Two Thousand 08

Annual Report

15 CFAR
Celebrating 15 years

Illinois Council on Food and Agricultural Research

Message from C-FAR

Greetings,

We proudly present this 2008 Annual Report of the Illinois Council on Food and Agricultural Research (C-FAR). The numerous and intertwined partnerships the C-FAR organization comprises are directly responsible for the past year's achievements, which have been captured throughout the report.

Fifteen years ago, C-FAR was established for highly notable and important purposes. We are pleased to highlight the milestone of our 15th anniversary within this report. In 1993, we likely did not anticipate just how impactful our organization could be. We likely underestimated the impact such an organization could have on Illinois' food and agricultural industries, its citizens, and its economy. And we likely did not fully appreciate the challenges our organization would be called upon to embrace.

Although C-FAR's role and purpose have been clearly illustrated over the past fifteen years, the need for a vibrant C-FAR organization and State of Illinois research appropriations are even more paramount today. And by any measure, this need will continue for the foreseeable future.

Indeed, the positive impacts C-FAR has had over the course of its existence may be dwarfed by the research opportunities and challenges we have before us. Many highly respected industry leaders suggest Illinois' food and agricultural industries have never before confronted such a dynamic period of change. C-FAR, through its many members and associated partners, readily embraces the continued ability to generate practical outcomes for Illinois through a diverse research portfolio, invaluable input from both private and public sectors, and accountability measures that ensure the public's trust.

As Illinois faces unprecedented challenges and opportunities, C-FAR – as Illinois' food and agricultural research arm – remains fully committed to being a continuing agent of positive change.

Sincerely,

Nels R. Kasey
Chairman of the Board

Kraig A. Wagenecht
Executive Administrator

C-FAR research funding is provided by the State of Illinois. C-FAR gratefully acknowledges the State of Illinois for these financial investments, which enable advancements in Illinois' food and agricultural industries and significantly contribute to the economic vitality of our state.

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C-FAR COMMEMORATES 15TH ANNIVERSARY

Established December 27, 1993, C-FAR, upon its 15th anniversary, proudly salutes its many members, universities and other research institutions, and the State of Illinois. This partnership has enabled numerous advancements for Illinois' food and agricultural research programs. Reflecting on this anniversary provides a defined opportunity to highlight the organization's establishment and achievements.

Critical Research for Illinois

The basis for C-FAR's establishment and the Food and Agriculture Research Act (the C-FAR appropriation's enabling legislation) is the absolute importance of the food and agricultural industry to Illinois citizens and the state's economy. It is widely embraced that very few food and agricultural advancements have been realized without a sound research base. Both public and private sectors realized that Illinois must be proactive in continuing to build upon its greatest economic asset.

C-FAR and Its Appropriation

C-FAR and the Food and Agriculture Research Act have distinct purposes while having highly intertwined roles. C-FAR's mission 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*. This mission is closely tied to the Food and Agriculture Research Act, which states: *The purpose of this Act is to put a solid foundation of stable and long-term State support under the important public activity of food and agricultural research while improving accountability and gathering public input concerning that research*.

As intended, the C-FAR research program has matured into being *the* core food and agricultural research program in Illinois. No other program provides such a comprehensive food and agriculture research portfolio directly tied to Illinois' needs and opportunities.

Snapshot of Research Outcomes

The return on investment generated from recent C-FAR-funded research is pronounced. A small sampling of these outcomes includes

- New technologies and food safety programs are preventing foodborne illnesses.
- Development of value-added agriculture is adding more than $42 million annually to Illinois farm income.
- Revolutionary online networks are connecting consumers and other food supply chain participants with locally grown foods in Illinois and across the nation.
- Comprehensive science-based water quality research is being utilized in establishing nutrient standards for Illinois.
- Urban landscape and agricultural wastes are being successfully composted to protect the environment and produce a soil improvement product.
- The Illinois Center for Soy Foods is providing alternative healthful food choices for Illinois citizens and for consumers across the globe and benefiting Illinois soybean producers from the expanded utilization of this crop.

- Groundbreaking research on various food properties is seeking to reduce cancer, cardiovascular disease, obesity, diabetes, and other life-threatening diseases.
- The world's largest open-air laboratory is determining the effects of rising atmospheric carbon dioxide and surface ozone on corn and soybean production.
- Renewable biofuels are being developed to reduce Illinois' and the nation's dependence on foreign oil and reduce greenhouse gas emissions.
- The farmdoc website at www.farmdoc.uiuc.edu provides the most comprehensive and unprecedented web-based source of decision-making tools for producers and other professionals.
- Numerous initiatives have resulted in distiller's grains (co-product of ethanol) being effectively utilized in livestock feed rations.
- Genomic biology and biotechnology research is advancing crop yields, livestock rates of gain, and disease prevention across both livestock and crops sectors.

A New Paradigm – An Unprecedented Partnership

The positive dynamics resulting from the C-FAR and State of Illinois partnership extend well beyond these notable research outcomes. The purpose for C-FAR's establishment, as reflected in its mission statement, reaches beyond advancing research viability. These additional advancements are highly noteworthy:

- The creation of the largest coalition of its kind, focused solely on food and agricultural research for Illinois (and the only known organization of its kind in the United States).
- Through this coalition, invaluable input is being realized from industry professionals in determining the state's greatest research needs. Today, these industry professionals are working hand-in-hand with the state's research community.
- Development of unprecedented research programs that enable Illinois scientists to embark on practical and largely applied research initiatives.
- Public access to State of Illinois-funded research outcomes is at an all-time high, with web-based information and other information being available, accompanied by stringent financial accountability.

Responsive and Adaptive

C-FAR research priorities are regularly monitored and updated by the C-FAR membership to ensure that current and future research needs and opportunities are being addressed. As a result, today's C-FAR research portfolio is not like that of a few years ago. Because of the C-FAR platform for meaningful dialogue, the current research portfolio reflects a noticeable emphasis on renewable energy, ethanol efficiencies, human nutrition, natural resource protection, consumer food preferences, livestock enterprise enhancement, and rural community invigoration. The latter part of this annual report details C-FAR's current research portfolio.

The Future

Although C-FAR members and partners justifiably share pride in what has been accomplished, their focus is on the future. By any measure, the foreseeable future clearly suggests that Illinois' food and agricultural industries face their greatest challenges and opportunities. C-FAR, in cooperation with its research partners and the State of Illinois, embrace this future and the continuing ability to underpin Illinois' highly important food and agricultural industry.

2008 Highlights

Annual Meeting

C-FAR held its 2008 Annual Meeting of the Membership in February. A special luncheon was held to recognize several members who reached various membership tenures. These Organizational, Affiliate, and Individual members were recognized for their commitment to and support of C-FAR and its mission. During the meeting Chuck Cawley, Wally Furrow, and Steve Scates were elected to serve on the 2008 Board of Directors. They joined Jim Charlesworth, Jerry Hicks, Nels Kasey, Karen Little, and Alan Puzey (past-chairman).

C-FAR members (from left) Lane Rayburn, William Whiteside, and George Fahey, Jr., in working group discussion at 2008 Annual Meeting.

Highlights of the meeting included the presentation of the 2008 Donald A. Holt Achievement Award to the Illinois Center for Soy Foods and a presentation on the UIUC Institute for Genomic Biology by Dr. Harris Lewin, director of the Institute. The state-of-the-art research facility opened in 2007 to advance life science research and stimulate bio-economic development in Illinois.

Illinois Center for Soy Foods Receives Achievement Award

C-FAR annually recognizes a C-FAR-funded research team that has demonstrated outstanding and innovative team research and outreach. The award is named in honor of Dr. Donald Holt, a longtime advocate for practical and sound food and agricultural research. This year's award was presented to the Illinois Center for Soy Foods.

Illinois Center for Soy Foods research team receives C-FAR 2008 Donald A. Holt Achievement Award. From left: Keith Cadwallader, Pradeep Khanna, Barbara Klein, and Karl Weingartner.

The center was established in 2000 with the mission "to create and promote healthy, economical, and good-tasting food products from soybeans and soy-based ingredients, thereby providing benefits to growers, processors, and consumers in Illinois." Led by UIUC researchers Keith Cadwallader, Barbara Klein, Pradeep Khanna, and Karl Weingartner, the center's 15 faculty and academic professionals have used their expertise in food chemistry, nutrition, management, and food technology to undertake a variety of successful projects and activities to promote soy foods. Established with C-FAR funding, the center has received additional support from the Midwest Food Manufacturing Alliance, Archer Daniels Midland, Cargill, Illinois Soybean Association, National Soybean Research Laboratory, and the USDA. The center is now self-supporting.

Working Groups Identify Priority Research for Funding

C-FAR's five working groups met during February and March to review and identify for funding research proposals submitted to the FY09 External Competitive Grants Program. Eighty pre-proposals requesting over $8.6 million were submitted by researchers from across Illinois. Due to the exceptional quality of proposals submitted to this year's program, the Board of Directors adopted an alternative funding protocol to allow more FY09 initiatives to be funded. The first year of research will be funded from the FY09 External Program's allocation, with the second and third year of multiyear initiatives being funded from the FY10 program allocation, either in full or in part. It was also decided to not conduct an FY10 program so that these funds are available to meet the funding commitments of initiatives started in FY09.

The working group chairs and vice chairs, based on the priorities established by the working groups, identified seven high-priority research initiatives to be funded through the FY09 program (see page 35).

C-FAR Day at Western Illinois University

Dr. Winthrop Phippen (right), WIU associate professor of agriculture, describes potential commercial uses for common milkweed and demonstrates the use of an experimental processor during C-FAR Day at WIU.

C-FAR held its 8th annual C-FAR Day during November at Western Illinois University. C-FAR Day is held annually to provide members with the unique opportunity to engage firsthand with university faculty about their C-FAR-funded research. This year, attendees learned about C-FAR-funded research in areas including alternative crops, fertilizer rates for grazing corn production, and livestock feed studies. Attendees also had the opportunity to view a milkweed harvester and processor demonstration and tour the university's beef and ram/goat facilities. C-FAR was pleased to have WIU President Alvin Goldfarb, Provost & Academic Vice President Jack Thomas, and Dean Tom Erekson welcome C-FAR Day attendees to their campus.

C-FAR Leadership

2008 Board of Directors and Staff

Board of Directors

Nels Kasey
CHAIRMAN OF THE BOARD
PARIS

Chuck Cawley
RESEARCH VICE CHAIR
ROCHELLE

Jim Charlesworth
MEMBERSHIP CHAIR
BLOOMINGTON

Wally Furrow
DIRECTOR
EL PASO

Jerry Hicks
VICE CHAIRMAN AND
RESEARCH CHAIR
SPRINGFIELD

Karen Little
SECRETARY-TREASURER
PLEASANT PLAINS

Stephen Scates
LEGISLATIVE CHAIR
SHAWNEETOWN

Alan Puzey
PAST CHAIRMAN AND
LEGISLATIVE VICE CHAIR
FAIRMOUNT

Staff

Kraig A. Wagenecht
EXECUTIVE ADMINISTRATOR

LeAnn M. Ormsby
COMMUNICATIONS DIRECTOR

Arena Jackson
OFFICE SUPPORT SPECIALIST

Gloria Buhrmester
OFFICE SUPPORT ASSOCIATE

2008 Working Group Leadership

Expanding Agricultural Markets

Heather Hampton+Knodle
CHAIR
FILLMORE

John Huston
VICE CHAIR
CHICAGO

Rural Economic Development

Kae Hankes
CHAIR
GALESBURG

Norbert Soltwedel
VICE CHAIR
SHUMWAY

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 and Environment

Byford Wood
CHAIR
BREESE

Dennis Godar
VICE CHAIR
ROCHESTER

2008 Members

C-FAR, a not-for-profit corporation, is a membership-based association. The C-FAR membership is anchored on professional expertise from both the public and private sectors. This year, C-FAR proudly recognizes its 15-year members who have been engaged in and supported the organization since its founding in 1993 (noted with [15]). A listing of 2008 members follows.

Organizational Members

C-FAR Organizational members are nonprofit Illinois organizations that represent varied food, agriculture, and agribusiness interests.

