

2005 SUMMARY OF ENGINEERING RESEARCH

A Report of Activities during 2004

This .pdf is part of the larger *2005 Summary of Engineering Research*, available on the Web at www.engr.uiuc.edu/research and on CD-ROM. The *Summary of Engineering Research* represents the extensive engineering research program conducted in 2004 at the University of Illinois at Urbana-Champaign. Detailed statistics about research in the College of Engineering are included in the *Directory of Engineering and Engineering Technology Programs and Research*, published by the American Society for Engineering Education, Washington, D.C.

How to Use the *Summary of Engineering Research*: Research projects are listed by title, followed by the names of the investigators and the sponsoring agencies. Projects are sorted by major topic areas. Project descriptions are brief. Additional information on each project may be obtained from the investigator in charge (denoted by an asterisk). Mailing addresses are provided on the introductory page.

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Agricultural and Biological Engineering

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Principles from many scientific and engineering disciplines are applied to address opportunities and problems of agricultural production, processing, and utilization. Life and engineering sciences are developed, applied, and integrated for analyzing and designing bio-based systems (the concept of “bringing life to engineering,” i.e., using life sciences as resources for engineering work). The overarching goal of agricultural and biological engineering work is to “enhance lives;” lives include humans, plants, animals, and microorganisms. Food and agribusiness industries account directly or indirectly for more than 20 percent of the U.S. Gross National Product and are the world’s largest industries. Illinois is ranked second nationally in the value of food processed and fifth in total value of agricultural products.

The research program areas of the department include environmental protection of air, soil, and water resources; bioenvironmental engineering of plant and animal production facilities; off-road equipment design; and food and bioprocess engineering. Alternative energy technologies, such as ethanol, biomass conversion, solar, vegetable oil, and agricultural waste utilization, continue to be explored along with efficient management of conventional energy sources.

More cooperation with industries that purchase, transport, process, and package agricultural commodities has broadened the scope of agricultural engineering research, especially in the development of monitoring sensors and process control systems using machine vision and other sensors. Research aimed at improving performance and reducing cost at all levels of production with minimal environmental impact is receiving considerable attention in an attempt to keep U.S. agricultural products competitive in the world market. Additionally, new markets, new products, and new uses are being sought for overly abundant agricultural commodities.

Geographically located in an area of intense agricultural production, with access to good transportation facilities

and surrounded by a large concentration of agricultural and industrial equipment manufacturers and food processors, the department is in an enviable position to serve all areas of the agricultural community. Many agricultural engineering graduates who have been educated and trained in the modern teaching facilities and research laboratories of the University of Illinois Agricultural Engineering Sciences Building are employed throughout the nation. Interaction and cooperation with these graduates and other alumni scattered throughout the world help the department maintain a viable, useful research program.

Faculty and Their Interests

Robert A. Aherin

Agricultural safety and health, safety behavior analysis, confined space safety, using sensors in safety systems

Loren E. Bode

Spray atomization, transport, and deposition; spray nozzle design, spray drift reduction

Philip Buriak

Technical systems management, learning theory, implications to college teaching

Leslie L. Christianson

New product development; engineering design; agricultural buildings; heating, ventilation, and air-conditioning; air quality; swine facilities

Richard A. Cooke

Subsurface drainage, vadose zone water and contaminant transport, modeling of watershed-scale drainage systems

Steven R. Eckhoff

Corn fractionation, wet milling, dry milling, ethanol production, hybrid specific processing

Bruce Elliott-Litchfield

Food engineering

Ted L. Funk

Livestock confinement structures, indoor climate control systems for livestock, manure management systems, residential housing structures, indoor air quality

Tony E. Grift

Sensors and controls in biosystems automation, machine vision systems, electronic sensor development and agricultural data acquisition systems, mathematical modeling and control

Alan C. Hansen

Biofuels for diesel engines, simulation modeling of material handling systems, off-road machinery systems, precision agriculture

Joe G. Harper

Technical systems management

Michael C. Hirschi

Water quality, erosion and sediment control

Prasanta K. Kalita

Hydrology, watershed-water quality modeling, pathogen transport, erosion and sediment control

Marvin R. Paulsen

Food and bioprocess applications, grain quality measurements, near-infrared and FT-NIR spectroscopy

Kent D. Rausch

Recovery of nutrients from bioprocesses, corn quality effect on co-product value, variability of co-product quality, co-product quality for human and animal consumption

Vijay Singh

Engineering economic analysis and modeling of bioprocesses, design of processes for corn fractionation, recovery and concentration of nutraceuticals and biobased products

Lei Tian

Sensors and information systems for precision agriculture, applied machine vision, remote sensing, variable-rate technology

K. C. Ting

Automation, systems analysis, alternative energy and thermal control; computerized simulation, optimization, and decision support for bioproduction and bioprocessing systems.

Xinlei Wang

Heating, ventilation, and air-conditioning controls; indoor air quality; waste management; environmental engineering

Qin Zhang

Off-road vehicle mechatronics, machinery systems for bioproduction, electrohydraulic systems control, computer-integrated agricultural systems, sensors and instrumentation

Yuanhui Zhang

Indoor air quality; effect of indoor air quality on occupants; sensor technology for bioenvironmental systems; heating, ventilation, and air-conditioning control; waste treatment

Agricultural Infotronic Systems

Development of an “On-Tractor” Information Manager for Crop Production Operations

Q. Zhang*

Illinois Council on Food and Agricultural Research

The objective of this research is to develop a farmer-oriented information management tool for crop production. Research is focused on the development of an “on-tractor” information management system that will be capable of integrating precision agriculture devices, synthesizing available information, and supporting operation decision-making. It will also be capable of linking the tractor to the Internet for receiving and transmitting operational information. This technology will utilize the current research results from precision agriculture, sensor and infotronic technology, and information management. This system will be evaluated under typical crop production conditions in Illinois.

Research on Agricultural Infotronic Systems

Q. Zhang*

U.S. Department of Agriculture Hatch Funds

This research is to establish infotonics technology for production agriculture. This technology is to provide farmers “actionable” information for performing precision farming operations, such as “where and how much nitrogen to apply” while operating a sprayer in the field. Specific objectives include the design of a general framework of an agricultural infotronic system that will consist of data collection, operation planning, and automatic implementation modules; the development of core information processing algorithms, including information classification, fusion, and attributes tracking algorithms for handling production information; and the validation of the developed agricultural infotronic systems in precision farming operations.

Agricultural Safety

Confined Space Entry Training for Agricultural Environments

R. A. Aherin,* L. Nickels, A. Hunter
University of Iowa Great Plains Center for Agricultural Health; University School of Public Health; Carle Center for Rural Health and Farm Safety

This project will revise a confined space training one-day short course that was developed by the University of Illinois approximately ten years ago. The program will be evaluated for knowledge transfer, format acceptability and safe practice improvement. The course will be offered in the states of Illinois, Iowa, Missouri, and Nebraska. The primary audience will be agricultural businesses that service silos, grain storage structures, and livestock waste handling facilities.

Disabled Farmers Project

R. A. Aherin,* R. E. Petrea
University of Illinois; U.S. Department of Agriculture

The primary objective of this project is to develop a model program that will provide comprehensive assistance to Illinois farmers with physical disabilities. This includes conducting research to identify the level of need for assistance among farmers in the state and the impact of services provided.

Farm Safety Mobile Program for Rural Youth

R. A. Aherin,* A. Hunter
National Children's Center for Rural and Agricultural Safety and Health; Carle Center for Rural Health and Farm Safety

The project involves the development and evaluation of interactive agricultural safety and health training modules that are transported to rural communities in a converted mini bus. Community instructors will be trained in the second year of the project. The goal is to reach rural area youth who are not readily exposed to farm safety training. One targeted group is Amish youth. Approximately 12 training modules were developed for pilot testing. Project team members consulted with the Amish safety committee in Douglas and Moultrie counties in the development of the Amish portion of the project.

