limited daily consumption of DG have had few choices for utilizing this feedstuff. A study was designed, with small-scale producers in mind, to evaluate a vacuum ensiling method as a means to preserve wet distiller's grains and to determine the resulting feeding value of the preserved DG for beef cows.

This study found the vacuum storing procedure could preserve DG for prolonged periods, but the vacuum procedure used did not ensile DG. The vacuum storage method works well from November–March. Because spoilage can occur during warmer weather, a recommendation for the months of April through October is to limit storage amounts under one covered pile to an amount that can be fed within 30 days. In this study, spoilage of the DG did not occur until the bag was opened for feeding. For a herd of 40 cows fed 6–10 lbs. of DG per head per day, each covered pile should contain 4–6 tons of DG. One shop vacuum will displace the air from several individual 4–6 ton piles. This study suggests that the feeding value of vacuum-stored wet distillers grain as a protein and energy supplement is similar to the feeding value of shelled corn and soybean meal supplementation for beef cows fed corn silage–based diets. Vacuum-stored DG supplementation resulted in similar cow performance as did shelled corn and soybean meal supplementation. Vacuum storage of DG can serve as a low-cost preservation method for beef cow-calf producers regardless of the size of the operation. This storage procedure allows small-scale operations the opportunity to take advantage of pricing strategies for utilizing high-moisture corn processing coproducts generally limited to larger operations.

Paul M. Walker, Agriculture

Illinois State University



Survey Characterization of the Illinois Lamb Industry in an Effort to Improve Marketing Opportunities

The four main objectives of this research were to (1) assess current economic literature regarding lamb production in Illinois, (2) define types of lamb production in Illinois, (3) determine regional differences, if any, in break-even pricing of lamb production in Illinois, and (4) identify potential for similarly managed lamb operations to cooperate in marketing opportunities of lamb production.

Illinois sheep producers have addressed solutions prescribed by researchers to remedy the declining industry. Sheep production practices such as grafting, bottle-feeding orphan lambs, and high lambing rates have been achieved to fill lamb marketing channels. Illinois producers have also participated in sheep-related U.S. government programs to increase the number of replacement ewes in sheep flocks.

The Illinois Cooperative Extension Service can use producer information as a way to promote the sheep industry to youth and encourage them to raise sheep. Young people should be targeted with encouragement through educational programs, funding, production consultation, and marketing strategy development. Even though there is a low rate of use of the Illinois Extension Service as expressed by the current Illinois sheep producers, there may be more interest from those who establish new flocks in the state with aid through the program. It is important that producers become more involved in the marketing of their sheep products in the future. Not only should they work to produce a large quantity of desirable product for the consumer, but they must also work to overcome the negative image of lamb in order to increase lamb meat consumption.

Initiatives should be geared toward using checkoff funds to promote wool use and lamb consumption in Illinois, particularly to the section of the population that does not use or eat them. There is an opportunity to increase wool use and lamb consumption among the growing population, specifically in younger generations.

Bryon R. Wiegand, Agriculture
Illinois State University

Research Lab Support for Research in Nutrition, Feed, Soils, Waste Materials, and Water

The purpose of this project was to repair broken analytical equipment housed in the Nutrition Laboratory, to purchase a new crude fat extractor/auto-analyzer to replace the antiquated Soxhlet wet lab procedure, to provide funding necessary for the hiring of undergraduate laboratory research technicians required to conduct analyses supporting numerous research projects, and to conduct analyses for on-farm cooperators and stakeholders associated with the various research studies.

The Atomic Absorption Spectrophotometer (AA) housed in the Nutrition Laboratory required repair. The computer-assisted AA is used to analyze feed, soil, manure, water, and human food for various elements. A number of investigators have used the AA, and it has been used to support human nutrition, animal nutrition, livestock waste, urban waste, and agronomic and aquaculture studies. The Automated Nitrogen Spectrophotometer housed in the Nutrition Laboratory also required repair. The nitrogen analyzer is used to calculate the nitrogen concentration in feed, soil, manure, water, and human food. The nitrogen analyzer is also utilized by a number of investigators. Prior to this project, the methodology used in the Nutrition Lab to determine crude fat content of compounds was a Soxhlet wet laboratory procedure. This ether extract system was purchased in the 1970s and had become obsolete. The Soxhlet system was very labor-intensive and could only conduct 6 extractions at a time. The new automated system increased accuracy of determination and the volume of samples analyzed.

Paul M. Walker, Agriculture
Illinois State University

Reducing the Impact of Emerging Iridoviral Diseases on Illinois Aquaculture

The purpose of this project was to determine, using a combination of epidemiological and experimental approaches, what factors affect the susceptibility of economically important fish to emerging viral diseases of the family Iridoviridae. Largemouth Bass Virus (LMBV), an emerging iridovirus of warmwater fishes, was used as a model system. LMBV was considered a pathogen exotic to Illinois, having been found mainly in Southern and Eastern states, but was discovered in Illinois in 2002. Researchers sought to investigate the roles of fish genetics, water quality, and fish housing density on the susceptibility of fish to clinical disease. Fish of different genetic lines were tested for susceptibility to the virus, as were fish housed at different densities. Water quality parameters were varied in tanks to mimic conditions in commercial aquaculture facilities. Findings will be communicated to members of the fish husbandry community in order to provide information that would help reduce economic losses caused by this and similar viral pathogens.

This project elucidated several important mechanisms that influence the susceptibility of fish to iridoviral pathogens. First, viruses of different genetic makeup had different clinical effects on infected fish. Second, hybrid fish resulting from crosses between genetically divergent parent stocks suffered higher mortality from the virus, as did fish from parental stocks. Third, rapid changes in water quality increased susceptibility to the virus more than chronically elevated levels of dissolved toxins did.