Association of Illinois Soil and Water Conservation Districts [15]

Audubon Council of Illinois [15]

Champaign County Farm Bureau

Dairy Management Inc.

DeKalb County Farm Bureau

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 [15]

Illinois Beef Association, Dues Division [15]

Illinois Cooperative Council

Illinois Corn Growers Association [15]

Illinois Corn Marketing Board [15]

Illinois Dietetic Association [15]

Illinois Farm Bureau [15]

Illinois Farm Business Farm Management Association [15]

Illinois Farm Credit Services

Illinois Fertilizer and Chemical Association [15]

Illinois Forage and Grassland Council

Illinois Grape Growers and Vintners Association

Illinois Lamb & Wool Producers

Illinois Landscape Contractors Association

Illinois Milk Producers' Association [15]

Illinois Pork Producers Association [15]

Illinois Pork Producers Association, Checkoff Division

Illinois Restaurant Association

Illinois Seed Trade Association

Illinois Society of Professional Farm Managers & Rural Appraisers [15]

Illinois Soil Testing Association

Illinois Soybean Association [15]

Illinois Specialty Growers Association [15]

Illinois State Grange

Illinois State Horticultural Society

ISU Agriculture Alumni Association [15]

Illinois State Veterinary Medical Association [15]

Illinois Stewardship Alliance [15]

Illinois Turfgrass Foundation

Illinois Wheat Association

Institute of Food Technologists, Chicago Section

Kane County Farm Bureau

Kankakee County Farm Bureau

Knox County Farm Bureau

Madison County Farm Bureau

Mason County Farm Bureau [15]

Mercer County Farm Bureau

Midwest Association of Golf Course Superintendents

Midwest Dairy Association

Ogle County Farm Bureau*

Orr Agricultural Research Center

Pike County Farm Bureau*

Scott County Farm Bureau*

SIU College of Agricultural Sciences Alumni Society [15]

The Chicago Farmers

UIUC College of Agricultural, Consumer and Environmental Sciences Alumni Association [15]

UIUC College of Veterinary Medicine Alumni Association

Warren-Henderson Farm Bureau

*New member in 2008

Affiliate Members

C-FAR Affiliate members are largely state agencies, university entities, and other organizations similarly related to the C-FAR mission.

Environmentally Correct Concepts

Greene Farm Management Services

Illinois Crop Improvement Association [15]

Illinois Department of Commerce and Economic Opportunity

Illinois Department of Natural Resources

Illinois Finance Authority

Illinois Forestry Development Council

Illinois Institute for Rural Affairs

Illinois State Geological Survey

ISU College of Applied Science and Technology

ISU Department of Agriculture [15]

Illinois State Water Survey

Illinois Sustainable Technology Center

National Center for Food Safety and Technology

Sangamon County Soil and Water Conservation District

SIUC College of Agricultural Sciences [15]

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

SIUC Illinois Soybean Center

The Nature Conservancy in Illinois

UIUC College of Agricultural, Consumer and Environmental Sciences [15]

UIUC College of Veterinary Medicine [15]

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 Allison Organic Farm

WIU Department of Agriculture [15]

WIU Department of Biological Sciences*

*New member in 2008

Individual Members

In addition to the Organizational and Affiliate members and all of their representatives, there were 132 Individual members who also supported food, agricultural, and related research in Illinois via C-FAR in 2008.

Fifteen-year members

William G. Beeler

John W. Dudley

David and Nancy Erickson

Jack Erisman

Dale D. Hedrick

Benjamin A. Jones, Jr.

Steve Jurgens

Carol Keiser-Long

John K. Rutledge

Sarahelen Thompson

Jack M. Widholm

Committees

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 on its mission and objectives
- develop recommendations for Council or Board approval
- implement and execute plans

Committee Members
Stephen Scates, chair; Alan Puzey, vice chair; Constance Locher Bussard; David Downs; David Erickson; Wally Furrow; Jerry Hicks; Karen Little; William Whiteside; and Herman Bodewes, *ex-officio*.

Membership Committee

This committee's responsibilities include obtaining and retaining members, development of consensus measures, and nurturing the support of and engagement in various C-FAR programs.

Committee Members
Jim Charlesworth, chair; Faye Dong; Jack Erisman; Terry Ferguson; Roger Hubele; and Tom Toohill.

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
Jack Erisman, chair; Dean Adams; Allan Aves; Bill Campion; Richard Denhart; Larry Fischer; Charlie Grotevant; William McCartney; and Bob Swires.

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
Jerry Hicks, chair; Chuck Cawley, vice chair; Susan Adams; Bill Becker; Constance Locher Bussard; Paul Gebhart; Molly Ann Godar; Heather Hampton+Knodle; Kae Hankes; Jeanne Harland; Richard Hull; John Huston; Pat Lawfer; Don Naylor; Jack Norman; Bert Princen; John Quandt; Wendell Shauman; Richard Showalter; William Whiteside; and Byford Wood. *Ex-officio:* William Bailey; George Fahey, Jr.; Jozef Kokini; Robert Rhykerd; and John Russin. Note: Dr. Todd Winters assumed Dr. Russin's position on the committee in November.

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; Maralee Johnson; Dan Kelley; Karen Little; Neal Merchen; and Ron Warfield.

Research Partners

University of Illinois at Urbana-Champaign

Robert Easter, Dean

COLLEGE OF AGRICULTURAL, CONSUMER AND ENVIRONMENTAL SCIENCES

Jozef Kokini, Associate Dean for Research

COLLEGE OF AGRICULTURAL, CONSUMER AND ENVIRONMENTAL SCIENCES

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

COLLEGE OF AGRICULTURAL, CONSUMER AND ENVIRONMENTAL SCIENCES

Southern Illinois University Carbondale

Gary Minish, Dean

COLLEGE OF AGRICULTURAL SCIENCES

Todd Winters, Associate Dean for Research and Personnel

COLLEGE OF AGRICULTURAL SCIENCES

Illinois State University

Robert Rhykerd, Interim Chair

DEPARTMENT OF AGRICULTURE

Western Illinois University

William Bailey, Chair

DEPARTMENT OF AGRICULTURE

C-FAR recognizes with appreciation Dr. John Russin for his commitment to and support of C-FAR during his tenure as SIUC Associate Dean for Research and Personnel. Dr. Russin assumed new responsibilities at a different university in August 2008.

In addition to these primary research partners, C-FAR is pleased to work with a number of additional research related entities.

C-FAR Research

C-FAR research programs are carefully developed to provide a comprehensive and well-balanced research portfolio. Every initiative is identified, funded, and carried out based on a highly deliberate set of research priorities representing the needs and opportunities of Illinois.

RESEARCH FOCUS AREAS

C-FAR research programs are organized around five general areas of research that address a broad spectrum of needs and opportunities for Illinois and its citizens. The objectives of the five research focus areas are:

Expanding Agricultural Markets: Enhance the Illinois food and agricultural industry's profitability by identifying consumer demand, developing marketing expertise, developing new technologies, and advancing existing technologies to retain and to expand markets for agricultural products.

Rural Economic Development: Identify, examine, and develop enterprises and practices that support economic vitality for healthy rural and urban communities.

Agricultural Production Systems: Grow Illinois agriculture by increasing efficiency, marketability, and acceptance of Illinois agriculture on the farm to meet changing world demand for food, energy, and other agricultural products through research and education.

Human Nutrition and Food Safety: Provide a nutritious, high-quality, safe, and secure food supply and enable consumers to make informed and healthful dietary choices.

Natural Resources and Environment: Foster environmental stewardship and the sustainable use of natural resources in Illinois.

RESEARCH PROGRAMS OVERVIEW

The C-FAR research portfolio comprises three programs: Strategic Research Initiative Program, University Internal Programs, and External Competitive Grants Program. Brief descriptions of the three research programs follow.

Strategic Research Initiative Program

The Strategic Research Initiatives (SRIs) are highly collaborative team-based research initiatives that provide a targeted, multidisciplinary, and multi-institutional approach for addressing major issues and concerns of Illinois' food and agricultural industry and consumers. These initiatives address longer-term needs and opportunities.

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 that have food and agricultural 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 nonprofit institutions, organizations, and agencies throughout Illinois. The program solicits proposals from Illinois nonprofit research entities. By legislation, a minimum of 15% of the C-FAR appropriation is allocated to this program.

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, pre-proposals. C-FAR working group participants evaluate pre-proposals based on relevance to C-FAR research focus areas, potential outcomes and their benefits to stakeholders, and dissemination plans. The second step is a review and prioritization of full proposals submitted from top-ranking pre-proposals.

Strategic Research Initiative Program

The following are highlights of FY08 progress reports submitted by the principal investigators of active SRIs.

Biomass Energy Crops for Power and Heat Generation in Illinois: Diversifying Cropping, Improving Energy Security, and Benefiting the Environment

Dr. Stephen Long, Robert Emerson 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*) and switchgrass (*Panicum virgatum*), perennial rhizomatous grasses, as a potential renewable energy source for Illinois and as a profitable alternative crop for Illinois agricultural producers.

Due to the research efforts of this SRI, energy company BP selected the University of Illinois in collaboration with University of California at Berkley and Lawrence Berkley National Laboratory to host the Energy Biosciences Institute. BP has committed $500 million for large-scale research and development of bioenergy systems. The Institute is now established, and research has begun on each campus. Additionally, ground has been broken on a 340-acre Energy Biosciences Institute Energy Farm at the University of Illinois at Urbana-Champaign, and the first research plots have been planted.

Principal Investigators

Stephen P. Long – Crop Sciences and Plant Biology

Yuanhui Zhang – Agricultural and Biological Engineering

Madhu Khanna – Agricultural and Consumer Economics

Michael S. Katterhenry – Animal Sciences

German A. Bollero, Jack M. Widholm – 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

Frank G. Dohleman – Plant Biology
University of Illinois at Urbana-Champaign

Field Trials

The University of Illinois South Farms has six blocks, with each block containing two 0.5 acre plots of Miscanthus, and one plot each of switchgrass, and corn/soybean rotation. This is a critical resource for assessing environmental impacts and testing harvest and weed control technologies. Over the past year, harvested rhizomes were used to establish 12 acres of Miscanthus at the Energy Farm as well as providing rhizomes for a number of Department of Energy studies. Harvested plots grew back with several being sprayed with Round-Up® and planted with soybeans to investigate Miscanthus eradication techniques.

Yield analysis continued in 0.25-acre trials established at Dixon Springs, Urbana and DeKalb, Perry, Havana, Fairfield, and Brownstown. In 2007, the average end of season harvestable biomass was 11.6 tons/acre for Miscanthus verses 4.4 tons/acre for switchgrass. Miscanthus, in terms of yield, appears a far more promising energy crop than switchgrass, showing two to three times higher yields.

Miscanthus Breeding and Improvement

Several hundred greenhouse hybridizations have been conducted between the Miscanthus parental species (*M. sinensis, and M. sacchariflorus*) without successfully generating any viable seed. *M. sinensis* is itself a prime target species for feedstock production based on its performance in European trials, its high degree of phenotypic and genetic variation, and its capacity to generate viable seed. Using 16 *M. sinensis* accessions, researchers have initiated crosses among paired parent plants that show distinct morphological phenotypes and biomass yields. Seed has been harvested from three of these crosses. Three populations of *M. sinensis* were planted in the greenhouse and transplanted to field plots for phenotypic evaluation and DNA genotyping.

Researchers are attempting to double the chromosome number of *M.* x *giganteus* to convert it from a triploid to a hexaploid plant. Chromosome doubling in other plant species has been shown to increase vegetative growth and biomass. Hexaploid plants could also restore plant fertility to promote conventional breeding. To date, from eight to ten assumed hexaploid plants have been regenerated. These will be moved to the greenhouse for evaluation of biomass productivity and potential fertility.

Miscanthus callus tissue infected with *Agrobacterium* carrying the *bar* herbicide resistance gene has generated transformed callus colonies which have been transferred to regeneration media. The *bar* herbicide resistance gene will be used as a selection marker to optimize transformation for higher yielding and better adapted forms of Miscanthus for Illinois. In addition, a resistance to herbicide would be of value for weed control in the first and second years of stand establishment.