The Farm Safety Mobile

R. A. Aherin,* A. Hunter
National Farm Children's Center for Agricultural Health and Safety; Carle Foundation Center for Rural Health and Farm Safety

The goal of this project is to provide farm safety training to rural area youth between the ages of 6 to 13. This age group generally is not exposed to this training. A portion of the youth targeted will be Amish youth. A Farm Safety Mobile will be developed so that farm youth agricultural safety programs can be transported and presented directly to rural communities through this unique and more readily accessible manner. The Farm Safety Mobile will be equipped with six to eight training modules. The project will be evaluated to measure impact and behavior change.

Occupational Exposures and Health Outcomes in Swine Confinement Facilities

L. Conroy,* R. A. Aherin, T. Schoonover, P. Scheff, S. Dorevitch, S. Erdal, D. Tessier, J. Franke, L. Forst, R. Cohen, L. Berman, D. Vinson, T. L. Funk, Y. Zhang
National Institute for Occupational Safety and Health; University of Illinois School of Public Health

The study evaluated worker's exposure to airborne contaminants, such as dust, bacteria, and ammonia, in a swine confinement facility. Measurements were taken that evaluated exposures by looking at symptoms and biological markers of inflammation before and after work. Each worker and control group participants completed a health history questionnaire. Each participant provided blood samples, exhaled air samples, and performed a lung function test. Tests were conducted before and after work for two consecutive workdays in the winter. Participants wore air-sampling devices that measured for dust, bacteria, and ammonia during their work shift. Data analysis is being completed.

Assistant Director for Agricultural Continuing Education

R. E. Petrea*
Great Lakes Centers for Occupational and Environmental Safety and Health; University of Illinois–Chicago

This project is to assist in the assessment, planning, and implementation of agriculturally related health and safety programs and training that meet the Great Lakes Centers goals of providing graduate and professional education in occupational safety and health and continuing education.

*Denotes principal investigator.

Alternative Fuels

Evaluation of Biomass-Derived Alternative Fuels for Off-Road Vehicles

A. C. Hansen*

U.S. Department of Agriculture Hatch Funds

More stringent emissions regulations and increasing reliance on imported crude oil has renewed interest in biofuels. The objective of this project is to evaluate selected biomass-derived fuels in off-road vehicles in terms of engine performance, durability, and emissions. Fuel blends will be tested in the laboratory and field. Laboratory tests will include the optimization of engine parameters so as to minimize emissions and maximize performance.

Impact of Biofuels on Emissions Reducing Technologies for Off-Road Diesel Engines

A. C. Hansen*

U.S. Department of Agriculture Hatch Funds

Emissions reducing strategies and technologies are at the forefront of research and development efforts of all major diesel engine manufacturers in order to meet future Environmental Protection Agency regulations. Very little work has been done to investigate the use of these technologies in conjunction with biofuels such as biodiesel and E-diesel (ethanol-diesel blended) fuels. The purpose of this study is to evaluate the impact of biofuels on both present and emerging emissions reducing technologies for diesel engines. Preliminary results with the exhaust gas recirculation NOx emissions reducing strategy show that a greater rate of emissions reduction occurs with biodiesel fuel.

Impact of Soybean Oil Methyl Ester Composition on NOx Generation from Combustion

A. C. Hansen*

Campus Research Board

Biodiesel fuel is seen as a promising alternative to petroleum-derived diesel fuel. One negative aspect of biodiesel combustion is an increase in regulated NOx emissions. The objective of this project is to investigate the effect of soybean oil methyl ester composition on NOx formation from combustion with the aid of experiments and a three-dimensional computational fluid dynamics program. Special emphasis is being placed on the accurate representation of fuel properties. Preliminary results suggest that relatively small changes in fatty acid composition can reduce NOx emissions to be the same or less than those obtained with standard diesel fuel.

Bioenvironmental Engineering

Bioenvironmental Engineering Research Laboratory

L. L. Christianson,* M. E. Tumbleson, M. Ellis, S. M. Larson, R. I. Mackie, M. T. McCulley, T. A. Newell, M. J. Rood, W. B. Rose, M. A. Smith, L. A. Spomer, Y. Zhang

National Science Foundation; U.S. Environmental Protection Agency; American Society of Heating, Refrigerating and Air-Conditioning Engineers; Center for Indoor Air Quality Research; U.S. Department of Agriculture; U.S. Department of Energy; University of Illinois

In cooperation with the departments of Animal Sciences, Natural Resources and Environmental Sciences, Civil and Environmental Engineering, Mechanical and Industrial Engineering, Nuclear, Plasma and Radiological Engineering, and Theoretical and Applied Mechanics; College of Veterinary Medicine; and the Small Homes Council/Building Research Council

An interdisciplinary research laboratory was established involving faculty from engineering and biological sciences. The purposes are to characterize and assess the microenvironment and its effects on organisms and biological products. Focus areas include animal and plant interactions with their microenvironments, sensors and instrumentation, indoor air quality, air and air contaminant movement, environmental conditioning equipment, and building materials.

Design and Planning for a Pilot Scale TCC System

L. L. Christianson,* Y. Zhang, T. L. Funk, S. Chen
World-Wide Bio-Energy L.L.C.

An industry partner was brought into the laboratory-scale thermo-chemical conversion research being conducted at the university. The industry partner provides financial support, is advising on research directions and approaches, and is working cooperatively with the university research team to design a farm-scale prototype system. The farm-scale system will be used to optimize the process and to evaluate the economic, energetic, and environmental benefits that can be achieved.

Development of a New Low-Reynolds-Number Turbulence Model for Indoor Air Flows

X. Wang,* J. B. Jiang, Y. Zhang

U.S. Department of Agriculture; University of Illinois

Information on air motion in a ventilated room is very important for study of contaminant transport and indoor air quality. During the past several decades, computational fluid dynamics (CFD) based on turbulence modeling has become a very powerful tool in the prediction of indoor airflows. However, their applications are limited due to low Reynolds number effects that are very common in full-scale indoor airflows. In this project, low-Reynolds effects are combined into RANS turbulence models by introducing the intermittency factor that reflects the ratio of turbulence and nonturbulence. The model will predict the transitional flow behaviors.

Engine Emission Control and Aftertreatment On-Board Diagnosis

X. Wang,* Q. Zhang, H. Wu

International Truck and Engine Corporation

In order to meet the EPA emission regulations, some control devices, such as an oxygen catalytic converter, diesel particulate filter, and lean NO_x trap (LNT), will be required. However, such “add-on” devices can experience deterioration and malfunction that can go unnoticed by both the driver and repair technician. Those types of malfunctions could result in high emissions without a corresponding adverse drivability or fuel economy impact. This problem could be avoided by incorporating a well-designed OBD-II system to detect emission system malfunctions. In this project, we are investigating various diagnostic methods to develop an aftertreatment OBD-II system for 2010 applications.

Modeling of Dust Spatial Distribution in Indoor Environment

X. Wang,* Y. Zhang

U.S. Department of Agriculture; University of Illinois

One of the challenges in indoor air quality research is to study the dust spatial distribution so that the nature of dust transport can be better understood and appropriate control strategies can be implemented. Numerical modeling will enhance the understanding of the mechanisms of dust transport and provide useful information to control dust sources, improve the design of ventilation systems, and implement the mitigation technologies. A mathematical model was developed based on mass-balance of particulate matter. The numerical simulation indicated that the dust spatial distribution was highly related with the airflow

pattern, dust source strength, and gravitational sedimentation of particles.

Solid-State Fermentation for Hydrogen Production from Manure

X. Wang,* R. Dong, Y. Zhang

U.S. Department of Agriculture; University of Illinois

The fuel cell is a clean power source, but its application is limited by the availability of hydrogen. At present the main hydrogen production technologies are either chemical conversion of fossil fuels or electrolysis of water. They are not renewable with fossil fuels or expensive when the process requires massive amounts of electricity. Hydrogen production via biological means is less energy intensive, environmental friendly, and renewable. The preliminary objective of this project is to evaluate raw materials for hydrogen production by anaerobic fermentation, to select bacteria species, and to optimize process conditions.