Tony L. Goldberg, Pathobiology

University of Illinois at Urbana-Champaign

David P. Philipp, Illinois Natural History Survey

Bioavailability of Low-Phytate Soybean Meal for Trout

The major objective of the project was to show that low-phytate soybean meal can be used to reduce the amount of phosphorus waste from rainbow trout farms. It was hypothesized that phosphorus and trace mineral content of scales and vertebral bones would be greater in fish that were fed diets that contained low-phytate soybean meal than in fish fed diets that contained normal soybean meal. Confirming this hypothesis could lead to increased demand for soybean meal as a source of protein in rainbow trout production worldwide.

Low-phytate soybean meal was used successfully in a previous C-FAR project that involved tilapia. After the current project was approved for funding, it became apparent that additional low-phytate soybean meal would not be available for experimental diets for rainbow trout. Low-phytate soybeans, unlike low-phytate corn, appeared to suffer from production problems that retarded the commercial development of the beans seeds.

Due to the lack of low-phytate soybean meal, a second project, titled "Degradation of Phytate and Lectins in Soybean Meal by Processing" (ongoing) was approved for funding. That project involves analysis of possible procedures for degrading phytate in soybean derivatives without the use of exogenous phytase. The successful identification of such a procedure will allow completion of low-phytate feeding trials with rainbow trout.

Kerry W. Tudor, Agriculture

Illinois State University

Biomarkers to Study Synergy Among Phytochemicals in Prevention of Cancer by AFB

The naturally occurring mycotoxin, aflatoxin B1 (AFB1), is a common contaminant of moldy peanuts, corn, and soy meals and is a primary factor in the development of liver cancer. Exposure to AFB1 is high in the tropics where mold contamination of grains is common, but significant exposure to AFB1 occurs in Western countries, making AFB1 a concern in areas of high corn and soybean production, like Illinois. Contamination of corn and soybeans by the *Aspergillus flavus* mold that produces AFB1 is possible when it is cool and wet during maturation and harvesting.

A consistent association has been made between diets rich in cruciferous vegetables and the prevention of several common cancers. The association has been linked to coordinated enhancement of the body's detoxification enzymes. Chemoprotection by cruciferous vegetables is linked to glucosinolates, which form bioactive breakdown products (BBPs) when the vegetables are prepared for consumption. Some BBPs induce detoxification enzymes that detoxify AFB1 and also prevent cancer in rodents. Two BBPs, indole-3-carbinol (I3C) and 1-cyano-2-hydroxy-3-butene (crambene) induce detoxification and prevent cancer in rodents. They also act synergistically to enhance detoxification at doses 80% lower than either enzyme acting alone, suggesting that BBPs interact cooperatively to produce protection. This might account for the gap between amount of whole vegetable needed for protection and higher doses of individual BBPs needed experimentally for the same effect.

The study was designed to explore this synergy further by assessing biomarkers of AFB1 cancer initiation (urinary/serum AFB1 adducts and histologic liver damage) in rats exposed to a combination of crambene and I3C and to either compound alone prior to exposure to a cancer inducing dose of AFB1. It was hypothesized that I3C + crambene would produce a significantly greater reduction in expression of these biomarkers than either BBP alone.

A histologic assessment of rats pretreated with crambene alone, I3C alone, or I3C + crambene in the diet prior to exposure to AFB1 provided fruitful results. Crambene was found to be mildly protective against karyomegaly (enlarged nucleus), biliary hyperplasia, and severity/extent of hepatic damage, which are all makers of AFB1-induced damage. I3C was not protective against karyomegaly or biliary hyperplasia and actually enhanced the severity/extent of hepatic damage. Crambene + I3C was more protective than crambene alone against biliary hyperplasia, but less protective than crambene against severity/extent of hepatic damage. The combined diet was not protective against karyomegaly.

These results suggest that I3C may not contribute much to chemoprotection in the early stages of AFB1 carcinogenesis and it actually may exacerbate damage. Crambene, on the other hand, appears to be more protective than anticipated, while the combination of crambene and I3C is not any more protective than crambene alone. Thus the synergy noted biochemically between I3C and crambene may not translate into chemoprotection in situations of AFB1 exposure. This study provides initial evidence that crambene may actually be a better chemoprotectant than more commonly known BBPs, such as I3C. This study also provides information at the whole animal level about the initial protection provided by BBPs in early stages of carcinogenesis.

A C-FAR External Competitive Grants project

Matthew A. Wallig, Pathobiology

University of Illinois at Urbana-Champaign

Soy Saponins as Colon Cancer Inhibitors

Comparisons of international cancer incidence rates indicate that consumption of a diet high in plant foods, typical of an Asian diet, is associated with less cancer risk as compared to populations consuming a typical Western diet. Higher soybean intake has been hypothesized as one dietary component that might explain the decreased cancer risks of Asian populations. Although considerable research has focused on the role of soy isoflavone phytoestrogens as being major contributors to this beneficial cancer suppressing effect, other soy components also may be active. This research project had as its primary objective to characterize the potential anticancer effects of soybean saponins toward human colon cancer cells.

Soybean B-group triterpenoid saponins inhibited the multiplication of human colon cancer cell cultures at concentrations that are achievable following consumption of a soybean-containing meal. Of particular interest is that exposure of colon cancer cells to B-group soyasaponins resulted in stimulation of a novel form of programmed cell death, called autophagic cell death. Autophagy is receiving increased attention as a potentially new mechanism by which drugs and phytochemicals may trigger cancer cell death. Moreover, researchers determined that the effect of the soyasaponins on colon cancer cell death was mediated in part by their ability to suppress a well-characterized, survival-enhancing molecular-signaling pathway in cancer cells. It may be that soybean triperpenoid saponins alone or in combination with other bioactive anticancer constituents of plants will be useful in dietary strategies to prevent cancer.