Soil Carbon and Gas Emissions

Researchers are working to quantify the short-term (5-year) influence of biomass crop production on changing and total organic carbon contents of the top 3 feet depth of Illinois soils, and to estimate the total global warming mitigation potential of these systems by collecting greenhouse gas emissions. Total and particulate organic matter carbon and nitrogen contents were quantified to assess changes in organic matter pools. Nutrient analyses of soils taken to 3 feet are also being assessed. This work will provide a baseline estimate of nutrient and organic matter stocks that is needed to evaluate the long-term impact of biofuels on the soil resource.

The data provide evidence that both Miscanthus and switchgrass are net absorbers of greenhouse gases, and they should therefore merit any credits given to farmers for climate change mitigation. Findings highlight the need to document initial soil condition for sites and indicate that space for time substitution may not be reliable, even where stands are located close to one another on similar soils. Nutrient analysis will help predict the rates of nutrient removal.

Water Resource Implications

Water usage and inorganic nitrogen leaching from biomass crops compared to conventional corn and soybean rotation are being evaluated. To quantify nitrogen leaching, resin lysimeters were installed in the field at a depth of 20 inches. Soil moisture has been measured to a depth of 35 inches during the growing season. Significant differences in soil moisture were observed between cropping systems. Soil moisture in switchgrass and Miscanthus was significantly less than in corn or soybeans early in the growing season. Late in the growing season, soil moisture for corn, soybean, and switchgrass were similar and significantly greater than in Miscanthus.

Results indicate that Miscanthus and switchgrass would greatly reduce nitrate losses in drainage water, providing an important water quality benefit. On the other hand, Miscanthus appears to use considerably more water than switchgrass, soybeans, or corn, which could reduce stream flows and extend periods of low flow in some growing seasons and in watersheds where Miscanthus constitutes a major land cover. The reduced flows can provide both benefits (flood reduction) and costs (reduced surface water availability for other uses).

Propagation and Eradications of *Miscanthus X Giganteus*

Soil temperature, soil moisture level, size of rhizome, and planting depth are being examined to achieve the greatest sprouting for Miscanthus. For successful sprouting, adequate moisture and carbohydrates in the rhizome are necessary. Future propagation and establishment research will study methods of soaking rhizomes in different solutions containing nutrients and/or growth regulators to improve establishment rates.

Tillage, herbicides, and planting techniques are also being evaluated to determine their effects on eradicating Miscanthus and converting fields to traditional crops. Although tillage or glyphosate did not completely eradicate Miscanthus, both significantly reduced biomass production. In another eradication study, Miscanthus shoots and rhizomes were harvested. Because rhizome harvesting typically leaves a percentage of living rhizomes in the field, shoot development occurred the following spring. The field was cultivated and planted with soybeans, with glyphosate being applied to developing Miscanthus and soybeans. Two applications of glyphosate appear to have controlled the Miscanthus adequately to enable soybean harvest.

Harvesting and Preprocessing Technologies

Miscanthus and switchgrass were harvested using a variety of different equipment and techniques in colloboration with the U.S. Department of Energy's Idaho National Laboratory. Three mowing machines were used: a New Holland HW 345 sickle mower-conditioner, a John Deere Bush Hog MX 8 rotary cutter powered by a Ford New Holland 8670, and an AGCO Hesston 9260 disk mower-conditioner. Raking was done with a New Holland HT 154 rake to evaluate dry matter loss.

Several conclusions can be drawn from an analysis of the baled material. The moisture content of the Miscanthus bales was on average about 8.5% higher than that of the switchgrass bales. The average weight of the Miscanthus bales on a wet basis was 134 lbs heavier than that of the switchgrass bales; however, the average dry matter weight of the Miscanthus bales was nearly the same. The average density of Miscanthus bales on a wet basis was 0.6 lbs per cubic foot greater than that of the switchgrass bales, but on a dry matter basis the density of the switchgrass bales was 0.5 lbs per cubic foot greater. A possible reason for this phenomenon is that the stem of switchgrass is smaller and can be more easily compacted in a large square bale than the larger stalk of Miscanthus.

Pellets can be made from both the switchgrass and the Miscanthus, but improvements still need to be made in the pelleting process to make a more desirable product.

Thermochemical Conversion of Biomass to Fuel

Researchers are evaluating the feasibility of converting Miscanthus into oil or other chemicals. To investigate the feasibility of a three-stage hydrothermal process, researchers initially focused on converting lignocellulosic materials to hydrocarbons at relatively high temperature. Miscanthus was successfully converted in an autoclave at 536° F and 30 minutes with the initial pressure of nitrogen 95 psi and the presence of a catalyst. It was found that the catalyst changed oil yield and quality distribution from cellulosic biomass. Preliminary results indicate that a catalyst may enhance the gasification of biomass, thus influencing the formation of oil product in a hydrothermal process.

Economic Analysis

Researchers are examining the potential for power plants to use bioenergy to replace a portion of their coal energy and obtain carbon credits by providing incentives to landowners to grow bioenergy crops or adopt conservation tillage with row crops. A dynamic land use decision model has been developed to identify the optimal mix of land use strategies over a 15-year planning horizon and to estimate marginal costs of achieving given carbon mitigation targets internally.

A delivered price of biomass of $18 per ton (U.S.) dry matter (a coal energy-equivalent price) if supplemented with a one time payment of $20 per ton equivalent carbon dioxide is estimated to moderate approximately 136 million tons of equivalent carbon dioxide emissions (equivalent to a permanent reduction of 15% carbon emissions by existing coal-fired power plants in Illinois) over a 15-year period. Much of this mitigation is achieved by displacement of carbon emissions from coal used by power plants, and the rest is due to soil carbon sequestration. Of the carbon sequestered, 92% is achieved through conservation tillage and only 8% by perennial grasses.

To achieve the 15% reduction in carbon emissions, 8% of the current coal-based electricity would need to be generated by co-firing biomass with coal. This in turn would require conversion of about 3% of existing cropland to Miscanthus and 6% of additional cropland under conservation tillage. At the above price of carbon, it would be economically feasible to transport biomass from almost two-thirds of the 102 counties in Illinois that are located

far as 70 miles away from a power plant. Planting of Miscanthus would be concentrated primarily in counties that are located in the vicinity of power plants, and a large portion of biomass crop production and consumption would occur in the southern part of the state.

Social Acceptability of Energy Crops

Mail surveys and focus groups targeted farming populations from across Illinois to better understand the social acceptability of potential energy crops. Survey packets were distributed with the help of the Northwest Illinois Ag Coalition, the Illinois Field Office of the National Agricultural Statistics Service, University of Illinois Extension, and the Illinois Farm Bureau. Focus groups were conducted in Winnebago, Sangamon, and Monroe counties, representing the Northern, Central, and Southern regions respectively.

Results revealed that areas of interest among producers include

- production practices (including equipment needs, information about storage and harvesting, soil fertility requirements, availability of material to plant, specific production practices, and potential pests and diseases)
- environmental services (including effects on water quality and soil quality, improving national energy security, reducing CO_2 emissions and nitrogen runoff, and producing a visually attractive crop)
- concerns and potential problems (including concern about Miscanthus becoming a weed, experience growing Miscanthus in Illinois, changing the operation's current crop rotation, unfamiliarity with growing a perennial crop, the existence of long-term contracts to grow Miscanthus, and crop insurance)
- markets and marketability (including the market potential for the crop, market prices, market demand, data, and existing markets)
- inputs reduction (including the opportunity to reduce inputs of fertilizer, pesticides, and fuel in producing a crop, and the opportunity to reduce labor and wear and tear on equipment).

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 addressing the economic and social challenges facing Illinois' livestock industry. The four-year SRI focuses on livestock facility siting in Illlinois; 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. Researchers received a no-cost extension in 2008 to bring the initiative to full fruition.

The SRI website, titled Illinois Livestock Trail and located at www.livestocktrail.uiuc.edu, was redesigned in 2007 and joined the suite of University of Illinois Extension websites. This website continues to provide the extension and outreach platform for the IL LIFT SRI initiatives.

Principal Investigators

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Livestock Facility Siting in Illinois

As Illinois livestock operations modernize and expand, they face requirements for manure handling, consumer acceptance, community reaction, and economic impact on their facilities. An on-farm survey of livestock manure nutrient management plans and practices has provided insight into regulatory compliance issues and information for designing producer education efforts. The findings of the surveys were incorporated into the state-mandated livestock producer certification training program. Twenty-two workshops were held throughout the state from December 2006 to March 2008, with a total of 481 producers, contractors, educators, and others participating.

A new website at www.EZregs.uiuc.edu gives producers easier access to the environmental regulations that affect livestock and crop production in Illinois. Another new site, the Illinois Manure Management Plans (IMMP) website at www.IMMP.uiuc.edu, is assisting producers and consultants in developing and updating complete manure management plans. IEPA field staff are urging producers to become familiar with IMMP as a regulatory compliance tool.

Using Illinois By-Product Feed in Livestock Feeding

An interactive website at http://ilift.traill.uiuc.edu/distillers was developed to inform Illinois livestock producers about the use of dried and wet distiller's grains in livestock diets. This online resource provides publications on distiller's grains and their utilization in swine, dairy, and beef cattle diets. It also lists ethanol plants within a 100-mile radius of Illinois, including contact person, yearly production of distiller's grains, products available, pricing structure, nutritive value/specifications, minimum load, and the website (if available). An economic spreadsheet calculates the break-even price of distiller's grain.

Using Illinois Forages Based on Pasture-Based System

Investigators are comparing and contrasting the relative economic value of integrating grazing animal systems into a conventional short-term crop rotation system. Forage testing indicates forage quality of managed grazing systems is sufficient to maintain a cow-calf enterprise. High production enterprises such as lactating ewes and dairy cows or growing calves may require energy supplementation to support desired performance. Although economic data summarization is ongoing, preliminary results suggest that complete utilization of annual forages is required to compete with perennial forages. Through January 2007, 764 forage samples have been collected, analyzed, and entered into a database.

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. The goal is to develop simple, effective, and permanently identified animals from birth to market. Test micrometer scale electronic devices are under development as a method for permanent animal identification and physiological monitoring, with an emphasis on body temperature tracking in real time. This project was expanded into a statewide program with support from the Illinois Department of Agriculture, Illinois Milk Producers Association, and USDA premise identification program.

Internal and External Research Projects: Final Report Summaries

The following section includes summaries of final reports submitted by the principal investigators of University Internal Program projects and External Competitive Grants Program projects that were completed in 2008. Please visit the C-FAR website at www.ilcfar.org/research/index.html for the complete reports for these projects.

Crops

Characterizing Corn for Grazing at Various Stages of Physiological Maturity

A previous research project has demonstrated that grazing systems consisting of perennial cool season grasses and legumes can produce acceptable animal performance and have the potential to generate more than twice as much income per acre as traditional crop rotations of corn and soybeans. One constraint identified in that study, however, was the greatly reduced production of cool season perennials during the hot summer months. Animal performance could potentially be maintained during this time frame with supplemental feeding or the inclusion of summer annuals. Corn is typically harvested at physiological maturity as whole plant silage or as grain, but could be grazed in the green leaf stage. This project was designed to document growth dynamics and nutrient accumulation of corn at various growth stages through physiological maturity, determine whether corn can produce adequate nutrient accumulation during the green leaf stage to be economically feasible as a grazing crop, and provide information for producers to select corn planting dates that will provide an appropriate grazing window to compliment cool season perennial forages.

Research data indicate plantings at various dates would provide a wide window of opportunity to graze large tonnages of forage that would produce stocker cattle average daily gains of 2.0-2.6 lbs/day with minimal supplementation. In addition to providing large amounts of high quality forage during the summer slump in cool season pasture production, corn could be stockpiled for feeding later in the fall or winter months. Corn grazed by mid-August to mid-September would provide an opportunity to double crop additional forages such as oats-turnips for fall grazing or winter annuals such as wheat, rye, or triticale for winter and early spring grazing. Producers raising grass-finished beef could graze up to the early R2 stage without disqualifying cattle from grass-finished status, providing approximately a 20-day grazing window for each planting date. Utilizing three planting dates would give a grazing window of approximately 50-60 days from late June to mid-August.

