2004 SUMMARY OF ENGINEERING RESEARCH

A Report of Activities during 2003

This .pdf is part of the larger *2004 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 2003 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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Tina M. Prow: Editor and Coordinator
Peggy Currid: Freelance Editor, Publications Sections
Jim Vattano: Graphic Designer
Thomas Habing: Research Programmer, Grainger Engineering Library Information Center
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COLLEGE OF ENGINEERING
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Agricultural and Biological Engineering

K. C. Ting, Head*
338 Agricultural Engineering Sciences Building
1304 W. Pennsylvania Ave., MC-644
Urbana, IL 61801-4797
(217) 333-3570
www.age.uiuc.edu
age@uiuc.edu

Principles from many scientific and engineering disciplines are applied to address opportunities and problems of agricultural production, processing, and utilization. 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 maintain a viable, useful research program.

**Loren E. Bode retired in November 2004. Dr. Bode served as department head for 11 years, including the year for research activity reported here.*

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
Chemical application system, spray nozzle design, spray drift reduction

Douglas L. Bosworth
Product development processes, product safety, engineering design

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

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

Bruce Elliott-Litchfield
Food engineering

Marvin R. Paulsen
Food and bioprocess applications, grain quality measurements, near-infrared and FT-NIR spectroscopy

Roscoe L. Pershing
Computer simulation, undergraduate education

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

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

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

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

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.

In-Season, Site-Specific Nitrogen Management for Corn

Q. Zhang,* R. G. Hoeft, E. D. Nafziger, S. Han
Illinois Council on Food and Agricultural Research

The goal of this research is to develop an on-machinery corn nitrogen stress sensor and evaluate its potential in real-time site-specific nitrogen management during side-dressing operations for corn production. Research objectives include: evaluate the capability of a multispectral image sensor to detect corn nitrogen deficiency; calibrate the sensor for real-time sensing capability; and develop a machinery-based automated in-season site-specific nitrogen management system. This technology will not only benefit the corn growers by increasing their profitability, but will benefit the general public by reducing the risk of nitrogen contamination in surface and ground water.

*Denotes principal investigator.

Agricultural Safety

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 Injury Medical System Surveillance
R. A. Aherin*
Carle Foundation Hospital Center for Rural Health and Farm Safety

The purpose of this project is to develop and test a farm injury and illness surveillance system for three primary sources of data within a medical system. These include patient admittance to emergency rooms, hospitals, and clinics. The systems developed will be evaluated for reliability and ease of use by admittance personnel.

Pulmonary Analysis of Selected Swine Confinement Workers
R. A. Aherin,* D. Hallam, D. Main, A. Hunter
National Institute for Occupational Safety and Health; National Farm Medicine Center; Carle Center for Rural Health and Farm Safety

This project involves the evaluation of the health risk level of swine confinement workers by surveying their respiratory health history, assessing their exposure to airborne contaminants, and measuring their acute respiratory responses. Workers are given a lung function test every three months over a 12-month period. A spirometer is used to obtain maximal expiratory flow-volume curves. This work group included young to middle aged workers. Preliminary results indicated that the work environment only minimally affected worker's respiratory systems. Swine facilities that are designed and managed properly would most likely provide only minimal risk to the respiratory health of workers.

Use and Recognition of the FARM Kit by Farmers: A Comparative Analysis of Selected Promotional Methods
R. A. Aherin,* P. D. Prat, R. E. Petrea
FARM Coalition

A coalition of agricultural safety proponents in Illinois collaborated to design and produce a retroreflective equipment marking system that would improve the visibility of farm equipment. The product, known as the FARM kit (Fewer Accidents with Reflective Material), was developed to decrease the incidence of motor vehicle collisions involving farm equipment that is operated on public roadways. Over 20% of the respondents in the study were FARM kit users. Sixty-one percent of the subjects reported that they were aware of the FARM kit. There was no significant difference in FARM kit recognition between the two county subgroups.

The Farm Safety Mobile
R. A. Aherin,* A. Hunter, S. Beever
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.

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.

National AgrAbility Program Curriculum Design
R. E. Petrea*
University of Wisconsin–Extension

This project involves assisting with the development of the curriculum design and subject matter for an on-line training course to be used with state project staff, rural professionals, and post-secondary students. Previous experiences based upon coursework for occupational therapists, physical therapists, state project staff, and farmers are used to guide such activities as identifying and developing subject matter resources and writing learning objectives, as well as evaluation components.

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 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, R. J. Adrian, 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
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.

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 studies 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.

*Denotes principal investigator.

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 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

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.