Aerial Pollutant Emissions from Animal Confinement Buildings

Y. Zhang,* J. W. McClure, S. Jerez

U.S. Department of Agriculture

Adverse impacts of target air pollutants including odor, particulate matter, ammonia, hydrogen, carbon dioxide, methane, and nitrous oxide emitted from animal production facilities have created significant public concerns. A mobile laboratory on an 8 x 14 trailer has been developed with the capacity to measure the following real-time variables: PM₁₀, ammonia, hydrogen sulfide, carbon dioxide, methane, ventilation rate, and other environmental variables including temperature, humidity, radiation, and wind speed. Other variables measured include odor and total suspended particles. The mobile lab has been set up on a commercial swine farm in Illinois.

Air Cleaning Technologies for Off-Road Machinery Cooling Systems Phase I: Characterization of Physical Properties and Plugging Mechanism of Different Types of Debris

Y. Zhang,* X. Wang, Z. C. Tan, S. E. Ford

Deere & Company

During a previous project contracted between Deere & Company and the University of Illinois, conceptual design and three prototypes (JD-1, JD-2, JD-3) of an aerodynamic deduster were developed. During the field tests of the JD-3 deduster prototype, several improvement areas were identified such as prescreening of large leaves and aspiration efficiency to remove collected dust. It is

*Denotes principal investigator.

critical to have a clearer understanding of the physical properties, mechanical behavior and testing procedures to evaluate the performance of the air cleaning/cooling system. The objective of this project is to characterize the physical properties and plugging mechanisms of different types of debris.

Analysis and Development of a Noncontact Aerodynamic Deduster

Y. Zhang,* Z. Tan, J. Ni

American Society of Heating, Refrigerating and Air-Conditioning Engineers; Illinois Council on Food and Agricultural Research

Existing dust removal equipment is limited in application, especially in farm animal buildings, as the equipment requires frequent cleaning and/or replacement of filters. This limitation is primarily due to the contact filtration process. In this study, a prototype of a noncontact, aerodynamic deduster has been developed to separate dust particles from the air. Theory of particle cut-size will be reviewed and modified. Parameters such as the deduster configurations and turbulence intensity affecting the cut size and particle separation efficiency will be determined. Data collected will be used to validate the theory.

Characterization of Dust Particles from Animal Buildings

Y. Zhang,* J. W. McClure, Z. Tan

Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture

An air quality laboratory was established in the Department of Agricultural and Biological Engineering, University of Illinois. Grants from several agencies enabled the department to acquire a state-of-the-art Aerodynamic Particle Sizer. Particle size distribution, number and mass concentrations, and microbiological composition of dust from animal buildings will be characterized to aid in developing air quality control strategies. Together with gas chromatography, mass spectrometry, and such instrumentation as a multipoint air sampler, a laser particle counter, and an Anderson sampler, the air quality laboratory has become one of the best equipped for air quality research in the nation.

Continuous Thermochemical Conversion (TCC) of Livestock Manure to Produce Oil

Y. Zhang,* L. L. Christianson, T. L. Funk, K. C. Ocfemia, J. M. Appleford

The Grainger Foundation Inc.

The goal of this project is to convert the TCC batch process into a continuous-mode process. A continuous TCC process is more advantageous because heat generated from the process can be recycled more efficiently, reactor volume can be reduced for the same capacity, and automated controls can be adapted more readily. This technology involves major changes in conventional waste handling processes. We envision a single unit CTCC system being able to process manure of a 2,000 hog farm or an equivalent amount, and the unit should be no larger than a hot-water boiler in a residential house.

Experimental Characterization of Airflows in Aircraft Cabins

Y. Zhang,* Y. Sun, A. Wang

Centers for Disease Control and Prevention; The Boeing Company

Nonintrusive, full-scale, quantitative and instantaneous measurement techniques for airflow in aircraft cabins (versus single-point measurements) are needed, especially for developing CFD models. For this project, a full-scale Boeing 767 aircraft cabin section, including 35 mannequins, has been developed. A 17.5 kw chiller cools the fuselage internal surface to simulate actual high-altitude flight situations. A 3-D stereoscopic particle imaging velocimetry (SPIV) technology has been developed to measure the cabin airflow under iso- and nonisothermal conditions, and various obstruction conditions.

Hydrothermal Process for Fiber Stream

Y. Zhang,* X. Wang, R. Dong, K. C. Ocfemia, J. M. Appleford

Archer Daniel Midland; Illinois Council for Food and Agricultural Research

The long-term goal of this subproject is to develop and pilot test the continuous thermal hydrolysis process and operating parameters to convert the fiber stream from corn milling, and miscanthus into value-added products, or products that can be easily further processed (such as fermentation or thermochemical conversion). The short-term goal is to define key parameters for the fiber feeding system and the reactor for pilot plant development. A bath reactor and a laboratory scale continuous reactor have been developed for the study.

Illinois Odor and Nutrient Control Proving Center (ION-PC)

Y. Zhang,* M. E. Ellis, A. Mutlu, T. L. Funk, A. Williams, G. Hollis
Illinois Council on Food and Agricultural Research

The primary goal of this project is to demonstrate odor control strategies to end-users. Most odor control technologies are tested in small-scale studies with most of the interactive variables controlled. These tests do not provide assurance that the technology will work in production swine facilities. In many situations, more than one technology and/or practice will be needed at the same time to control all sources of odor. The proving center is able to develop and test all the required abatement methods simultaneously.

Microvolumetric Particle Tracking Velocimetry to Study Stenosis Flow in Arteries

Y. Zhang,* D. Li, Y. Sun, X. Wang
U.S. Department of Agriculture

The long term goal of the investigators is to develop technologies to measure and predict flow velocity profiles in a flow field such as a human artery. In this study, the objectives are to develop a 3-dimensional microvolumetric particle tracking velocimetry (MVPTV) system for measurement of fluid flow in a simulated artery system. An MVPTV experimental set-up including image acquisition, laser illumination particle seeding, and flow generation systems has been developed.

Thermochemical Conversion (TCC) of Swine Manure to Produce Fuel and Reduce Odor

Y. Zhang,* K. C. Ocfemia, J. M Appleford, T. L. Funk, L. L. Christianson, B. J. He
Illinois Council on Food and Agricultural Research

Thermochemical conversion (TCC) is a chemical reforming reaction of organic compounds in a heated enclosure. Swine manure with 5% to 20% solid matter was processed in a scale batch TCC reactor, which converted 70% of volatile solids into a crude oil. Based on the batch reactor results, a continuous thermochemical conversion (CTCC) reactor that has a capacity of processing 50 liters of slurry and producing 5 liters of crude oil per day has been developed.

Ventilation Equipment Testing Program in BESS Laboratory

Y. Zhang,* S. E. Ford, L. L. Christianson, T. L. Funk, X. Wang
Ventilation Equipment Industry

More than 95% of agricultural ventilation fan manufacturers and many other ventilation equipment companies test their products at the University of Illinois Bioenvironmental Structure and Systems (BESS) Laboratory. The lab publishes all fan data annually and conducts industry research related to ventilation, airflow characterization, and equipment development. This long-standing program is managed through the Bioenvironmental Engineering Division and conducted within the BESS Laboratory. The program has resulted in a 25% increase in fan efficiency across the United States in the past decade. The program is self-supporting.