WIU Internal Program

Kenneth O. Nimrick, Gordon K. Roskamp – Agriculture

Western Illinois University

Degradation of Phytate and Lectins in Soybean Meal by Processing

The objective of the project was to investigate various processing methods to determine which methods were potentially most effective in reducing or eliminating the antinutritional effects of phytate and lectins in soybean meal. Previous research indicated that the most promising procedure for reducing phytate was fermentation. Previous research also implied that the steps involved in processing soybeans into soybean meal normally caused lectins to be reduced below detrimental levels.

Soybean meal was fermented using *Aspergillus sojae* or *Aspergillus oryzae* mold and submerged fermentation procedures. *A. sojae* was utilized in one trial, and *A. oryzae* was utilized in two trials. For all trials, 0.33 lbs. of meal was steamed for one hour in a food steamer. Steamed meal was then placed into a baking dish or flask with varying numbers of mold spores. Meal was fermented for 48 hrs at 86° F, and then water was added to bring the contents of the container to 50% water and 50% meal. Meal was fermented for an additional 12 hours and then dried at 113° F for 20 hrs. For the second trial only with *A. oryzae*, meal was fermented for an additional 24 hrs after water was added, and drying occurred at 113° F for 30 hrs. For comparison purposes, two batches of ordinary soybean meal were analyzed. The strain of *A. sojae* utilized in this study appeared to be more effective at reducing phytic acid than the strain of *A. oryzae*. Swine and poultry producers and feed processors will benefit from the information generated by this study as they develop alternative feeding strategies designed to limit phosphorus loading in surface waters.

ISU Internal Program

Kerry W. Tudor – Agriculture

Illinois State University

Enhanced DDGS from the Elusieve Process: Foodstuff for Nonruminants

Separation of fiber from distiller's dried grains with solubles (DDGS) in a dry-grind plant increases protein and fat contents and reduces fiber content in the residual DDGS. Researchers have developed a process (the elusieve process) to separate fiber from DDGS. This process uses a combination of sieving (size classification) and elutriation (air classification) to separate fiber. The objective of this study is to produce enhanced DDGS using the elusieve process and conduct feeding studies with enhanced DDGS in poultry and swine diets.

Enhanced DDGS and fiber samples were produced from two commercial DDGS samples using the elusieve process. Original DDGS and enhanced DDGS were evaluated for true metabolizable energy and amino acid digestibility in adult rooster chickens. One enhanced DDGS fraction was found to contain markedly increased protein, amino acids, fat and phosphorus (protein level increased from approximately 30% to 40%), and reduced fiber content. The metabolizable energy content of enhanced DDGS was also increased substantially compared to original DDGS. Several other elusieve treatments produced intermediate increases in protein, amino acids, and metabolizable energy. Digestibility of amino acids in elusieve DDGS was as good as for original DDGS. Elusieve processing of DDGS increases the nutritional value of DDGS for poultry.

Pig studies confirmed that the enhanced DDGS from the elusieve process had 6-7% greater nutritional energy density than did the original DDGS. This was expected because of the removal of some of the fiber, which is poorly digestible. The increase in energy density was found in both digestible energy and metabolizable energy. The increased energy density is even more important now than a few years ago because of the current high prices of fats that are often used to increase energy density of the diet. Of the total digestible or metabolizable energy of the original DDGS, 94% was captured in the enhanced DDGS.

The greater energy density of enhanced DDGS will allow practical, cost-effective nonruminant diets to have higher energy concentration. Higher energy concentration will allow not only improved feed efficiency, but also, in many situations, increased growth rates. The end result in many cases is predicted to be increased profits.

External Competitive Grants Program

Vijay Singh, Kent D. Rausch - Agricultural and Biological Engineering

Carl M. Parsons, James E. Pettigrew - Animal Sciences

University of Illinois at Urbana-Champaign

On-Farm Evaluation of Alternatives to Antibiotics in Pig Production

Illinois pork producers will face tightening restrictions on the use of antibiotics in pig production. These restrictions may be imposed by either the government or the market, and they may reshape the swine industry, providing a competitive advantage to those producers who successfully adapt, and severely challenging the survival of those who do not.

There are a number of feed ingredients suggested to improve growth performance and/or health of pigs through physiological effects that go beyond simple provision of bioavailable nutrients. These ingredients may be considered "functional foods" for pigs. A few examples are fibrous feeds, egg products, milk products, spray-dried plasma, acidifiers, mannan oligosaccharide, and fructo-oligosaccharide. This research was conducted to critically evaluate the value of some of these alternatives in practical pig production conditions.

The most important finding from this research is that feeding a small amount of rice to pigs during the first week after weaning improves their health markedly. All three of the comparisons of cereals on a commercial farm adapted for research showed that total pig removals (pigs that died plus those removed to hospital pens) were cut approximately in half by feeding rice. This startling discovery may bring substantial benefits to the swine industry and to the health and welfare of pigs.

Researchers also found a modest improvement in feed efficiency from feeding a special hyperimmune egg product to newly weaned pigs on a commercial farm. The eggs were produced by hens immunized against phospholipase a, an enzyme involved in intestinal inflammation. It is not yet clear whether this technology will be of use to the industry. It was also found that feeding spray-dried conventional eggs improved health of young pigs, as indicated by a reduction in the number of medical treatments needed. Further evaluation is needed regarding this potential feed ingredient.

External Competitive Grants Program

James E. Pettigrew, Gilbert R. Hollis – Animal Sciences

University of Illinois at Urbana-Champaign

Gary A. Apgar – Animal Science, Food and Nutrition

Southern Illinois University Carbondale

The Physiological Impact of Co-mingling Pigs

Every day across the United States, thousands of pigs are relocated. The average time a group of pigs spends on the trailer might be as short as 15 minutes and as long as 20 hours. Regardless of the weight class of pigs, it is imperative that a maximum level of swine comfort and welfare be maintained. Both producers and packers have been motivated to minimize death loss, bruising, and the percentage of non-ambulatory pigs during transport. An area that has not previously been examined is how pigs interact on the trailer during transport. Are behavioral aspects, such as fighting to establish dominance of co-mingled pigs, interrupted during transport, and, if not, what impact does this have on the hauling experience?

Two different weight classes of pigs were used in the study. Pigs weighing between 40 and 60 pounds were classified as feeder pigs, and pigs weighing between 265 and 300 pounds were classified as market hogs. The trailer was divided into four compartments of equal size for the data collection. Within each of the four replications, there were two pens of control pigs (pigs that originated from the same pen) and two pens of test pigs (pigs that originated from different pens). Pigs were allocated to one of two designated travel times. The duration of travel time was either one hour or four hours. Each pig was individually weighed before and after transportation to determine the percentage of body weight loss. Additionally, each pig was subjectively scored on comfort level and skin abrasions during the weighing process before and after transportation.

Results indicate that time of transportation had minimal influence on the percentage of weight loss in market hogs. Pigs that were transported for one hour averaged 2.41% weight loss, whereas pigs transported for four hours averaged 2.93% weight loss. In contrast, feeder pigs that were transported for one hour averaged 5.37% weight loss, whereas pigs transported for four hours averaged 8.46%. These results indicate that the feeder pigs experienced more stress than market hogs during transportation and that duration of transportation had a significant impact on feeder pigs in terms of weight loss. There was not a significant difference between the control and test groups. Feeder pigs that were co-mingled did experience a greater increase in scores for comfort level and abrasions after transportation when compared to market hogs that were co-mingled with an average score increase of 1.23 and 1.85 versus .8 and 1.0, respectively.

WIU Internal Program

Mark D. Hoge – Agriculture

Western Illinois University

Foods

Clinical Testing of the Anti-diabetic Effects of High-Isoflavone Soy Protein

The overall objectives of this study were to determine the therapeutic potential of a high-isoflavone soy protein diet, and to determine the importance of the isoflavone-enriched fraction to the insulin-sensitizing effects of high-isoflavone soy protein in individuals with Type 2 diabetes who exhibit risk factors associated with the metabolic syndrome.

This study addressed the treatment of glucose intolerance, diabetes, and the metabolic syndrome. Successful completion of clinical studies will help determine whether soy bioactive compounds can ameliorate insulin resistance associated with Type 2 diabetes and the metabolic syndrome. These studies may also provide a sound scientific basis to evaluate the validity of soy or soy bioactive compounds as alternative medical therapies. For example, the addition of soy foods or a dietary supplement containing specific soy compounds could reduce insulin-resistance and decrease the incidence of Type 2 diabetes, of the metabolic syndrome, and of cardiovascular disease. Incorporation of soy into the diet could also reduce or prevent the need for costly prescription drugs and could potentially reduce drug-induced side effects (e.g., hepatic dysfunction or fluid retention, and congestive heart failure).
External Competitive Grants Program

William J. Banz – Animal Science, Food and Nutrition

Stuart R. Adler – Physiology

Southern Illinois University Carbondale

Romesh K. Khardori – Internal Medicine

Southern Illinois University School of Medicine

College Students' Perceptions, Concerns, and Knowledge of Obesity, Body Image, and Health

The objective of this study is to investigate how college student's body weights are affected by understanding and knowledge of obesity and the implications of such knowledge for health, perceptions of body image, and consumption of fast food and soft drinks as well as students' exercise behavior. Collaboration in this project allowed researchers to compare students from Illinois and California.

Written surveys were conducted with 304 undergraduate students at Illinois State University and 131 undergraduate students at California Polytechnic State University. Given the height and weight information, the Body Mass Index (BMI) was calculated. The majority of the respondents were seniors and juniors. The sample consisted of 53% female and 47% male students. Regarding ethnicity, 89% of the respondents were White/Caucasian, 5% were Black/African-American and 6% were of other ethnicities. Most students grew up in either a rural or suburban area. The majority of the respondents earn less than $500 per month. Students indicated that stress is the main reason for their weight fluctuation, followed by change in physical activity. Regarding leisure time activities, Cal Poly students exercise more and spend fewer hours playing video games and watching TV. In addition, Cal Poly students drink fewer soft drinks.

Most of the students indicated good or excellent nutrition knowledge. Regarding health behavior, the majority exercise at least once a week. However, 59% of the students rated the nutritional quality of their food consumption as poor or fair. Although most students claimed to have good nutrition knowledge, the quality of their nutritional intake did not reflect this awareness, as most of them self-rated intake as only poor or fair. Most students think that healthy food is expensive. Thus, in addition to other factors, such as convenience, taste, and lack of availability or variety, high food prices may prevent students from consuming healthier foods. Since the National College Health Risk Behavior Survey in 1995, there has been a 10% increase in the level of obese and overweight students. Regarding obesity knowledge, the majority of the students were aware that certain diseases and health conditions are affected by overweight and obesity.
ISU Internal Program

Aslihan D. Spaulding – Agriculture

Illinois State University

Christiane Schroeter – Agribusiness

California Polytechnic State University

High-Quality Protein Diets Decrease Insulin Resistance and Breast Cancers

Breast cancer is the second leading killer of women in the United States and is the most prevalent cancer affecting American women. These statistics make it imperative to identify risk factors that could inform strategies for limiting the development of breast cancer. Recently, there is growing interest to identify nutritional factors that modify risk and development of breast cancer. Epidemiological data suggest that there may be a preventive effect of protein consumption on breast cancer incidence, whereas other studies suggest that consumption

of animal protein may increase the relative risk of breast cancer. No previous study has evaluated direct effects of normal levels of dietary protein on breast cancer incidence in an experimental model.

Researchers developed a unique meal-feeding study that mimics human eating patterns to examine the effects of different levels of dietary protein and carbohydrate on tumor incidence, size, and progression, using a chemically-induced model of breast cancer. Protein and carbohydrate levels were selected to represent the normal range of dietary guidelines established in the acceptable macronutrient distribution range. A second objective was to examine the relation of insulin and glycemic regulation on the aforementioned parameters.

Investigators chemically induced breast cancer tumors in 7-week-old female rats and for 10 weeks fed them one of two experimental diets that differed in protein and carbohydrate amounts within normal, recommended dietary guidelines. Diets were isocaloric with the low-protein diet containing 60% carbohydrate and 15% protein, and the high-protein diet containing 40% carbohydrate and 35% protein. Body weight, food intake, and tumor appearance and growth were monitored throughout the study, and blood insulin, IGF-1, tumor size, and pathology were evaluated at the end of the study.