Development of an Aerodynamic Air Cleaning System to Improve Cooling Efficiencies for Combine Engines

Y. Zhang,* Z. C. Tan, S. E. Ford, A. C. Hansen, J. F. Reid
Deere & Company

Cooling efficiency of combine engines is reduced by 30% due to dusting conditions, and in extreme circumstances, may cause engine overheating. The goals are to improve cooling efficiency by developing efficient and economical

*Denotes principal investigator.

air cleaning technologies and systems and to reduce the maintenance requirement of cooling systems on off-road engines. The objective of this project is to develop an aerodynamic-deduster system to provide clean cooling air for the radiator. To date, three prototypes have been developed and tested.

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.

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.

Stereoscopic Particle Image Velocimetry (SPIV) Technology for Measurement and Analysis of Flow Patterns and Particle Distribution

Y. Zhang,* Y. Sun, X. Wang
Illinois Council on Food and Agriculture Research

The long-term goal of this project is to develop technology to measure and predict the spatial distribution of particulate contaminants for better design and management of air handling and distribution systems. In this study, the objectives are to develop a three-dimensional stereoroscopic particle imaging velocimetry (SPIV) system for measurement of low-speed airflow and particulate air contaminant transport and distribution, and to evaluate the ventilation efficiency.

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

The "Quick Protein" Process to Enhance Dry-Grind Ethanol Plant Profitability

S. R. Eckhoff,* D. Gupta, L. Dickey, K. D. Rausch, V. Singh, M. E. Tumbleson
Illinois Corn Marketing Board

The objective of the study is to produce a protein-rich fraction from corn that has already gone through the quick-germ and quick-fiber processes. This protein-rich

*Denotes principal investigator.

fraction will be looked at for the amount of zein that can be extracted. A new process was developed based on preliminary data that provides both a starch stream suitable for ethanol production and a starch stream suitable for starch production. A provisional patent has been applied for the process. A modification to the process using novel technology increases starch yield.

Coproduct Characterization from Dry Grind Ethanol Processing for Enhanced Value

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

Currently, 60% of fuel ethanol is produced by the dry grind process, which has been optimized for ethanol yield. However, little is known about solids and nutrients that are coproduced with ethanol made from corn. This project characterizes the composition of process streams within state-of-the-art bioprocess facilities and identifies opportunities for future improvements. It has been found that phosphorus is concentrated in the thin stillage stream, which becomes part of the distillers dried grains with solubles (DDGS) coproduct. The value of DDGS could be increased if phosphorus content, an environmental concern, could be reduced.

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 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

*Denotes principal investigator.

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 SO_2 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 (SO_2) 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 SO_2. 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 Starch Yield Calibrations with NIT
M. R. Paulsen,* M. Singh
U.S. Department of Agriculture; Dupont; Monsanto

A calibration for extractable starch in corn was expanded for the Infratec 1229 NIT grain analyzer based on over 2600 samples collected from 1997 to 2003. Extractable starch was predicted with a standard error of prediction (SEP) of 1.34, R2 of 0.8, and RPD of 2.2. The calibration was used on samples from 640 subplots planted with two varieties at four populations and five nitrogen levels. NIT protein increased significantly while extractable starch, ranging from 63 to 72%, decreased significantly as the nitrogen rate increased. A 1% point gain in extractable starch is worth about 4 to 6 cents per bushel.

Measurement of Isoflavones in Soybeans with FT-NIR
M. R. Paulsen,* S. Nimaiyar
Illinois Council on Food and Agricultural Research

Soybeans from four crop years were scanned on a Perkin Elmer Spectrum One FT-NIR spectrophotometer. The isoflavone calibration equations had a relatively low root mean square error of prediction (RMSEP) for all three types of isoflavones. FT-NIR calibrations had an RMSEP of 295, 269, and 82 for the total of three forms of daidzin, genistin, and glycitin, respectively. The validation data set correlation coefficients (r) ranged from 0.85 to 0.88 for the total of the three forms of daidzin and genistin. Results indicate that the FT-NIR technique with ground samples can be useful in screening for isoflavone levels in soybeans.

Off-Road Equipment Engineering

Fuzzy Controls for Mechatronized Off-Road Equipment
Q. Zhang*
U.S. Department of Agriculture Hatch Funds

This research is to develop automated guidance control systems for off-road equipment. The hypothesis is that human operators, using their experience, common-sense, and intelligence, can maneuver off-road equipment well, and an intelligent control system could do the same. The specific objectives of this program are to develop redundant guidance sensing technology, vehicle path planning technology, sensor fusion technology, and fuzzy controls for electrohydraulic steering control. This

*Denotes principal investigator.

guidance control system has been partially developed and implemented on an agricultural tractor on crop production fields. Further efforts will be focused on developing a sensor fusion path planner.

Vision Guidance for Wheel-Type Agricultural Tractors
Q. Zhang*
Deere & Company

The objective of this research is to develop machine-vision navigation sensing capability for guiding agricultural tractors to follow row crops in the field. The study will address challenging technical problems in developing vision-based navigation sensing technology capable of detecting crop rows or edges in typical farming operation conditions. The lack of skillful operators, the aging of the farm labor force, and the application of new agricultural technology make this research technologically significant and important.