A C-FAR External Competitive Grants project

Keith W. Singletary, Food Science and Human Nutrition

University of Illinois at Urbana-Champaign

High Quality Protein Enhances Diet Control of Type 2 Diabetes

The goal of this research was to demonstrate the potential for diets with increased high-quality protein and reduced levels of high-glycemic carbohydrates to contribute to regulation of blood glucose and insulin. Researchers sought to evaluate the mechanism for regulation of blood glucose using experiments with type 2 diabetics and a new animal protocol developed as a model for study of pre-diabetes conditions. Key elements of the regulation of glucose metabolism were evaluated, including liver control of glucose production and insulin regulation of glucose uptake by skeletal muscle and fat tissues.

The research was pursued along two avenues. The first was a pilot study to test a moderate protein weight-loss diet for treatment of individuals with type 2 diabetes. The pilot study was completed with 10 subjects finishing a 10-week diet protocol. Researchers found that the diet with increased levels of high-quality proteins and reduced carbohydrates was effective in reducing clinical symptom of diabetes with no adverse effects. Subjects reduced fasting blood sugar, improved insulin sensitivity, and reduced body weight. The pilot study established the efficacy of the diet for treatment of type 2 diabetes. A large scale diabetes treatment program is being planned at Carle Hospital in Urbana.

The second component of this research served to develop an animal feeding protocol that mimics the metabolic conditions seen in the pre-diabetes condition known as Syndrome X. Results show the high carbohydrate diet treatment (similar to the USDA Food Guide Pyramid) produces a sustained post-prandial hyperinsulinemia and chronic low fasting blood sugar. The high insulin levels after a meal increases insulin signaling activity in fat tissue and causes increased uptake and storage of dietary carbohydrates as body fat. Contrary to the high carbohydrate diet, the moderate protein diet serves to stabilize blood sugar levels and minimizes storage of body fat. This new animal model provides molecular support for the hypothesis that the dietary ratio of carbohydrates to protein can produce a fundamental shift in regulation of blood glucose from a high carbohydrate diet that requires high insulin responses to stabilize blood glucose to the moderate protein diet that relies on liver regulation of glucose production.

A C-FAR External Competitive Grants project

Donald K. Layman, Food Science and Human Nutrition

University of Illinois at Urbana-Champaign

Consumer Perception of Irradiated Ground Beef Products

The primary goal of this project was to better understand consumer perception of irradiated ground beef products. Researchers explored and identified important attributes of food irradiation and the role of irradiation on consumer purchasing decisions. Researchers sought to identify key attributes leading to consumer preference and the selection of irradiated beef products.

Results showed that most consumers had heard of food irradiation and would be willing to purchase irradiated food products. However, those surveyed were somewhat concerned about the impact of irradiation on food safety, taste, and nutritional value, which were identified as the three most important attributes in food purchases. Consumers indicated they trust medical professionals and food scientists the most and government the least when it comes to information on irradiation of food.

Focus group findings showed that there was a significant change in the opinions of consumers after the educational focus group discussions. The term "irradiated" is a major concern since it has a negative impact on consumers' willingness to purchase irradiated ground beef products. Selling the product at no additional cost had a positive impact on consumers' willingness to purchase. This implies that the cost of irradiation may have to be absorbed by the industry or the producer utilizing irradiation technology. If irradiation proves effective in improving food safety, if the benefits of technology are communicated better, and if consumers' misconceptions are clarified, then irradiated ground beef products could achieve additional consumer appeal, resulting in greater demand and increased profitability for the U.S. meat industry.

Aslihan D. Spaulding, Bryon R. Wiegand, Patrick D. O'Rourke, Agriculture

Illinois State University

Assessing Intervention Strategies to Insure the Safety of Ground Beef Patties

This project was part of a larger effort to understand consumer perception of irradiated ground beef products. Identification of important attributes of beef products and the role of irradiation on consumer purchase decision is being explored. Researchers are working to identify the important attributes leading to consumer preference and selection of irradiated beef products. The identification of the attributes should provide a useful guidance for the beef industry in terms of determining marketing strategies to increase the level of consumer preference for irradiated products.

Funding for this project was used to purchase equipment for the meat science research laboratory at Illinois State University. As part of an ongoing effort to evaluate consumer perception of certain meat products, it is critical to be able to manufacture these products to industry standards. This aspect makes the research conducted in this area directly applicable to consumer behavior as it pertains to meat products marketed in Illinois.

Bryon R. Wiegand, Agriculture

Illinois State University

Mass Media Frames and Public Understanding of Agricultural Biotechnology

The objectives of the biotechnology analysis were to (1) analyze content of television and newspaper news reports in Illinois on agricultural biotechnology; (2) determine and characterize the types of public responses to television and newspaper reports on biotechnology issues; and (3) identify specific determinants of public understanding of biotechnology issues, specifically using rural and urban focus groups.

There was considerable information in mass media coverage (television and newspaper) of genetic engineering in agricultural projects. Newspapers and television articles regularly included both risk frames and benefits frames. The primary sources were government, business, university, and social movement groups. Social movement groups were the primary sources who were opponents of biotechnology, although a subgroup of university scientists also included risk themes. Neither the newspapers nor the television presented a consensus on whether genetic engineering or genetic modification was a risk.