Data indicates that consuming a high-protein diet produced no differences in initiation or early progression of chemically-induced breast cancer tumors when compared to a low-protein diet. This is in spite of elevation of IGF-1 in the high-protein group, a factor reported to promote growth and tumor development capacity of breast carcinomas. Findings from this study fail to support any direct affect of normal levels of dietary protein or carbohydrates to accelerate or exacerbate the initiation and early progression of breast cancer tumors.

External Competitive Grants Program

Donald K. Layman – Food Science and Human Nutrition

University of Illinois at Urbana-Champaign

Use of Plasma for Destruction of Microbial Hazards in Food

From 2001 to 2003, recalls in the United States involved 74 million pounds of meat products due to concerns about contamination. Meat can harbor several types of bacterial pathogens if it becomes contaminated during slaughter and processing for market. The most common foodborne infections are caused by *Campylobacter, Salmonella,* and *Escherichia coli,* but other bacteria such as *Listeria Staphylococcus, Bacillus,* and *Mycobacteria* may also be transmitted through food consumption. Elimination of these organisms is necessary to ensure safe and high-quality food for consumers. Reduction in the number of food-spoilage microorganisms prior to packaging might also extend product shelf life. Current means of treatment include heat, chemicals, and radiation. However, these methods may alter food quality and flavor, lack acceptance by the public, or require costly facilities. The use of low-temperature (nonthermal) plasmas to destroy pathogens on meat surfaces is a promising alternative technology.

The objective of this research was to assess the effectiveness of a novel technology to treat meat using a nonthermal plasma to kill microbial pathogens on exposed surfaces of meat. Preliminary studies determined that a plasma generated with argon gas was better than helium gas for killing *Escherichia coli.* Cells from a pure culture of each microorganism were spread onto the surface of gelatin to simulate a contaminated meat surface. The surface was then exposed to a nonthermal argon plasma. After exposure for different periods of time (0-180 seconds), the gelatin was liquefied, and the number of surviving cells was enumerated using the standard plate count technique. Survivor curves in which the number of survivors versus exposure time were used to determine decimal reduction values (d-value; the time required to achieve a 90% reduction in cell number) in order to compare the killing efficiency among the tested microorganisms.

Escherichia coli and *Campylobacter* were most susceptible to the plasma treatment, with 90% of the cells being rendered as nonviable within 15 seconds of exposure. *Listeria* and nonsporulated *Bacillus* cells had d-values of less than 60 seconds. The d-value for *Salmonella* was less than 90 seconds. As expected, *Bacillus* spores were resistant. *Staphylococcus* was also resistant, but addition of a small amount of nitrogen gas to the argon produced a d-value similar to that of *Salmonella*. Exposure of beef and pork surfaces to plasma did not significantly reduce the number of potential meat-spoilage organisms, however.

The results of this study show that the most common bacterial pathogens that cause foodborne illness can be destroyed with brief exposure to a nonthermal plasma. Development of the technology could help to reduce the incidence of disease and product recalls and may lower production costs in a way that is acceptable to the producer, food processor as well as the consumer.

External Competitive Grants Program

John D. Haddock – Microbiology

Allan Higginbotham – Animal Science, Food and Nutrition

Glafkos D. Galanos – Electrical Engineering

Southern Illinois University Carbondale

Ongoing Research Projects

The following projects were ongoing in FY08. Those projects having received a no-cost extension are marked with an asterisk (*). Requests for no-cost extensions are granted when unforeseen circumstances arise in completing the research. All initiatives receiving FY08 funding were granted a one-year extension due to funding being realized late in the fiscal year.

Research Focus: Expanding Agricultural Markets

Alternative Crops Development
Winthrop B. Phippen, WIU

The purpose of this initiative is the establishment of an alternative crops breeding and production program, initially aimed at introducing alternative crops, such as cuphea and milkweed, to the Midwest region.

Effect of Distiller's Grains on Fatty Acid Composition and Meat Quality in Steers*
Rebecca L. Atkinson, SIUC

Feedlot steers are being fed increasing levels of distiller's grains to determine the optimal level of inclusion that will enhance unsaturated fatty acid incorporation into meat without negatively effecting meat quality or increasing prevalence of *E. coli* and *Salmonella*.

Engineering Yeast Strains to Enhance Bioethanol Production Efficiency*
Ahmad M. Fakhoury, SIUC

Due to increased demands for ethanol as a biofuel, there is need to enhance the process by which ethanol is fermented from corn starch. Successful fermentation requires strains of *Saccharomyces cerevisiae* that can tolerate, among other conditions, increasing ethanol concentrations and decreasing pH. Although existing strains of this yeast may be adequate for current needs, there is great need to develop improved strains that will generate ethanol more effectively. Specific goals of this project are to generate yeast mutants tolerant to high concentrations of ethanol and low pH and to partially characterize mutations in generated *S. cerevisiae strains*.

Enhancing the Nutritional Value of Milk and Milk Products by Boosting their Omega-3 Fatty Acids Content*
Amer A. AbuGhazaleh, SIUC

The primary objective of this project is to establish procedures for the on-farm production of omega-3 enriched milk and milk products. The production of omega-3 enriched milk, cheese, and ice cream will be accomplished through supplementing grazing cows with dietary algae, fish oil, and linseed oil. Consumer acceptability of milk, cheese, and ice cream enriched with omega-3 will also be evaluated.

Establishing an Illinois Soy Foods Center for Research and Education*
Barbara P. Klein and Keith R. Cadwallader, UIUC

This initiative focuses on developing and testing healthy new foods made from soybean. The Illinois Center for Soy Foods also works on marketing and technology transfer. The goal is to greatly increase human consumption of soy.

Evaluating Crude Glycerol, a Biodiesel Byproduct, as a Feed Supplement for Dairy Cows*
Amer A. AbuGhazaleh, SIUC

This study evaluates the potential of crude glycerol as a feed supplement in diets of dairy cows. The long-term goal is to develop a new market for crude glycerol through the animal feed industry.

Evaluation and Scale-up Research Capability for Ethanol Research
Vijay Singh, UIUC
Investigators will set up and test a pilot-scale (300 liters) dry-grind fermentation capacity plant, determine engineering and fermentation data for the E-mill process at the pilot plant scale, and produce material for feeding studies and for recovery of zein and other bioproducts.

Examination of Ethanol, Marketing, Input Procurement Practices, and Technological Flexibility of U.S. Ethanol Producers*
Aslihan D. Spaulding, ISU

This study examines (1) the current marketing and procurement practices of ethanol production plants; (2) ethanol producers' flexibility and readiness for new technologies; (3) the differences and similarities between small versus large production plants; and (4) the differences and similarities between farmer cooperatives and private investors.

Fractionation of Thin Stillage from Dry-Grind Processes to Determine Water Recycling Rates and Heat Transfer Properties
Kent D. Rausch, UIUC

Determine membrane filtration and heat transfer fouling characteristics of the thin stillage process stream in an effort to identify opportunities for increasing value of this stream while increasing water recycle and reducing energy requirements during production of ethanol.

Identity-Preserved Grain: Will There Be a Market? A Survey of Illinois Grain Elevator Managers*
Rick C. Whitacre, ISU

The purpose of this study is to determine grain elevator manager's perception of the future of the identity preserved grain market in Illinois.

Impact of Vermicompost on the Establishment and Production Practices of *Maclura pomifera* for Utilization in Bioproduct Development*
Gary R. Bachman, ISU

Best management practices are being developed for field establishment and cultivation of *Maclura pomifera* as a managed crop for use in the production of bioproducts.

New and Alternative Crops for a Biobased Economy*
Winthrop B. Phippen, WIU

This research evaluates the potential of selected new crops as biobased fuel sources. Crops to be evaluated include *Brassica* species, cuphea, okra, and milkweed.

Optimizing Food and Fuel Production
Larry L. Berger, UIUC

The effects of plant maturity and chemical treatment on the nutritional value of corn stalklage fed with distiller's grains to growing cattle will be determined. Investigators will determine the energy feasibility and process economics for both drying and freezing alternatives in corn preservation. The quality of the fermentations resulting from these two alternatives will be quantified.

Pork: A Potential Omega-3 Food Source in the American Diet
Amer A. AbuGhazaleh, SIUC

The purpose of this project is to enhance the nutritional value and quality of Illinois pork by boosting the concentration of omega-3 fatty acids. The long-term objective of this project is to enable Illinois hog farmers to enter the fastest-growing and -expanding sector of the agricultural market in the United States today (the healthy food market) by engaging them in alternative hog production systems through which value-added products are produced.

Thermochemical Conversion (TCC) of Biomass for Renewable BioEnergy
Yuanhui Zhang, UIUC

Investigators will establish an integrated, hydrothermal, and biological-based thermochemical conversion technology and process for renewable bioenergy production using agricultural waste. A variety of biomass will be converted to fuel, fuel additives, and value-added chemicals.

Research Focus: Rural Economic Development

Characterizing Virus-Nematode Complexes that Limit Vineyard Sustainability

Bradley H. Taylor, SIUC

Locally grown grapes drive winery production and marketing opportunities. Emergence of chronic debilitating diseases threatens these opportunities. This project will define incidence of virus-nematode complexes in Illinois vineyards, relate it to associated management practices, and develop strategies to preserve the $34 million overall potential impact to our rural economies.

Development of Enterprise Profit Models for the Illinois Livestock Industry

Michael F. Hutjens, UIUC

This project is designed to identify financially profitable opportunities for Illinois producers interested in livestock as a main or alternative enterprise. The objective of this research is to ultimately develop strategic profit models for the swine, dairy, and beef industries.

Engineering-Economic System Models for Rural Ethanol Production Facilities*

Luis F. Rodríguez, UIUC

The emergence of the ethanol industry has boosted the rural economy, although small plants are under competitive pressure. Researchers are building an integrated systems model of the industry to evaluate the sustainability of cooperative dry-grind facilities.

Multifunctionality (Postproductivism) of Agriculture: Measuring Nonmarket Value of U.S. Agriculture

Wanki Moon, SIUC

This research will address a set of interrelated topics under the concept of multifunctional agriculture including: (1) quantifying the monetary value that society places on nonmarket goods and services of agriculture; (2) redesigning domestic farm and trade policies and programs compatible with World Trade Organization (WTO) rules that recognize the multifunctional role of agriculture; (3) analyzing the role of multifunctionality in WTO trade liberalization talks; and (4) developing a rural development research agenda compatible with the concept of multifunctionality

Organization, Financial Feasibility, and Rural Economic Impacts of Bioenergy in Illinois

Ira J. Altman, SIUC

This research focuses on the organization, financial feasibility and rural economic impacts of a biopower facility in Southern Illinois. A biomass producer survey and linear programming tool will be designed and implemented to collect information for the analysis.

Public Beliefs and Attitudes Concerning Wind Farms in Central Illinois*

J. Randy Winter, ISU

Investigators are assessing the beliefs and attitudes of the general public on the development of wind farms in Central Illinois. Results will assist wind energy developers to address the appropriate concerns of the general public and could potentially lead to a better relationship between the companies and the communities in which they operate.

YouthWorks: Youth Leading Rural Communities' Economic Revitalization

Laurie F. Kramer, UIUC

This research builds on current USDA-NRI funded research to promote the further development, evaluation, and dissemination of YouthWorks, a system of interrelated interventions designed for increasing the number of competent young adults in the Illinois agricultural and entrepreneurial systems, and for enhancing local youths' commitment and future contributions to their community.

Research Focus: Agricultural Production Systems

A Comparative Analysis of the Average Daily Gain and Feed Efficiency of Sheep and Goats*

Mark D. Hoge, WIU

This research is providing guidance to producers so they may compare genetics and make directed breeding decisions for their enterprise.

A New Approach in Deciphering the Interaction Between SDS and SCN

Jason P. Bond, SIUC

This project will elucidate some aspects of the complex interaction between soybean sudden death syndrome (SDS) and soybean cyst nematode (SCN), which will aid development of cultivars with durable resistance to both problems. Immediate objectives will use new tools to investigate the role of SCN in soybean root penetration by the SDS fungus.