Food and Bioprocess Engineering

Evaluation of Ethanol Production Technologies

K. D. Rausch,* B. Dien, V. Singh
National Center for Agricultural Utilization Research; Agricultural Research Service; U.S. Department of Agriculture

The fuel ethanol industry is rapidly growing and becoming more competitive. As a result, more value needs to be extracted from coproducts made with ethanol. This collaborative project seeks to understand the role of raw material (corn) in optimally producing ethanol and other bioproducts and to identify process methods that generate multiple coproducts with increased value. A small-scale (25g) dry grind procedure is being developed and evaluated to serve as a reference for the fuel ethanol and corn genetics industries. As new sources of genetic material are developed, the procedure will determine ethanol yields accurately.

Process Development to Recover Nutrients from Agricultural Solids

K. D. Rausch,* V. Singh, M. E. Tumbleson
U.S. Department of Agriculture

Bioprocessing of agricultural materials typically uses an intensive amount of water. As a result, bioprocess streams carry nutrients in dilute quantities, causing difficult recovery and low or negative economic value of recovered solids. Conventional drying methods are inherently energy-intensive because of evaporation of water and other solvents. This project investigates emerging technologies

*Denotes principal investigator.

or technologies from other industries for use in bioprocesses that dewater, dry, or convert solids into higher valued products. Currently, work has applied membrane filtration technology to corn processes to conserve water and recover nutrients.

Controlling Microorganism Growth in Enzymatic Corn Wet Milling Process

V. Singh,* L. Hoyer, D. B. Johnston, M. E. Tumbleson
Corn Refiners Association

Use of sulfites in the conventional corn wet milling process presents health and environmental concerns. An enzymatic corn wet milling process is being developed to reduce use of sulfites in the process. One of the roles of sulfites is to control microbial contamination in the conventional corn wet milling process. Replacement of sulfites by enzymes could result in microbial contaminations. This study evaluates strategies to control microbial growth in the enzymatic corn wet milling process.

Effect of Hybrid Variability and Planting Location on Ethanol Yields

V. Singh,* J. Graeber
Syngenta Seeds, Inc.

This study investigates the effect of hybrid variability and planting location on the ethanol yield. Approximately 100 different dent corn hybrids grown at multiple locations in the Midwestern United States will be processed using a laboratory dry grind procedure to determine ethanol yield. Influence of the growing location and hybrid on ethanol yields will be observed. Selected hybrids also will be laboratory wet milled to determine starch yield and the correlation between the starch extractability and ethanol yield.

Effect of Milling Parameters on Fiber and its Removal from the DDGS Dry Grind Ethanol Plant

V. Singh,* R. A. Moreau, R. L. Belyea, K. D. Rausch
Illinois Council on Food and Agricultural Research

This project investigates removal of fiber from distillers dried grains with solubles (DDGS), a coproduct produced in dry grind corn processing. There is a need to reduce the volume of DDGS and diversify its uses. Removal of fiber from DDGS has three potential benefits: another coproduct is added to the process which can be used for recovery of high-valued nutraceutical compounds or other industrial products; protein and fat content increases in the resulting DDGS; and fiber content is reduced in the DDGS. The latter two effects may allow use of DDGS in nonruminant animal diets.

Modified Milling Technologies for Dry-Grind Ethanol

V. Singh,* K. D. Rausch, D. B. Johnston
Eastern Regional Research Center, U.S. Department of Agriculture, Agricultural Research Service

The objective of this research is to develop new or modify existing corn milling technologies that allow value-added processing and lower the capital and operating costs of ethanol production facilities. The project involves recovering multiple coproducts and improving the efficiency of dry-grind corn processing. Economic assessment of process improvements will be done by process simulation and economic modeling.

Use of Enzymes to Reduce Steep Time, Reduce SO₂ Emissions and Improve Product Yield in the Corn Wet Milling Process

V. Singh,* D. B. Johnston
Cooperative State Research, Education, and Extension Service; U.S. Department of Agriculture

An enzymatic corn wet milling process is being developed to reduce or eliminate sulfur dioxide (SO₂) requirements during steeping, reduce steep time and produce starch yields comparable to conventional processes. Benefits of the process are that it reduces use of sulfur dioxide in the wet milling process. This change would have an effect on reducing environmental and health risks associated with use of SO₂. Enzymatic milling reduces process time by 70% while maintaining product yields and quality. We are working with corn wet milling processors to evaluate this process at commercial scale.

Use of Transgenic Corn for Processing Facilities

V. Singh,* K. D. Rausch
Syngenta Biotechnology, Inc.

A transgenic corn that produces high levels of endogenous amylase is being evaluated for dry grind corn processing. The enzyme is activated in the presence of water and high temperature. In a conventional process, exogenous alpha amylase enzymes are added during liquefaction to break down starch into dextrins. In this study, liquefaction and fermentation properties of transgenic corn are being tested using a small-scale laboratory dry grind procedure and compared to the fermentation properties of a control sample of isogenic corn.

Grain Qualities and Properties

Corn Extractable Starch Calibrations with NIT

M. R. Paulsen,* E. Newgard
DuPont, Monsanto

A calibration for extractable starch in corn was expanded for the Infratec 1229 and 1241 NIT grain analyzers based on over 3000 samples collected from 1997 to 2004. Extractable starch was predicted with a standard error of prediction (SEP) of 1.31, R² of 0.84, and RPD (ratio of laboratory standard deviation to the SEP) of 2.4. A one percentage point gain in extractable starch is worth about 4 to 6 cents/bu. The extractable starch calibration has been licensed to a major spectrophotometer company and a new calibration became available in January 2005.

Measurement of Fatty Acids in Soybeans with FT-NIR

M. R. Paulsen,* S. Nimaiyar
Illinois Council on Food and Agricultural Research

Soybeans were scanned on a Perkin Elmer FT-NIR spectrophotometer to measure palmitic, stearic, oleic, linoleic, and linolenic acids. The calibration models predicted oleic and linolenic acids in 16 ground soybean samples with r-values of 0.77 and 0.81, respectively; RMSEP of 3.46%, 0.55% of total oil; and RPD of 1.6 for both fatty acids. The calibration model predicted linoleic acid with an r-value of 0.87, RMSEP of 2.37%, and RPD of 1.9. Of the fatty acids, linoleic acid was predicted best, followed by oleic and linolenic acids, and then palmitic acid. Stearic acid was the most difficult to predict.

Off-Road Equipment Engineering

Real-Time Decision Support System for In-Field Agricultural Operations

A. C. Hansen,* R. H. Hornbaker, Q. Zhang
Deere & Company

Major advances in agricultural vehicle technologies in recent years have resulted in much higher work rates and efficiencies on a per vehicle basis. However, very little attention has been paid to systems of vehicles cooperating, for example, during crop planting and during harvesting. The overall goal of the project is to develop a decision support system with intervehicle, real-time data communication for optimizing in-field grain handling by combines, grain wagons, road transport, and grain elevator. Wireless communication protocols have been established and preliminary field tests on a prototype have been successfully completed in the United States and Australia.

Investigation on Automatic Tuning and Adaptive Control Technologies for Intelligent Vehicle Path Tracking

Q. Zhang*
Deere & Company

To obtain a high maneuvering performance on ground vehicles, researchers have developed many high-level controllers, including but not limited to PID, feedforward-PID, fuzzy, sliding mode, and LQR. This study intends to identify relevant approaches and research results of a few selective controllers; identify the strengths and weaknesses of each candidate; and recommend approaches and construct guidelines for vehicle controllers. Some representative controllers will be implemented on a laboratory-scale, hardware-in-the-loop control system simulator to provide preliminary validation on the results.

Maintenance and Fault Diagnosis Tools for Hydraulic Pumps

Q. Zhang*
National Fluid Power Association

The primary goal of this project is focused on developing a better understanding of fluid power among graduate and undergraduate students through participating research activities on developing a prognostic tool for hydraulic pump health assessment. It consists of the following specific objectives: developing an educational tool for hydraulic pump maintenance and fault diagnosis; providing engineering students with significant experiences in evaluating the health condition of a fluid power system and determining maintenance requirements; and stimulating future research in fault diagnostics and prognostics of hydraulic systems, which has potential to have a major impact on the fluid power industry.