Six focus groups were conducted in three regions of Illinois (rural and urban groups in northern, central, and southern Illinois). All groups were given articles that summarized the negative and the positive information distributed in Illinois newspapers. Halfway through the study, fact sheets were distributed to participants in the focus groups. There was no difference in consumer reaction by region or after the information fact sheets were read. Illinois consumers were more likely to adopt a risk frame (to concentrate on the potential risk of biotechnological foods) than they were to adopt a benefits frame. However, rural groups overall felt more constrained by economic issues relative to food purchasing. They were also less concerned with a variety of views about the risks of biotechnology and were more concerned with the potential economic advantages to farmers.

Ann E. Reisner, Human and Community Development

University of Illinois at Urbana-Champaign

E-Commerce and Internet Use by Rural and Urban Small Businesses in Illinois

The economic and social vitality of rural communities throughout the United States is becoming ever more dependent upon the creation of small businesses. By their very nature, these businesses have a small market, many times drawing customers from a geographically limited area; however, the Internet economy provides even the smallest and most isolated business access to the national or even the global economy at a very low cost. Research suggests that a large percentage of small rural businesses fail to survive beyond five years. A contributing factor for this high rate of failure is a geographically limited customer base. A possible solution for small businesses is to expand the market for their products and services through e-commerce. This project addresses the level and effectiveness of Internet use by small rural businesses. While the use of the Internet and e-commerce by agribusinesses has been the subject of several studies over the past few years, little research effort has been

directed towards the use of the Internet and/or e-commerce by small businesses outside of metropolitan areas.

This project involved a survey of rural businesses in five geographically dispersed nonmetropolitan counties in Illinois. Survey respondents indicated they were mainly engaged in retail sales (42%) and service businesses (31%) followed by finance, insurance, real estate (8%), and wholesale (8%). Websites were mainly developed by professional web services (45%). Primary function of the websites included description of the product (71%), general firm information (56%), customer service (27%), price information (21%), and online sales (19%). Customers were able to make online purchases from 23 percent of the respondents' websites. Fifty-three percent of the businesses responding indicated they believed sales increased due to their website.

Rick C. Whitacre, Agriculture

Illinois State University

Implementation of ProStar: A Web-Enabled Agribusiness Management Simulator of Farm Supply Dealerships

ProStar is a web-enabled agribusiness simulator that is used as an instructional tool. Users study financial and operating statements for simulated six-month periods for a simulated business and make management decisions for the next six-month period based on those financial and operating results. The process may be repeated several times by several simulation teams representing businesses for each of several simulated markets. The management decisions include setting prices, ordering supplies, hiring and firing labor, setting credit policy, setting promotional expenditures, financial decisions, and buying and selling equipment assets.

The simulator features real-life business complexities, competition with peer companies, market uncertainties, and a complete set of professionally designed financial and operating reports. All reports and team decisions remain in the website pages until the facilitator deletes them. Students and managers use the ProStar simulation to learn to apply management decision-making tools and to become better managers.

Patrick D. O'Rourke, Agriculture

Illinois State University

Remediation of Biodiesel Contaminated Soil

The fate of biodiesel fuel in soil was compared to that of petroleum diesel fuel in soil to determine if biodiesels are more, less, or similar in toxicity. The influence of biodiesel on microbial populations and on plant survival was examined. Researchers also sought to determine the potential of using bioremediation and phytoremediation to clean biodiesel-contaminated soil.

Research results indicate that biodiesel fuel is less phytotoxic than petroleum diesel fuel. Evidence includes a higher rate of soybean seedling emergence, plant height, root and shoot biomass, and nitrogen fixation rates in biodiesel-contaminated soil compared to petroleum diesel-contaminated soil.

Robert L. Rhykerd, Kenneth D. Smiciklas, Agriculture

Illinois State University

Research Lab Support for Soils, Materials Analysis, and Water for Ropp Greenhouse

The goal of this project was to purchase and install a water distillation unit in the Ropp Greenhouse to improve the quality of water being used for research studies. The water purification system has been installed and is operational. The addition of this equipment has enhanced researchers' ability to conduct research on container media that is important to numerous agricultural industries in Illinois and beyond.

Robert L. Rhykerd, Gary R. Bachman, Bryon R. Wiegand, Kenneth D. Smiciklas, Agriculture

Illinois State University

Measurement of the Wind Resource at the ISU Farm at Lexington

The goal of this project is to evaluate wind as a possible energy source at the ISU Farm in an effort to identify potential new business opportunities for farmers. An 80-m-tall tower was erected and outfitted with two anemometers: a shaded temperature sensor at 10 m and single wind vanes at heights of 25, 60, and 80 m. The readings from the sampling equipment are recorded in the nonvolatile memory of the cell-logger that contains a cellular phone. The data set consists of temperature readings and measurements of the average wind speed and direction. The wind speed and direction are sampled at a rate of one per second and are averaged over ten-minute intervals at each height. The data set is transmitted as an ASCII text file that is attached to an electronic mail message.

The wind regime has been measured and determined for the ISU farm at Lexington. With almost two complete years of data collected at hub height, a complete analysis of the production estimate of a specific turbine, such as a Vestas NM-82, can be determined. The wind data set provides the most thorough evaluation of the wind potential for central Illinois, an evaluation that was previously undeterminable. Through this project, non-biased information has been provided to wind developers, politicians, constituents, farmers, university students, school-aged children, and power providers. This project has facilitated an increased awareness of wind energy issues specific to Illinois.

Findings from this study have provided meaningful information to the state oversight body that determines electrical pricing for customers served by renewable energy production. This includes proposed pricing for the purchase of electrical energy from planned wind turbine projects, both large and small. The project has had an impact on the development of a State of Illinois Renewable Portfolio Standard (RPS). Researchers have received $500,000 of additional funding from the Illinois Clean Energy Community Foundation and $1 million from the U.S. Department of Energy to continue this work.