A Novel Method for Disease Control in Livestock: Distillers Dried Grains with Solubles and Other Fibrous Feeds

James E. Pettigrew, UIUC

Investigators will evaluate the impact of dietary distiller's dried grains with solubles on young pigs experimentally infected with *Escherichia coli* and on young chicks challenged with the coccidial species *Eimeria acervulina*.

Can an Herb Restore Performance in Fescue-Fed Cattle?*

Karen L. Jones, SIUC

Fescue toxicosis, which induces deleterious effects in grazing livestock species, can be ameliorated by using the drug Domperidone. Although this approach requires FDA clearance, use of the herb *Cnicus benedictus*, may not. This herb may have properties necessary to combat fescue toxicosis. This project is providing initial evaluations of efficacy by *C. benedictus* to reverse toxicosis symptoms.

Consumer Attitudes and Expectations Toward Farm Animal Welfare*

Aaron S. Moore, ISU

This study focuses on developing and testing the use of survey instruments and interview techniques to ascertain how consumers conceptualize farm animal welfare and identify consumer expectations for welfare-friendly livestock production.

Development and Evaluation of a Value-Added Feedstuff Using Distiller's Grains*

Paul M. Walker, ISU

This study uses extrusion technology to combine wet distiller's grains with either whole soybeans or soybean meal to develop a value-added feed for swine and cattle. It includes digestibility trials and feeding trials with both swine and cattle.

Development and Evaluation of High-Efficiency, Flexible Intelligent Farming Tools: Phase I - Autonomous Weed Control

Tony E. Grift, UIUC

This project seeks to develop robotic hardware, networking capabilities, and software algorithms necessary for optimal weed management within a variety of conventional and alternative cropping systems.

Effect of Distiller's Grains on Beef Cow Dystocia and Conception

Rebecca L. Atkinson, SIUC

Increasing levels of distiller's grains will be fed to winter-calving cattle to determine the optimum inclusion level of distiller's grains that can be fed without negatively effecting reproduction.

Effect of Variability in Gestation Stall Micro-Environment on Sow Well-Being, Physiology, and Productivity
Robert V. Knox, UIUC

A research facility will be created with capability for advanced control and measurement systems using sensors that will simulate microenvironment variations in light intensity and thermal zones similar to those found in commercial swine gestation buildings. Physiology, behavior, and reproductive efficiency of the sow will be assessed in this environment.

Estimation of Soybean Cyst Nematode Genome Diversity: A Prelude to Association Mapping
Kris N. Lambert, UIUC

Investigators will perform population genetic analysis of the soybean cyst nematode genome and develop a soybean cyst nematode biodiversity collection.

Identification of Pathogen-specific Apple Genes through Transcriptome Analysis during Interaction with the Fire Blight Pathogen *Erwinia amylovora*
Youfu "Frank" Zhao, UIUC

Investigators will (1) characterize the resistance response of apple to fire blight disease in terms of global gene expression and thereby identify new opportunities for improving fire blight resistance in apple; and (2) develop biotechnology strategies such as RNAi to control this major disease of apples and pears by knocking out the expression of genes associated with pathogenicity.

Impact of Distiller Grain and Genetics on Beef Quality
Larry L. Berger, UIUC

Increasing supplies of distiller's grains will replace corn in feedlot diets. The objective of this research is to determine the effect of distiller's grains level and form on beef quality grade and consumer acceptance.

Impact of Fermented Soybeans on Phosphorous Absorption in Weaned Pigs*
Kerry W. Tudor, ISU

In this study, two nursery pig diets are fed to weaned pigs in a replicated experiment. The control diet will contain standard soybean meal, and the other will contain fermented soybean meal.

Improving Soybean Yield and Seed N Content by a Novel Inoculation Strategy
Brian P. Klubek, SIUC

Inoculation of soybean with superior nitrogen-fixing *Bradyrhizobium japonicum* strains generally is not recommended unless fields have been idle for at least five years. Successful inoculation will require a novel approach that favors nodule formation by these superior strains of *B. japonicum*. This research will evaluate potential to enhance this targeted root colonization by reducing nodulation by native bradyrhizobia through use of antibiotic-producing Streptomycetes, enhancing infection and nodulation of developing soybean roots by plant growth promoting rhizobacteria (PGPR), and employing novel carriers to insure viability of the applied inocula and provide a physical barrier to the native microflora.

Initiative for Low-Input Apple Production in Illinois*
Schuyler S. Korban, UIUC

The overall goal of this initiative is to develop a low-input production system for the Illinois apple industry that minimizes pesticide use, coupled with economic and marketing strategies for increasing profit and diversifying income.

Integrated Genomic Biology in Beef Cattle
Dan B. Faulkner, UIUC

Investigators will obtain estimates of genetic parameters for all traits measured, including the unique measurement of individual feed intake, feed efficiency, residual feed efficiency, and tenderness. The relationship between heterosis and breed composition will be studied. Genetic x environment interactions will be assessed, and an evaluation of residual feed efficiency on subsequent performance of heifer calves will be conducted.

Micropropagation Techniques for Wintergreen (*Gaultheria Procumbens*)*
Marietta M. Loehrlein, WIU

This research is examining the ability to grow and propagate wintergreen using micropropagation techniques.

Multidisciplinary Research and Discovery Program to Convert Renewable Plant/Crop Biomass into Renewable Fuels and Chemicals*
Hans P. Blaschek, UIUC

A diverse, multidisciplinary group of scientists are working together to integrate and focus research on overcoming problems related to the conversion of biomass to renewable fuels and chemicals.

Nitrogen Rates for Grazing Corn*
Kenneth O. Nimrick, WIU

This project examines nitrogen fertilizer rates for corn destined for grazing in the green leaf stages.

Pioneering Bionanosensing Systems for Use as a Decision Support Tool for Soybean Disease Management*
Linda S. Kull, UIUC

A decision support tool will be developed to assist soybean producers to define if and when to apply fungicides for management of soybean rust.

Soybean Health: Rust Gene Discovery Initiative
Schuyler S. Korban, UIUC

A search for candidate genes associated with soybean rust resistance will be undertaken. High-throughput screening of these candidate genes will be accomplished. The functionality of these genes and their role in rust resistance in soybean plants will be confirmed by developing knock-out mutants using RNAI technology.

The Sentinel Crop Gene Identification Project*
Lila O. Vodkin, UIUC

The goals of this project are to develop, test, and implement new approaches to determine the biological functions for corn and soybean crop-specific genes (CSGs). These approaches are integrating the use of bioinformatics, molecular biology, and genetics to add functional information to genomes and evaluate the potential of CSGs in crop improvement.

Toward Reducing Soybean Yield Losses Caused by Ozone
Brian W. Diers, UIUC

Physiological and molecular tools will be used to identify the most ozone-tolerant soybean germplasm. Tools will be tested by evaluating diverse accessions from the USDA Soybean Germplasm Collection.

Towards a System Biology Approach to Networks for Metabolic Engineering and Crop Improvement of Soybeans
Gustavo Caetano-Anolles, UIUC

Investigators will (1) develop a novel phylogenomic strategy that will delineate proteomes as evolutionary mosaics of protein domains and trace these functional units in metabolic networks; (2) dissect enzyme recruitment in metabolic networks; (3) identify transcriptional factors and metabolic enzymes controlling oil content and fatty acid composition based on bioinformatic, transcriptomic, and metabolomic analysis; and (4) link transcript and metabolic networks, and determine functions of individual genes involved in soybean oil production.

Research Focus: Human Nutrition and Food Safety

Adipotoxicity Biomarker Discovery Using a Canine Diet-Induced Obesity Model*

Kelly S. Swanson, UIUC

Investigators are identifying changes in adipose and blood mononuclear cell gene expression profiles as weight gain and adipotoxicity develop in a canine diet-induced obesity model. Key gene-metabolite relationships associated with weight gain and adipotoxicity will be identified by correlating mRNA abundance with physiological end-points such as adipose histological outcomes and blood metabolites.

Defining Protein Needs and Carbohydrate Tolerance for Adult Health

Manabu T. Nakamura, UIUC

Project goals are to determine (1) whether the amino acid leucine is the regulatory signal for muscle protein synthesis and a marker for adult protein requirements, (2) whether consistent macronutrient ratios across meals will optimize skeletal muscle protein synthesis and stabilize glycemic regulation, and (3) the relative impact of increased dietary protein versus moderation of dietary carbohydrate quantity and quality on improving glucose homeostasis.

Feeding the Human Gut Microbiota with Health-enhancing Carbohydrates

David C. Hernot, UIUC

Investigators will (1) evaluate the nutritional profile, fermentation profile, and prebiotic potential of various whole grains and whole grain components and determine the effects of processing on these outcomes; (2) determine the prebiotic potential and gas production capacity of oligosaccharide substrates and their blends; and (3) evaluate novel carbohydrates currently used in food systems as thickeners, stabilizers, and viscosity-enhancing agents for their potential to enhance large bowel health.

Folate Produced in the Large Intestine by Probiotics Can Mediate Colorectal Cancer Development via Epigenetic Mechanisms

Michael J. Miller, UIUC

This research seeks to determine whether folate produced by probiotic bifidobacteria in the large intestine of humans can prevent the development of colorectal cancer.

Novel Cardiovascular Benefits of a Diet Enriched in Both Soy Oil and Soy Isoflavones

William J. Banz, SIUC

Cardiovascular disease remains the top killer in the United States. Because soy oil is enriched in unsaturated fatty acids but low in isoflavone, researchers want to investigate novel cardiovascular health benefit of a combination of soy oil and soy isoflavone in a diet.

The STRONG Kids Project: Cross-disciplinary Investigation of Media Effects on Childhood Obesity and Health within Family and Community Contexts

Kristen Harrison, UIUC

Investigators will (1) survey the status of food marketing to children and families by gauging child and parent media exposure and by mapping the neighborhood retail food store environment; (2) assess the relationship between children's media exposure and their nutritional knowledge and reasoning; (3) study parent-child relationships and conversation styles as mediators and moderators of the relations among family practices, media exposure, and children's health behaviors and cognitions; and (4) test the links among family media literacy, health literacy, and childhood obesity, weight control, and body image among low-income and other families.

Tomatoes and Broccoli for the Reduction of Prostate Cancer in Illinois African-American Men

John W. Erdman, UIUC

This project focuses on (1) increasing prostate cancer awareness among African-American men through enhanced screening; (2) developing research-based recommendations for consumption of vegetables and vegetable combinations optimized for prostate cancer prevention; (3) developing research-based continuing education for health professionals in Illinois; and (4) increasing availability of these vegetable foods among African-American men in Illinois.

Research Focus: Natural Resources and Environment

A Watershed-Scale Assessment of the Water Quality Impacts of Riparian Buffers in Southern Illinois

Jon E. Schoonover, SIUC

Riparian ecotones are critically important transition areas along stream margins, where they provide the last opportunity for the effects of nutrients, sediments, and chemicals to be weakened before being transported to streams. These riparian buffers can be increasingly useful in Southern Illinois, where agricultural fields commonly are not tile drained. This project will assess riparian zone vegetation for its sediment, nutrient, and fecal coliform attenuation performance at the watershed scale in Southern Illinois agricultural watersheds.

Costs and Environmental Benefits of Conservation Tillage in the Lower Illinois Basin*

Jeffrey R. Beaulieu, SIUC

Study objectives are (1) to develop and statistically estimate an econometric model for evaluating responsiveness of conservation tillage adoption to economic factors, and (2) to use this model to assess economic, tillage intensity, and environmental consequences of changes in economic factors for the Lower Illinois Basin.

Environmental Effects of Swine Manure Application to Non-corn Crops*

Kenneth D. Smiciklas, ISU

This project evaluates the separated fractions of liquid swine manure (separated effluent and composted solids) to safely utilize animal manure while ensuring minimal disruption to the soil environment. It is hoped that the liquid effluent can be applied to soils without a corresponding large buildup in soil nutrient levels for phosphorous values.

Establishing Groundcover Management Systems for Sustainable Vineyards*

Bradley H. Taylor, SIUC

The goal of this research is to develop sustainable alternatives for vineyard floor management at a critical stage of the industry's development. Ground cover management systems that reduce herbicide usage and soil erosion, increase water infiltration and retention, and improve vine vigor and plant water use efficiency, as well as suppress nematodes and weeds, will be tested under the range of soil conditions found in the state. Researchers are determining the effect of alternative vineyard floor management systems using noncompetitive plant species in established, mature vineyards. The most successful treatments will be demonstrated to growers through publications, presentations, and field days.