Site-Specific Agriculture

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.

Development of a Precision Herbicide Application System
L. Tian,* J. W. Hummel
University of Illinois

The goal of this project is to develop a precision herbicide application (robotic) system for low-input pest control strategies in soybean and maize production. Specific objectives include evaluating the agronomic and environmental benefits of low-input herbicide applications and the status of current technology in this area; developing practical, real-time prototype systems for individual plant sensing and equipment control; and conducting on-farm trials to evaluate the prototype under the constraints of normal farm operation. With this precision system, herbicide would be applied only to the target weeds in the fields.

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.

Using Remotely Sensed Data to Diagnose Soybean Yield Limiting Factors
L. Tian,* D. Bullock
North Central Soybean Research Program

Procedures to accurately explain crop yield variation are needed to provide crop consultants, producers, and researchers with the necessary information to interpret yield maps and develop the most appropriate site-specific management options for a given field. These site-specific options, based on factors that affect crop yield, will improve profitability. The objective of this project is to

*Denotes principal investigator.

develop sensor-based procedures to map within-field weed, disease, and nutrient deficiencies in order to diagnose their presence in the field and evaluate their contribution to yield variation. This could lead to development of site-specific management options for crop production.

Variable Rate Herbicide Applications Using Remotely Sensed Imagery
L. Tian,* L. Wax, C. Sprague
NASA CRSP Ag20/20 Initiative

An estimated $6.1 billion was spent by farmers on herbicides in 1997. Current methodology for weed control is to apply the herbicide uniformly throughout the field. However, weeds do not grow uniformly in the field, but often grow in patches with up to 90% of the field being weed-free. This means that a major portion of the field may not need to be sprayed. The goal of the variable-rate technology using remote sensing is to evaluate the effectiveness of remote-sensing-based, variable-rate herbicide in terms of cost savings, effectiveness in eliminating weeds, and ability to maintain acceptable yield levels compared to traditional, conventional application of herbicide.

Soil and Water Resources

Incorporation of the Effect of Artificial Subsurface Drainage into Surface Water Quality Models
R. A. Cooke*
University of Illinois

Most of the agricultural lands in central Illinois are drained by artificial subsurface drains. These drainage systems provide pathways for solute movement to rivers and streams. The goal of this project is to incorporate the effects of these systems into watershed-scale flow and transport models.

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.

*Denotes principal investigator.

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.

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 System Layout on Yield, Yield Uniformity, and Water Quality
R. A. Cooke*
University of Illinois

The overall goal of this research is to improve the characterization of subsurface drainage processes in tile-drained watersheds and to quantify the effect of several depth and spacing combinations on yield, yield uniformity, and water quality. In the long run, the results can be used to select subsurface drainage management practices that optimize yield, water quality, or both.

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.

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.

*Denotes principal investigator.

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Water Quality

Doheny, A. **Amelioration of tile nitrate and atrazine using inline biofilters.** M.S. thesis, R. A. Cooke, advisor (2003).

Dupre, D. **Modeling the effects of land-use change and dredging on Wonder Lake, Illinois.** M.S. thesis, M. C. Hirschi, advisor (2003).

Patents

Food and Bioprocess Engineering

Singh, V. and Taylor, F. (USDA/ARS/ERRL). **Method of Removing the Hull from Corn Kernels**, # 6,592,921 B2, Jul. 2003.

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

Fellow, American Society of Agricultural Engineers, 1992

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

Paul A. Funk Achievement Award, University of Illinois College of Agriculture, 1993

ASAE President's Citation, American Society of Agricultural Engineers, 2000, 2002

Douglas L. Bosworth
Fellow, American Society of Agricultural Engineers
President, American Society of Agricultural Engineers, 1992-1993
General Electric Scholar, University of Illinois College of Engineering, 1998-2000

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
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

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

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
Superior Paper Award, American Society of Agricultural Engineers, 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

Michael C. Hirschi
Paper Reviewers Award, American Society of Agricultural Engineers, 1988
Educational Aids Competition Blue Ribbons (5), American Society of Agricultural Engineers, 1991 (3), 1994, 1998
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
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 by 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. K. 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

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

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

Roscoe L. Pershing
Fellow, American Society of Agricultural Engineering

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

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
National Corn Refiners Association Young Faculty Excellence Award, 2003

Lei Tian
Novel Academic Idea Award for Young Faculty, Jilin University of Technology, 1988
Recipient, Novel Academic Idea Award for Young Educator, Jilin University of Technology, 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

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

Yuanhui Zhang
Outstanding Paper Award, American Society of Agricultural Engineers, 1989
Honorarium Professorship, Beijing University of Agricultural Engineering, China, 1994
Honorarium Professorship, Shadong 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

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