Douglas M. Kingman, Agriculture

Illinois State University

Projects Receiving Extensions

Researchers for the following projects were granted no-cost extensions to complete their research. Requests for no-cost extensions are granted when unforeseen circumstances arise. While the due dates for these projects have been extended, no additional funds were allocated. These projects will be reported on after their new maturity dates in 2006.

Degradation of Phytate and Lectins in Soybean Meal by Processing

FY04 ISU Internal Program

Kerry W. Tudor, Agriculture

Illinois State University

Effect of Milling Parameters on Fiber and its Removal from the DDGS

FY04 External Competitive Grants project

Vijay Singh, Agricultural and Biological Engineering

University of Illinois at Urbana-Champaign

Examination of Most Influential Factors on Crop Insurance Purchase Decisions of Northern Illinois Farmers

FY05 ISU Internal Program

Aslihan D. Spaulding, Agriculture

Illinois State University

Expanding Market for Activated Carbon from Corn-to-Ethanol By-Products

FY05 External Competitive Grants project

Massoud Rostam-Abadi

Illinois State Geological Survey

From Research to Marketable Wheat By-Product Composites: Phase II

FY03 External Competitive Grants Program

Vivak M. Malhotra, Physics

Southern Illinois University Carbondale

Identification of the Sources of Nitrate in the Upper Illinois River

FY04 External Competitive Grants project

Samuel V. Panno

Illinois State Geological Survey

Strategies for Management of Vegetable Diseases in Organic and Traditional Farms

FY04 External Competitive Grants project

Mohammad Babadoost, Crop Sciences

University of Illinois at Urbana-Champaign

The Effect of Using Disease-Free Planting Stock on Horseradish Yield and Quality

FY03 External Competitive Grants Program

Robert M. Skirvin, Natural Resources and Environmental Sciences

University of Illinois at Urbana-Champaign

Fiscal Year 2006:
Internal Competitive Grants Programs

The FY06 internal competitive grants programs at the University of Illinois at Urbana-Champaign (UIUC), Southern Illinois University Carbondale (SIUC), Illinois State University (ISU), and Western Illinois University (WIU) focused on supporting ongoing research initiatives and funded the following new projects in FY06.

FY06 Projects	Principal Investigator
Research Focus: Expanding Agricultural Markets	
Expanding the Demand for Illinois Corn: High Speed Rail Loading Facilities Impact on Corn Prices	Rick C. Whitacre, ISU
New Product Development and Supply Chain Management of the U.S. Confectionery Manufacturers	Aslihan D. Spaulding, ISU
Pork: A Potential Healthful Dietary Replacement for Fish in the American Diet	Amer A. AbuGhazaleh, SIUC
Research Focus: Rural Economic Development	
Development of Enterprise Profit Models for the Illinois Livestock Industry	Michael F. Hutjens, UIUC
Evaluating Short Season Field Peas as an Economically Viable and Nutritionally Appropriate Diet for Nursery Pigs	Bryon R. Wiegand, ISU
YouthWorks: Youth Leading Rural Communities' Economic Development	Laurie F. Kramer, UIUC
Research Focus: Agricultural Production Systems	
Development of a Soybean Cyst Nematode Genetic Infrastructure	Kris N. Lambert, UIUC
Evaluation of a Swine Manure Management System to Control Odor and Reduce Nonpoint Source Pollution	Paul M. Walker, ISU
Exploiting GDHA+ Corn to Control Aflatoxin Contamination in Infected Kernels	Ahmad M. Fakhoury, SIUC
Initiative for Low-input Apple Production in Illinois	Schuyler S. Korban, UIUC
Multidisciplinary Research and Discovery Program to Convert Renewable Plant/Crop Biomass into Renewable Fuels and Chemicals	Hans P. Blaschek, UIUC
The Sentinel Crop Gene Identification Project	Lila O. Vodkin, UIUC
Research Focus: Human Nutrition and Food Safety	
How Healthy is Pasture-fed Beef?	Karen L. Jones, SIUC
Research Focus: Natural Resources	
Costs and Environmental Benefits of Conservation Tillage in the Lower Illinois Basin	Lyubov A. Kurkalova, SIUC
Implementation of No-tillage Production Practices for Jack-o-lantern Pumpkins	S. Alan Walters, SIUC
Utilizing Processed Swine Manure as a Soil Amendment for Crop Production	Kenneth D. Smiciklas, ISU

Fiscal Year 2006:
External Competitive Grants Program

In accordance with the Food and Agriculture Research Act, the C-FAR appropriation's enabling legislation, a minimum of 15% of the total C-FAR appropriation (minus fees) is allocated to an external competitive grants program. This program enabled support to the following projects in FY06.

FY06 Projects	Principal Investigator
Consumer Attitudes Towards Issues of Food Safety Concern	Mary Susan Brewer, UIUC
Development and Evaluation of a Value-Added Feedstuff Using Distiller's Grains	Paul M. Walker, ISU
Enhancing the Nutritional Value of Milk and Milk Products by Boosting their Omega-3 Fatty Acids Content	Amer A. AbuGhazaleh, SIUC
Integrated Management of Summer Diseases of Apples	Mohammad Babadoost, UIUC
Use of Plasma for Destruction of Microbial Hazards in Food	Shirshak K. Dhali, SIUC

Fiscal Year 2006:
Strategic Research Initiatives

The C-FAR Strategic Research Initiatives provide a targeted, multidisciplinary, and multi-institutional approach to addressing major issues and concerns of the Illinois food and agricultural industry and consumers. The SRI research portfolio includes the following initiatives in FY06.