Evaluation of Land Application Systems for Swine Manure to Reduce NPS Pollution

Paul M. Walker, ISU

This research evaluates surface and subsurface irrigation of separated effluent compared to injection of unprocessed slurry on nonpoint source pollution.

Exploring the Economic and Environmental Possibilities of Giant Cane as a Best Management Practice

Jon E. Schoonover, SIUC

This project will create a fully functional and experimental giant cane nursery at SIUC, which will facilitate further refinement of planting methods, fertilization treatments, and soil amendments for this species. Specific objectives include (1) establishing and maintaining sustainable sources of giant cane for Illinois restoration projects; (2) exploring genotypic variation among giant cane sources to match varieties to planting sites; and (3) establishing a long-term riparian buffer research/demonstration site at SIUC.

Forage Radish: An Alternative Cover Crop for Organic Farms in Illinois*

Joel Gruver, WIU

This project is evaluating opportunities to enhance soil and water quality on organic farms by integrating forage radish within diversified cash grain production systems.

Implementation of No-Tillage Production Practices for Jack-o-lantern Pumpkins*

S. Alan Walters, SIUC

The major limitation for implementing no-tillage practices in vegetable production is weed management. Improved weed management practices must be developed before no-tillage systems will be readily adopted. Implementing no-tillage vegetable production practices would be of tremendous benefit, not only to Illinois vegetable growers, but also to the future of Illinois agriculture through soil conservation.

Integrated Management of Summer Diseases of Apples*

Mohammad Babadoost, UIUC

This project is evaluating the effectiveness of two disease-warning systems, an organic fungicide, and a reduced-risk fungicide on controlling apple diseases. It also will compare economics of the new IPM strategies with conventional practices.

Thermochemical Conversion Process to Produce Oil from Various Types of Livestock Manure

Yuanhui Zhang, UIUC

The research group has developed a thermochemical conversion process (TCC) and successfully converted up to 70% of fresh swine manure into oil. Researchers will investigate the feasibility of converting other types of livestock manure into oil using this TCC process.

Fiscal Year 2009

Based on the FY09 C-FAR appropriation level, the vast majority of available funding is being directed to support ongoing research initiatives (projects begun in FY08 or earlier). The following is an overview of FY09 C-FAR research programs.

EXTERNAL COMPETITIVE GRANTS PROGRAM

The following new projects were selected for funding through the FY09 External Competitive Grants Program.

A Novel Method for Early Detection of Foreign Substances in Milk
Amer A. AbuGhazaleh, SIUC

Dairy production is considered a vulnerable industry from a security standpoint. A single load of undetected contaminated milk from one dairy farm could rapidly and broadly taint large milk supplies as it is combined with milk from other farms at the processing plant. Current milk contamination detection techniques can take anywhere from two days to two weeks, and they require sophisticated equipment. This research will examine the effectiveness of using lactic acid bacteria as an effective, reliable, simple, and rapid tool to identify adulterated milk. Efforts will also be made to develop a color-based kit to detect contaminated milk.

Can Tropical Maize Sweeten Ethanol Production?
Fred E. Below, UIUC

The increasing demand for biofuels has created a market for new feedstocks for the ethanol industry. Tropical maize sets itself apart from other crops being grown for biofuels by accumulating large amounts of sucrose in its stalk, which can easily be fermented into alcohol or used as high-energy forage. This project will evaluate tropical maize's biological potential for sugar production, its value as a feedstock for making biofuels, and its value as a forage for ruminant animals.

Comparison and Evaluation of Sow Housing Options During Gestation
Janeen L. Salak-Johnson, UIUC

The swine industry faces substantial challenges in efforts to enhance profitability and sustainability while improving sow performance, health, and well-being. There is mounting concern among pork producers and consumers regarding the impact of current housing systems on the welfare of the gestating sow. The goal of this research is to design, optimize, and implement alternative housing and management systems that will enhance sow well-being while sustaining productivity and profitability of swine production in Illinois.

Comprehensive Legal Guide for Illinois Direct Farm Businesses
A. Bryan Endres, UIUC

Less than 0.2% of Illinois agricultural products are sold directly to Illinois consumers, and 95% of organic food sold in Illinois is grown and processed outside the state. This results in an export of food dollars from Illinois to the detriment of all communities. Currently, significant barriers exist to information gathering and understanding of the legalities associated with direct farm enterprises. This research will identify and analyze legal impediments and create a guide with an accompanying website to assist Illinois farmers in navigating the legal environment for direct farm businesses.

Creating Strategies for an Entrepreneurial Culture in Rural Illinois Communities
Christopher D. Merrett, WIU

A paradox in rural Illinois communities is a desire for economic development, and at the same time, a tendency to resist specific development opportunities. Strategies will be identified to help communities create and support businesses while creating community wealth and community acceptance of these enterprises.

Enhancing Soybean Plant Resistance to Soybean Rust via Genetic Engineering
Vera V. Lozovaya, UIUC

Asian soybean rust, first reported in the United States in 2004, has become a significant potential threat to the nation's soybean production. Caused by an airborne fungal pathogen, the disease can be very severe and can result in yield losses of 40 – 80%. In this research, critical targets for genetic engineers and breeders aimed at rust resistance will be identified by correlating rust disease development with metabolic changes in leaves of inoculated plants of different genotypes including genetically engineered lines.

Identifying Trends in Soil Profile Nutrient Resources in Illinois
Harold F. Reetz, International Plant Nutrition Institute and Foundation for Agronomic Research

Although agronomic recommendations in Illinois help to maintain soil test levels in the top six inches of soil, questions have developed regarding the subsoil fertility levels and how those deeper fertility levels are maintained. This project will compare soil tests of archived samples from research farms and soil survey work to contemporary soil tests from the same locations. The comparison will help determine the effect management practices have on soil fertility resources at one or more depths in the soil profile.

INTERNAL COMPETITIVE GRANTS PROGRAM

The internal competitive grant programs at the University of Illinois at Urbana-Champaign, Southern Illinois University Carbondale, Illinois State University, and Western Illinois University funded ongoing research in FY09. Illinois State University, with no ongoing research commitments, is expected to fund a limited number of new initiatives.

STRATEGIC RESEARCH INITIATIVE PROGRAM

New initiatives were unable to be sought through the Strategic Research Initiative Program in FY09 due to the appropriation level.

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 and related support programs. The following pages detail all FY08 expenditures and FY09 allocations. A summary precedes the individual expenditure and allocation reports.

Summary of FY08 Expenditures and Obligations

External Competitive Grants Program [a]		$1,417,486
Research Expenditures	497,633	
Research Obligations	918,094	
Scientific Reviewer Expenditures	0	
Scientific Reviewers Obligations	1,759	
University Internal Programs and Other Programs/Accounts [a]		6,026,771
Research Expenditures	3,114,037	
Research Obligations	2,912,734	
Strategic Research Initiatives Program [a]		542,236
Research Expenditures	311,625	
Research Obligations	230,611	
Scientific Reviewers Expenditures	0	
Scientific Reviewers Obligations	0	
Illinois Department of Agriculture Fee		22,500
1% Member Expense Account		29,615
Total Expenditures and Obligated Funds		*$8,038,608* [b]
Research Expenditures	3,923,295	
Research Obligations	4,061,439	
External Scientific Reviewers	0	
External Scientific Reviewers Obligations	1,759	
SRI Scientific Reviewer Expenditures	0	
SRI Scientific Reviewer Obligations	0	
IDOA Fee & 1% Member Expense	52,115	

[a] *Individual and detailed expenditure reports for these programs follow and are an integral component of this report.*

[b] *FY08 research expenditures and FY09 obligations are higher than the FY08 appropriation as a portion of funds from the previous fiscal year(s) were obligated for investment in the subsequent year(s) (i.e., multiple-year research initiatives).*

Summary of FY09 Appropriation Allocations

External Competitive Grants Program	$392,374 [c]
(15% of the total appropriation, after IDOA fee and Member Expense)	
University Internal Programs and Other Programs/Accounts	1,904,744
Strategic Research Initiative Program	0
Illinois Department of Agriculture Fee	11,375
($50,000, or ½ of 1% of the total appropriation, whichever is less)	
1% Member Expense Account	22,750
(1% of the total appropriation)	
Total FY09 Allocations	*$2,331,243* [d]

[c] *External Competitive Grants Program funding comprised of: (1) 15% of FY09 appropriation minus fees; (2) $39,099 of unexpended/returned SRI and External Program funds; (3) $15,385 of unexpended funds from the FY08 1% Member Expense account; (4) $1,759 of unexpended funds from the External Program Reviewer account.*

[d] *Due to the addition of unexpended funds from a previous fiscal year, FY09 allocations are slightly greater than the appropriation of $2,275,000.*

Please see additional notes on individual summary reports.

Pursuant to State of Illinois Appropriations - Section 15 of the Food and Agriculture Research Act (Public Act 89-182)

FY08 Expenditure Summary: External Competitive Grants Program

(July 1, 2007 – June 30, 2008)

Actual Fiscal Year Expenditures						
C-FAR RESEARCH FOCUS AREAS	**EXPENDITURE**	**UIUC**	**SIUC**	**ISU**	**WIU**	**TOTALS**
Expanding Agricultural Markets	Equipment	0	395	0	N/A	**395**
	Materials/Supplies	14,014	552	1,479	N/A	**16,045**
	Personnel	48,210	12,130	9,500	N/A	**69,840**
	Services/Contracts	8,232	2,391	6,054	N/A	**16,677**
	Transportation	799	2,047	120	N/A	**2,966**
Rural Economic Development	Equipment	2,946	0	N/A	N/A	**2,946**
	Materials/Supplies	1,007	2,899	N/A	N/A	**3,906**
	Personnel	40,323	74,895	N/A	N/A	**115,218**
	Services/Contracts	6,330	5,614	N/A	N/A	**11,944**
	Transportation	2,319	6,704	N/A	N/A	**9,023**
Agricultural Production Systems	Equipment	2,203	N/A	N/A	N/A	**2,203**
	Materials/Supplies	1,115	N/A	N/A	N/A	**1,115**
	Personnel	57,729	N/A	N/A	N/A	**57,729**
	Services/Contracts	4,995	N/A	N/A	N/A	**4,995**
	Transportation	4,421	N/A	N/A	N/A	**4,421**
Human Nutrition and Food Safety	Equipment	0	21,732	N/A	N/A	**21,732**
	Materials/Supplies	7,649	8,769	N/A	N/A	**16,418**
	Personnel	13,750	63,273	N/A	N/A	**77,023**
	Services/Contracts	814	15,104	N/A	N/A	**15,918**
	Transportation	138	837	N/A	N/A	**975**
Natural Resources and Environment	Equipment	0	N/A	N/A	N/A	**0**
	Materials/Supplies	80	N/A	N/A	N/A	**80**
	Personnel	44,127	N/A	N/A	N/A	**44,127**
	Services/Contracts	1,937	N/A	N/A	N/A	**1,937**
	Transportation	0	N/A	N/A	N/A	**0**
Subtotals		**263,138**	**217,342**	**17,153**	N/A	**497,633**
Scientific Reviewers		N/A	N/A	N/A	N/A	**0**
Indirect Costs [1]		0	18,824	1,177	N/A	**20,001**
Unexpended/Obligated Funds for FY09 Research		417,929	454,583	45,582	N/A	**918,094**
Total FY08 Expenditures and Obligated Funds for FY09		**$681,067**	**$690,749**	**$63,912**	**N/A**	**$1,435,728**

[1] Indirect costs are assessed on appropriations prior to FY08.