Vehicle-in-the-Loop Virtual Reality Simulation of Tractor Rollover

Q. Zhang*
Great Lakes Center for Agricultural Safety and Health

The final goal of this research is to develop a vehicle-in-the-loop (VIL) virtual reality simulator consisting of a robot model tractor, a model field, and a tractor dynamic model. This VIL simulator will be capable of assessing the possibility of a tractor rollover under various operating conditions. Upon completion of the research, this simulator can be implemented remotely via the Internet, used as a training tool for drivers, and as a tool for researchers. The current phase is a pilot project focusing on collecting field data and design system architecture for the VIL virtual reality simulator.

*Denotes principal investigator.

Site-Specific Agriculture

Precise Application of Agricultural Chemicals

L. E. Bode,* S. R. Bretthauer

University of Illinois; U.S. Department of Agriculture

Improvements in the application of agricultural chemicals are needed to improve the safe and efficient application of agricultural chemicals. New nozzle designs, sensors and control systems for agricultural sprayers have the potential to improve deposition efficiency with a corresponding decrease in spray drift. The objective of this project is to develop new technology, techniques, and practices that improve the efficiency of applying substances used for control of pests. Specific goals are to characterize new nozzle designs for increasing chemical deposition on plant and pest targets while reducing off-target spray drift.

Data Collection and Analysis for Future Farms

L. Tian,* G. Schnitkey, M. Welge

Dudley Smith Foundations

High-quality data are essential for future crop management. Site-specific information will have higher value when the sensing system is optimized and error is minimized. This project is a pilot study to see what the future data set might be and how researchers could best plan to analyze it. The team will use state-of-the-art technologies in the development of sensing systems for future farms. High-performance computing systems will be used in the data management study. A prescriptive study will be conducted concerning the value of information from site-specific technologies.

Developing an Agricultural Remote Sensing Program at the University of Illinois

L. Tian,* D. Bullock, J. Westervelt

Sentinel Program of Illinois Council on Food and Agricultural Research

Cooperating with NASA researchers, University of Illinois scientists are expanding the agricultural remote sensing program at the University of Illinois. Program objectives are to develop the key technologies needed for NASA remote sensing data applications in precision agriculture settings; design and develop new courses in the area of agricultural remote sensing, spatial data management, and precision agriculture; foster cooperation among scientists from universities, government agencies, and industry working in precision agriculture and remote sensing; and bring new technologies to farmers, assess their needs, target research to address those needs, and maximize the relevancy of the program.

Improved Application of Pest Control Substances

L. Tian*

University of Illinois; U.S. Department of Agriculture

Equipment and techniques are being developed to improve the application efficiency of agricultural chemicals. Droplet size spectra from various atomizers are measured to determine target coverage versus spray drift potential. Field studies of spray drift deposits are used to verify the droplet size evaluations. Sensors and automatic control systems are being developed to apply pest control substances as a function of soil organic matter, travel speed, and other input variables. Techniques for incorporation of herbicides in the soil profile of conservation tillage systems are being developed and evaluated.

Soil and Water Resources

DHARMA: Domain Specific Metaware for Hydrologic Applications

P. K. Kalita,* M. C. Hirschi

National Science Foundation

Many hydrologic models at the watershed scale are limited in resolution and scope by their computational demands. A goal of this project is to build a middleware layer to provide the resources for revolutionizing hydrologic modeling. The required resources range from local data to the supercomputing power on the national computational grid. Researchers intend to expand the applicability of the Water Erosion Prediction Project model to large watersheds, specifically applying the extended model to the Lake Decatur Watershed in Illinois, and enable the model for predicting erosion within the watershed by allowing significantly easier access to the computational power and data acquisition capabilities.

Evaluation of Range Design Relative to Combat Readiness and Environmental Risks

P. K. Kalita,* M. C. Hirschi

U.S. Army Construction Engineering Research Laboratory

Training and testing ranges on U.S. Army installations are essential for combat readiness of military personnel. A wide variety of range types are needed to provide realistic training conditions. Problems such as soil erosion and water quality degradation, poor air quality from dust, wildfires, smokes, and obscurants, and heavy metal accumulation that result from live fire activities are environmental risks that can affect training and testing activities on U.S. Army installations. The objectives of

this project are to analyze training and testing range design elements with respect to mission, environmental degradation and regulatory noncompliance, and long-term operations and maintenance requirements.

Understanding and Modeling the Hydrology of Tile-Drained Watersheds

P. K. Kalita,* R. A. Cooke, M. C. Hirschi, J. K. Mitchell
*Illinois Council on Food and Agricultural Research;
University of Illinois*

The overall objective of the study is to develop strategies that mutually benefit both agriculture and water quality in regions where hydrology is strongly influenced by subsurface drainage. Researchers have been monitoring flow and water quality from the subsurface tile drains in the Little Vermilion River Watershed in Illinois. Results from field observations have been used to develop fundamental relationships describing flow components to incorporate in computer simulation models. These data have been used to calibrate and validate these models. Work is in progress to develop watershed-scale model(s) to evaluate the effects of Best Management Practices on watershed water quality.

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

P. K. Kalita,* M. S. Kuhlenschmidt, R. D. Smith,
T. L. Funk
*Illinois Council on Food and Agricultural Research;
University of Illinois*

Microbial pathogens such as *Cryptosporidium parvum* and *Escherichia coli* from animal production facilities have threatened rural health and environment. The goal of this study is to limit the delivery of microbial pathogens and nutrients from animal production facilities and to provide a healthy and sustainable environment to small and mid-size farmers. This study is investigating the fate and transport of *C. parvum* and *E. coli* in surface and near-surface water to develop management strategies to limit their transport. A microbial transport predictive model will be developed with goals of understanding, predicting, and limiting movement of microbial pathogens to the water supply.

Water Quality

Amount, Timing, and Quality of Water Coming from Managed (Controlled) and Unmanaged Drainage Systems in Illinois

R. A. Cooke*
*U.S. Department of Agriculture; Agricultural
Research Service*

This research project is designed to quantify and compare the amount, timing, and quality of water discharging from managed and unmanaged drainage systems in Illinois. It involves monitoring flow and obtaining flow-weighted water quality samples from managed and free drainage systems on a range of soil types in various locations in the state. The resulting data will be used for developing management criteria for drainage water management systems in Illinois.

Combined Drainage Water Management/Bioreactor System for Improving the Quality of Tile Outflow

R. A. Cooke*
Sand County Foundation; Agricultural Watershed Institute

The goal of this project is to evaluate the effectiveness and cost efficiency of bioreactors, either as stand-alone practices or in combination with drainage water management systems, in reducing nitrogen discharge from agricultural fields with subsurface tile drainage. This information will be helpful in scaling up a regional initiative to reduce nitrogen and other discharges from agricultural lands and to reduce environmental impacts and protect and possibly enhance income to rural communities and landowners.

Development of Conservation Drainage in Illinois

R. A. Cooke*
University of Illinois

The objectives of this project are to test the hypothesis that while different drainage practices may result in the same intensity of drainage, thereby producing the same production benefits, they differ in their effect on water quality; to determine the design configurations that optimize production benefits while having the least deleterious impact on the environment; and to involve producers, drainage contractors, educators, and local conservation personnel in drainage research.

*Denotes principal investigator.

Development of Design Criteria for Watershed-Scale Subsurface Bioreactors

R. A. Cooke,* P. K. Kalita

U.S. Department of Agriculture; Cooperative State Research, Education, and Extension Service

The objectives of this project are to demonstrate the efficacy of passive subsurface bioreactors in removing nitrates from the outflow from small watersheds, evaluate the effectiveness of wood chips from softwoods and hardwoods as carbon sources in subsurface bioreactors, and to develop design criteria for watershed-scale subsurface bioreactors.