FY06 Projects	Principal Investigator
Biomass Energy Crops for Power and Heat Generation in Illinois: Diversifying Cropping, Improving Energy Security, and Benefiting the Environment	
Agronomic Trials	Stephen P. Long, UIUC
Water Resource Implications	Mark B. David, UIUC
Miscanthus Breeding and Improvement	John A. Juvik, UIUC
Economic Analyses	Madhu Khanna, UIUC
Social Acceptability	Anne Heinz Silvis, UIUC
Propagating and Eradicating *Miscanthus x giganteus*	Thomas B. Voigt, UIUC
Carbon Sequestration and Greenhouse Gas Accounting	Michelle M. Wander, UIUC
Genetic Engineering	Jack M. Widholm, UIUC
Bioconversion	Yuanhui Zhang, UIUC
Illinois Livestock Integrated Focus Team (IL LIFT)	
Technology Development	Michael F. Hutjens, UIUC
Livestock Facility Siting in Illinois	Peter D. Goldsmith, UIUC
Animal Identification for Enhanced Food Quality and Monitoring Livestock Health	Geoffrey L. Dahl, UIUC
Pasture-Based Forage Systems to Sustain Illinois Livestock Producers	Justin W. Sexten, University of Illinois Extension
Water Quality with a Focus on Total Maximum Daily Loads	
SRI Leader Support and Coordination	George F. Czapar, University of Illinois Extension
Seasonal Dynamics of Nutrients, Algae, and Dissolved Oxygen in Agriculturally Dominated Headwater Streams	William L. Perry, ISU
Effects of Phosphorus Mediated through Algal Biomass in Illinois Streams	Walter R. Hill, Illinois Natural History Survey
Spatial and Temporal Relationships between Biotic Integrity of Illinois Streams, Dissolved Oxygen, and Nutrients (Including Controls on Dissolved Reactive and Particulate Phosphorus)	Mark B. David, UIUC
The Impact of Sediments on the Potential Bioavailability of Phosphorus in Illinois Streams	Michael L. Machesky, Illinois State Water Survey

Financials

A complete financial accounting of C-FAR-appropriated funds is compiled and reported to the State of Illinois annually. This reporting is organized in detail by C-FAR's research programs and related supporting accounts.

The following pages detail all FY05 expenditures and FY06 allocations. A summary precedes the individual expenditure and allocation reports.

Summary of FY05 Expenditures and FY06 Obligated Funds

External Competitive Grants Program		**$1,166,043**
Research Expenditures	400,325	
Research Obligations	761,147	
Scientific Reviewers	1,423	
Scientific Reviewers Obligations	3,148	
University Internal Programs and Other Programs/Accounts		**$3,856,440**
Research Expenditures	2,672,087	
Research Obligations	1,184,353	
Strategic Research Initiatives Program		**$1,868,461**
Research Expenditures	1,177,807	
Research Obligations	690,654	
Scientific Reviewers	0	
Scientific Reviewers Obligations	0	
Illinois Department of Agriculture Fee		**$17,500**
1% Member Expense Account		**$29,455**
Total FY05 Expenditures and FY06 Obligated Funds		**$6,937,899[1]**
Research Expenditures	4,250,219	
Research Obligations	2,636,154	
External Scientific Reviewers	1,423	
External Scientific Reviewers Obligations	3,148	
IDOA Fee & 1% Member Expense	46,955	

[1]FY05 research expenditures are higher than the FY05 appropriation as a portion of funds from the previous fiscal year(s) were obligated for investment in subsequent year(s).

Summary of FY06 Allocations

External Competitive Grants Program	**$506,782[2]**
(15% of the total appropriation, after IDOA Fee and 1% Member Expense)	
University Internal Programs and Other Programs/Accounts	**$1,991,768**
Strategic Research Initiative Program	**$880,000**
Illinois Department of Agriculture Fee	**$17,150**
($50,000, or 1/2 of 1% of the total appropriation, whichever is less)	
1% Member Expense Account	**$34,300**
(1% of the total appropriation)	
Total FY06 Allocations	**$3,430,000[2]**

[2]An additional $5,545 was allocated to the FY06 External Program due to distributing unexpended funds from the FY05 1% Member Expense Account. Therefore, the total FY06 External Program funding level is $512,327 and the total FY06 C-FAR allocation is $3,435,545.

Please see additional notes on individual summary reports.

C-FAR FY05 Expenditure Summary: External Competitive Grants Program

(July 1, 2004 – June 30, 2005)

Actual Fiscal Year Expenditures							
C-FAR Research Focus Areas	**Expenditure Areas**	**UIUC**	**SIUC**	**ISU**	**WIU**	**Other Entities***	**TOTALS**
Expanding Agricultural Markets	Equipment	1,277	5,189	0	0	0	**6,466**
	Materials/Supplies	15,335	3,503	0	0	0	**18,838**
	Personnel	38,232	9,257	0	0	0	**47,489**
	Services/Contracts	8,073	8,178	0	0	0	**16,251**
	Transportation	3,930	2,777	0	0	0	**6,707**
Rural Economic Development	Equipment	0	0	0	0	0	**0**
	Materials/Supplies	3,456	0	0	0	76	**3,532**
	Personnel	23,454	0	0	8,100	0	**31,554**
	Services/Contracts	21,559	0	0	0	103	**21,662**
	Transportation	11,015	0	0	0	554	**11,569**
Agricultural Production Systems	Equipment	0	0	0	0	0	**0**
	Materials/Supplies	7,847	0	0	0	0	**7,847**
	Personnel	50,438	0	0	0	0	**50,438**
	Services/Contracts	8,992	0	0	0	0	**8,992**
	Transportation	3,687	0	0	0	0	**3,687**
Human Nutrition and Food Safety	Equipment	0	1,311	1,127	0	0	**2,438**
	Materials/Supplies	34,805	2,784	0	0	0	**37,589**
	Personnel	12,555	26,570	0	0	139	**39,264**
	Services/Contracts	6,533	12,309	0	0	0	**18,842**
	Transportation	760	3,820	0	0	148	**4,580**
Natural Resources	Equipment	0	0	17,402	0	0	**17,402**
	Materials/Supplies	2,360	0	2,783	0	0	**5,143**
	Personnel	13,871	0	6,115	0	0	**19,986**
	Services/Contracts	7,285	0	3,095	0	0	**10,380**
	Transportation	0	0	0	0	0	**0**
Subtotals		275,464	75,698	30,522	8,100	872	**390,656**
Indirect Cost		N/A	7,587	1,199	810	73	**9,669**
Scientific Reviewers		N/A	N/A	N/A	N/A	N/A	**1,423**
Unexpended/Obligated Funds for FY06 Research		447,436	247,484	64,877	1,350	0	**761,147**
Total FY05 Expenditures and FY06 Obligated Funds		**722,900**	**330,769**	**96,598**	**10,260**	**945**	**1,162,895**