FY08 Expenditure Summary: Strategic Research Initiative Program

(July 1, 2007 – June 30, 2008)

Actual Fiscal Year Expenditures							
STRATEGIC RESEARCH INITIATIVES (SRI)	**EXPENDITURE**	**UIUC**	**SIUC**	**ISU**	**WIU**	**OTHER ENTITIES [1]**	**TOTALS**
Swine Odor and Waste Management	Equipment	0	N/A	N/A	N/A	N/A	**0**
	Materials/Supplies	271	N/A	N/A	N/A	N/A	**271**
	Personnel	0	N/A	N/A	N/A	N/A	**0**
	Services/Contracts	0	N/A	N/A	N/A	N/A	**0**
	Transportation	274	N/A	N/A	N/A	N/A	**274**
	Coordination	0	N/A	N/A	N/A	N/A	**0**
Biomass Energy Crops for Power and Heat Generation in Illinois	Equipment	2,286	N/A	N/A	N/A	N/A	**2,286**
	Materials/Supplies	11,808	N/A	N/A	N/A	N/A	**11,808**
	Personnel	157,442	N/A	N/A	N/A	N/A	**157,442**
	Services/Contracts	40,335	N/A	N/A	N/A	N/A	**40,335**
	Transportation	10,478	N/A	N/A	N/A	N/A	**10,478**
	Coordination	N/A	N/A	N/A	N/A	N/A	**0**
Illinois Livestock Integrated Focus Teams	Equipment	0	N/A	N/A	N/A	N/A	**0**
	Materials/Supplies	1,324	N/A	N/A	N/A	N/A	**1,324**
	Personnel	30,862	N/A	N/A	N/A	N/A	**30,862**
	Services/Contracts	6,987	N/A	N/A	N/A	N/A	**6,987**
	Transportation	1,661	N/A	N/A	N/A	N/A	**1,661**
	Coordination	N/A	N/A	N/A	N/A	N/A	**0**
Water Quality with a Focus on Nutrient Standards	Equipment	0	N/A	(100)	N/A	0	**(100)**
	Materials/Supplies	300	N/A	2,011	N/A	316	**2,627**
	Personnel	399	N/A	2,200	N/A	170	**2,769**
	Services/Contracts	10,476	N/A	128	N/A	0	**10,604**
	Transportation	967	N/A	1,740	N/A	299	**3,006**
	Coordination	28,912	N/A	N/A	N/A	N/A	**28,912**
Subtotals		304,782	N/A	5,979	N/A	785	**311,546**
Indirect Cost [2]		0	N/A	0	N/A	79	**79**
Unexpended/Obligated Funds for FY09 Research		230,611	N/A	0	N/A	0	**230,611**
Total FY08 Expenditures and Obligated Funds for FY09		**$535,393**	**N/A**	**$5,979**	**N/A**	**$864**	**$542,236**

[1] Other entity is Indiana University.

[2] Indirect costs are assessed on appropriations prior to FY08.

FY08 Expenditure Summary: University Internal Programs and Other Programs/Accounts

(July 1, 2007 – June 30, 2008)

Actual Fiscal Year Expenditures							
C-FAR RESEARCH FOCUS AREAS AND PROGRAMS	**EXPENDITURE**	**UIUC**	**SIUC**	**ISU**	**WIU**	**FOOD AND AGRICULTURE RESEARCH ACT**	**TOTALS**
Expanding Agricultural Markets	Equipment	95,530	11,175	1,685	0	N/A	**108,390**
	Materials/Supplies	7,804	7,753	3,016	397	N/A	**18,970**
	Personnel	382,059	33,828	18,760	54,710	N/A	**489,357**
	Services/Contracts	25,691	2,612	29,507	13	N/A	**57,823**
	Transportation	4,519	2,216	3,343	0	N/A	**10,078**
Rural Economic Development	Equipment	0	0	N/A	N/A	N/A	**0**
	Materials/Supplies	2,091	620	N/A	N/A	N/A	**2,711**
	Personnel	89,683	10,158	N/A	N/A	N/A	**99,841**
	Services/Contracts	7,400	12,780	N/A	N/A	N/A	**20,180**
	Transportation	1,574	0	N/A	N/A	N/A	**1,574**
Agricultural Production Systems	Equipment	2,865	0	3,915	0	N/A	**6,780**
	Materials/Supplies	142,572	647	3,573	630	N/A	**147,422**
	Personnel	849,014	6,632	8,172	6,426	N/A	**870,244**
	Services/Contracts	231,484	2,062	1,985	18,773	N/A	**254,304**
	Transportation	17,405	1,398	0	0	N/A	**18,803**
Human Nutrition and Food Safety	Equipment	2,009	N/A	0	N/A	N/A	**2,009**
	Materials/Supplies	77,616	N/A	637	N/A	N/A	**78,253**
	Personnel	240,792	N/A	3,421	N/A	N/A	**244,213**
	Services/Contracts	46,304	N/A	1,564	N/A	N/A	**47,868**
	Transportation	9,658	N/A	0	N/A	N/A	**9,658**
Natural Resources and Environment	Equipment	N/A	839	0	0	N/A	**839**
	Materials/Supplies	N/A	4,145	0	1,279	N/A	**5,424**
	Personnel	N/A	45,412	6,548	6,841	N/A	**58,801**
	Services/Contracts	N/A	5,524	1,048	7,812	N/A	**14,384**
	Transportation	N/A	891	1,694	84	N/A	**2,669**
Subtotals		**2,236,070**	**148,692**	**88,868**	**96,965**	**0**	**2,570,595**
Research Support		67,742	193,748	0	162	N/A	**261,652**
C-FAR Administrative Office		228,203	30,612	11,132	8,449	N/A	**278,396**
Achievement Award	(included above)	—	—	—	—	N/A	**0**
Indirect Costs [1]		0	0	3,394	0	N/A	**3,394**
1% Member Expense		N/A	N/A	N/A	N/A	29,615	**29,615**
IDOA Fee		N/A	N/A	N/A	N/A	22,500	**22,500**
Unexpended/Obligated Funds for FY09 Research		2,674,099	56,040	147,490	35,105	N/A	**2,912,734**
Total FY08 Expenditures and Obligated Funds for FY09		**$5,206,114**	**$429,092**	**$250,884**	**$140,681**	**$52,115**	**$6,078,886**

[1] Indirect costs are assessed on appropriations prior to FY08.

FY09 Allocations Summary

(July 1, 2008 – June 30, 2009)

C-FAR RESEARCH FOCUS AREAS AND PROGRAMS	UNIVERSITY INTERNAL PROGRAMS					EXTERNAL COMPETITIVE GRANTS PROGRAM [1]	STRATEGIC RESEARCH INITIATIVE PROGRAM [2]	FOOD AND AGRICULTURE RESEARCH ACT	TOTAL ALLOCATIONS
	UIUC (82%)	SIUC (11%)	ISU (4%)	WIU (3%)	TOTAL INTERNAL UNIVERSITY ALLOCATIONS				
Expanding Agricultural Markets	373,425	10,000	9,109	49,160	441,694	57,181	N/A	N/A	**498,875**
Rural Economic Development	0	19,983	9,109	0	29,092	100,939	N/A	N/A	**130,031**
Agricultural Production Systems	645,123	19,439	9,109	0	673,671	114,508	N/A	N/A	**788,179**
Human Nutrition and Food Safety	285,862	0	9,110	0	294,972	60,280	N/A	N/A	**355,252**
Natural Resources and Environment	0	39,439	9,110	0	48,549	59,466	N/A	N/A	**108,015**
Scientific Reviewers [3]	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	**0**
Research Support	39,300	91,393	20,000	0	150,693	N/A	N/A	N/A	**150,693**
Research Discretionary	0	0	0	0	0	N/A	N/A	N/A	**0**
C-FAR Administrative Office [4]	218,180	29,268	10,643	7,982	266,073	N/A	N/A	N/A	**266,073**
Achievement Award [5]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**0**
1% Member Expense	N/A	N/A	N/A	N/A	N/A	N/A	N/A	22,750	**22,750**
IDOA Fee	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11,375	**11,375**
Totals	**$1,561,890**	**$209,522**	**$76,190**	**$57,142**	**$1,904,744**	**$392,374**	**N/A**	**$34,125**	**$2,331,243**

[1] External Program funding comprised of: (1) 15% of FY09 appropriation minus fees; (2) $39,099 of unexpended/returned SRI and External Program funds; (3) $15,385.02 of unexpended funds from the FY08 1% Member Expense account; (4) $1,758.60 from the External Program Reviewer account.

[2] There are no SRI funding commitments in FY09.

[3] No scientific reviewer expense is anticipated in FY09.

[4] The FY09 C-FAR Administrative Office budget total is $297,950 and is met by $31,877 of unexpended funds from the FY08 Administrative Office account and $266,073 of FY09 funds.

[5] The Achievement Award program is not being conducted in FY09.

● Notes ●

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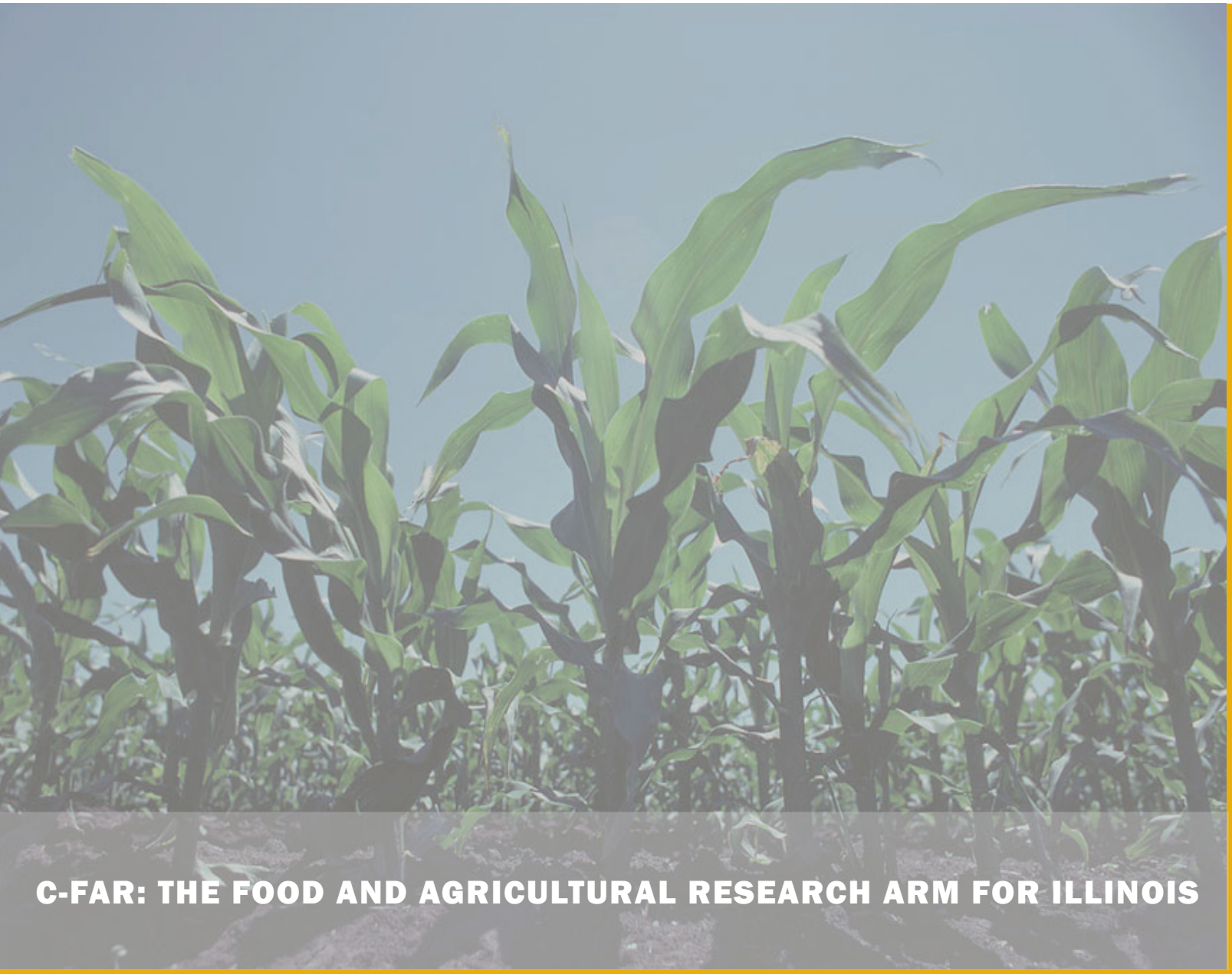

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