Effect of Drainage Water Management on Tile Water Quality

R. A. Cooke*

Natural Resources Conservation Service

This research project is designed to test the hypothesis that drainage water management will reduce the loadings of nitrates and phosphorus from tile drainage systems without adversely affecting crop yield. It involves the continuous monitoring, over a three-year period, of tile effluent from a pair of fields. The pair consists of two 40-acre fields that are side by side with similar soils, crops, and climate. This pairing greatly reduces climatologic and soil differences, and major sources of external variability, thereby reducing the length of time required to draw conclusions.

Illinois Conservation Drainage Research and Demonstration Watershed Project

R. A. Cooke*

*Natural Resources Conservation Service;
Agricultural Research Service Soil Drainage Unit*

The project was established to provide a showcase watershed for drainage water management and other environmentally friendly drainage practices; to conduct research on stream flow, water quality, controlled drainage, and bioreactors; to collect data that can be used to model flow and transport in a tile-drained watershed; and to work in conjunction with local stakeholders to promote conservation drainage.

Understanding Hydrologic and Water Quality Response of a Tiled Watershed

P. K. Kalita,* R. A. Cooke, M. C. Hirschi, R. J. Hudson

U.S. Department of Agriculture, National Research Initiative Competitive Grants Program

Tile-drained watersheds contain much of the productive agricultural land in the north central United States, yet the hydrology of these watersheds is not well understood. This study will initiate a new dimension for watershed management to improve water quality in tile-drained watersheds. Once the techniques and relationships are validated, an estimate of total maximum daily load (TMDL) to a surface water source will be available through simple and accurate means. Overall, the results of this study will be utilized for better management of agricultural practices in east central Illinois and similar areas with tile-drained watersheds.

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Rathore, S., Yuan, W., Paulsen, M. R., and Hansen, A. C. **Prediction of soybean oil properties for biodiesel fuel using a Fourier-transform near infrared (FT-NIR) spectrometer.** American Society of Cereal Chemists 2004 Annual International Meeting (San Diego, CA, Sep. 2004). Proceedings of the American Society of Cereal Chemists 2004 Annual International Meeting (2004).

Yuan, W. and Hansen A. C. **Computational modeling of biodiesel fuel properties effect on NOx emissions from a DI diesel engine.** 36th American Chemists Society Great Lakes Regional Meeting (Peoria, IL, Oct. 2004). Proceedings of the 36th American Chemists Society Great Lakes Regional Meeting (2004).

Yuan, W., Hansen, A. C., and Wang, X. **Spray, ignition and combustion modeling of biodiesel.** American Society of Agricultural Engineers Annual International Meeting (Ottawa, ON, Jul. 2004). Proceedings of the American Society of Agricultural Engineers Annual International Meeting (2004).

Yuan, W., Hansen, A. C., and Zhang, Q. **Prediction of biodiesel fuel properties based on fatty acid composition.** American Society of Agricultural Engineers Annual International Meeting (Ottawa, ON, Aug. 2004). Proceedings of the American Society of Agricultural Engineers Annual International Meeting (2004).

Yuan, W., Hansen, A. C., and Zhang, Q. **An analysis of the relationships between biodiesel physical properties.** Proceedings of the International Conference of the Commission Internationale du Genie Rural (Beijing, China, Oct. 2004). Proceedings of the International Conference of the Commission Internationale du Genie Rural (2004).

Zhang, Q. **Machinery automation for the 21st century farming.** Japanese Agricultural Machinery Society Symposium on Agricultural Equipment Automation (Matsuyam, Japan, Mar. 2004). Proceedings of Japanese Agricultural Machinery Society Symposium on Agricultural Equipment Automation 38-51 (2004).

Site-Specific Agriculture

Kaleita, A. L., Tian, L. F., and Hirschi, M. C. **Identification of optimal sampling locations and grid size for soil moisture mapping.** American Society of Agricultural Engineers Annual International Meeting (Ottawa, ON, Jul. 2004). Proceedings of the American Society of Agricultural Engineers Annual International Meeting (2004).

Soil and Water Resources

Cooke, R. A., Wildman, T. A., and Northcott, W. J. **Accurate, low-cost instrument for measuring subsurface drain flow under submerged outlet conditions.** 8th International Drainage Symposium (Sacramento, CA, Mar. 2004). Drainage VIII: Proceedings of the 8th International Drainage Symposium 332-339 (2004).

Water Quality

Cooke, R. A., Kalita, P. K., and Mitchell, J. K. **Analysis of water quality from retrofitted drainage water management systems.** 6th International Conference on Hydro-Science and -Engineering (Brisbane, Australia, May 2004). Proceedings of the 6th International Conference on Hydro-Science and -Engineering (2004).

Kalita, P. K., Mitchell, J. K., Algoazany, A., Cooke, R. A., and Hirschi, M. C. **Chemical transport through subsurface drains in a flat subsurface drained watershed—Lessons learned from long-term monitoring.** 6th International Conference on Hydro-Science and -Engineering (Brisbane, Australia, May 2004). Proceedings of the 6th International Conference on Hydro-Science and -Engineering (2004).

Pitts, D. J., Cooke, R. A., and Terrio, P. J. **Illinois drainage water management demonstration project.** 8th International Drainage Symposium (Sacramento, CA, Mar. 2004). Drainage VIII: Proceedings of the 8th International Drainage Symposium (2004).

Theses

Bioenvironmental Engineering

Ali, N. **Ammonia adsorption using selected chemicals in an aerodynamic air cleaning system.** M.S. thesis, Y. Zhang, advisor (2004).

Gentry, M. **An experimental study of aerodynamic intake air cleaning for large diesel engines.** M.S. thesis, Y. Zhang, advisor (2004).

Ni, J. **Development and evaluation of vertical dedusters for emission control from a swine building.** M.S. thesis, Y. Zhang, advisor (2004).

Tan, Z. **Mechanisms of particle separation in aerodynamic air cleaning.** Ph.D. thesis, Y. Zhang, advisor (2004).

Food and Bioprocess Engineering

Beesabathuni, K. **Effect of corn flour particle size on ethanol yield and soluble solids in dry grind processing.** M.S. thesis, V. Singh, advisor (2004).

Kwiatkowski, J. **Membrane processing of ethanol-extracted corn oil.** Ph.D. thesis, M. Cheryan, advisor (2004).

Nimaiyar, S. **Measurement of isoflavones, fatty acids, and amino acids in soybeans using FT-NIR spectroscopy.** M.S. thesis, M. R. Paulsen, advisor (2004).

Wilkins, M. **Analysis of heat transfer fouling by thin stillage from dry grind corn processing facilities.** Ph.D. thesis, K. D. Rausch, advisor (2004).

Site-Specific Agriculture

Yao, H. **Hyperspectral imagery for precision agriculture.** Ph.D. thesis, L. Tian, advisor (2004).