*Other entities are Eastern Illinois University and Illinois Institute of Technology. The University of Illinois at Springfield returned $2,045 of unexpended funds as the project was concluded.

C-FAR FY05 Expenditure Summary: Strategic Research Initiative Program

(July 1, 2004 – June 30, 2005)

Actual Fiscal Year Expenditures							
Strategic Research Initiatives (1)	**Expenditure Areas**	**UIUC**	**SIUC**	**ISU**	**WIU**	**Other Entity (2)**	**TOTALS**
Information Systems and Technology	Equipment	8,526	0	0	0	0	**8,526**
	Materials/Supplies	1,357	0	0	0	0	**1,357**
	Personnel	40,263	(2,504)	0	0	0	**37,759**
	Services/Contracts	160	0	0	0	0	**160**
	Transportation	2,728	0	0	0	0	**2,728**
	Coordination	3,875	N/A	N/A	N/A	N/A	**3,875**
Rural Community Development	Equipment	2,099	0	0	0	0	**2,099**
	Materials/Supplies	1,816	193	0	0	0	**2,009**
	Personnel	9,594	10,883	0	0	0	**20,477**
	Services/Contracts	17	775	0	0	0	**792**
	Transportation	0	782	0	0	0	**782**
	Coordination	N/A	0	N/A	N/A	N/A	**0**
Swine Odor and Waste Management	Equipment	710	9,929	0	0	0	**10,639**
	Materials/Supplies	10,554	0	0	0	0	**10,554**
	Personnel	205,633	0	0	0	0	**205,633**
	Services/Contracts	(20,875)	0	0	0	0	**(20,875)**
	Transportation	16,665	184	0	0	0	**16,849**
	Coordination	29,384	N/A	N/A	N/A	N/A	**29,384**
Food Safety	Equipment	0	0	0	0	0	**0**
	Materials/Supplies	(147)	0	0	0	0	**(147)**
	Personnel	11,014	0	0	0	0	**11,014**
	Services/Contracts	2,117	915	0	0	0	**3,032**
	Transportation	846	429	0	0	0	**1,275**
	Coordination	N/A	0	N/A	N/A	N/A	**0**
Water Quality	Equipment	1,874	9,179	0	0	0	**11,053**
	Materials/Supplies	2,186	353	0	0	0	**2,539**
	Personnel	79,448	5,745	0	0	0	**85,193**
	Services/Contracts	1,423	3,032	0	0	0	**4,455**
	Transportation	3,422	1,880	0	0	0	**5,302**
	Coordination	1,242	N/A	N/A	N/A	N/A	**1,242**

Biomass Energy Crops for Power and Heat Generation in Illinois	Equipment	11,551	0	0	0	0	**11,551**
	Materials/Supplies	9,404	0	0	0	0	**9,404**
	Personnel	137,047	0	0	0	0	**137,047**
	Services/Contracts	28,746	0	0	0	0	**28,746**
	Transportation	12,552	0	0	0	0	**12,552**
	Coordination	N/A	0	0	0	0	**0**
Illinois Livestock Integrated Focus Teams	Equipment	3,378	0	0	0	0	**3,378**
	Materials/Supplies	3,401	0	0	0	0	**3,401**
	Personnel	92,286	0	0	0	0	**92,286**
	Services/Contracts	5,348	0	0	0	0	**5,348**
	Transportation	1,781	0	0	0	0	**1,781**
	Coordination	N/A	0	0	0	0	**0**
Water Quality with a Focus on TMDLs	Equipment	0	0	4,882	0	0	**4,882**
	Materials/Supplies	28,312	186	14,814	0	757	**44,069**
	Personnel	162,231	14,872	38,876	0	6,543	**222,522**
	Services/Contracts	27,359	6,021	3,622	0	0	**37,002**
	Transportation	19,162	5,738	1,844	0	1,077	**27,821**
	Coordination	70,640	N/A	N/A	N/A	N/A	**70,640**
Subtotals		1,029,129	68,592	64,038	0	8,377	**1,170,136**
Indirect Cost		N/A	6,834	0	0	837	**7,671**
Unexpended/Obligated Funds for FY06 Research		602,966	25,193	62,131	0	364	**690,654**
Total FY05 Expenditures and FY06 Obligated Funds		**1,632,095**	**100,619**	**126,169**	**0**	**9,578**	**1,868,461**

(1) The first five SRIs listed above did not receive additional funds in FY05. Amounts shown represent expenditures of funds carried over from previous fiscal years to complete work. The last three SRIs listed above were initiated in FY04.

(2) Other entity is Kent State University.