Awards and Honors

Robert A. Aherin

Educational Aids Competition Blue Ribbons, American Society of Agricultural Engineers, 1980 (3), 1981 (4), 1982 (3), 1984 (3), 1986 (2), 1988, 1989, 1990
Maynard Coe National Agriculture Safety Award, National Institute for Farm Safety, 1980
Outstanding Young Men of America Award, National Jaycees, 1981
Honorary State Farmer Degree, Minnesota FFA Association, 1983
Outstanding Service Award, American Lung Association, 1983
Agriculture Safety Professional-of-the-Year Award, Minnesota Safety Council, 1983
Packer Engineering Safety Award, American Society of Agricultural Engineering, 1987
Teaching Award, Program, American Society of Agricultural Engineers, 1989
Young Faculty Award for Excellence in Extension, University of Illinois College of Agriculture, 1993
Outstanding Alumni Award, College of Applied Sciences and Technology, Illinois State University, 2002

Loren E. Bode

Educational Aids Competition Blue Ribbons, American Society of Agricultural Engineers, 1976, 1981, 1982, 1985, 1986, 1988, 1993
Paper Award, Honorable Mention, American Society of Agricultural Engineers, 1982
Young Extension Worker Award, American Society of Agricultural Engineers, 1983
Senior Faculty Award for Excellence in Extension, University of Illinois College of Agriculture, 1990
Midwest Agricultural Chemical Association Educator's Award, 1991
Fellow, American Society of Agricultural Engineers, 1992
Paul A. Funk Achievement Award, University of Illinois College of Agriculture, 1993
ASAE President's Citation, American Society of Agricultural Engineers, 2000, 2002
Hall of Fame Award, Illinois Extension Agricultural Association, 2004

Philip Buriak

Teaching Award of Merit, National Association of College Teachers of Agriculture, 1986
Honorary American Farmer Degree, National FFA Organization, 1987
Paper Award, Outstanding Research Presentation, National Agricultural Education Research Meeting, 1988
Teaching Excellence Award, University of Illinois Department of Agricultural Engineering, 1989, 1992, 1994
Karl E. Gardener Outstanding Undergraduate Advising Award, University of Illinois College of Agriculture, 1993
Author of the Year, 1st Runner Up, *Journal of Agriculture Education*, 1994
Author of the Year, 2nd Runner Up, *Journal of Agricultural Education*, 1997
Honorary Illinois Farmer Degree, Illinois Association FFA, 1997
Teaching Academy of Excellence, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 1997-2002
Teaching Award of Excellence, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 1997
Senior Teaching Award of Excellence, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 1999
Campus Award for Excellence in Undergraduate Teaching, University of Illinois, 1999
National Award for Excellence in College and University Teaching, U.S. Department of Agriculture, 1999
Distinguished Teacher/Scholar, University of Illinois, 2000

Paul A. Funk Recognition Award, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2001
J. Kent Mitchell Teaching Excellence Award, University of Illinois, Department of Agricultural and Biological Engineering, 2001
Team Award for Excellence, The ACES Teaching Course Team, University of Illinois, College of Agricultural, Consumer and Environmental Sciences, 2001
E. B. Knight Journal Award, North American Colleges and Teachers of Agriculture, 2003
Teaching Fellow Award, North American Colleges and Teachers of Agriculture, 2003

Leslie L. Christianson

Teaching Excellence Award, University of Illinois Department of Agricultural Engineering, 1987, 1991
Andersen Consulting Award for Excellence in Advising, University of Illinois College of Engineering, 1989, 1990, 1991
Stanley H. Pierce Award, University of Illinois College of Engineering, 1989
Paper Award, American Society of Agricultural Engineers, 1994
Paper Award, American Society of Heating, Refrigeration and Air-Conditioning Engineers, 2003

Richard C. Coddington, Emeritus

Teaching Excellence Award, University of Illinois Department of Agricultural Engineering, 1988, 1992
Amoco Award for Innovative Teaching, 1991

Richard A. Cooke

Dissertation Research Award, Virginia Polytechnic Institute and State University Chapter of Sigma Xi, 1995

James O. Curtis, Emeritus

Fellow, American Society of Agricultural Engineers

Donald L. Day, Emeritus

Fellow, American Society of Agricultural Engineers
Paper Reviewers Award, American Society of Agricultural Engineers, 1989
Certificate for Distinguished Paper, University of Guadalajara, Mexico, 1990
Research Fellowship, Japan Society for Promotion of Science Travel, 1992

Steven R. Eckhoff

Dow Outstanding Young Educator Award in the Midwest Region, American Society for Engineering Education, 1986

Kansas State University Presidential Lecturer, 1986, 1987
Outstanding Paper in Cereal Chemistry Award, Corn Refiners Association, 1989
Research Fellowship, Corn Refiners Association, 1990, 1991
Teaching Excellence Award, University of Illinois Department of Agricultural Engineering, 1993
Excellence in Teaching Award, American Association of Cereal Chemists, 1999

Bruce Elliott-Litchfield

Andersen Consulting Award for Excellence in Advising, University of Illinois College of Engineering, 1989, 1993
Teaching Excellence Award, University of Illinois Department of Agricultural Engineering, 1990
Everitt Award for Teaching Excellence, University of Illinois College of Engineering, 1991
Research Fellowship, Corn Refiners Association, 1991
Young Faculty Award for Excellence in Teaching, University of Illinois College of Agriculture, 1992
A. W. Farrall Young Educator Award, American Society of Agricultural Engineers, 1993
University Scholar, University of Illinois, 1994
Engineering Council Advisors List for Outstanding Advising, University of Illinois, 1995
Faculty Award for Excellence in Research, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 1996
Collins Award for Innovative Teaching, University of Illinois College of Engineering, 1997
Harriet and Charles Luckman Undergraduate Distinguished Teaching Award, University of Illinois, 1997
Team Award for Excellence, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2001
Distinguished Teacher/Scholar Award, University of Illinois, 2003

Ted L. Funk

Outstanding Program Team Award in Extension, University of Illinois College of Agriculture, Consumer and Environmental Sciences, 1999
Sustained Excellence in Extension Programming, University of Illinois College of Agriculture, Consumer and Environmental Sciences, 1999
Professional Staff Award for Excellence, Innovation and Creativity, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2003
Campus Award for Excellence in Public Engagement, University of Illinois, 2004

Carroll E. Goering, Emeritus

Fellow, American Society of Agricultural Engineers
Outstanding Technical Paper Awards, American Society of Agricultural Engineers, 1985, 1990, 1992; honorable mention, 1986, 1989
Everitt Award for Teaching Excellence, University of Illinois College of Engineering, 1986
Senior Faculty Award for Teaching Excellence, University of Illinois College of Agriculture, 1994
Paul A. Funk Recognition Award, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 1996
Massey-Ferguson Award, American Society of Agricultural Engineers, 2001

Tony E. Grift

Superior Paper Award, American Society of Agricultural Engineers, 2002, 2003
Information and Electrical Technologies (IET) Division Outstanding Paper Award, American Society of Agricultural Engineers, 2003

Alan C. Hansen

Paper Award, Outstanding Technical, American Society of Agricultural Engineers, 1990
Silver Medal for Academic Achievement, South African Institute of Agricultural Engineers, 1990
Silver Medal for Best Publication of the Year, South African Institution of Mechanical Engineers, 1992
Silver Medal for Best Paper Published, South African Institute of Agricultural Engineers, 1992
Faculty Award for Excellence in Teaching, University of Natal, Faculty of Engineering, South Africa, 1994, 1996
Teaching Excellence Award, American Society of Agricultural Engineers Student Branch, University of Illinois, 2002
Accenture Consulting Outstanding Advisor Award, University of Illinois College of Engineering, 2003
Information and Electrical Technologies Division (IET) Division Outstanding Paper Award, American Society of Agricultural Engineers, 2003
Everitt Award for Teaching Excellence, University of Illinois, College of Engineering, 2004

Michael C. Hirschi

Paper Reviewers Award, American Society of Agricultural Engineers, 1988
Educational Aids Competition Blue Ribbons (6), American Society of Agricultural Engineers, 1991 (3), 1994, 1998, 2004
Early Career Award, Epsilon Sigma Phi Alpha Nu Chapter, 1992

Young Faculty Award for Excellence in Extension, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 1995
Teaching Excellence Award, University of Illinois Department of Agricultural Engineering, 1997
Certificate of Excellence, American Society of Agronomy Education Materials Contest, 1998
Accenture Consulting Outstanding Advisor Award, University of Illinois College of Engineering, 2000, 2001
Academy of Teaching Excellence, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2002, 2003, 2004
Karl A. Gardner Outstanding Undergraduate Advising Award, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2003

Donnell R. Hunt, Emeritus

Fellow, American Society of Agricultural Engineers

Donald G. Jedele, Emeritus

Fellow, American Society of Agricultural Engineers
Rural Builder Hall of Fame, Rural Building News, 1987
Certificate of Merit, Illinois Farm Electrification Council, 1988

Benjamin A. Jones, Jr., Emeritus

Fellow, American Society of Agricultural Engineers

Prasanta K. Kalita

Research Excellence Award, Iowa State University, 1992
Advisor of the Year, Kansas State University College of Engineering, 1996
Who's Who in Science and Engineering, 1996
Most Outstanding Advisor of the Year, Kansas State University BAE Department, 1997
Outstanding Kansas State University Instructor and Advisor K-State Mortar Board, 1997
Who's Who Among America's Teachers, 1998, 2000
Finalist, President's Outstanding Advisor Award, Kansas State University, 1999
Collins Scholar, The Academy for Excellence in Engineering Education, University of Illinois, 2000, 2001
Teaching Excellence Award, American Society of Agricultural Engineering Student Branch, University of Illinois, 2002
Outstanding Engineering Advisor, University of Illinois College of Engineering, 2002
J. Kent Mitchell Teaching Excellence Award, University of Illinois Department of Agricultural and Biological Engineering, 2003

Faculty Award for Excellence in Teaching, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2003
Academy of Teaching Excellence, University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2003
Food and Agricultural Sciences Excellence in College and University Teaching Awards Program Nominee, U.S. Department of Agriculture, 2003
Best Paper Award, International Association of Science and Technology for Development, 2003
Accenture Consulting Outstanding Adviser Award, University of Illinois College of Engineering, 2004
Teaching Fellow Award, North American Colleges and Teachers of Agriculture, 2004

J. Kent Mitchell, Emeritus

Fellow, American Society of Agricultural Engineering
Educational Aids Competition Blue Ribbons, American Society of Agricultural Engineers, 1972, 1975, 1979, 1984
Alpha Zeta Outstanding Instructor, University of Illinois College of Agriculture, 1986
Teaching Excellence Award, University of Illinois Department of Agricultural Engineering, 1986
Everitt Award for Teaching Excellence, University of Illinois College of Engineering, 1987
Faculty Award for Excellence in Teaching, University of Illinois College of Agriculture, 1989
Paul A. Funk Recognition Award, University of Illinois College of Agriculture, 1994
Honorary Badge, Warsaw Agricultural University (Warsaw, Poland), 2001
Hancor Soil and Water Engineering Award, American Society of Agricultural Engineers, 2002

Arthur J. Muehling, Emeritus

Fellow, American Society of Agricultural Engineers
Educational Award, Illinois Pork Producers Association, 1974
Paul A. Funk Award, University of Illinois College of Agriculture, 1979
Farm Builder Hall of Fame, Rural Builder Magazine, 1984
University of Illinois Cooperative Extension Award for Sustained Excellence, 1985
Bernon G. Perkins Award, National Farm Builders Association, 1993

Elwood F. Olver, Emeritus

Fellow, American Society of Agricultural Engineers

Marvin R. Paulsen

Fellow, Committee on Institutional Cooperation, 2000-2001

Fellow, American Society of Agricultural Engineers, 2002
Andersons/NC-213 Grain Quality Research Award, 2002

William H. Peterson, Emeritus

Appreciation Plaque, South Dakota Rural Electric Member Services Association, 1977

Certificate of Appreciation, Illinois Farm Electric Council, 1981

Educational Aids Competition Blue Ribbons, American Society of Agricultural Engineers, 1981, 1983, 1987

Certificate of Merit, Illinois Electric Council, 1996

Robert E. Petrea

President's Award, National Institute for Farm Safety, 2004

Special Recognition Award, National Institute for Farm Safety, 2004

Hoyle B. Puckett, Emeritus

Fellow, American Society of Agricultural Engineers

Errol D. Rodda, Emeritus

Stanley H. Pierce Award, University of Illinois College of Engineering, 1977

John C. Siemens, Emeritus

Educational Aids Competition Blue Ribbon, American Society of Agricultural Engineers, 1985

Agronomic Educational Material Publication, American Society of Agricultural Engineers, 1992

Senior Faculty Award for Excellence in Extension, University of Illinois College of Agriculture, 1993

John Deere Gold Medal Award, American Society of Agricultural Engineers, 1999

Vijay Singh

Young Faculty Excellence Award, National Corn Refiners Association, 2003

Lei Tian

Novel Academic Idea Award for Young Faculty, Jilin University of Technology, 1988, 1989

Nominee, CGS Award for Most Distinguished Dissertation of the Program, Department of Biological and Agricultural Engineering, University of California at Davis, 1995

Nominee, Kinsella Memorial Prize, University of California at Davis, 1995

Nominee, University Microfilms International

Distinguished Dissertation Award in Mathematics and Physics and Engineering, University of California for National Council of Graduate Schools, 1995

Outstanding Accomplishment of Training on Teaching College, University of Illinois College of Agricultural, Consumer and Environmental Sciences Academy of Teaching Excellence, 1997

Honorable Mention for the Graduate College of Outstanding Mentor Award, University of Illinois College of Graduate Studies, 1999-2000

Superior Paper Award, American Society of Agricultural Engineers, 1999-2000

Faculty Fellow, National Center for Supercomputing Applications, University of Illinois, 2000-2001

K. C. Ting

Ralph and Mable Hunter Fellow, 1978-1979

Certificate of Appreciation, American Society of Agricultural Engineers, 1991, 1999, 2000

Certificate of Appreciation, Taiwan Agricultural

Mechanization Research and Development Center, 1991

Best Paper Award, CIOSTA-CIGR (International Agricultural Engineering Society), 1993

Best Paper Award, American Society for Plastics, 1993

Team Award for Excellence in Research, Cook College/New Jersey Agricultural Experiment Station, Rutgers University, 1996

Honorary Professor of the National Bio-Environment Engineering Laboratory of the Ministry, China Agricultural University, Beijing, P.R. China, 1996

Cook College/Alpha Zeta Professor of the Year, Rutgers University, 1997

Japanese Government Research Award for Foreign Specialists, 1999

Paper Award, American Society of Agricultural Engineers, 2000

Fellow, American Society of Agricultural Engineers, 2001

Fellow, American Society of Mechanical Engineers, 2002

Certificate of Appreciation, Mie University, Japan, 2003

Xinlei Wang

Paper Award, American Society of Heating, Refrigeration and Air-Conditioning Engineers, 2002

Qin Zhang

Best Paper in the Decade Award, Transactions of Chinese Society of Agricultural Engineering, 1995

General Electric Scholar, University of Illinois College of Engineering, 1998

Collins Award for Innovative Teaching, University of Illinois College of Engineering, 1999

Information and Electrical Technologies (IET) Division
Select Paper Award, American Society of Engineers,
2001

SCI Control Systems Best Paper Award, World Multi-
Conference on Systemics, Cybernetics and Information
(SCI), 2001

Fellow, National Center for Supercomputing Applications,
2002

Adjunct Chair Professor, College of Engineering, China
Agricultural University, 2003

Adjunct Professor, College of Biological Engineering and
Food Sciences, Zhejiang University, China, 2003

Fellow, Japanese Society for the Promotion of Science,
2004

Adjunct Professor, College of Mechanical Engineering,
Department of Mechatronics, Yanshan University,
China, 2004

Yuanhui Zhang

Outstanding Paper Award, American Society of
Agricultural Engineers, 1989, 2001

Honorarium Professorship, Beijing University of
Agricultural Engineering, China, 1994

Honorarium Professorship, Shandong Institute of
Technology, China, 1994

Everitt Award for Teaching Excellence, University of
Illinois College of Engineering, 1997

General Electric Scholar, University of Illinois College of
Engineering, 1997

Blue Ribbon Award, American Society of Agricultural
Engineers, 1998

Teaching Excellence Award, University of Illinois
Department of Agricultural Engineering, 1999

Superior Paper Award, American Society of Agricultural
Engineers, 2001

Annual Paper Award, American Society of Heating,
Refrigeration and Air-Conditioning Engineers, 2002

Fellow, National Center for Supercomputing Applications,
2004