C-FAR FY05 Expenditure Summary: University Internal Programs and Other Programs/Accounts

(July 1, 2004 – June 30, 2005)

Actual Fiscal Year Expenditures							
C-FAR Research Focus Areas and Programs	**Expenditure Areas**	**UIUC**	**SIUC**	**ISU**	**WIU**	**Food and Agriculture Research Act**	**TOTALS**
	Equipment	26,318	0	0	0	N/A	**26,318**
	Materials/Supplies	3,892	0	0	0	N/A	**3,892**
Expanding Agricultural Markets	Personnel	165,853	0	8,906	0	N/A	**174,759**
	Services/Contracts	6,098	0	0	0	N/A	**6,098**
	Transportation	2,222	0	0	0	N/A	**2,222**
	Equipment	1,475	5,160	2,362	0	N/A	**8,997**
	Materials/Supplies	613	0	1,059	3,765	N/A	**5,437**
Rural Economic Development	Personnel	54,564	4,237	1,969	52,594	N/A	**113,364**
	Services/Contracts	2,171	187	0	895	N/A	**3,253**
	Transportation	2,468	416	0	989	N/A	**3,873**
	Equipment	12,416	0	9,798	0	N/A	**22,214**
	Materials/Supplies	170,915	258	2,057	0	N/A	**173,230**
Agricultural Production Systems	Personnel	607,887	16,430	0	0	N/A	**624,317**
	Services/Contracts	74,575	13,876	5,030	0	N/A	**93,481**
	Transportation	2,505	1,338	0	0	N/A	**3,843**
	Equipment	13,083	0	4,500	0	N/A	**17,583**
	Materials/Supplies	25,278	4,473	0	0	N/A	**29,751**
Human Nutrition and Food Safety	Personnel	472,745	11,859	0	0	N/A	**484,604**
	Services/Contracts	10,289	3,730	0	0	N/A	**14,019**
	Transportation	15,088	0	0	0	N/A	**15,088**
	Equipment	0	4,950	3,758	0	N/A	**8,708**
	Materials/Supplies	5,020	3,347	567	0	N/A	**8,934**
Natural Resources	Personnel	282,833	6,385	1,469	0	N/A	**290,687**
	Services/Contracts	17,965	26	2,024	0	N/A	**20,015**
	Transportation	3,534	0	0	0	N/A	**3,534**
Subtotals		1,979,807	76,672	43,499	58,243	N/A	**2,158,221**
Indirect Cost		N/A	N/A	2,087	1,654	N/A	**3,741**
Research Support		96,989	117,860	827	0	N/A	**215,676**
C-FAR Administrative Office		241,448	32,389	11,778	8,834	N/A	**294,449**
Achievement Award	(included above)	0	0	0	0	N/A	**0**
1% Member Expense		N/A	N/A	N/A	N/A	29,455	**29,455**
IDOA Fee		N/A	N/A	N/A	N/A	17,500	**17,500**
Unexpended/Obligated Funds for FY06 Research		1,147,656	3,328	15,113	18,256	N/A	**1,184,353**
Total FY05 Expenditures and FY06 Obligated Funds		**3,465,900**	**230,249**	**73,304**	**86,987**	**46,955**	**3,903,395**

FY06 C-FAR Allocations Summary Report

Reflective of 2% Reserve

(July 1, 2005 – June 30, 2006)

C-FAR Research Focus Areas and Programs	Internal Grants Program					External Competitive Grants Program (1)	Strategic Research Initiative Program	Food and Agriculture Research Act	Total Allocations
	UIUC (82%)	SIUC (11%)	ISU (4%)	WIU (3%)	Total Internal University Allocations				
Expanding Agricultural Markets	140,113	0	14,700	0	154,813	125,503	N/A	N/A	**280,316**
Rural Economic Development	42,088	10,000	17,000	51,135	120,223	0	*Biomass Energy* 290,773	N/A	**410,996**
Agricultural Production Systems	595,479	35,000	20,000	0	650,479	120,872	*Livestock Focus* 94,227	N/A	**865,578**
Human Nutrition and Food Safety	367,932	20,000	0	0	387,932	147,627	N/A	N/A	**535,559**
Natural Resources	212,070	15,000	7,800	0	234,870	118,325	*Water Quality* 495,000	N/A	**848,195**
Scientific Reviewers (2)	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	**0**
Research Support	40,000	103,787	0	0	143,787	N/A	N/A	N/A	**143,787**
Research Discretionary	0	3,706	5,271	0	8,977	N/A	N/A	N/A	**8,977**
Indirect Costs	N/A	N/A	3,409	0	3,409	N/A	N/A	N/A	**3,409**
C-FAR Administrative Office (3)	235,568	31,601	11,491	8,618	287,278	N/A	N/A	N/A	**287,278**
Achievement Award (4)	0	0	0	0	0	N/A	N/A	N/A	**0**
1% Member Expense	N/A	N/A	N/A	N/A	N/A	N/A	N/A	34,300	**34,300**
IDOA Fee	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17,150	**17,150**
Totals	**1,633,250**	**219,094**	**79,671**	**59,753**	**1,991,768**	**512,327 (1)**	**880,000**	**51,450**	**3,435,545 (1)**

(1) $5,545 of unexpended funds from the FY05 1% Member Expense Account was allocated to the FY06 External Competitive Grants Program (included in figures above).

(2) $3,148 of unexpended funds from the FY05 Scientific Reviewer Account was utilized for FY06. Therefore, no allocation from FY06 funds was necessary.

(3) The FY06 C-FAR administrative office budget is $306,529. This budget was met with $287,278 from the FY06 appropriation and $19,251 of unexpended FY05 funds from this account.

(4) The Achievement Award was not given in FY06 so that these funds could be directed to ongoing research.

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